SN: 100.123/002

ROHDE&SCHWARZ

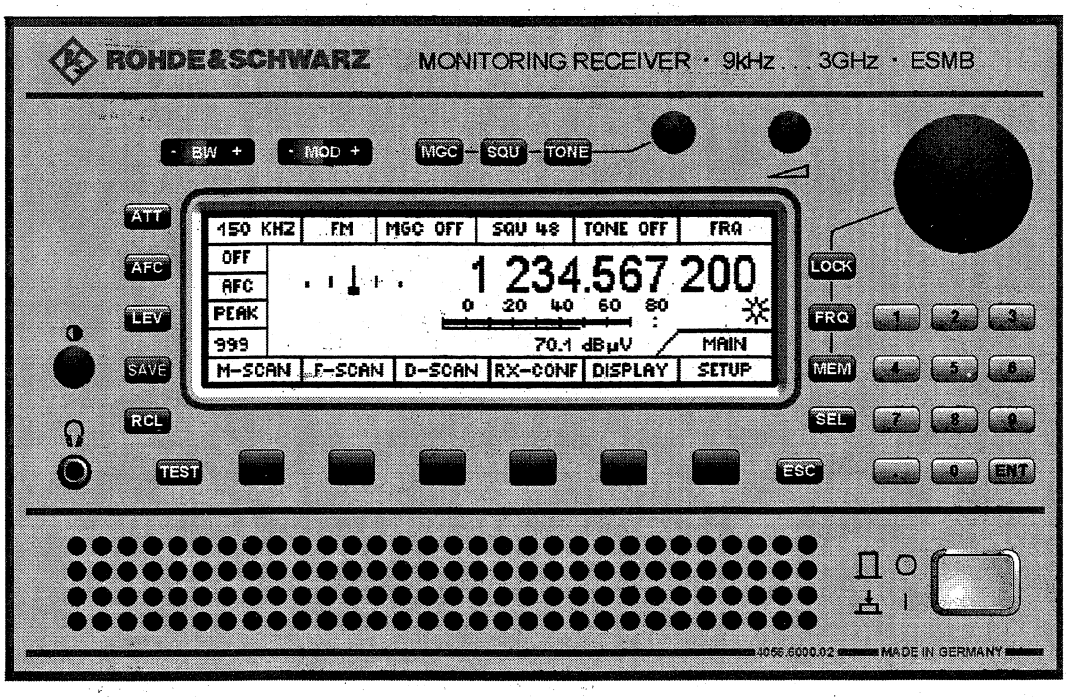
Division
Radiomonitoring and Radiolocation

Manual

MONITORING RECEIVER

ESMB

4056.6000.02



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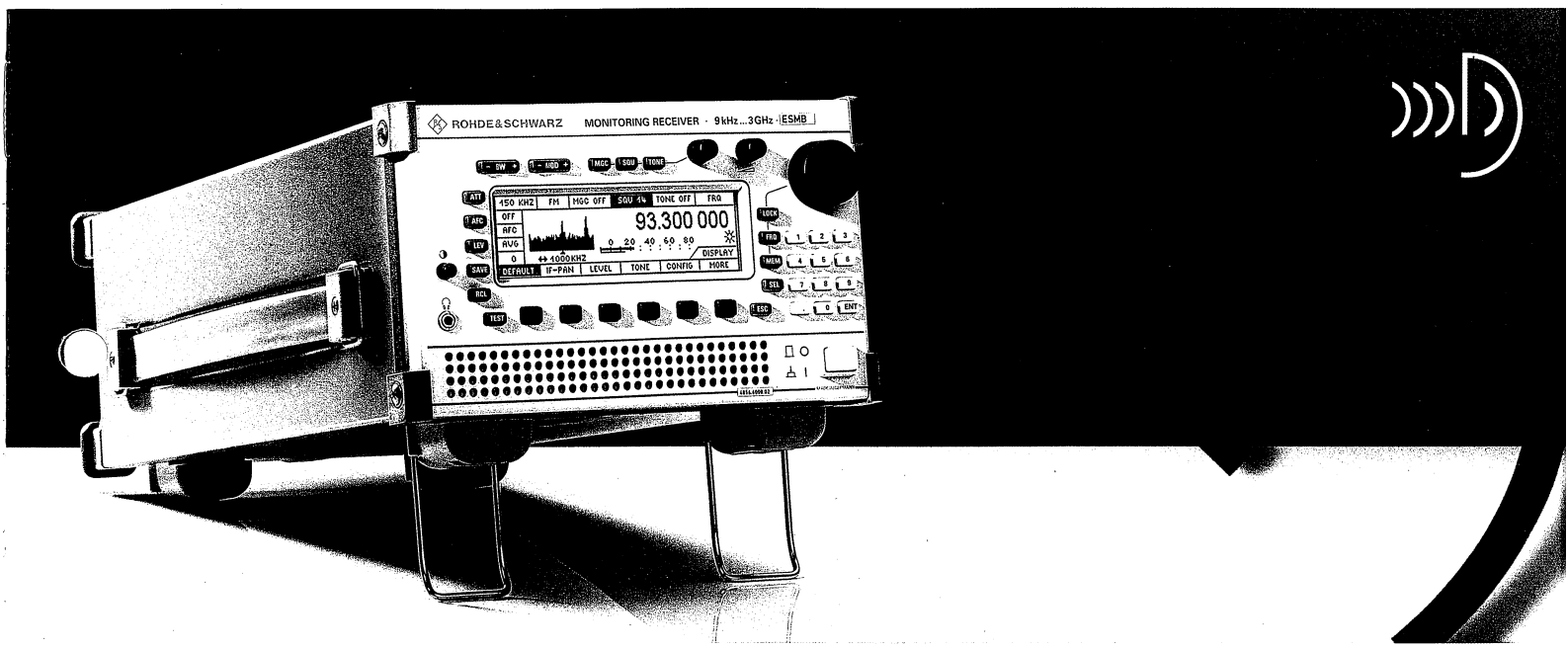

Monitoring Receiver ESMB

ITU-compliant measurements from 9 kHz to 3 GHz

Monitoring Receiver ESMB from Rohde & Schwarz is ideally suited for spectrum monitoring according to ITU recommendations and for radio investigation services.

- Signal reception
- Search mode, frequency and memory scans
- Spectrum occupancy measurement
- Coverage measurement
- RF and IF analysis

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General

Monitoring Receiver ESMB is a test and monitoring receiver for all radiomonitoring tasks according to ITU-R and for radio investigation services. The compact and sturdy design combined with low weight makes ESMB a versatile and universal unit for stationary and mobile use.

Application

With ESMB the following measurements in line with ITU-R specifications can be performed:

- Frequency and frequency offset to ITU-R SM 377
- Field strength to ITU-R SM 378
- Modulation to ITU-R SM 328
- Spectrum occupancy and identification with external PC to ITU-R SM 182
- Bandwidth to ITU-R SM 328

For radio investigation services the following tasks can be performed:

- Frequency scan with predefined frequency ranges
- Memory scan of up to 1000 memory channels
- RF frequency spectrum (option)
- Audio monitoring of CW, AM, SSB and FM transmissions
- Identification

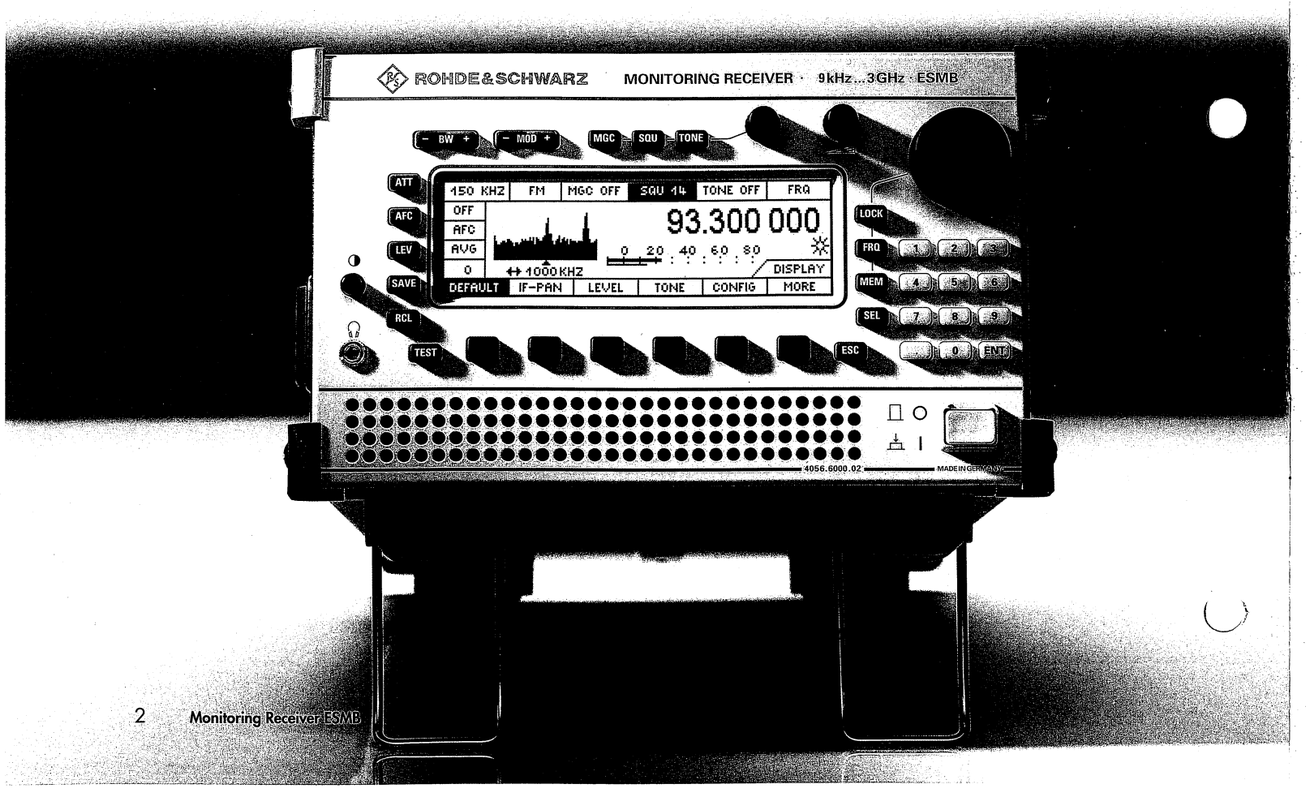
Description

Monitoring Receiver ESMB is a ½ 19" rack-mountable unit. The basic elements of ESMB are:

- A/D and DSP module with digital IF filters, digital demodulators for CW, AM, LSB, USB, PULSE, FM, PM, IQ and ISB, parameter measurements and FFT processing of IF panoramic display
- Band and tracking preselection
- RF frontends to convert the antenna signal into an IF of 10.7 MHz
- Fast synthesizer
- Processor system
- Display and control unit
- Remote interface
- Power supply unit

Digital IF section

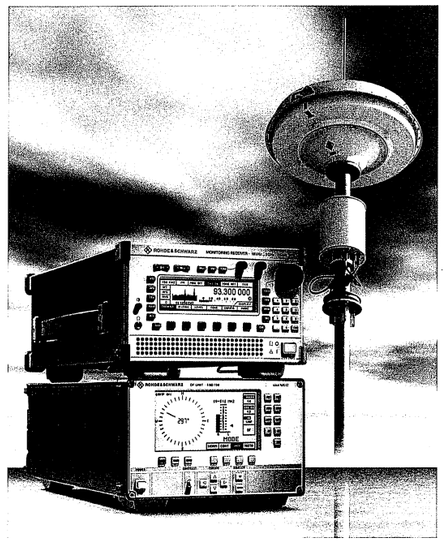
ESMB covers the wide frequency range of 9 kHz to 3 GHz. Processing the various signals available with optimum signal-to-noise ratio requires a large number of IF bandwidths. This problem cannot be solved with analog filters, as space is limited. The solution is a digital IF section in which a wide variety of different filters can be realized on relatively small space with the aid of DSP. ESMB is provided with 18 IF bandwidths between 150 Hz and 300 kHz and up to 1 MHz in the IF panorama mode.



Operation

Monitoring Receiver ESMB provides manual operation via the front panel. The operating concept meets all the demands made on a state-of-the-art spectrum monitoring receiver, ie all main functions such as type of modulation, bandwidth, etc can easily be set directly via labelled keys.

Menu control is organized in priority levels so that signal processing is not interrupted by menu changes and the user has an optimized view of current operations.



In conjunction with Direction Finder DDF190 Monitoring Receiver ESMB forms a monitoring system with excellent price/performance ratio

Scan modes

Frequency scan
It is possible to define a frequency range to which a complete data set can be allocated. In addition to receiver settings, the following scan parameters may be included in the data set:

- Step width
- Signal threshold (dBµV)
- Dwell time
- Hold time
- Number of scans
- Signal-controlled continuation
- Suppression (individual frequencies or search ranges)

Memory scan
ESMB uses 1000 definable memory locations. A complete data set such as frequency, mode of demodulation, bandwidth, squelch level, etc can be assigned to each memory location. The content of any memory location can be transferred to the receiver manually using the RCL key.

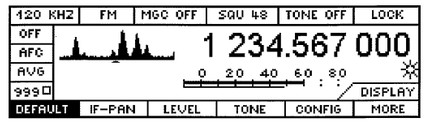
Frequency spectrum
Fitted with the frequency spectrum option **DIGI-Scan**, ESMB scans the frequency range of interest with digital control and displays the associated spectrum. Emissions detected can be seen at a glance. Aural monitoring of the information is possible by simply pressing a softkey. ESMB then goes to the DIGI-Scan listen mode. The stored spectrum is displayed in the background, and the emission of interest can be selected and monitored by marking it with the frequency cursor.

Location of miniature transmitters at close range is possible in the **differential mode** of the DIGI-Scan option. In this mode, the displayed spectrum is stored as a reference. Current spectra are superimposed on the reference spectrum, and any new signals or variations in signal strength are clearly discernible as peaks. For detecting unknown signals the field strength of transmitters at close range varies to a greater extent than that of transmitters located far away.

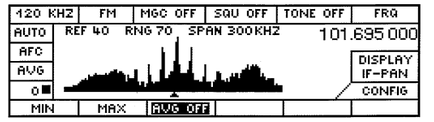
This differential display ensures fast and reliable location of miniature transmitters even in case of spread-spectrum transmission.

Optimized view for current task

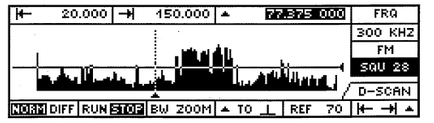
Overview



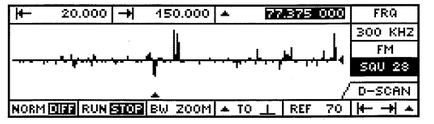
IF panorama



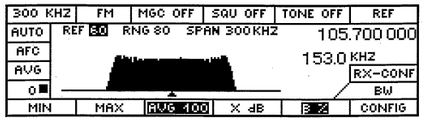
DIGI-Scan listen mode



DIGI-Scan differential mode

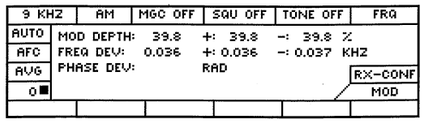


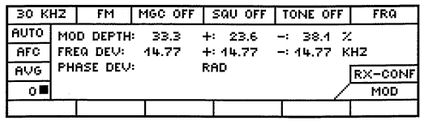
ESMB in measurement mode

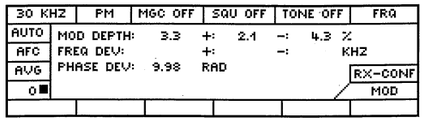


Bandwidth measurement

Modulation measurement







Interfaces

For system applications the receiver is provided with a number of important interfaces:

- Baseband output (digital)
- AF output (digital)
- IF 10.7 MHz, ± 1 MHz, VHF-UHF
  IF 10.7 MHz, ± 5 kHz, HF
  uncontrolled for external panoramic display
- AF balanced 600 Ω, 0 dBm
- Output for external loudspeaker, 4 Ω, 500 mW
- Headphone socket via volume control
- Output for antenna control with antenna number
- Connector for external bidirectional reference frequency, 10 MHz

Remote control interface
LAN TCP/IP (Ethernet 10Base-T), optional 9-pin RS232C.

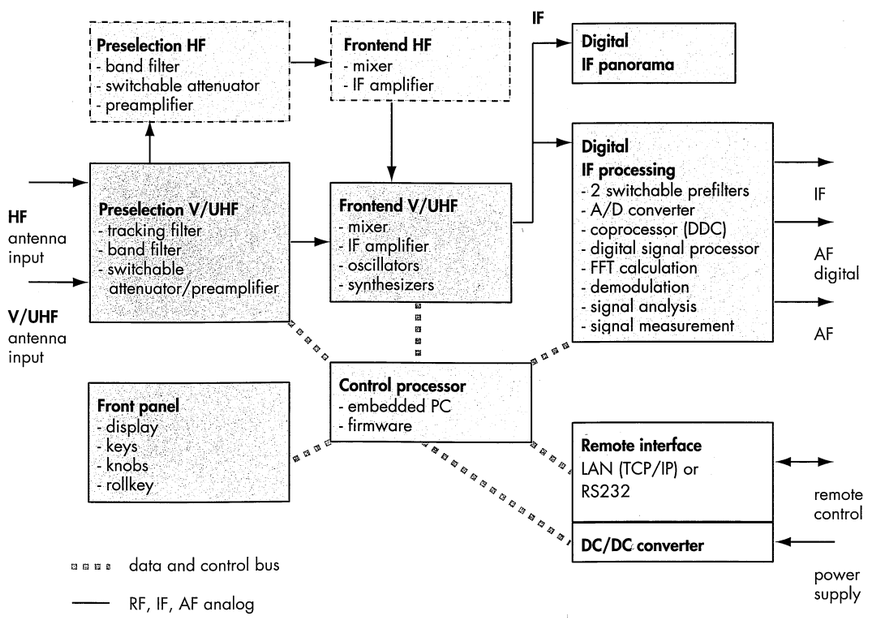
Designed to meet the standards

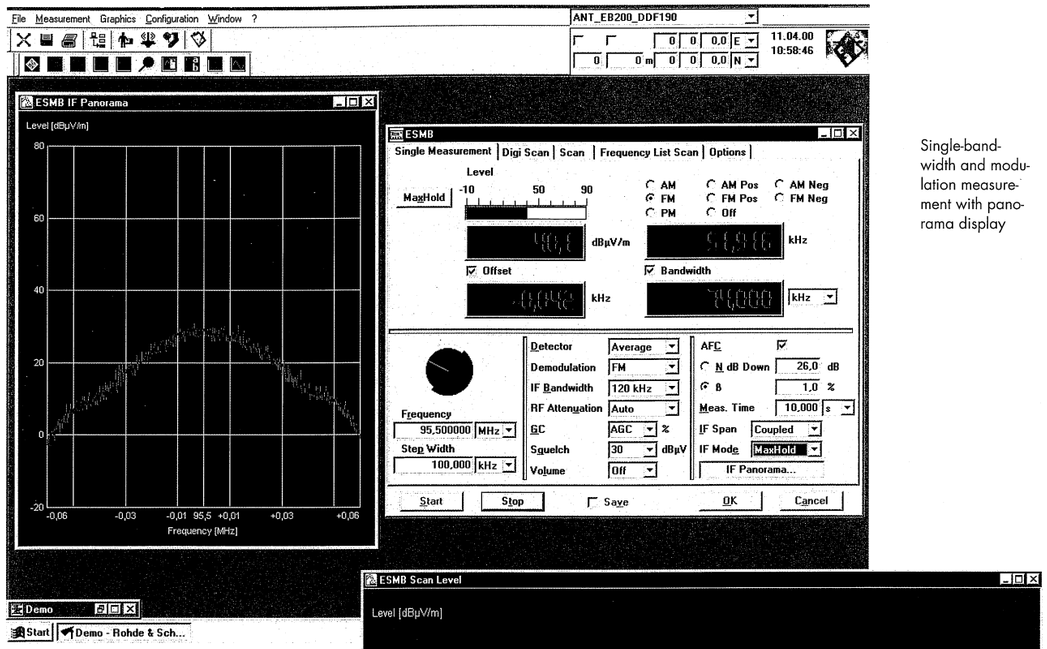
State-of-the-art design
The receiver is designed for both mobile and stationary operation. Careful screening and filters in all the input and output lines guarantee extremely low spurious and high interference rejection.

BITE
The receiver is permanently monitored by built-in test equipment. If deviations from the nominal are detected, an error message is output with a code informing on the type of fault so that the faulty module can easily be found.

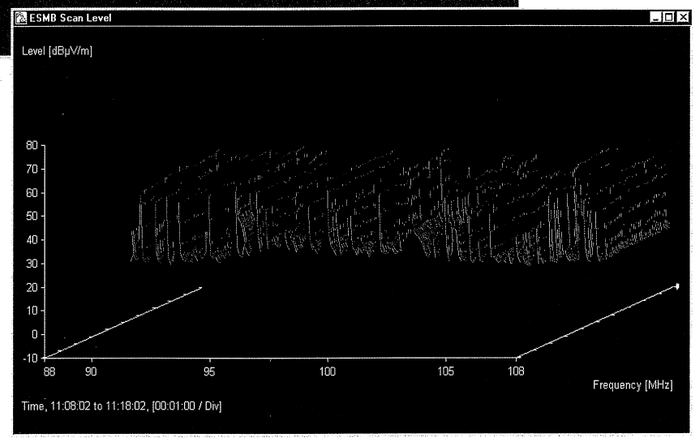
Serviceability
Modern design and the use of plug-in modules guarantee short repair times. All the modules may be exchanged without any recalibration or adjustments being required.

Block diagram of Monitoring Receiver ESMB





Single-bandwidth and modulation measurement with panorama display



Scan with 3-D waterfall diagram

Use in computer-controlled systems

Full use of the measurement features of the receiver is possible only in the remote mode via LAN using a powerful PC in connection with the Rohde & Schwarz spectrum monitoring software ARGUS or RAMON, for example.

RAMON, used in the military and security application fields, is for fast frequency detection and transfer to support monitoring receivers (concentration on interactive operation and signal identification). ARGUS is intended for measurement concentrated applications, eg for authorities with frequency management tasks such as long-term monitoring of specific frequency bands.

To simplify entry into ARGUS, the software ARGUS MON is offered – a version reduced in functionality and consequently price – for remote control of one ESMB. This version allows remote control of all settings, measurement and scan functions and saving of measured data such as frequency, level, offset, date and time. The basic ARGUS MON software can be extended to ARGUS for use in systems of any size. The pictures above show that the operation of ARGUS MON is still user-friendly and clear. ESMB together with ARGUS MON is a low cost minisystem that fulfils all the recommendations according to ITU.

Specifications

Frequency range	
Basic unit	20 MHz to 3 GHz
Basic unit with optional HF Unit EB200HF	9 kHz to 3 GHz
Frequency setting via keypad or rollkey	1 kHz, 100 Hz, 10 Hz, 1 Hz; or in selectable increments
Frequency accuracy	≤1 x 10^{-6} (0 to +45 °C)
Input for external reference	10 MHz
Synthesizer setting time	≤3 ms
Oscillator phase noise	≤–120 dBc/Hz at 10 kHz offset (HF range) ≤–100 dBc/Hz at 10 kHz offset (V/UHF range)
Antenna inputs	N socket, 50 Ω
VSWR	≤3, typ. 2
Oscillator reradiation	≤–107 dBm
Input selection	
9 kHz to 30 MHz	5 bandpass filters
20 (30) MHz to 1500 MHz	tracking preselection
1500 MHz to 3000 MHz	highpass, lowpass
Interference rejection, nonlinearities – HF range (only with optional HF Unit EB200HF)	
Image frequency rejection	≥90 dB, typ. 100 dB
IF rejection	≥90 dB, typ. 100 dB
2nd order intercept point	≥40 dBm, typ. 55 dBm (ATT off)
3rd order intercept point	≥20 dBm, typ. 25 dBm (ATT off)
Internal spurious signals	≤–107 dBm
Interference rejection, nonlinearities – VHF-UHF range	
Image frequency rejection	≥80 dB, typ. 90 dB
IF rejection	≥90 dB, typ. 100 dB
2nd order intercept point	≥30 dBm, typ. 40 dBm (f=20 (30) to 2700 MHz, low distortion mode)
3rd order intercept point	≥10 dBm, typ. 18 dBm (f=20 (30) MHz to 2700 MHz, low distortion mode)
Internal spurious signals	≤–107 dBm
Sensitivity – HF range (only with optional HF Unit EB200HF)	
Overall noise figure (including AF section)	≤14 dB, typ. 12 dB (f ≥50 kHz, ATT off)
Signal-to-noise ratio (f=0.1 to 30 MHz)	≥10 dB, measurement with telephone filter
CW, bandwidth 300 Hz, V=0.6 µV	
SSB, bandwidth 2.5 kHz V=1 µV	
AM, bandwidth 9 kHz f_{mod}=1 kHz, m=0.5 V=1 µV	
Sensitivity – VHF-UHF range	
Overall noise figure (including AF section)	≤12 dB, typ. 10.5 dB (f = 20 (30) MHz to 2700 MHz, low noise mode)
Signal-to-noise ratio	measurement with telephone filter
AM, bandwidth 9 kHz, f_{mod}=1 kHz, m=0.5 20 (30) MHz to 2700 MHz, V=1 µV	
2.7 GHz to 3 GHz, V=1.3 µV	≥10 dB (low noise mode)
FM, bandwidth 15 kHz f_{mod} = 1 kHz, deviation=5 kHz 20 (30) MHz to 2700 MHz, V=1 µV	
2.7 GHz to 3 GHz, V=1.3 µV	≥25 dB (low noise mode)

Detection modes	AM, FM, PM, USB, LSB, CW, ISB, PULSE, IQ
IF bandwidths for level detection and offset measurement	23 filters (150 Hz to 1 MHz)
IF bandwidths with standard demodulation (–6 dB bandwidth)	0.15, 0.3, 0.6, 1, 1.5, 2.4, 3, 4, 6, 8, 9, 15, 30, 100, 120, 150, 250, 300 kHz (reduced IF bandwidth in HF range: ±5 kHz)
Squelch, signal-controlled	–10 dBµV to 110 dBµV
Gain control	AGC, MGC (120 dB)
AFC	digital retuning for unstable signals
Modulation measurement	
AM (f_{max}=100 kHz)	m=1 to 99 % (resolution 0.1 %)
Indication error	<5% for m=50 %, S/N >40 dB, AF=1 kHz
FM (f_{max}=100 kHz)	deviation max. 125 kHz less modulation frequency (resolution 0.001 kHz)
Indication error narrow BW (≤15 kHz)	100 Hz plus 3 % of reading
broad BW (≤250 kHz)	2 kHz plus 3 % of reading for S/N >40 dB, AF=1 kHz
PM (f=0.3 to 5 kHz)	Δφ=0 to 4π
	Δφ=0 to 12.5 rad (resolution 0.01 rad)
Indication error	<0.1 rad plus 5 % of reading for S/N >40 dB, AF=1 kHz
Level and offset measurement	
Offset indication	graphically with tuning label or numerically
Signal level indication	–10 dBµV to 110 dBµV (dBµV/m) numeric 3 digits resolution 0.1 dB (error max. ±2 dB for V = 20 to 100 dBµV, AVG, 0 to +45 °C) or graphic as level line acoustic indication by level tone
IF panorama display	internal module
Span range	0.15 kHz to 1000 kHz (23 steps)
Scan characteristics	
Automatic memory scan	1000 definable memory locations
Frequency scan	start/stop/step and 100 suppress ranges
DIGI-Scan (option)	RF spectrum 9 kHz to 3 GHz or smaller on display
Inputs / outputs	
Bidirectional reference frequency connector	10 MHz, SMA
IF 10.7 MHz, wideband	±1 MHz, VHF-UHF range ±5 kHz, HF range uncontrolled for external panorama display, SMA
Baseband output (digital)	serial, 2 x 16 bit (clock, data, frame)
AF output (digital)	AF signal, 2 x 16 bit
AF output, symmetrical	600 Ω, 0 dBm
Loudspeaker output	4 Ω, 500 mW
Headphone output	via volume control
BITE	monitoring of test signals by means of loop test
Data interface	LAN (ETHERNET 10Base-T) or 9-pin RS232C, PPP

Certified Quality System
ISO 9001
DQS REG. NO 1954

Certified Environmental System
ISO 14001
REG. NO 1954-03

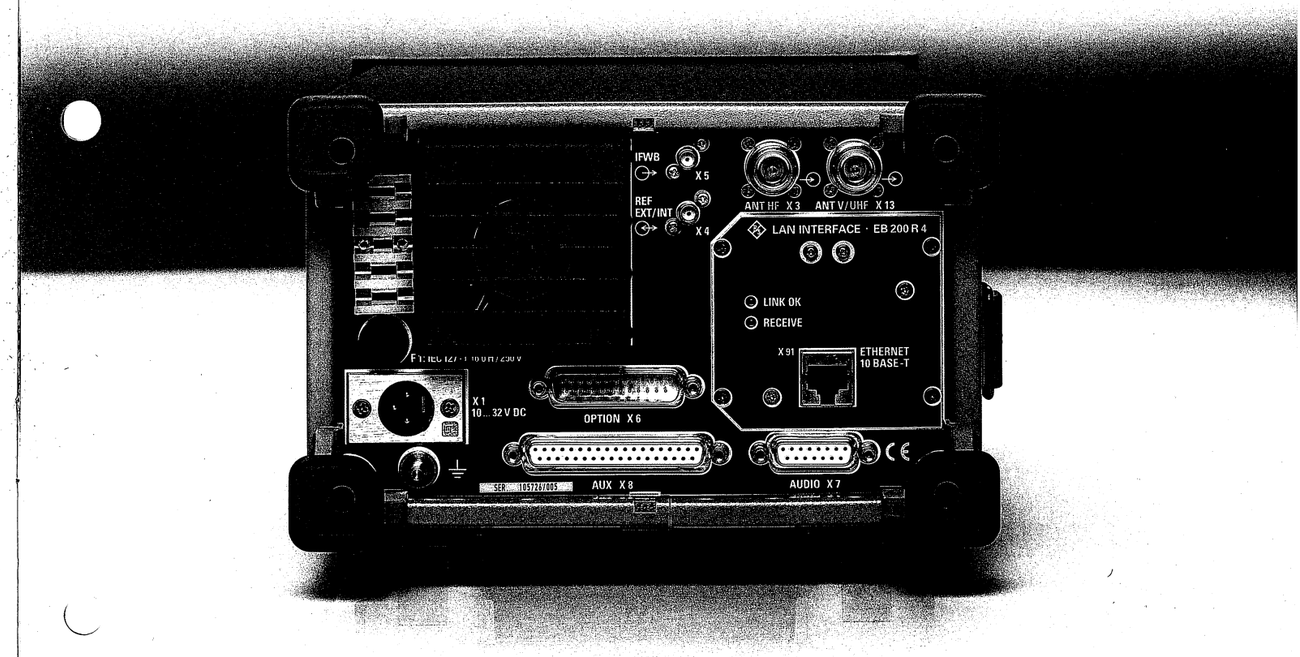
General data

Rated temperature range	0 to +45 °C
Operating temperature range	–10 to +50 °C
Storage temperature range	–40 to +70 °C
Humidity	max. 80%, cyclic test 25/40 °C max. 95% without condensation
Shock	DIN IEC 68-2-27 (MIL-STD-810D, MIL-T-28800D), 40 g, shock spectrum 45 Hz to 2 kHz
Vibration (sinewave)	DIN IEC 68-2-6 (MIL-T-28800D), 5 Hz to 55 Hz, 0.15 mm amplitude, 55 Hz to 150 Hz, 0.5 g
Vibration (noise)	DIN IEC 68-2-36, 10 Hz to 500 Hz, 1.9 g rms
Electromagnetic compatibility (EMC)	EN 50081-1/ 82-2
Power	10 V to 32 V DC (max. 40 W) or via external AC/DC supply
Dimensions (W x H x D)	227 mm x 153 mm x 474 mm
Rack model (1/2 19" x 3 HU)	210 mm x 132 mm x 460 mm
Weight	8 kg

Ordering information

Monitoring Receiver with external power supply	ESMB	4056.6000.02
RF option 9 kHz to 30 MHz	ESMBHF	4056.6100.02
Frequency spectrum DIGI-Scan	ESMBDS	4056.6200.02
RS232 Serial Interface	ESMBR2	4052.9056.02
Software ARGUS MON		4049.9859.02
ARGUS driver for ESMB		4049.9859.35

Rear view of ESMB



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Annex I (Digital IF Output) I.1

Interface Description ..... **4056.6000.01 SB**

Cable Plan **4056.6000.01**

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2 Preparation for Use

2.1 Installation

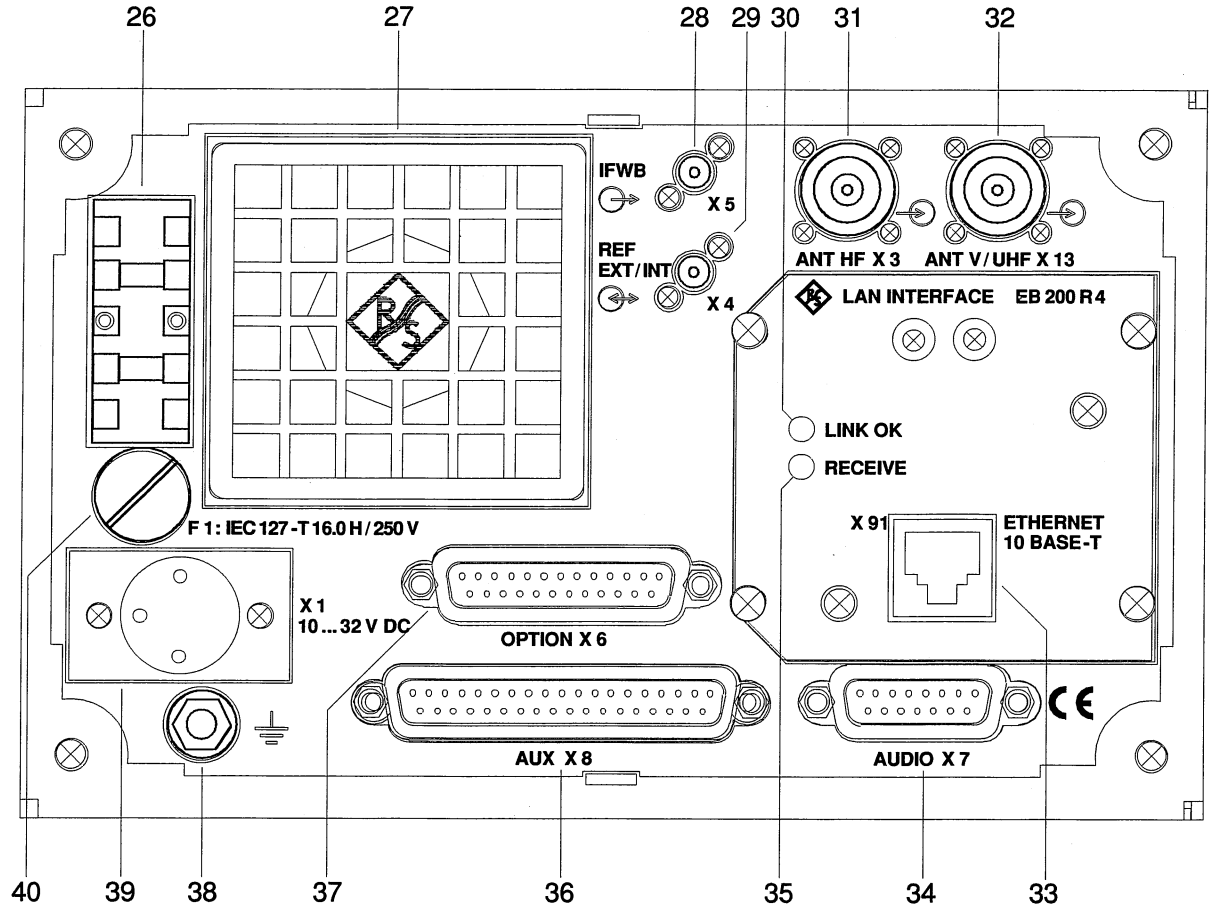


Fig. 2-1: Rear view

Pos.	Description	Function
26		Spare fuses
27	Fan	Temperature control
28	X5 IFWB	IF output, wide (10.7 MHz ± 1 MHz max.) Connection for panoramic display unit SMA connector, 50 Ω
29	X4 REF EXT/INT	Input for external reference signal or output for internal reference signal 10 MHz Selectable in menu SETUP-REF SMA connector, R_i = 500 Ω, R_{out} = 50 Ω
30	LINK OK	LED indicator
31	X3 ANT HF	Antenna input N connector, 50 Ω
32	X13 ANT V/UHF	Antenna input N connector, 50 Ω

Pos.	Description	Function
33	X91 ETHERNET 10 BASE-T	Connection for serial remote control LAN Western socket
34	X7 AUDIO	Audio output signals; signal level External speaker output by setting of the internal jumpers
35	RECEIVE	LED indicator
36	X8 AUX	Universal connectors Antenna number; control commands for external options; digital control inputs; digital AF for DAT recorder
37	X6 OPTION	Connection for external digital panoramic display unit (option) Digital IF Output, connection for software update
38	⏚	Ground bolt
39	X1 10...32 V DC	Connection for external DC power supply
40	F1: IEC 127 - T 16.0H / 250 V	Fuse

2.2 Speaker

The external speaker output is activated by setting an internal jumper which automatically sets the internal speaker out of order (see 5.2.4.2 Modules and Speaker Jumper).

2.3 Pin assignment of the connectors

For the pin assignment of the connectors refer to interface description 4056.6000.01 SB in the annex.

3 Operating Instructions

3.1 Description of the front panel

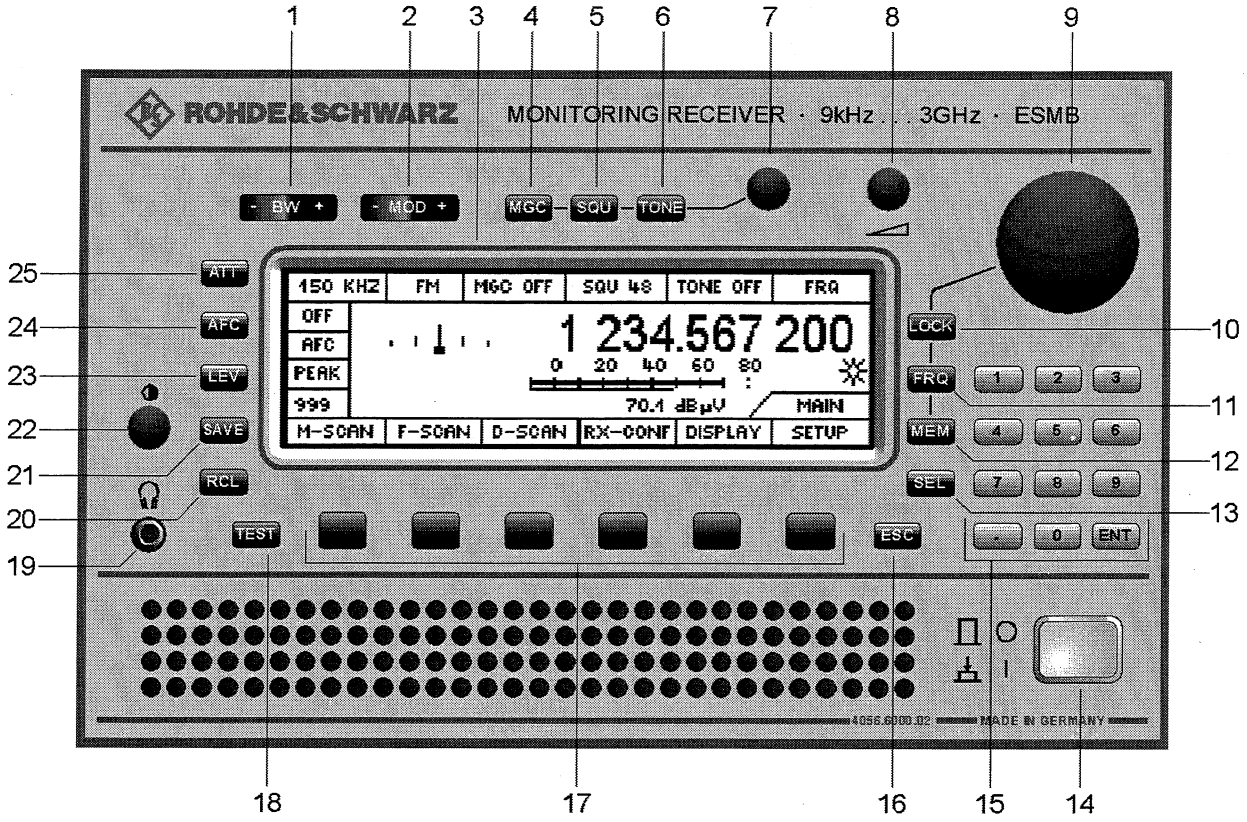


Fig. 3-1: Front view

Table 3-1: Controls and displays

Item	Designation	Function
1	BW	Bandwidth selection
2	MOD	Selection of modulation mode FM, AM, PULSE, CW, USB, LSB, PM, IQ, ISB
3	Display	The display is subdivided into the working area and the softkey area and also into areas for direct functions, VAR pot functions, menu names, spinwheel functions and the selector (see "Display" on page 6)
4	MGC	Switches MGC function on or off. Adjustments with potentiometer (7).
5	SQU	Switches the squelch function on or off. Adjustments with potentiometer (7).
6	TONE	Switches the tone function on or off. Adjustments with potentiometer (7).
7	VAR pot	Potentiometer for adjusting the values of MGC, SQU and TONE.
8	Volume control	Volume control for headphones, loudspeaker and loudspeaker-output on the rear panel
9	Spinwheel	Selects frequency, memory location or configuration parameters
10	LOCK	Key for enabling or disabling the spinwheel function
11	FRQ	Key for entering receive frequencies

Item	Designation	Function
12	MEM	Key for selecting the memory location number (0 to 999)
13	SEL	For selecting parameters in the configuration menu
14	ON/OFF switch	Switches the internal power supply on or off
15	Decimal keypad	For entering values into the editor, keys 0 to 9, decimal point and storage in the current selection with the ENT key. With the keys FRQ, MEM, MGC, SQU and TONE, the value is taken from the editor and stored directly.
16	ESC	Closes editor or temporary window or for moving a level upwards in the menu tree.
17	Softkeys	Function depends on the menu status. The key lettering is provided by the field above in the display.
18	TEST	Selftest is performed while the key is held down.
19	Headphone connector	Connector for headphones
20	RCL	Recalls values from a memory location to the receiver
21	SAVE	Saves receiver values to a particular memory location
22	Contrast control	Controls display contrast
23	LEV	Level display (PEAK, AVG, FAST, RMS)
24	AFC	Switches the AFC function on or off
25	ATT	Function for connecting the 30 dB attenuation path (on, off, and auto)

3.2 Overall view of operating elements and menus

- MOD +
Selects modulation mode FM, AM, PULSE, CW, USB, LSB, PM, IQ, ISB

- BW +
Selects IF bandwidth

MGC - SQU - TONE
Selects the manual gain control, squelch and tone function; values can be varied with the VAR potentiometer

ATT
Toggles between 30 dB attenuation ON, OFF or AUTO

AFC
Switches automatic frequency control on or off

LEV
Toggles between PEAK, AVG, FAST or RMS level display

SAVE

RCL
Writes to memory locations with SAVE reads from memory locations with RCL

TEST
Quick test

1 2 3

4 5 6

7 8 9

. 0 ENT
For writing values and storing with ENT as currently selected parameter.
The keys FRQ, MEM, MGC, SQU, TONE, SAVE and RCL transfer the value from the editor and store it directly.

LOCK
|
FRQ
|
MEM
Disable spinwheel functions with LOCK
Select frequencies with spinwheel function FRQ
Select a memory location with spinwheel function MEM

SEL
Selects a parameter in the configuration menu

ESC
For going a level higher in the menu tree or escaping from the editor

The functions of softkeys F1 to F6 depend on what menu has been selected. The currently selected function is displayed by the LCD.

MAIN menu

M-SCAN (scan with stored values)
- RUN (starts scan)
- STOP(stops scan)
- SUPP (suppresses memory location)
- CONFIG (selects configuration menu)
  - RUN (starts scan)
  - ACTIVATE (activates memory location)
  - SUPP (suppresses memory location)
  - DELETE (clears current memory location or all memory locations)
  - RX <-> MEM (swaps the receiver parameters with contents of memory location)

F-SCAN (frequency scan)
- RUN (starts scan)
- STOP (stops scan)
- SUPP (suppresses frequency range)
- CONFIG (go to configuration menu)
  - RUN (starts scan at from current frequency)
  - SUPP (suppressed frequency ranges)
    - SORT (sorts suppressed frequency ranges)
    - DELETE (deletes current line from the table)
    - DEL ALL (deletes the whole table)

D-SCAN (RF spectrum display, option)
- NORM DIFF (differential or normal spectrum)
- RUN STOP (sweep mode: listening mode)
- BW ZOOM (change-over to bandwidth-zoom mode)
- REF 25 (Y-scaling for 25, 50, 70, 90, 110 dB reference level)
- RNG 60 (Y-scaling 20, 40, 60, 80 dB of the spectrum display)
- CONFIG (change into the configuration menu)
  - NORM DIFF (normal or differential display of the spectrum)
  - MAX (max. hold in the spectrum display)
  - CLRWRITE (clear write in the spectrum display)
  - RNG 60 (Y-scaling for 20, 40, 60, 80 dB)
  - |<- ->| ^ (start, stop, marker frequency) or <-> >|< ^ (span- center-, marker frequency)

RX-CONF (receiver configuration)
- ANT/ATT (antenna)
- ATT (attenuation and operating modes)
- MEASURE (measuring time and cycle)
  - CONTIN (continuous measurement)
  - PERIODIC (periodic measurement)
- AF (AF parameters SPEAKER, TONE, BALANCE)
- SYSTEM (displays system data)
  - PROTECT (password protection)
    - EDIT PW (enter password)
    - DEL PW (delete password)
  - SW OPT (display and installation of software options)
    - INSTALL (installation of software options)
  - RESET (reset to the default values)
- TEST (selftest)
  - LONGTEST (starts overall test)

DISPLAY (menu display)
- DEFAULT (selection of display setting)
- IF-PAN (IF-panorama display)
- LEVEL (level measurement)
- TONE (signal tone whose pitch depends on the signal level)
- CONFIG (setting the display mode)
- MORE (more menus)

- FREQ (large frequency display)
- BANDW (bandwidth measurement)
- MVALUE (measurement-value display for modulation, offset, level and bandwidth measurement)
- CONFIG (setting of the selected display mode)
- MORE (back to previous menus)

SETUP
- KEYS (characteristics of spinwheel and keys)
- MESSAGE (configuration of the acoustic and optical messages)
- REF (internal or external reference frequency)
- AUX (configuration of the AUX port parameters)
- REMOTE (configuration of the remote-control parameters)
  - STANDARD (simple ASCII protocol through the RS232 interface)
  - RS232 PPP (point-to-point protocol through the RS232 interface)
  - APPLY (transfer of the parameters)
    - YES (acknowledgement of the parameter transfer)
    - NO (refusal of the parameter transfer)

3.3 Display

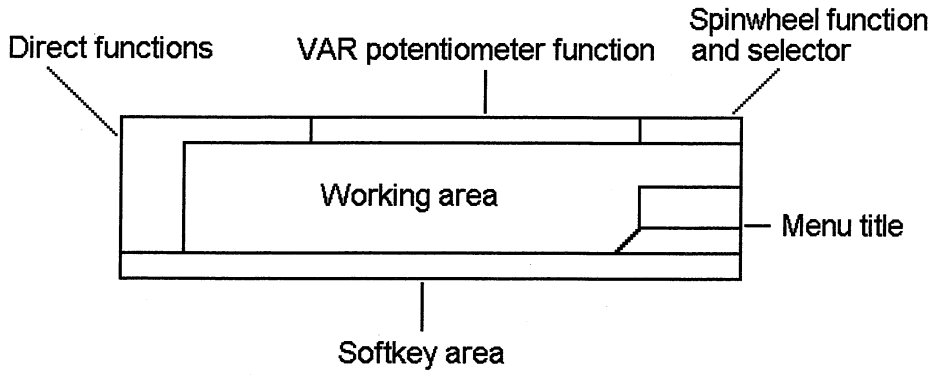


Fig. 3-2: Display

Working area

The working area can be expanded for certain, display-intensive menus or for panorama displays. Because of that the direct-function fields, the VAR potentiometer functions and the display area for the spinwheel functions may be partially or completely obscured.

Direct functions

The currently selected state of each key function (except softkeys) is displayed in an LCD window next to or below the key in question.

VAR pot functions

At the top of the display, there are three fields for the MGC, SQU and TONE functions. Their values can be adjusted with the digital VAR potentiometer.

Spinwheel functions

In the upper right hand corner of the display, there is a field in which the current function of the spinwheel (FRQ, MEM, LOCK) is displayed. If in a submenu for configuring a parameter, the spinwheel function is set to this parameter, the short designation or the symbol for this parameter (eg T_DWELL, T_NOSIG, CYCLES etc) is displayed in this field.

Softkey area

The six fields that provide the labeling for the softkeys below are provided for every menu status.

The softkey bar may be temporarily obscured by status and error messages.

Menu names

On the right-hand side of the screen above the softkey bar, there is a window for the name or designation of the menu that is currently activated.. The menu name always corresponds to the designation of the softkey that was used to activated the menu. If you are in a second or third level submenu, the names of the menus above are displayed above the menu name window.

3.3.1 Frequency display

The frequency display can be presented in different sizes but always at the same position in the working area of the display. When the IF-panorama option has been activated, the small frequency display is automatically selected.

All frequencies are displayed in MHz without a unit as standard; the step frequency is displayed in kHz with a unit.

The receive frequency is always displayed with six places after the decimal point.

The start and stop frequencies are displayed with only three places after the decimal point.

To make the numbers easier to read, their digits are marked off in groups of three.

3.3.2 Level display

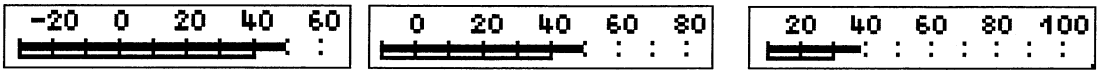
Level-bar display

The top bar shows the signal level with 1 dB resolution.

The lower bar shows the squelch threshold with 1 dB resolution.

The lowest value of the level scale is configurable with the parameter LOW BAR LIMIT in steps of –30, -10 and 10 dBµV.

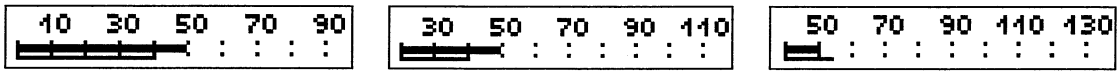
Scaling of the level-bar display with ATT OFF



LOW BAR LIMIT: -30 dBµV -10 dBµV 10 dBµV

Scaling of the level-bar display with ATT ON

With cut-in attenuator the scale moves by 30 dB to the top. This indication makes also clear, that the attenuation is switched on if ATT AUTO is set.



LOW BAR LIMIT: -30 dBµV -10 dBµV 10 dBµV

Large level-bar display

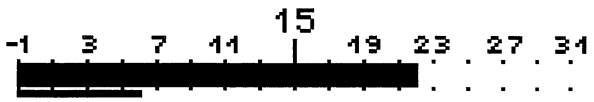
The top bar shows the signal level with 1 dB resolution.

The lower bar shows the squelch threshold with 1 dB resolution.

The scaling of the large level-bar display and the small level-bar display is the same in reference to the LOW BAR LIMIT and the ATT setting.

Wide level-bar display

For the operation mode TONE the level scale is widened around a tunable center.



Numeric level display

The numeric level value is also displayed in different sizes. The value is displayed in dBµV with a decimal point (resolution 0.1 dB).

At bandwidths ≤ 0,6 kHz, also level values ≤ -20 dBµV are displayed.

3.3.3 Offset display, TUNING

The offset display is configurable and can be presented as a numerical display or in the form of a tuning meter (TUNING).

Symbolic offset display

The bar, which is 5 pixels wide and 4 pixels high, moves to the right or the left from its central position depending on whether there is a positive or negative frequency offset (± 0.5 bandwidth).

The display is for the selected bandwidth and can only be used for qualitative assessments.

Numerical offset display

TUNING
−1.523 KHZ

The display is in kHz with three digits after the decimal point.

3.3.4 IF spectrum

The width of the IF-panorama display can be adjusted by the SPAN parameter.

The setting range is 150 Hz up to 1000 kHz in 17 steps. Additionally the width of the IF-panorama display can be set to COUPLED. In that case the width of the IF-panorama display corresponds always to the set IF-bandwidth.

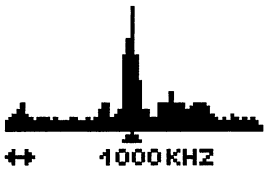
Appearance of the IF spectrum in the IF PAN display

Above this panorama display, the reference level REF, the displayable level range RNG and the current frequency span are displayed. The reference level corresponds to the highest display limit. The lowest display limit results from REF minus RNG.

With switched on squelch a horizontal line is indicated according to the squelch value in the spectrum. This line can be used for the measuring of the level of individual signals.

The level range RNG is represented by a vertical resolution of 30 pixels. The frequency span SPAN is represented by a horizontal resolution of 127 pixels.

Representation of the IF spectrum in the DEFAULT - Display



Below this panorama display the current frequency span (SPAN) is indicated.

The level range RNG is represented vertically with a resolution of 30 pixels. The frequency span SPAN is represented horizontally with a resolution of 63 pixels.

3.3.5 DATA lamp

DATA Indicates a data transmission in progress

Note:
The DATA lamp (remote data traffic) only appears in the KEYLOCK menu.

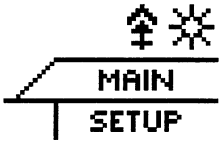
3.3.6 Symbols

'Signal > threshold display

The lamp symbol appears only above the menu name in the working area if the receive signal threshold is exceeded.

Overdrive indication

This symbol is flashing if the IF section is overdriven. Level measurement is possible without overdriving to approx. 85 dBµV (at ATT ON 113 dBµV). If the attenuation is set on 'ATT AUTO', the 30-dB attenuator switches on not before the overdriving limit of approx. 85 dBµV and with a hysteresis of approx. 7 dB it switches off again.



Note:
This display is obscured by the menu names when lower-level menus are selected.

Measuring mode display

At the position of the overdrive display, the currently active measuring mode of the unit may also be displayed alternatively. The relevant settings are available via the menu RX-CONF – Measure.

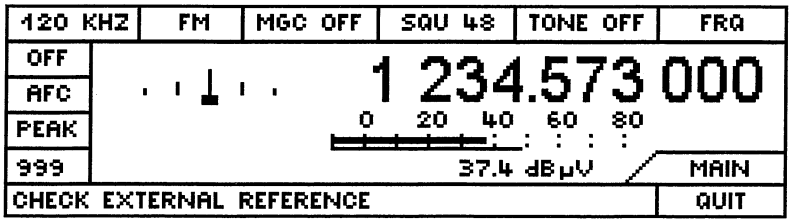
No display	The measuring time has been set to **DEFAULT and as measuring mode continuous** (**CONTIN**) measurement has been selected.
P	The measuring time has been set to **DEFAULT** and as measuring mode periodic (**PERIODIC)** measurement has been selected.
M C	A specific measuring time has been set and as measuring mode continuous (**CONTIN**) measurement has been selected.
M P	A specific measuring time has been set and as measuring mode periodic (**PERIODIC**) measurement has been selected.

Memory location status display (information to the right of the memory location number)

	empty	not set
▫	full	not set
·	empty	set
▪	full	set

FULL	refers to the memory location filled with receiver parameters
NOT SET	corresponds to 'suppressed', SUPP softkey in the menu M-SCAN
SET	corresponds to 'activated', ACTIVATE softkey in the menu M-SCAN - CONFIG

3.3.7 Status and error messages



A window for error messages can be temporarily opened by means of the softkeys. Depending on the configuration, the window will remain open for a certain time or continuously. However, you can close the window whenever you want with the QUIT softkey.

The ESC and ENT keys can also be used to close the window.

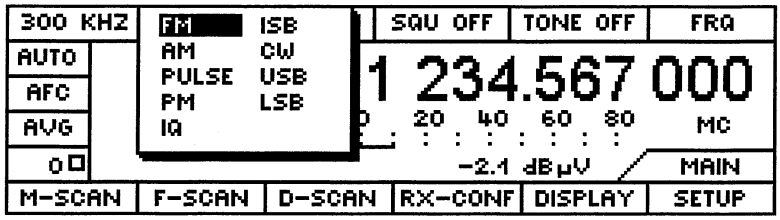
3.4 Direct keys

Note:
When you press the keys MOD, BW, MGC, SQU, TONE, ATT, AFC and LEV once, the next selection is activated. The displayed window shows the already changed setting.

3.4.1 MOD key (modulation modes)

Selection of one of the modulation modes FM, AM, PULSE, CW, PM, IQ, ISB, LSB, USB by means of the + or – function of the key.

When you press the MOD key, the pulldown menu shown below with a number of items for selection is displayed. When you press the key once, the next selection is activated. In the pulldown menu, the currently selected modulation mode is shown in inverse video.



If you continue to press the key, the next selection is activated. The toggle function is cyclic - in other words the selections loop round from the end to the start or from the start to the end.

The pulldown menu disappears after about 2 to 4 seconds, or if another key is pressed.

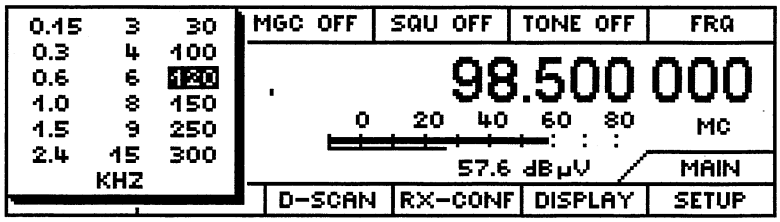
3.4.2 BW key (bandwidth)

IF bandwidth selection

Under the BW key, the LCD indicates the currently selected value of the IF filter in inverse video.

As with the modulation modes, a pulldown menu is used for selection.

The sequence of bandwidth selections is not cyclic - in other words you have to change direction at the ends of the sequence.



Note:
If the receiver is being operated in the HF range (up to 30 MHz), an IF selection of ±5 kHz will be effective. However, the selection of IF bandwidth ≥15 kHz won't be suppressed.

3.4.3 MGC-SQU-TONE keys and VAR potentiometer

All three functions can be turned on or off. In the ON state, a setting value can be assigned. This value can be adjusted with the VAR potentiometer (on the left next to the volume control).

The functions are independent and switching on one function need not necessarily have an effect on another.

The following applies to all three functions:

When you press a key (MGC, SQU or TONE), the function is turned on and, at the same time, the digital pot for adjusting the associated setting value is activated.

The lettering (MGC, SQU or TONE) and the presentation of the value in inverse video indicate that variation with the digital pot has been selected.

If the function has already been selected and the same key is pressed again, the function is turned off. The following is then displayed in the appropriate field:

MGC OFF (= AGC)

SQU OFF

TONE OFF

When you press a key, one of the three functions goes from the OFF-state to the ON-state and is simultaneously selected, the selection of one of the other two functions being cancelled.

The values are displayed in dBµV.

MGC key

Switching the MGC function on or off (switch over from MGC to AGC)

MGC is short for Manual Gain Control (gain control by potentiometer).

AGC is short for Automatic Gain Control.

The MGC or AGC status (corresponds to MGC OFF) is presented below the MGC key on the display.

If MGC is selected, MGC is displayed with a value between -30 and 110.

The unit of the MGC value is dBµV.

SQU key

Turning the squelch function on or off

The SQU status is presented below the SQU key on the display.

If SQU is turned off, SQU OFF is displayed.

If SQU is turned on, SQU is displayed with a value between -30 and 110 (threshold value).

The unit of the SQU value is dBµV.

TONE key

Turning the tone function on or off

The TONE status is presented below the TONE key on the display.

If TONE is turned off, TONE OFF is displayed.

If TONE is turned on, TONE is displayed with a value between -14 and 94 (tone reference value).

The unit of the TONE value is dBµV.

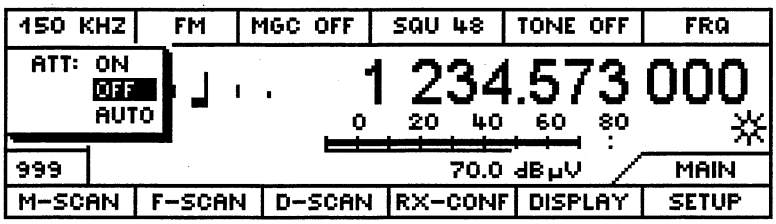
-14 dBµV = minimum level -30 dBµV + 16 dB

94 dBµV = maximum level at ATT ON 110 dBµV - 16 dB

Starting from this value, the level scale is expanded in the range -15 to +15 dB and the level magnitude is represented by the pitch of a tone (0 dB corresponds to about 400 Hz). The TONE function is a frequency tone, proportional to the input level.

3.4.4 ATT key (attenuator)

Multiple toggle ON, OFF, AUTO for the function that connects the 30 dB attenuation path.



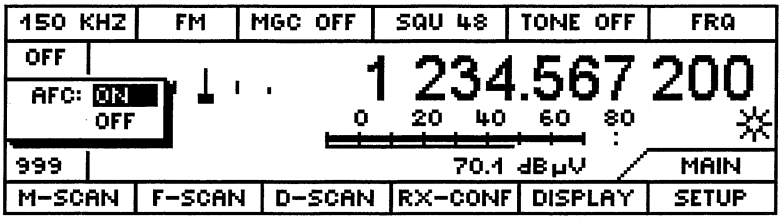
The selected function is displayed.

In the AUTO position the attenuation path is switched on immediately before the tuning limit of the IF section is reached and with a hysteresis of 7 dB it is switched off again.

One can indirectly recognize the current condition by the scaling of the level bar. See also "Level display" on page 8.

3.4.5 AFC key (automatic frequency control)

Turning the AFC function on or off

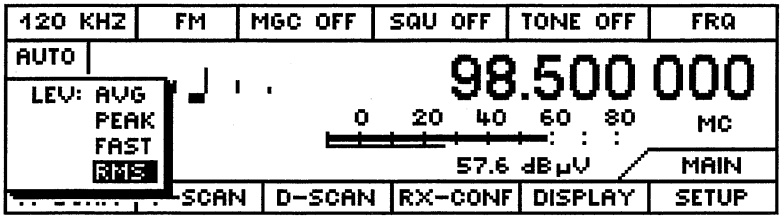


When the AFC is on, the lettering is in inverse video.

After pressing the AFC key (automatic frequency control) the frequency of the receiver is followed up automatically to a changing signal frequency. The range of the AFC corresponds approx. to the selected IF-bandwidth. At built up AFC the offset indication (TUNING) is centered. The AFC function can be activated at AM, FM and PULSE.

3.4.6 LEV key (level indicator)

Multiple toggle AVG, PEAK, FAST, RMS



The selected function is displayed.

3.4.7 SAVE and RCL keys (memory functions)

Writing to and reading from memory locations

With **SAVE,** the receiver settings are transferred to a memory location. The configuration of the SAVE key determines on which memory location the settings are stored (see also "KEYS" on page 53).

With, **RCL** the contents of the memory location with the number shown in the MEM window are transferred to the receiver.

If a number was entered before SAVE or RCL was pressed, then this number will be interpreted as a memory location number.

3.5 Decimal keypad

Keys 0 to 9, decimal point and Enter key (ENT)

The effect of pressing the **ENT** key is to store the value in the editor as the currently selected parameter.

As there is no CLR key and no +/- key, these functions are implemented as softkeys in the temporary editor (see "POP-UP editor" on page 22).

3.6 Spinwheel (rotary pulse generator)

The spinwheel excites 24 bursts per spin and has a magnetic indexing mechanism.

In the configuration menus, the spinwheel is used for the change of selected parameters.

The spinwheel is generally used to set receive frequencies in the menus. Different progressions can be selected in the menu SETUP: KEYS. For the tuning of the frequency in a channel spacing an increment per spinwheel burst can be defined through INCR VALUE.

3.7 Keys for selecting the spinwheel functions

FRQ and MEM are selection keys with a fixed parameter assignment. They also act as Enter keys for these parameters.

FRQ Key for entering receive frequencies

MEM Key for selecting the memory location (0 to 999)

LOCK Key for enabling and disabling the spinwheel functions

Example:

By entering the number 78 with the decimal keypad and then pressing the MEM key, you can select memory location 78. The frequency can also be selected independently at the same time with the spinwheel, if the FRQ field is active.

Pressing the MEM and FRQ keys only causes a switchover of the spinwheel function, if a numerical entry has not been made previously.

If the FREQ key is pressed whenever a receive frequency has already been selected then the receive frequency is rounded off to the next channel spacing. The channel spacing can be set in the menu SETUP: KEYS through parameter INCR VALUE (see also KEYS on page 53).

At the top right of the LCD, there is a field which displays the current status of the spinwheel function: LOCK, FRQ or MEM.

At this point, the designation of a configuration parameter can also be displayed (see "Select key (SEL)" on page 19).

If LOCK is displayed, the spinwheel has been deactivated. If you now turn the spinwheel, the display will flash.

3.8 Memory functions

If you want to modify the contents of a memory location, the contents of the memory location must be transferred to the receiver with RCL (see "SAVE and RCL keys (memory functions)" on page 16), modified with the hardkeys or softkeys in RX-CONF (see "RX-CONF (receiver configuration)" on page 36) and stored again with SAVE.

The SAVE and RCL (recall) keys are used to read and write receiver states from and to the 1000 memory locations.

The setting and resetting of memory locations is handled by softkeys in the M-CONF menu.

The display window for the memory locations also contains a symbol with features that indicate whether the memory location is full, or empty, or set, or not set, for polling (see "Symbols" on page 11).

3.9 Menu-control keys

The SEL key is used to select parameters in the configuration menu.

Toggle and increment or decrement functions can be operated by means of the spinwheel.

3.9.1 Softkeys

The functions of the softkeys are determined by the current menu status. The softkey labeling is provided by the LCD field above each key.

3.9.2 Escape (ESC)

When the ESC key is pressed once, one step is taken up the menu tree.

This key is used to abort the editor.

Temporary windows (eg error messages) are also closed.

3.9.3 Select key (SEL)

The SEL key is used to select parameters in the configuration menu.

When a configuration menu is entered, the selector always jumps to the parameter that was edited the last time in this menu.

The short designation of the selected parameter (eg F-START, F-STOP, F-STEP, T_DWELL, T_SIGNAL etc) is displayed in the spinwheel selector window, provided that the spinwheel functions have not been cancelled with LOCK.

If LOCK has been activated and the editor has been started by entering a number, the selector is nevertheless displayed in the spinwheel window provided that the editor is open.

If the spinwheel is turned in that state, LOCK flashes.

3.9.4 Relationship between the FRQ, MEM, SEL and LOCK keys

FRQ and MEM are selection keys with permanently assigned parameters. Their function does not depend on the menu status.

The SEL key is an alternative to the FRQ and MEM keys

Example:

If FRQ is pressed in a configuration menu, the selection of the current parameter is overridden and it becomes possible to tune the receive frequency with the spinwheel. When the SEL key is pressed, selection is switched back to the previous configuration parameter.

In every case, the LOCK key disables the spinwheel. The LOCK state does not have any influence on the SEL function.

3.10 TEST key

The "short test" is run while the TEST key is held down.

During the "short test" an amplitude-modulated line spectrum (64-MHz grid) is fed in behind the antenna input and the receiver is tuned to the line frequency which is the closest to the current receive frequency. Then the complete receive-path from the antenna input of the tuner is measured up to the AF-processing and weighted.

If all data are within the permissible limits, the message "TEST OK SIGNAL PATH" is output. If the measured level is not in the expected range, the message "SENSITIVITY OUT OF RANGE" is output.

3.11 ON/OFF switch

This switch turns the operating voltage to the ESMB, which is generated by a DC/DC converter, on or off.

The backlit LCD indicates when the ESMB is ON.

The selected parameters are stored.

3.12 Contrast control

The contrast control is used to set the vertical reading angle for the LCD display, to adapt it to the workplace and to compensate for the temperature dependence of the LCD. This function cannot be altered from the menus.

3.13 VAR pot (MGC, SQU, TONE)

The digital potentiometer which has 24 switch positions per turn is used to vary the MGC values, the threshold and the tone values. The value in inverse video is the one that can be varied with the pot.

3.14 Volume potentiometer

The digital potentiometer which has 24 switch positions per turn is used to vary the AF level. The levels at the headphone connector, the integral loudspeaker and at the regulated AF-output on the rear panel can be adjusted.

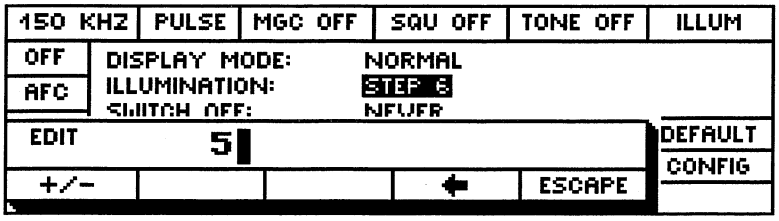
The volume of the BEEP and the sound of the key click are configured separately in the SETUP-MESSAGE and SETUP-KEYS menus, respectively (see "**SETUP**" on page 53).

3.15 Headphone connector

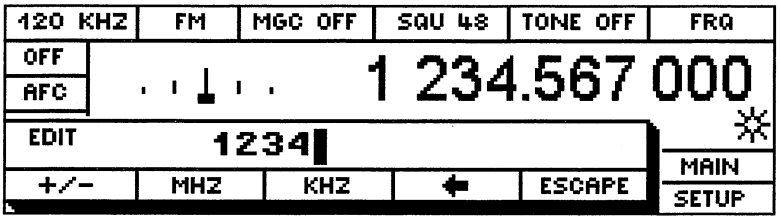
A 3.5-mm stereo banana socket for headphones is provided on the front panel. When the headphone is plugged in, the loudspeaker is not turned off automatically but it can be cut off by menu 'AF configuration' (see "AF configuration" on page 40).

3.16 POP-UP editor

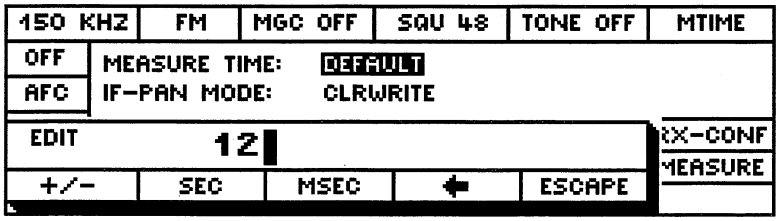
When one of the decimal keys (0 to 9 and the decimal point) is pressed for the first time, a temporary EDIT window is displayed above the softkey bar; all numerical entries are shown in this window.



The EDIT window does not have preferred values. Exceptions are the MHZ and the KHZ key. These two keys will only be displayed if the spinwheel function is connected to a frequency.



If a time parameter was selected, the time units SEC and MSEC are presented as ENTER keys.



While the editor window is open, you can continue to use the spinwheel to adjust the selected parameter (e.g. FRQ or F-START).

Value transfer with the ENT key

When the Enter key is pressed, the value becomes the value of the parameter displayed in the spinwheel selector window. Either FRQ or MEM is displayed in the spinwheel selector window or the name of a selected parameter from the configuration menu.

Value transfer with the FRQ, MEM, SQU, MGC, TONE, SAVE and RCL keys

The value can also be turned into the value of the parameter in question with one of these function-linked Enter keys.

3.16.1 Softkeys in the editor window

MHZ softkey

The basic unit of all frequencies is always MHz. From that this softkey has the same importance as the ENT key does.

KHZ softkey

The basic unit of all frequencies is always MHz. To make kHz entries easier, a KHZ softkey has also been provided. Pressing the KHZ key multiplies the entered value by a factor of 10^{-3} and transfers it (Enter function). If the selected parameter is not a frequency, the KHZ softkey is disabled and not displayed.

SEC softkey

The basic unit of all times is always seconds. From that this softkey has the same importance as the ENT key does.

MSEC softkey

The basic unit of all times is always seconds. In order to facilitate the input of milliseconds, there is the MSEC softkey in addition. This causes that the entered value is multiplied by the factor 10^{-3} and taken over (enter function). If the selected parameter is not a time, no MSEC softkey appears then.

<- softkey

The arrow key is used to clear falsely entered characters.

ESC softkey

The ESC softkey as well as the ESC key closes the editor window without any value being transferred.

Sign change

By pressing the +/- softkey, you change the sign of a number.

3.17 Changing configuration parameters

A selected parameter can be changed in the F-SCAN, M-SCAN and D-SCAN configuration menus and in the SETUP submenus. Parameters can be selected by using the SEL softkey.

Numerical and non-numerical parameters can be changed by the spinwheel and the decimal keypad.

In the case of non-numerical parameters, the digits referred to below are interpreted in the following way:

'0' is equivalent to OFF

'1' is equivalent to ON

'.' is equivalent to the infinity sign (eg CYCLES parameter)

As the ESMB does not have any CURSOR keys, toggle and increment or decrement functions are implemented by means of the spinwheel.

In order to be able to also enter non-numerical parameters when the spinwheel is locked, the numbers 0, 1, 2, etc. refer to these parameters correspondingly. Thus by pressing a number and the ENT button a parameter is selected.

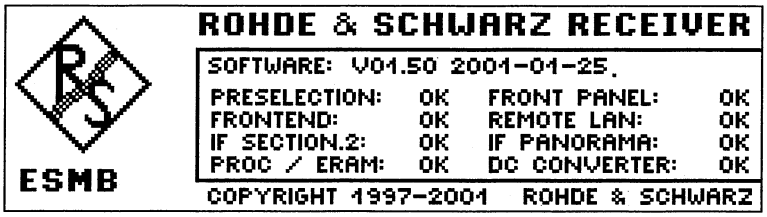
3.18 Softkey menus

The current menu is indicated indirectly by the display format.

The name of the menu will be found in a window above the SETUP softkeys.

POWER-ON menu

This menu display is shown for 30 s whenever the ESMB is turned on.



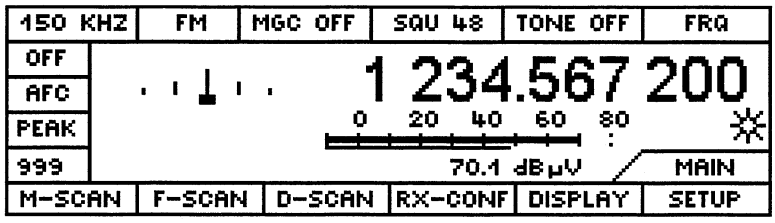
Note:
If the processor is supplied with expansion-RAM then **PROC/ERAM** *will be displayed instead of* **PROCESSOR**.

As soon as keys or knobs are used, the MAIN menu appears.

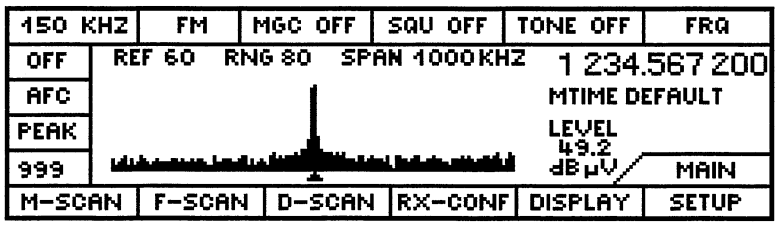
MAIN menu

The MAIN menu can be recognized at the MAIN menu title at the lower right-hand side, above the softkey area. Depending on the configuration, this menu can have a different appearance. Two variants are represented here as examples. Further variations can be selected and configured in the DISPLAY submenu.

MAIN menu default setting



MAIN menu with DISPLAY-IF-PAN

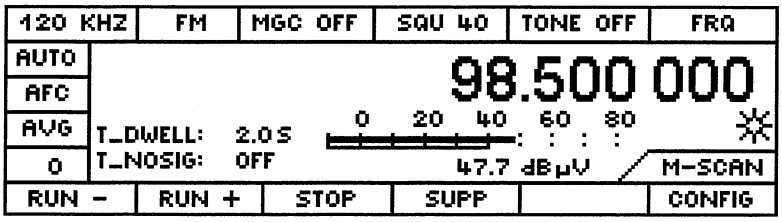


The MAIN menu is accessible from any submenu by repeatedly pressing the ESC key.

3.18.1 M-SCAN

The ESMB contains 1000 definable memory locations. Every memory location contains the essential receiver parameters such as frequency, modulation mode, bandwidth, squelch, antenna number, attenuation and AFC. In the operation mode Memory Scan the stored and activated channels are scanned in a periodical way on occupancy . On the busy channels, the ones with a signal being higher than the current squelch threshold, the search run continues for a definable time. The effective squelch threshold can generally be set by the squelch potentiometer or loaded during the search run from every memory location.

This menu is obtained by pressing the M-SCAN softkey in the MAIN menu.



Softkeys

RUN-: Scan starts from current memory location, decreasing location numbers

RUN+: Scan starts from current memory location, increasing location numbers

Note:
If the current RUN key is in inverse video this tells you that an M-SCAN is being performed. If the RUN key is pressed and it is in inverse for only a short time then no memory location was set for this operation. The scan can also get by itself from the run-state to the stop-state if the CYCLE-COUNT is reached.

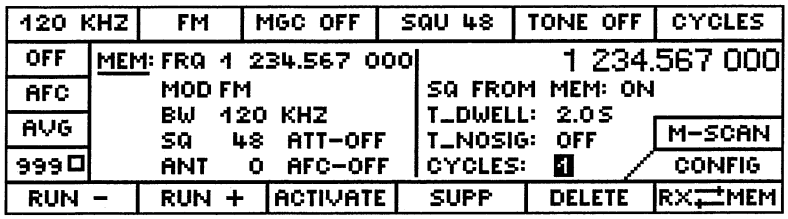
STOP: Stops scan

SUPP: Memory location with MEM number is suppressed or skipped

CONFIG: Selects the M-SCAN CONFIG configuration menu

3.18.1.1 M-SCAN - CONFIG

This menu is obtained by pressing the CONF softkey in the M-SCAN menu.



Softkeys

RUN-: Scan starts from current memory location number, decreasing frequency, menu change after M-SCAN

RUN+: Scan starts from the current memory location number, increasing frequency, menu change after M-SCAN

ACTIVATE: Memory location with the number MEM-NO set for scanning

SUPP: Memory location with number MEM-NO is suppressed

DELETE: Branching to temporary pop-up menu with repeated scan (see "M-SCAN - CONFIG - DELETE" on page 28)

RX <->MEM: The receiver parameters values are swapped with the values in the memory location

Memory location contents MEM:

FRQ Receive frequency

MOD Demodulation mode

BW Bandwidth

SQ Squelch OFF or squelch value

ANT Antenna number (controlled by CPU in stationary mode)

ATT Attenuation

AFC Automatic frequency control (only relevant for listen mode)

The following parameters are global and are **not** stored at any memory location:

LEV Level indicator (not relevant when M-SCAN is running)

MGC/AGC Gain control (depends on the current reception conditions)

Configuration of the scan-run parameters

The parameters T_DWELL, T_NOSIG and CYCLES can be selected with SEL and then varied with the spinwheel or entered by the editor.

SQ FROM MEM	Squelch status and value from memory location:	ON / OFF
T_DWELL	Dwell time:	0.0 to 10.0 s / infinity
T_NOSIG	Signal-controlled scan after pause:	OFF / 0.0 to 10.0 s

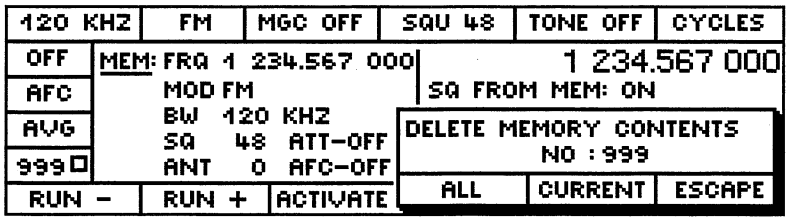
The hold time **T_NOSIG** can well be used to skip non-speaking times in radio communications. In order to control the dwell time by a signal of an occupied channel, the parameter **T_NOSIG** is required additionally. If a hold time is defined for the parameter **T_NOSIG**, the signal bit is queried during the normal dwell time **T_DWELL** in a periodical way. The signal bit corresponds to the signal on pin 6 of the audio connector X8 at the rear panel of the ESMB and indicates whether the instantaneous signal level is above the squelch value. If the signal bit disappears, the hold time is activated. After the hold time has elapsed the scanning will continue with the next frequency. If, however, the signal bit emerges during the hold time again, the hold time is stopped and the disappearance of the signal is waited for again. Thus the hold time behaves like a monoflop that can be retriggered and abort the normal dwell time **T_DWELL** early. If **T_NOSIG** is OFF after **T_DWELL** has elapsed the scanning will proceed with the next frequency independently from the state of the signal bit.

CYCLES	Number of scan cycles:	1 to 1000 / infinity
STATUS	Softkeys ACTIVATE or SUPP (see "Symbols" on page 11)	
MEMORY	Memory location number (selected by spinwheel and entered by MEM key)	

Note:
The parameters FRQ, MOD, BW, SQ, ATT, ANT and AFC are directly displayed parameters and cannot be directly edited in the memory location. They can only be modified by exchanging the contents of the current memory location with the data of the receiver by the ***RX <->MEM*** *key and then editing them and exchanging them once again.*

3.18.1.2 M-SCAN - CONFIG - DELETE

This menu is obtained by pressing the DELETE softkey in the M-SCAN - CONFIG menu. A window with commands for deleting memory location contents opens.



Softkeys

ALL: Delete all

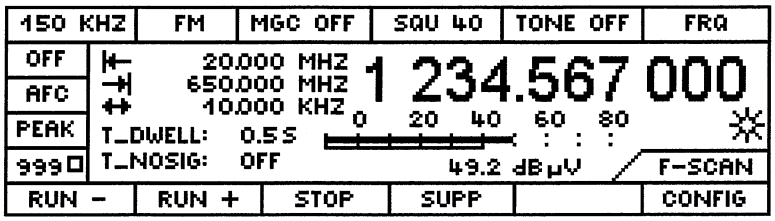
CURRENT: Delete current memory location (select with the MEM key, then choose the memory location with the spinwheel)

ESCAPE: Nothing is deleted, window is closed

3.18.2 F-SCAN

In the operation mode F-SCAN a frequency range which is defined with start frequency and stop frequency is monitored during scanning. To the current frequency the step frequency is added or subtracted from it and the resulting frequency is set. For every set frequency the level is measured. On the occupied channels, that is, channels with a signal bigger than the set squelch threshold, the scanning stops for a definable time. The effective squelch threshold can be tuned with the squelch potentiometer. The IF bandwidth should be at least as large as the selected stepwidth.

This menu can be obtained by pressing the F-SCAN softkey in the MAIN menu. The MAIN menu contains frequency scan menus.



Displayed parameters

|<-	Start frequency:	9 kHz to 3 GHz
->|	Stop frequency:	9 kHz to 3 GHz
<->	Step frequency:	1 Hz to 10 MHz
T_DWELL	Dwell time:	0.0 to 10.0 sec / infinity
T_NOSIG	Signal-controlled scan after pause:	OFF/ 0.0 to 10.0 sec

Definition of **T_DWELL** and **T_NOSIG** see **Configuration of the scan-run parameters** on page 28.

Softkeys

RUN-: Scan starts from current frequency or from stop frequency, decreasing frequency

RUN+: Scan starts from current frequency or from start frequency, increasing frequency

Note:
When the current RUN key is in inverse video, this indicates that an F-SCAN is being performed. If the RUN key is pressed and it is in inverse for only a short time then the complete scan range is suppressed.

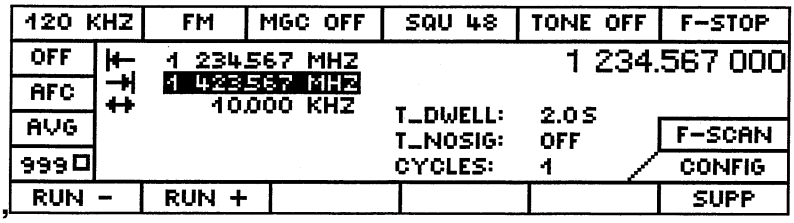
STOP: Stops the scan

SUPP: The SUPP function suppresses a frequency range. This frequency range is derived from the current frequency +/- ½ bandwidth. Up to 100 frequency ranges can be stored and edited in the menu F-SCAN CONFIG SUPP.

CONFIG: Goes to the F-SCAN CONFIG configuration menu

3.18.2.1 F-SCAN - CONFIG

This menu is obtained by pressing the CONFIG softkey in the F-SCAN menu.



Softkeys

RUN- Scan starts from the current frequency or the stop frequency with decreasing frequency. There is a menu change after F-SCAN.

RUN+ Scan starts from the current frequency or the start frequency with increasing frequency. There is a menu change after F-SCAN.

SUPP Goes to the F-SCAN CONFIG SUPP configuration menu

Configuration of the scan-range parameters

Select F-scan range

|<- Start frequency:10 kHz to 3 GHz

->| Stop frequency:10 kHz to 3 GHz

<-> Step frequency:1 Hz to 10 MHz

Configuration of the scan-run parameters

T_DWELL Dwell time: 0.0 to 10.0 sec / infinity

T_NOSIG Continues under signal control after pause: OFF/ 0.0 to 10.0 sec

For definition of **T_DWELL** and **T_NOSIG** see "**Configuration of the scan-run parameters** on page 28.

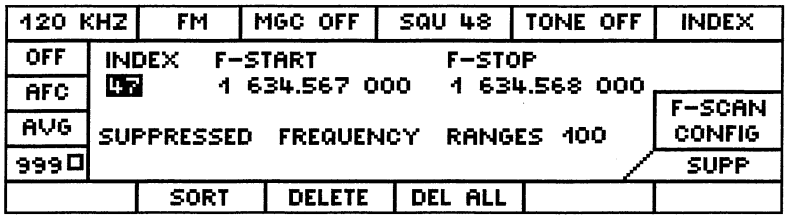
CYCLES Number of scan cycles: 1 to 1000 / infinity

Note:
Scanning can change from the RUN state into the STOP state by itself if the CYCLE-COUNT is reached.

3.18.2.2 F-SCAN - CONFIG - SUPP

This menu is obtained by pressing the SUPP softkey in the F-SCAN-CONFIG menu.

Only one line of the table with the suppressed frequency range is edited at a time.



Configuration parameters

INDEX Current line number of the suppress table: 0 to 99

F-START Start frequency of the suppressed range

F-STOP Stop frequency of the suppressed range

Displayed parameters

SUPPRESSED FREQUENCY RANGES Current number of suppressed frequency ranges: 0 to 100
The number can be optimized by the SORT function.

Softkeys

SORT: Sorts the suppressed frequency ranges in order of increasing frequency and, as appropriate, combines ranges that are contiguous

DELETE: Deletes the current line in the table

DEL ALL: Deletes the whole table

This menu is obtained by pressing the DEL ALL softkey.

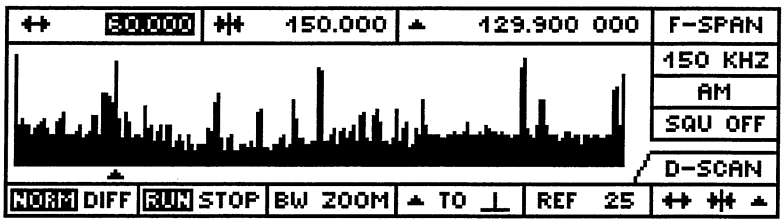
Softkeys

YES The whole table will be deleted.

NO Abort

3.18.3 D-SCAN (option)

This menu is obtained by pressing the D-SCAN softkey in the MAIN menu.



The marker position is highlighted through a dashed line. To the right next to the marker, the level measured at the marker position is represented in a tracking window. Thus individual signals can be measured for level and frequency.

Softkeys

The softkeys display the current corresponding status.

NORM DIFF: Toggle key: Differential or normal spectrum

RUN STOP: Toggle key: Sweep mode: listening mode (frozen spectrum)

BW ZOOM: Toggle key: Change-over to bandwidth-zoom mode

^ TO ⊥ : Start action: Mark to peak

The frequency marker jumps over to the next relative level maximum that is to the right of the marker in the DSCan spectrum at SQU OFF. If the squelch function is switched on, the frequency marker is set to the next level maximum on the right above the squelch line. If no further level maximum is available on the right of the current level maximum, the frequency marker jumps over to the first level maximum on the left in the DSCan spectrum.

RNG 60 4-way toggle key: Y-scaling (20, 40, 60, 80 dB sweep width)

CONFIG Switch over to the configuration menu D-SCAN CONFIG

Symbols

^ Marker or receiver frequency

|<- Start frequency

->| Stop frequency

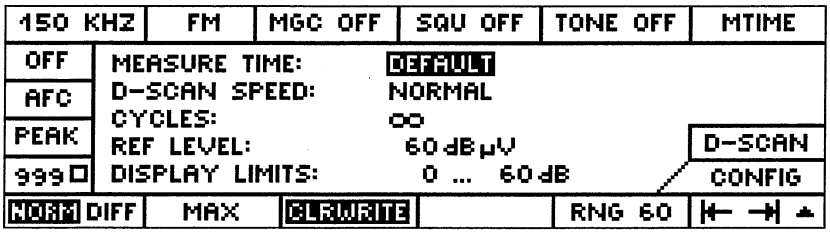
<--> Span frequency range (= stop frequency - start frequency)

->|< Center frequency (= stop frequency + start frequency / 2)

Note:
Owing to system conditions, the sweep width of 9 to 200 kHz for IF filter bandwidth 15 to 150 kHz cannot be used. The sweep width of 9 to 60 kHz for IF filter bandwidths < 15 kHz cannot be used.

3.18.3.1 D-SCAN CONFIG

This menu is obtained by pressing the CONFIG softkey in the D-SCAN menu.



Softkeys

Each softkey shows the currently active state.

NORM DIFF	Toggle key:	Normal or differential display of the spectrum
MAX	In the spectrum the peak values are represented	
CLRWRITE	In the spectrum the current values are represented	
RNG 60	4-way toggle key:	Y-scaling (20, 40, 60, 80 dB display range)
|< >| ^	Toggle key:	Parameter selection, start, stop, marker frequency or
<-> ->|<- ^		span, center, marker frequency

Configuration of D-SCAN parameters

MEASURE TIME Measuring time: DEFAULT / 0.5 msec to 900 sec

MEASURE TIME is valid globally for all measuring functions and can also be set in some other CONFIG menus. In some cases the name is shortened from lack of space with MTIME.

D-SCAN SPEED Scan speed: MTIME PER CHANNEL / LOW / NORMAL / HIGH

In the position **MTIME PER CHANNEL** the hardware-supported sweep mechanism of the DSCAN is not used, but a step-by-step incrementing of the frequency as in the F-SCAN. That way it is possible to carry out the level measurement with a defined measuring time for each channel. This operation mode is suitable for the measurement of impulsive noise with simultaneous representation of the spectrum on the display of the ESMB.

The digital scan can not be stopped in his procedure. Therefore the generated data can disappear, if they are not picked up fast enough at the remote control interface. The maximum data quantity at the remote control interface can be determined indirectly by setting the DSCan speed.

The position **NORMAL** corresponds to an average speed with which under good preconditions all resulting data can be passed on through the Ethernet interface by means of TCP to an application. This is the default setting after switch-on of the ESMB and corresponds to the DSCan speed corresponding to firmware versions up to V01.07.

The position **LOW** corresponds to a speed that is smaller by eg a factor around 10 than in the position NORMAL. The maximum data quantity limit is around 6 Kbyte/s. With this setting it is possible to transfer all data via the RS232 PPP interface by means of UDP.

The position **HIGH** corresponds to the maximum speed. The data quantity can amount to as much as 320 Kbyte/s. The resulting data can then be transmitted only through the Ethernet interface and by means of UDP to an application.

CYCLES	Number of sweeps	1 to 1000 / infinite
REF LEVEL	The reference level determines the largest level value to be represented. It can be set in the range of 0 to 110 dBµV in steps of 10 dB. Also intermediate values can be set via remote control or by means of direct number input.	
DISPLAY LIMITS	Display range of the spectrum:	eg –20 dBµV to 60 dBµV

Initially the upper value of the DISPLAY limits is firmly linked to the reference level.

If, however, the SW option EB200FS (Field Strength Measurement) is fitted, the upper value of the DISPLAY LIMITS can be configured independent of the reference level. In this case it can be varied in the range from 0 to 250 dB in 10-dB increments. Shifting the display range to values near 250 dB is only necessary if very high antenna k-factors are to be taken into account.

The lower value is calculated from the upper value of the DISPLAY limits minus the current RNG.

Note:
The measuring time is only relevant if D-SCAN SPEED is set on MTIME PER CHANNEL. In this case a frequency scan is really carried out and the results are represented as a spectrum.

3.18.3.2 D-SCAN cycle

When D-SCAN (digital scanning) is running (RUN is shown in inverse video), the synthesizer is being tuned to the exact frequency of the channels. Channel spacing always equals half the IF bandwidth. The level of each channel is being measured. The displayed spectrum is derived from the sum of the measured levels

The number of channels is derived from the span frequency divided by half the IF bandwidth. The higher the number of channels is, the longer takes the D-SCAN cycle.

3.18.3.3 Spectrum display NORM (normal)

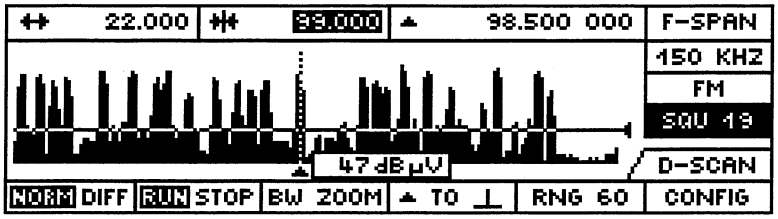
The display always shows a spectrum of 190 level lines according to its pixel resolution and it does not depend on the number of channels. If the number of channel exceeds 190, the measured values of several channels will be combined in a way that the respective highest level will be displayed. The frequency of the channel with the highest level will be stored in the background so that the correct frequency can be set for the mark-to-peak process.

However, through the remote control interface, all measured channels are always output. In this case the representation reduced to 190 lines is not available.

If the number of channels is smaller than 190, several level lines will get the same length from which a spectrum of rough steps is derived.

The level is indicated by 35 pixels in the y-axis. The resolution can be set in four steps by the **RNG** softkey. In order to avoid overdriving of the receiver, the reference level is set to the highest expected positive signal level. Every desired reference level can be set via remote control by command `VOLTage:AC:RANGe` in the range of 0 to 110 dBµV.

3.18.3.4 Spectrum display NORM with squelch on

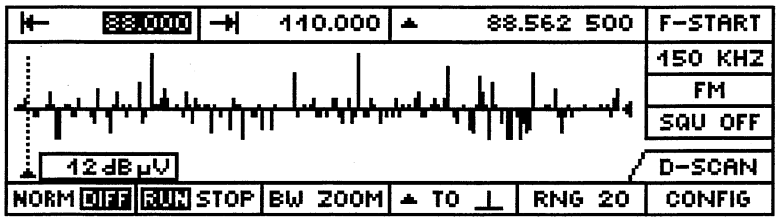


When the squelch is set on, the squelch line is displayed at a y-position corresponding to the squelch value. Furthermore the function of the mark-to-peak softkey is extended so that every time the softkey is pressed, the mark jumps to the next signal maximum above the squelch line, one after another.

3.18.3.5 Spectrum display in STOP mode

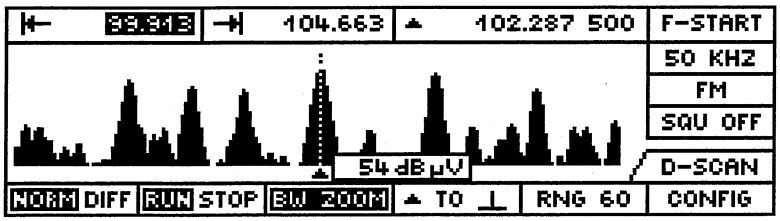
If a spectrum was generated and displayed in the RUN mode and STOP is pressed then the current spectrum will be frozen. The receiver sets the mark frequency. By pressing mark-to-peak softkey there will be a jump to the next signal maximum which can be listened to.

3.18.3.6 Spectrum display DIFF (differential mode)



Every time being in the **RUN** mode when there will be a change-over from **NORM** to **DIFF**, the last spectrum will be internally stored as a reference spectrum and the differential display will be set on. For this spectrum the last stored reference spectrum will be subtracted from the current one and the resulting level lines will be displayed with correct signs. Thus new signals will be displayed as positive and missing signals as negative level lines. The y-scaling is set to -/+ ½ of the RNG value regardless of the **RNG** softkey setting. With squelch off, the mark-to-peak softkey lets the marker frequency jump to the absolute level maximum. With squelch on, the marker frequency will jump to the next level maximum with a positive deflection above 5 dB.

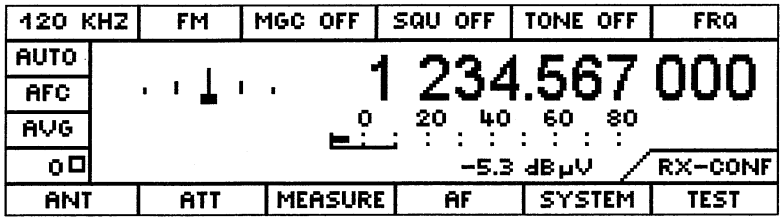
3.18.3.7 Spectrum display with BW ZOOM



For a more accurate analysis of single signals the **BW ZOOM** can be set on. In this mode there is a firm rule that one pixel on the y-axis equals one channel and thus the frequency range of half the IF bandwidth. When the **BW ZOOM** is set on, the frequency mark is set to the display center and from there a new frequency span is built corresponding with above rule. If the IF bandwidth will be changed now the frequency span will be carried along correspondingly. The old span and center frequency and IF bandwidth are stored when the **BW ZOOM** is set on and when it is set off they are restored.

3.18.4 RX-CONF (receiver configuration)

This menu is obtained by pressing the RX-CONF softkey in the MAIN menu.

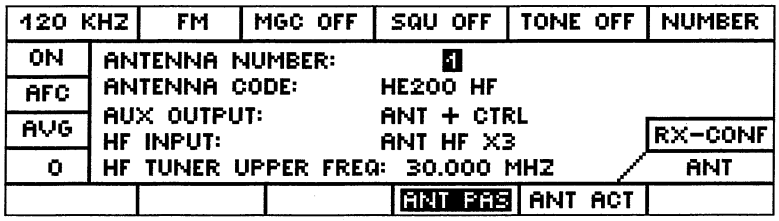


Softkeys

ANT	Branch into the menu for antenna number parameters
ATT	Branch into the menu for attenuator parameters
MEASURE	Branch into the menu for measuring time parameters
AF	Branch into the menu for **A**udio **F**requency parameters
SYSTEM	Branch into the menu for software versions and software releases
TEST	Branch into the menu for built-in test

3.18.4.1 ANT (antenna)

This menu is obtained by pressing the ANT softkey in the RX-CONF menu.



Antenna control via AUX port X8 using 2-digit BCD. The AUX port X8 is the connector with the name X8 at the rear panel of the ESMB. For the pin assignment please see interface description 4056.6000.01 SB in the annex.

Displayed parameters

ANTENNA NUMBER: Antenna number from 0 to 99

ANTENNA CODE: 5-digit antenna code

If the parameter **ANTENNA CODE** is selected one character at a time can be selected with the softkey <- or -> and it can be varied with the spinwheel.

AUX OUTPUT: FREQ or ANT + CTRL (selection by spinwheel)

At the rear panel of the ESMB, on the two 8-bit ports, can be output either the frequency information in BCD four-digit (1 MHz, 10 MHz, 100 MHz and 1 GHz) or the antenna number with two digits on one port and the CTRL byte in binary form on the other port (see also AUX on page 55).

HF INPUT: Choice of 2 inputs:

ANT HF X3: Antenna signals in the range of 9 kHz to 30 MHz are fed in via connector X3 (ANT HF).

ANT V/UHF X13: Antenna signals in the range of 9 kHz to 3000 MHz are fed in via connector X13 (ANT V/UHF).

HF TUNER UPPER FREQ Change from HF to V/UHF signal path.

Softkeys

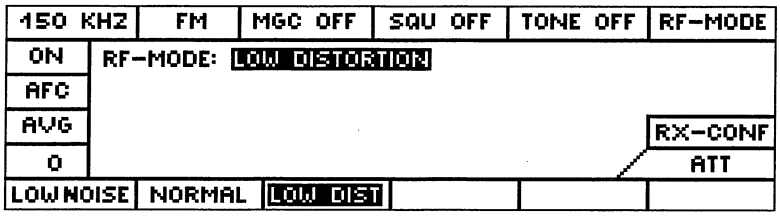
The following two softkeys appear only with installed software option EB200FS (Field Strength).

ANT PAS K-factor table for passive antennae (eg HE200 without amplifier)

ANT AKT K-factor table for active antennae (eg HE200 with amplifier)

3.18.4.2 ATT (attenuation and operating modes)

This menu is obtained by pressing the ATT softkey in the RX-CONF menu.



By internally connecting amplifiers and attenuators the operating mode of the receiver can be optimally matched to differing receive conditions.

Displayed parameters

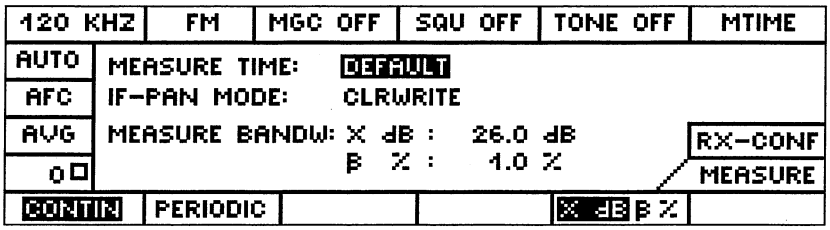
RF-MODE: Operating mode of receiver:

LOW NOISE	especially low noise
NORMAL	good noise figure and good large-signal characteristics
LOW DISTORTION	best linearity, operation with many strong signals

Softkeys

LOW NOISE	especially low noise
NORMAL	good noise figure and good large-signal characteristics
LOW DIST	best linearity, operation with many strong signals

3.18.4.3 MEASURE (configuration of measuring time parameters)



Softkeys

The softkeys indicate in each case the currently active state in inverse video.

CONTIN Continuous measurement of all values

PERIODIC Periodic measurement of all values with measuring time

X dB ß % Measurement of the bandwidth with regard to the 'X dB' definition or the ß% - definition

Configuration of the MEASURE parameter

MEASURE TIME: Measuring time: DEFAULT / 0.5 msec to 900 sec

The TIME MEASURE applies globally to all measuring functions and can also be set in some other CONFIG menus. In part the name is shortened from lack of space with MTIME.

IF-PAN MODE: Level evaluation in the spectrum of the IF-panorama: MIN, MAX, AVG, CLRWRITE

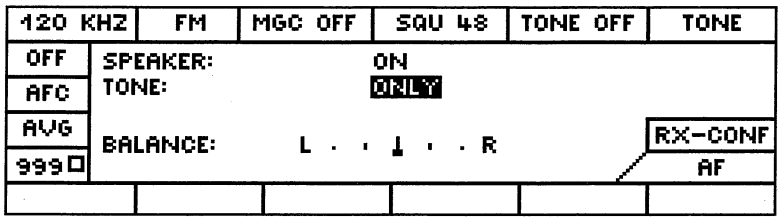
MEASURE BANDW: Configuration parameter for the bandwidth measurement

X dB 0 to 100 dB

ß % 0.1 to 99.9 %

3.18.5 AF configuration

This menu is obtained by pressing the AF softkey in the RX-CONF menu.



Configuration of the AF (Audio Frequency) parameters

SPEAKER: Speaker status OFF, ON

This switch works only for the built-in loudspeaker. The AF is always available at the headphone socket.

TONE: ONLY, WITH AF

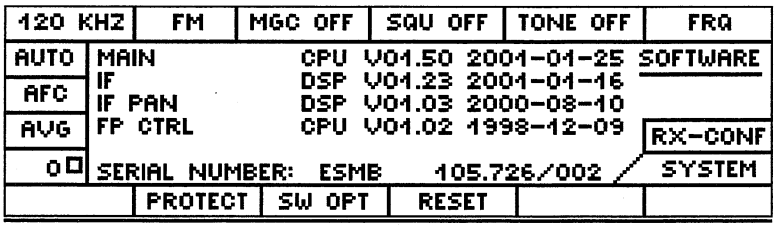
In the position TONE WITH AF, the audio frequency is audible additionally to the signal tone.

BALANCE: Between left and right audio channel at the headphone connector

The bar can be shifted to the left or to the right by spinwheel. The ESMB is not equipped for stereo reception.

3.18.5.1 SYSTEM menu

This menu is obtained by pressing the SYSTEM softkey in the RX-CONF menu.



Display function for software version and series number

MAIN CPU	Main controller
IF DSP	DSP for the IF-section
IF PAN DSP	DSP for IF-panorama (option)
FP CTRL	Keyboard controller
SERIAL NUMBER	Receiver serial number

Softkeys

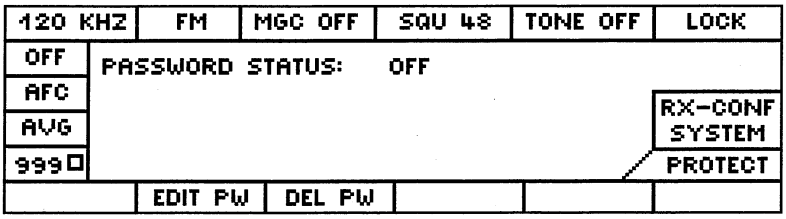
RESET Resets to the Rohde & Schwarz default settings. The same function is triggered via remote control by the command *RST.

PROTECT Branches to the password entry menu

SW OPT Branches to the menu for SW options

PROTECT password entry

This menu is obtained by pressing the PROTECT softkey in the SYSTEM menu.



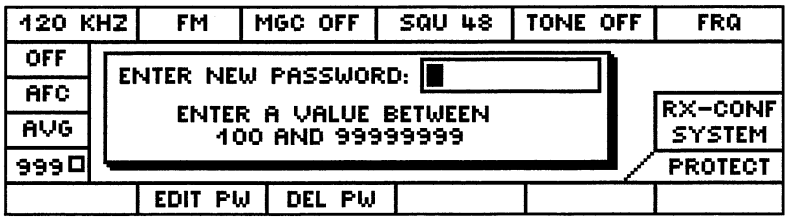
If the password status is ON, the user is asked to enter the password when the unit is turned on.

Display parameter

PASSWORD STATUS: ON, OFF

Softkeys

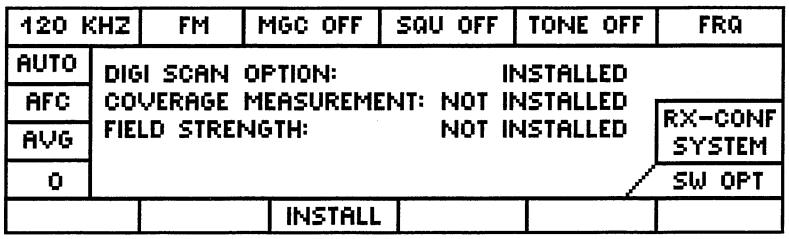
EDIT PW: Branches to the password entry menu



DEL PW: Branches to the menu for deleting the password. This menu looks like the password entry menu.

SW OPT software options

This menu is obtained by pressing the SW OPT softkey in the SYSTEM menu.



Displayed parameters:

Status display, activated SW options

DIGI SCAN OPTION: Quick sweep function with spectrum display and remote-controlled output of all measured values

COVERAGE MEASUREMENT: Fast externally or internally triggered level measurement on a frequency or on a frequency list. This option can be used only via remote control.

FIELD STRENGTH: With this option, it is possible to carry out field strength measurements. Additionally to the level indication in dBµV the field strength is indicated in dBµV/m. For the calculation of the antenna correction factors the k-factors of the Rohde & Schwarz antennae HE200 and HE200HF as well as a generic dipole are permanently stored. Self-defined k-factor data can be loaded into the ESMB via remote control.

Softkey

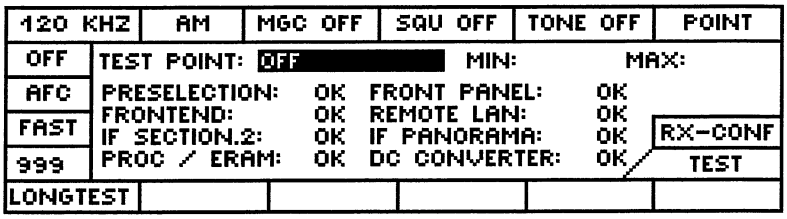
INSTALL Branches to the SW_OPT menu

Activating a SW option by entering an 8-digit code number

Note:
When ordering a software option at a later stage the serial number of the ESMB is to be indicated.

3.18.5.2 TEST

This menu is obtained by pressing the TEST softkey in the RX-CONF menu



Note:
If the processor is equipped with the expansion RAM, **PROC/ERAM** *instead of* **PROCESSOR** *is displayed.*

It the ESMB is equipped with a new IF section (produced as from April 2000), IF SECTION.2 appears on the display. This IF section has an extended dynamic range. Level measurements can be made up to 85 dBµV (with ATT ON 113 dBµV) without overdrive. If overdrive occurs, the symbol ⇞ *is displayed.*

With the new IF section, the 30 dB attenuator cuts in at the overdrive limit of 85 dBµV and switches off with a hysteresis of 7 dB.

Softkey

LONGTEST Starts a complete unit testing procedure

At the LONGTEST all test spectrum lines are scanned. At first two runs with attenuator and the bandwidth 150 kHz and/or 9 kHz are carried out. With that the preselection is bypassed first and feeding-in takes place directly at the Frontend. If both of the runs supply an error-free result, a third run with disconnected attenuator is carried out. If also this run does not supply any errors, a short test is carried out with the current receive frequency.

As a result the OK message "TEST OK , RF RANGE AND SIGNAL PATHS" or an error report is output. The error reports are determined as follows:

1st or 2nd test run reports errors:

If all measuring frequencies report errors the message "SENSITIVITY OUT OF RANGE" is generated. Otherwise it is checked whether all measurement points produce errors at a specific bandwidth. In this case the message "IF PREFILTER WIDE DEFECTIVE" or "IF PREFILTER NARROW DEFECTIVE" is generated.

If the error fits into neither category a list with up to 4 faulty frequencies and an error message like eg "LEVEL TOO HIGH AT 128 MHZ" is output.

1st and 2nd test runs do not report any error, 3rd test run reports error:

If all measuring frequencies report errors the message "SENSITIVITY OUT OF RANGE" is generated. Otherwise error messages for those preselection ranges are generated in the frequency range of which faulty measuring points are located.

Configuration parameters

TEST POINT: OFF or selection of a test point of the subassemblies. When a test point is selected, a permanent display windows opens.

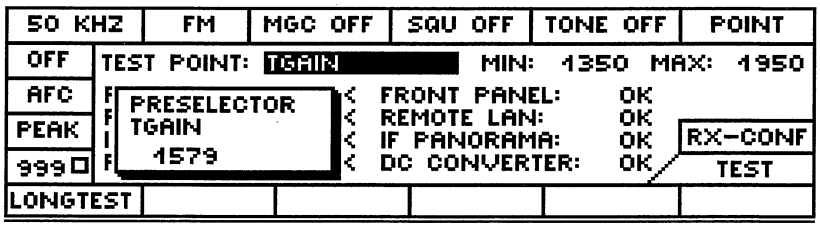
The window contains the name of the module of the selected test point, the current voltage in mV and, if necessary, an arrow that indicates whether is above or below the limit.

Displayed parameters

MIN: The permissible minimum test point voltage (in mV)

MAX: The permissible maximum test point voltage (in mV)

If no min. and max. values are displayed, this test point is not relevant for the current state of the unit.

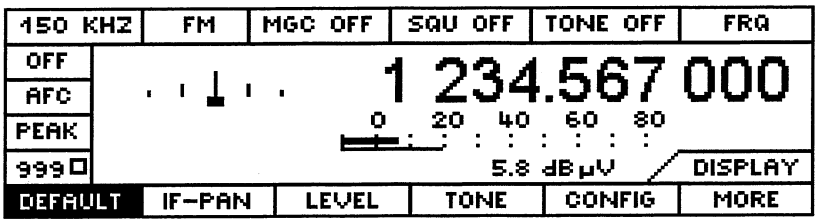


The test-point window without minimum and maximum values can be displayed in every menu of the unit. This means that it is possible to observe a particular point in all the unit's operating states.

In menus where the SEL key has no function and where this key is pressed, a test point can be selected by spinwheel.

3.18.6 DISPLAY (display variants)

This menu is obtained by pressing the DISPLAY softkey in the MAIN menu.



With this menu, you can select quickly from a number of display variants.

Using the MORE softkey, further parallel selection modes can be chosen.

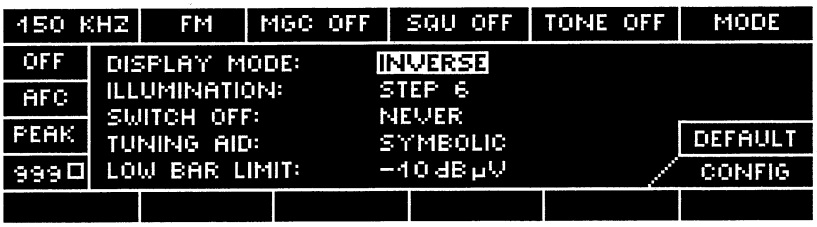
Each display variant has its specific CONFIG menu.

The selected variant is retained even if the MAIN menu or any other menu is selected.

If DEFAULT was selected a specific display variant appears in the submenus M-SCAN and F-SCAN . D-SCAN has no specific display variant.

DEFAULT - CONFIG

This menu is obtained by pressing the CONFIG softkey in the DISPLAY menu



Configuration parameters

DISPLAY MODE: INVERSE, NORMAL (this setting is global)

ILLUMINATION: Illumination of back lighting OFF / STEP1 ... STEP6

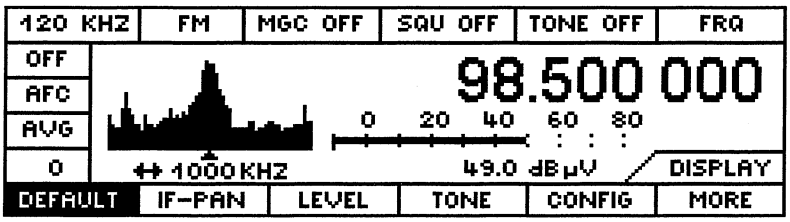
SWITCH OFF: Switch-off time of backlighting
NEVER, 0.5 MIN, 1 MIN, 2 MIN, 3 MIN, 5 MIN, 10 MIN, 20 MIN

TUNING AID: Display variations of frequency offset (see "Offset display, " on page 9)
NUMERIC, SYMBOLIC, IF PAN (option)

LOW BAR LIMIT: Setting of the lower end of scale
of the level bargraph at ATT OFF: -30 dBµV, -10 dBµV, 10 dBµV

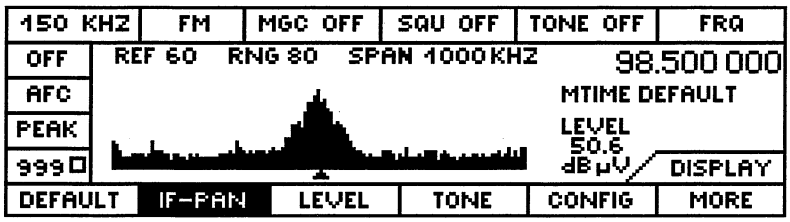
DISPLAY DEFAULT with TUNING AID: IF PAN

This menu is obtained by configuring, in the Default Config Menu, the **LOW BAR LIMIT** to IF PAN.



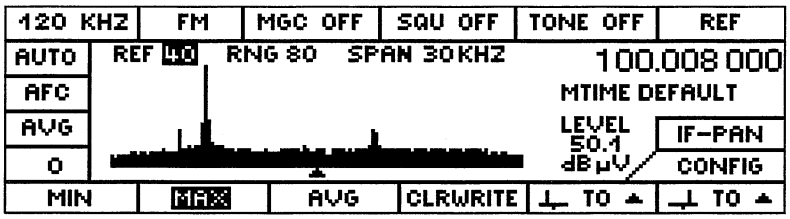
3.18.6.1 IF-PAN (IF-panorama)

This menu is obtained by pressing the IF PAN softkey in the DISPLAY menu.



IF-PAN (IF-panorama) - CONFIG

This menu is obtained by pressing the CONFIG softkey in the IF-PAN menu.



Display parameter

LEVEL Level measured on receive frequency

Configuration parameters

REF The reference level sets the maximal level value that can be displayed. It can be set within a range of -20 to 120 dBµV in steps of 10 dB.

RNG The range value sets the range that can be displayed on the y-axis. It can be set within a range of 10 to 160 dBµV in steps of 10 dB.

SPAN The Span sets the width that can be displayed in the IF-panorama in 17 steps within the range of 150 Hz to 1000 kHz. In the COUPLED mode the displayed width equals the width of the cut-in IF filter.

MTIME Measuring time: DEFAULT / 0.5 msec to 900 sec

Softkeys

MIN Starts the MIN-Hold process. Every time this key is pressed the MIN-Hold process is restarted.

MAX Starts the MAX-Hold process. Every time this key is pressed the MAX-Hold process is restarted.

AVG Starts averaging according to selection. Each time this key is pressed the averaging function AVG is started anew. The measured level values are averaged over the measuring time.

CLRWRITE Activates the CLEAR WRITE function. The currently measured level values are displayed. Here the measuring time is of no importance.

_|__ TO ^ Centers the spectrum to the next relative level maximum left of the marker when the squelch is off. When it is on the center frequency is set to the next level maximum to the left which is above the squelch line.

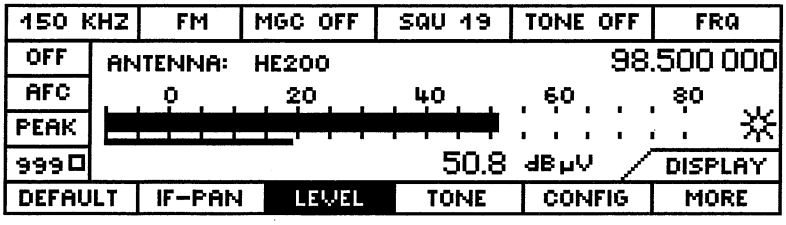
__|_ TO ^ Centers the spectrum to the next relative level maximum right of the marker when the squelch is off. When it is on the center frequency is set to the next level maximum to the right which is above the squelch line.

With switched on squelch the squelch value is indicated as a horizontal line in the spectrum. Thus the level of the individual frequencies can be measured.

Note:
The level indication of the receiver is identical only in exceptions with the height of the average spectrum line (for example with a CW carrier). In the case of broad-band signals or noise, differences up to 20 dB and more occur. This is caused by the different bandwidth with which the level detection is carried out. The resolution bandwidth of the panorama equals approx. 1/1000 of the set span.

3.18.6.2 LEVEL BAR (level measurement)

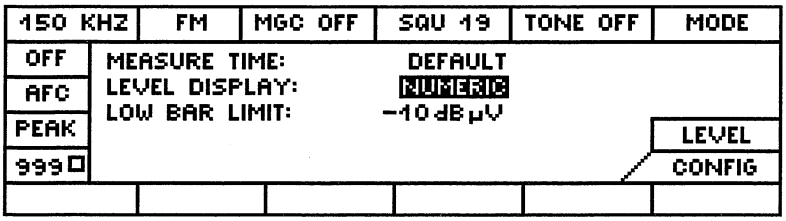
This menu is obtained by pressing the LEVEL softkey in the DISPLAY menu.



Just as the large level bar display, this window also shows the antenna which is currently activated, and the numerical level indication.

LEVEL (level measurement) - CONFIG

This menu is obtained by pressing the CONFIG softkey in the LEVEL menu.

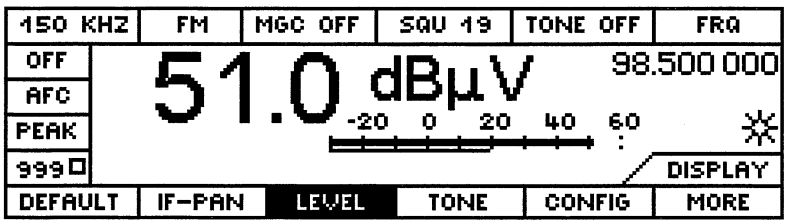


Configuration parameters

MEASURE TIME:	Measuring time:	DEFAULT / 0.5 msec to 900 sec
LEVEL DISPLAY:	Level indication:	BAR / NUMERIC
LOW BAR LIMIT:	Setting of lower end of scale of level bargraph indication at ATT OFF:	-30 dBµV, -10 dBµV, 10 dBµV

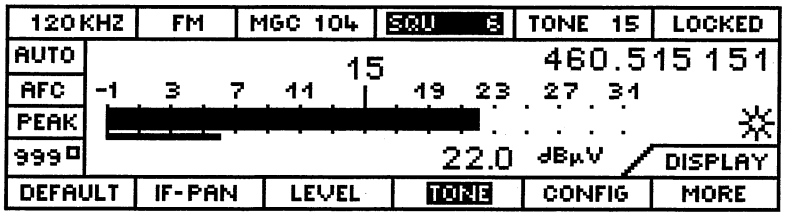
LEVEL NUMERIC

This menu is obtained by pressing the LEVEL softkey in the DISPLAY menu if in the LEVEL-CONFIG menu the parameter LEVEL DISPLAY has been set to NUMERIC.



3.18.6.3 TONE (signal tone; pitch depends on the signal level)

The menu is obtained by pressing the TONE softkey in the DISPLAY menu.



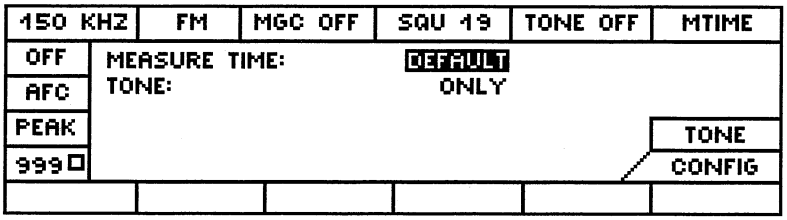
This menu shows the expanded level bar display (see "Level display" on page 8).

Starting from this value, the level scale is expanded into the range -15 to +15 dB and the level magnitude is represented by the pitch of a tone (0 dB corresponds to about 400 Hz).

When the MORE softkey is pressed, the following selection modes are available.

TONE - CONFIG

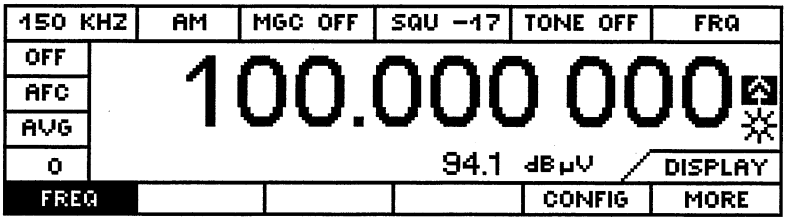
This menu is obtained by pressing the CONFIG softkey in the TONE menu.



MEASURE TIME:	Measuring time:	DEFAULT / 0.5 msec to 900 sec
TONE:	Tone without/with audio frequency	ONLY / WITH AF

3.18.6.4 FRQ (frequency)

This menu is obtained by pressing the FRQ softkey in the DISPLAY-MORE menu.

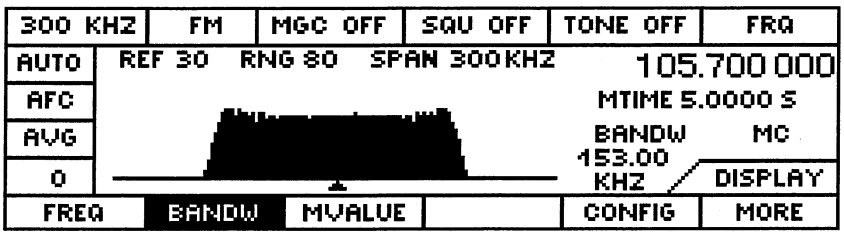


Here the numerical level value is shown in addition to the large frequency display.

For reasons of space, the position of the overdrive indicator differs from that in the other menus. This symbol flashes to indicate that the IF section is overdriven.

3.18.6.5 BANDW (bandwidth measurement)

This menu is obtained by pressing the BANDW softkey in the DISPLAY-MORE menu.



Bandwidth measurements are always carried out within the display width of the IF-panorama. This width can be chosen from the list of all available IF bandwidth, or it can be selected to be 25 kHz, 50 kHz, 200 kHz, 500 kHz or 1 MHz.

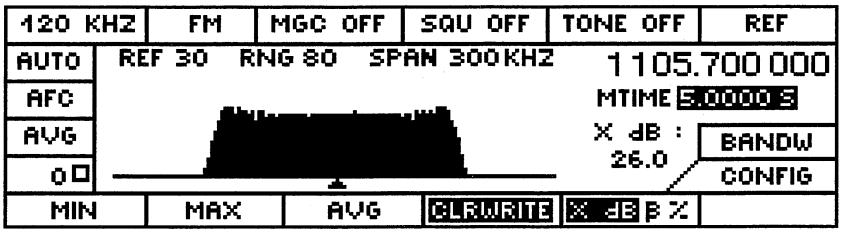
Bandwidth measurements can be carried out any time independent of other parameters such as the selected demodulation mode.

Display parameters

BANDW Display of the measured bandwidth 0 to 1000 kHz

BANDW - CONFIG

This menu is obtained by pressing the CONFIG softkey in the BANDW menu



Configuration parameters

REF The reference level determines the highest level value to be displayed. It can be set in the range from –20 to 120 dBµV in 10-dB increments.

RNG The range value determines the display range on the Y-axis. It can be set in the range from 10 to 160 dBµV in 10-dB increments.

SPAN The span determines the display width of the IF-panorama in 17 steps in the range from 150 Hz to 1000 kHz. With setting COUPLED the selective display width corresponds to that of the active filter.

MTIME Measuring time: DEFAULT / 0.5 msec to 900 sec

X dB Parameter for the x dB method of bandwidth measurement 0 to 100 dB

ß% Parameter for the ß % method of bandwidth measurement 0.1 to 99.9 %

Softkeys

MIN Starts the MIN-Hold process. Every time this key is pressed the MIN-Hold process is restarted.

MAX Starts the MAX-Hold process. Every time this key is pressed the MAX-Hold process is restarted.

AVG Starts averaging according to selection. Each time this key is pressed the averaging function AVG is started anew. The measured level values are averaged over the measuring time.

CLRWRITE Activates the CLEAR WRITE function. The currently measured level values are displayed. Here the measuring time is of no importance.

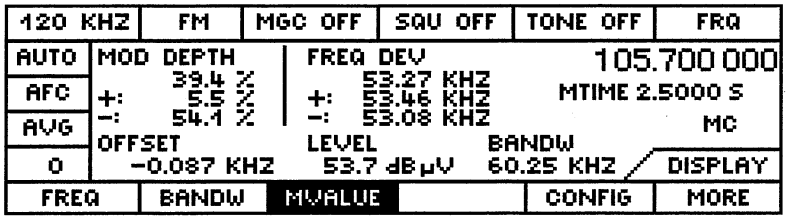
X dB ß % Bandwidth measurement acc. to 'X dB' definition or ß% definition

3.18.6.6 MVALUE (display of all measured values)

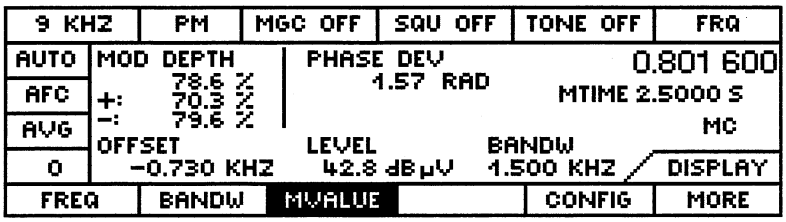
This menu is obtained by pressing the MVALUE softkey in the DISPLAY-MORE menu.

The MVALUE display depends on the selected demodulation mode..

MVALUE with demodulation mode FM , AM or PULS



MVALUE with demodulation mode PM



Display parameters

The display shows either the current modulation depth (AM), the frequency deviation (FM) or phase deviation (PM) (see table below).

A valid value for the frequency deviation is only available in demodulation mode AM or FM, whereas a valid value for the phase deviation is only available in demodulation mode PM.

Demodulation mode	Parameter	Measured value	Range of values	Resolution	Unit
AM	MOD DEPTH	AM modulation depth	0 to 100.0	0.1	%
	MOD DEPTH	AM positive modulation depth	0 to 999.9	0.1	%
	MOD DEPTH	AM negative modulation depth	0 to 999.9	0.1	%
FM	FREQ DEV	Frequency deviation	300.0	0.001	kHz
	FREQ DEV	Positive frequency deviation	300.0	0.001	kHz
	FREQ DEV	Negative frequency deviation	300.0	0.001	kHz
PM	PHASE DEV	Phase deviation	4π	0.01	rad

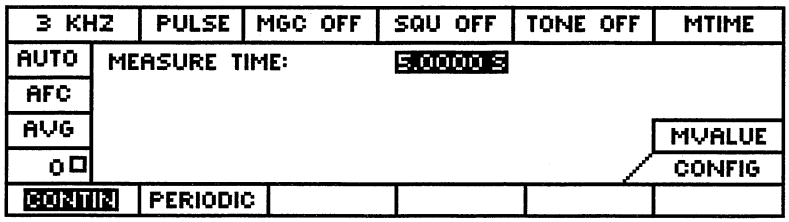
OFFSET Offset display numerical in kHz

LEVEL Level display in dBµV

BANDW Measured bandwidth value ...1000 kHz

MVALUE CONFIG

This menu is obtained by pressing the CONFIG softkey in the MVALUE menu.



Configuration parameters

MEASURE TIME Measuring time: DEFAULT / 0.5 msec to 900 sec

Softkeys

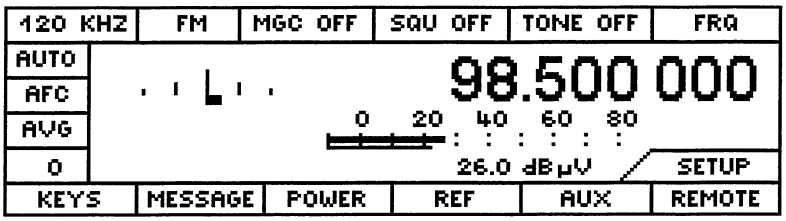
The softkeys indicate the currently active state.

CONTIN Continuous measurement of level and offset

PERIODIC Periodic measurement of level and offset with measuring time

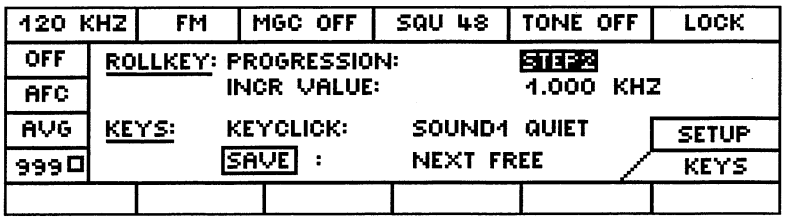
3.18.7 SETUP

This menu is obtained by pressing the SETUP softkey in the MAIN menu.



3.18.7.1 KEYS

This menu is obtained by pressing the KEYS softkey in the SETUP menu.



Configuration of the spinwheel functions and the key characteristics. The selection is made with SEL, the spinwheel and the editor (number block).

ROLLKEY configuration

PROGRESSION Progression factor of frequency setting by spinwheel
OFF, STEP1 to STEP9

INCR VALUE Any increment which is added to or subtracted from the receiving frequency if there is a rollkey pulse.
0.001 to 1000 kHz
For SSB modulation (CW, LSB and USB) an increment value of 1 Hz is automatically set.

KEYS configuration

KEYCLICK Setting the key click
OFF, SOUND1 QUIET, SOUND1 LOUD, SOUND2 QUIET, SOUND2 LOUD, SOUND3 QUIET, SOUND3 LOUD,

SAVE KEY Determines the function of the SAVE key

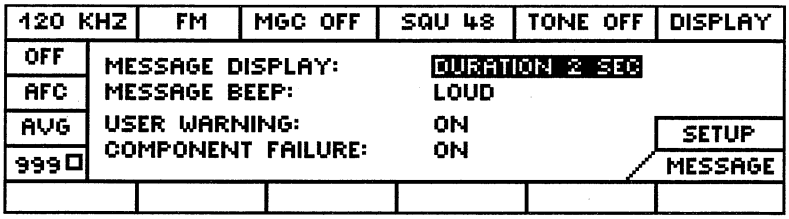
CURRENT MEM	The receiver parameters will be stored in the current memory location
CURRENT MEM + ACT	Like CURRENT MEM, additionally the memory location will be set for an MSCAN query (ACTivate)
NEXT FREE	The receiver parameters will be stored in the next free memory location
NEXT FREE + ACT	Like NEXT FREE, additionally the memory location will be set for an MSCAN query (ACTivate)

Configuring the SAVE key to NEXT FREE + ACT is very useful when it comes to save frequencies found with F-SCAN or D-SCAN to the memory with just one key stroke. These frequencies can then be further observed by using the M-SCAN.

3.18.7.2 MESSAGE

Configuration of the acoustic and optical messages to the operator.

This menu is obtained by pressing the MESSAGE softkey in the SETUP menu.



Error messages

MESSAGE DISPLAY OFF, display duration for error messages: 1, 2, 3, 4, 5 sec and infinite (see **"Status and error messages"** on page 12)

MESSAGE BEEP Setting the volume of the error beep
OFF, QUIET, LOUD

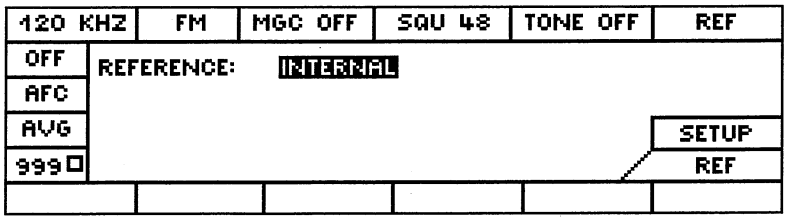
USER WARNING Setting the user warning on and off
ON, OFF

COMPONENT FAILURE Enabling or disabling messages of component errors
ON, OFF

3.18.7.3 REF

Selection of the reference signal.

This menu is obtained by pressing the REF softkey in the SETUP menu.



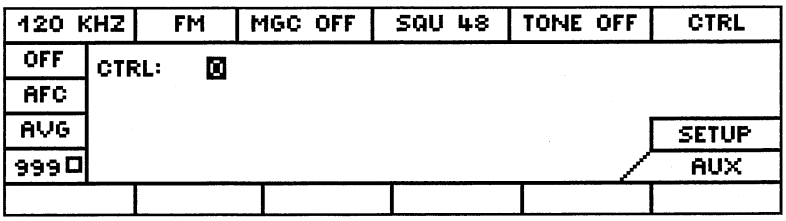
Configuration parameter

REFERENCE: Selection of reference frequency source
INTERNAL, EXTERNAL

3.18.7.4 AUX

Configuration of the AUX-port parameters

This menu is obtained by pressing the AUX softkey in the SETUP menu.



Configuration parameters

CTRL: Setting the AUX bits of socket X8 (rear panel)
0 to 255

OUTPUT: **FREQ** or **ANT+CTRL**

The two 8-bit ports at the rear panel of the unit can output either frequency information in 4-digit BCD (1 MHz, 10 MHz, 100 MHz and 1 GHz) or the 2-digit antenna number at one port and the binary CTRL byte at the other port.

The connector X8 is located at the rear panel of ESMB. For its pin assignment refer to the interface description contained in the manual.

3.18.7.5 REMOTE

Configuration of the remote-control parameters

This menu is obtained by pressing the REMOTE softkey in the SETUP menu.

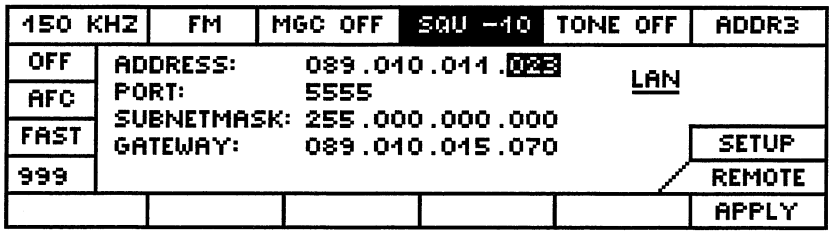
One of the two options below can be fitted:

- LAN control interface
- RS232C control interface

The appropriate window for the fitted option opens automatically.

After a cold start, the Rohde & Schwarz default values are always used.

LAN control interface



Configuration parameters

IP-ADDRESS: Network identification of the ESMB

PORT: Access port for remote control

SUBNETMASK: Mask for subnet, if applicable

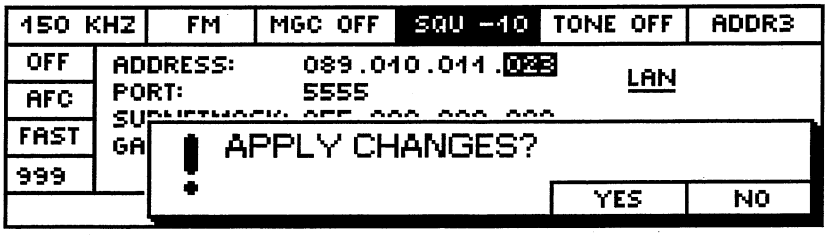
GATEWAY: Network identification of a router, if applicable

Softkey

APPLY: Step to the next submenu

APPLY CHANGES

For technical reasons, some parameters can take effect only if the unit is switched off and on again. The change of such parameters, when accepted by the YES softkey, will output the message "POWER DOWN REQUIRED FOR NEW SETTINGS".



YES: The changes will be entered. In some cases the unit must then be switched off and on again.

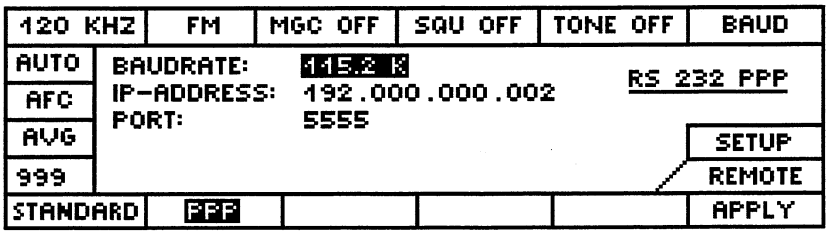
NO: The changes will be ignored.

RS 232 PPP control interface (option)

If the RS232 interface is installed, there will be the choice between the two modes RS232 PPP and RS232 Standard. See also annex A.

RS 232 PPP

In this operating mode, TCP/IP with the **P**oint to **P**oint **P**rotocol is activated for remote control.



Configuration parameters

BAUDRATE: Baud rate: 50 to 115 k with many steps in between

IP-ADDRESS: Network identification of the ESMB

PORT: Access port for remote control

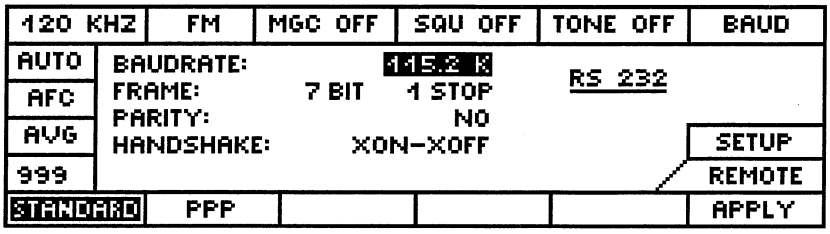
Softkeys

APPLY: Step to the next submenu APPLY CHANGES

STANDARD: Switch to RS232 standard

RS 232 standard

In this operating mode, remote control can be carried out by using simple ASCII command strings, terminated with <LF>.



Configuration parameters

BAUDRATE: Baud rate: 50 to 115 k with many steps in between

FRAME: 7 or 8 data bits, 1 or 2 stop bits

PARITY: NO, ODD or EVEN

HANDSHAKE: NO, XON-XOFF or RTS-CTS

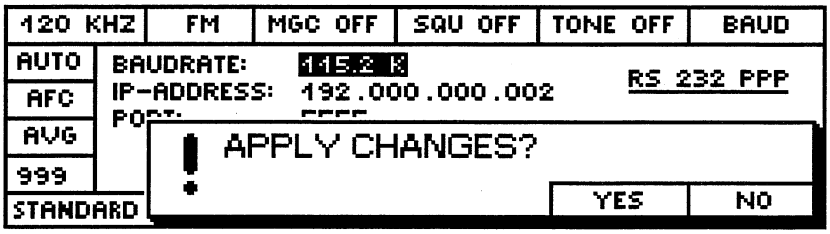
Softkeys

APPLY: Step to the next submenu APPLY CHANGES

PPP: Switch to RS232 PPP

APPLY CHANGES

For technical reasons, some parameters can take effect only if the unit is switched off and on again. The change of such parameters, when accepted by the YES softkey, will output the message "POWER DOWN REQUIRED FOR NEW SETTINGS".

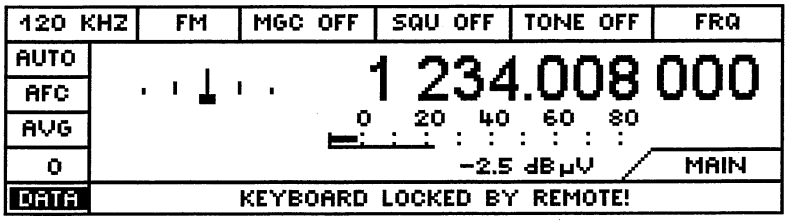


YES: The changes will be entered. In some cases the unit must then be switched off and on again.

NO: The changes will be ignored.

Locking of the controls with remote control

The message in the softkey area of the display is turned on or off by the remote command `SYSTem:KLOCk ON|OFF`. At the same time keyboard and spinwheel are turned off. The unit can only be remotely controlled.



In this mode, a DATA lamp comes on in the text window.

The test in the message window can be specified by REMOTE with a special command.

The Rohde & Schwarz default text is: KEYBOARD CONTROLLED BY REMOTE.

Locking of the display and the controls for remote control

The display can be switched on and off by the remote-control command `DISPlay:ENABle ON|OFF`. In this case, the entire front panel editing is disabled, providing additional processor capacity for remote control and hardware control.

MEASURE MODE: Indicates the current mode of the unit set via remote-control command `FREQuency:MODE`.

CW	Receiver monitors a frequency.
SWEEP	Receiver is in frequency sweep mode.
MSCAN	Receiver is in memory scan.
DSCAN	Receiver is in Digiscan mode.
FASTLEVCW	Receiver is in mode for fast triggered level measurement.
LIST	Receiver is in mode for fast level measurement in a frequency list.

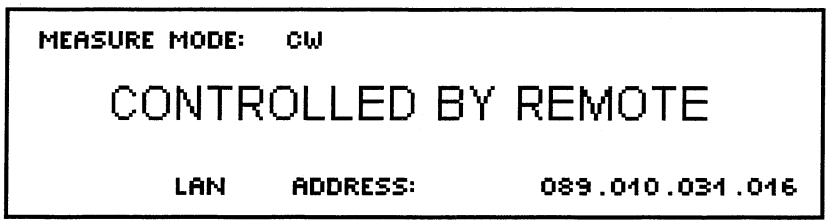
The DSCAN mode can only be switched on if the SW option EB200DS (Digiscan) is fitted.

The FASTLEVCW and LIST modes can only be switched on if the SW option EB200CM (Coverage Measurement) is fitted.

The text in the second line of the message window can be specified by the remote control command `DISPlay:ENABle:LABel „String with max 24 chars"`. The Rohde & Schwarz default text is: CONTROLLED BY REMOTE.

The third line indicates mainly the parameters of the remote control interface.

Remote control-option: LAN



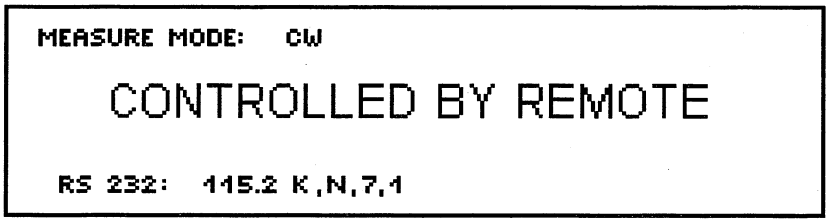
LAN ADDRESS: Network identification of ESMB

Remote-control option: RS232 in PPP mode

RS232 PPP: Baud rate: 50 to 115 k with many steps in between

ADDRESS: Network identification of ESMB

Remote-control option: RS232 in STANDARD mode



RS232 : Baud rate, parity, data bits, stop bits

4 Remote Control

4.1 Introduction

The device is equipped as standard with a LAN interface EB200 R4. The 8-pin RJ45 connector X91 is located at the rear of the device. The TCP/IP protocol is run on this 10 MBIT Ethernet interface.

The device can be equipped optionally with an RS232 interface. The 9-pin connector X9 is located at the rear of the device. The TCP/IP protocol with PPP is applied to this interface.

The device supports the SCPI command syntax of version 1993.0 (Standard Commands for Programmable Instruments). The SCPI standard is based on IEEE 488.2 and is aimed at standardizing device-specific commands, error handling and status registers (see "Notation" on page 13).

This section assumes basic knowledge of 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 for command syntax, error handling and configuration of the status registers are explained in the relevant sections. Tables provide a fast overview of the commands implemented in the device and the bit assignment in the status registers. The tables are supplemented by a comprehensive description of every command and the status registers. Detailed programming examples of the main functions are to be found in Annex D. Annex C contains a reference list for all unit functions in local and remote control with all the relevant references to the manual.

4.2 Brief instructions for remote-control interfaces

4.2.1 RS232 interface (option)

The default values of the interface parameters of the ESMB are configured by host name and IP-address, respectively.

192.0.0.2 and port: 5555

For more information see annex A, interfaces.

1. Connect the ESMB and the controller by using the modem bypass cable RS232 stipulated for WindowsNT.
2. The RAS service has to be installed on the controller.
3. The PPP-connection to the controller is set up by starting the EB200.PBK file.
4. The ping command is a simple way to check whether the controller is able to make connection to the ESMB. Just enter the command "ping <IP-Address>" (eg "ping 192.0.0.2") in the DOS box.
5. Commands can be sent to and messages can be received from the ESMB by means of a Telnet application which is started and configured with the interface parameters of ESMB.
6. To test the connection, *idn? can be entered, for example, to query the ESMB identification. The response string should then be displayed.

4.2.2 Remote control via LAN interface (option)

The default values of the interface parameters of the ESMB are configured by host name and IP-address, respectively.

89.10.11.23 and port: 5555

For more information see Annex A, interfaces.

1. Connect the ESMB and the controller by using an Ethernet cable with RJ45 connectors. For direction connection to a network adapter card use a cross-cable. If the ESMB is connected to a network either via a hub or directly, a 1-to-1 cable is required.
2. On the controller TCP/IP must be installed. The network adapter card must be set to half-duplex.
3. When the ESMB is operated within a network, is must be set to a network-compatible IP address. The network administrator will be able to provide further information on this. Also see Annex D.
4. The ping command can be used to easily check whether the controller is able to make connection to ESMB. Just enter the command "ping <IP-Address>" (eg "ping 89.10.11.23") in the DOS box.
5. By using a Telnet application configured with the interface parameters of ESMB commands can be sent to and responses be received from ESMB.
6. To test the connection, *idn? can be entered, for example, to query the ESMB identification.

Note:
If previously a connection had been made to another unit with the same IP address, it may be necessary to delete the corresponding entry in the ARP table by entering the command "ARP -d <IP address>" in the DOS box.

4.3 Configuring the remote control

The device can at the same time be operated via the front panel and the remote-control interface. This operation is called "competing control" and is characterized by the fact that both the local operator and a detached operator have full access to all device functions. Moreover, any operator setting can be monitored by the remote-control interface.

"Competing control" can be switched over in favor of remote control via the remote control command `System:Klock ON` (see Annex A). In this case, manual control is fully disabled and has to be enabled by the remote-control `System:Klock OFF`.

4.3.1 Setting the IP-A and port number

If ESMB is equipped with a remote-control interface parameters like baud rate, IP address and port number can be set in submenu SETUP REMOTE.

The set IP address and port number become immediately effective. After changing the baud rate, the device must be switched on/off.

4.4 Structure and syntax of the device messages

4.4.1 SCPI introduction

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming devices, irrespective of the type of device 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. 4-1 illustrates this tree structure using a section of command system SENSe which operates the sensor functions of the devices. The other examples regarding 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 "Responses to queries" on page 8).

4.4.2 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, eg blank). The headers may consist of several keywords. Queries are formed by directly appending a question mark to the header.

Note:
The commands used in the following examples are not in every case implemented in the device.

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 a hierarchical structure (see Fig. 4-1). The different levels are represented by combined headers. Headers of the highest level (root level) have only one keyword. This keyword denotes a complete command system.

Example: `SENSe` This keyword denotes the command system `SENSe`.

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

Example: `SENSe:FREQuency:STARt 118 MHz`

This command lies in the third level of the SENSe system. It sets the starting frequency of a scan to 118 MHz.

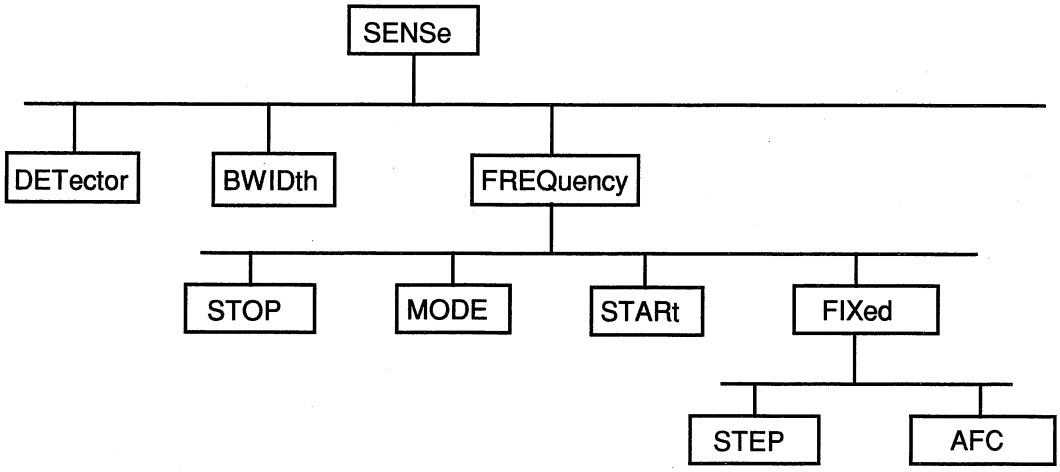


Fig. 4-1: Tree structure of the SCPI command system using the SENSe system by way of an example

Some keywords occur at 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: `OUTPut:OUTPut:SQUelch:STATe ON`

This command contains the keyword `STATe` at the third command level. It defines the state of the `SQUelch` function.

`OUTPut:FILTer:LPAS:STATe OFF`

This command contains the keyword STATe at the fourth command level. It defines the state of the AF filter.

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

Example: `[SENSe]:FREQuency[:CW]: STEP [:INCRement] 25 kHz`

This command sets the stepwidth for frequency UP-DOWN to 25 kHz. The following command has the same effect:

`FREQuency:STEP 25 kHz`

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

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

Example: Long form: STATus:QUEStionable:ENABle 1

Short form: 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 device itself does not make any difference between upper- 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 "Parameters" on page 9.

Example: `SENSe:FREQuency? MAXimum` Response: `3000000000`

This query requests the maximal value for the input frequency.

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

4.4.3 Structure of a command line

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

Example:

```
SENSe:FREQuency:STARt MINimum;:OUTPut:FILTer:LPAS:STATe ON
```

This command line contains two commands. The first command is part of the SENSe system and is used to specify the start frequency of a scan. The second command is part of the OUTPut system and sets the AF filter.

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. 4-1). The colon following the semicolon must be omitted in this case.

Example:

```
SENSe:FREQuency:MODE CW;:SENSe:FREQuency:FIXed:AFC ON
```

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 FREQuency, i.e. they have two common levels.

When abbreviating the command line, the second command begins with the level below SENSe:FREQuency. The colon after the semicolon is omitted.

The abbreviated form of the command line reads as follows:

```
SENSe:FREQuency:MODE CW;FIXed:AFC ON
```

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

Example: SENSe:FREQuency:MODE CW
SENSe:FREQuency:FIXed:AFC ON

4.4.4 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: `SENSe:FREQuency:MODe` Response: `SWE`

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: `3000000000`

3. Numerical values are output without a unit. Physical quantities are referred to the basic units.

   Example: `FREQuency?` Response: `100000000` for 100 MHz

4. Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).

   Example: `OUTPut:FILTer:STATe?` Response: `1`

5. Text (character data) is returned in a short form (see also "Parameters" on page 9).

   Example: `SENSe:FREQuency:MODe?` Response: `SWE`

4.4.5 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, block data and expressions. The type of parameter required for the respective command and the permissible range of values are specified in the command description (see "Description of commands" on page 13).

Numerical values

Numerical values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the device are rounded up or down. The mantissa may comprise up to 41 characters, the exponent must lie inside the value range -999 to 999. 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 units are as follows:

for frequencies	GHz, MHz or MAHz, kHz and Hz, default unit is Hz
for times	s, ms, µs, ns; default unit is s
for levels	dBuV; default unit is dBuV
for percentage	PCT, default unit PCT

If the unit is missing, the default unit is used.

Example:

```
SENSe:FREQuency 123 MHz = SENSe:FREQuency 123E6
```

Special numerical

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

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

Example: Setting command: `SENSe:GCONtrol MAXimum`

Query: `SENSe:GCONtrol` Response: `100`

MIN/MAX

MINimum and MAXimum denote the minimum and maximum value.

UP/DOWN

UP, DOWN increases or reduces the numerical value by one step. The step width can be specified for some parameter which can be set via UP, DOWN via an allocated step command (see Annex C). Some parameters can only be changed in fixed steps (eg `SENSe:BWIDth UP`).

INF `INFinity` represent + ∞. In case of queries the numeric value 9.9E37 is output. The INF value 9.9E37 is entered into the result buffers `MTRACE` and `ITRACE` for `MSCAN`, `FSCAN` or `DSCAN` to identify the range limit.

NINF `Negative INFinity (NINF)` represent -∞.. In case of queries the numeric value -9.9E37 is output. This value is output when a measured value is queried and measurement is not possible because of the unit settings.

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 (eg at TRACe[:DATA]?).

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:
`OUTPut:FILTer:STATe ON`
Query: `OUTput:FILTER:STATe?`
Response: `1`

Text Text parameters (character data) observe the syntactic rules for keywords, i.e. they can be entered using the 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: `SENSe:FREQuency:MODE FIXed`
Query: `SENSe:FREQuency:MODE?` Response `FIX`

Strings Strings must always be entered in quotation marks (' or ").

Example: `SYSTem:SECurity: OPTion "123ABC"` or
`SYSTem:LANGuage 'English'`

Block data

Block data (Definite Length Block) 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".

Expressions

Expressions must always be in brackets. The device requires this data format for the indication of channel lists. A channel list always starts with @ followed by a path name or channel numbers or ranges of channel numbers.

Example: `ROUTe:CLOSe (@23)`

4.4.6 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 asterisk 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.
()	Brackets enclose an expression (channel lists).

4.5 Description of commands

Note:
For overview of commands see tables in Annex C.

4.5.1 Notation

In the following sections, all commands implemented in the device are described in detail. The notation corresponds to a large extent to that of the SCPI standards. The SCPI conformity information can be taken from the list of commands in Annex C.

Indentations

The different levels of the SCPI command hierarchy are represented in the description by means of indentations to the right. The lower the level is, the further is the indentation to the right. Please observe that the complete notation of the command always includes the higher levels as well.

Example: `SENSe:FREQuency:MODE` is indicated in the description as follows:

SENSe	first level
. **:FREQuency**	second level
. . **:MODE**	third level

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 next section). The device itself does not distinguish between upper- and lower-case letters.

Special characters |

A selection of keywords with an identical effect exists for some commands. These keywords are given in the same line and are separated by a vertical stroke. Only one of these keywords has to be indicated in the header of the command. The effect of the command is independent of the keywords being indicated.

Example: SENSe
:FREQuency
:CW|:FIXed

The two following commands of identical meaning can be formed. They set the frequency of the device to 123 MHz:

```
SENSe:FREQuency:CW 123E6 = SENSe:FREQuency:FIXed 123E6
```

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 parameter for command

```
SENSe:GCONTrol:MODE    FIXed |MGC AUTO |AGC
```

If the parameter `FIXed` is selected, the gain is determined by the MGC voltage. In case of `AUTO` the gain depends on the signal.

The two parameters `MGC` and `AGC` are synonymous for `FIXed` and `AUTO`.

[ ] Keywords in square brackets can be omitted in the header (see "Common commands" on page 15). The device has to accept the full command length due to reason of compatibility to SCPI standard.

Parameters in square brackets can also be optionally inserted into the command or can be omitted.

{ } Parameters in braces can be inserted in the command either with the options not at all, once or several times.

4.5.2 Common commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. A particular command has the same effect on different devices. The headers of these commands consist of an asterisk "*" followed by three letters. Many common commands concern the "Status reporting system" on page 134.

Command	Parameter	Unit	Remarks
***CLS**			no query
***ESE**	0 to 255		
***ESR?**			only query
***IDN?**			only query
***IST?**			only query
***OPC**			
***OPT?**			only query
***PRE**	0 to 255		
***RST**			no query
***SRE**	0 to 255		
***STB?**			only query
***TRG**			no query
***TST?**			only query
***WAI**			

***CLS**

CLEAR STATUS sets the status byte (STB), the standard event register (ESR) and the EVENt sections 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 to 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 unit about identification.

The output of the unit can be:

"ROHDE&SCHWARZ,ESMB,105.726/003,01.00-4055.3671.00

105726/003	is the serial number of the unit
01.00	is the version number of the firmware of the main processor (EB200P1)
4055.3671.00	is the ident number of the software for the main processor (EB200P1)

***IST?**

INDIVIDUAL STATUS QUERY states the contents of the IST flags in decimal form (0 | 1).

***OPC**

OPERATION COMPLETE sets the bit in the event-status register to 0 if all previous commands were carried out. This bit can be used for triggering a service request (see "Status reporting system" on page 134).

***OPC?**

OPERATION COMPLETE QUERY writes the message '1' into the output buffer as soon as all previous commands were carried out (see "Status reporting system" on page 134).

***OPT?**

OPTION IDENTIFICATION QUERY queries about the options in the unit and outputs a list of installed options. The options are separated by a comma.

Explanation for the output characters:

SU = internal IF-panorama module

BP = battery pack (not included in ESMB)

DS = RF Spectrum DIGI-Scan (software option)

ER = Expansion RAM

HF = HF modules PRESELECTION HF and FRONTEND HF

CM = Coverage Measurement (software option)

FS = Field Strength measurement (software option)

Example of a device response: 0,BP,DS,ER, HF,0,FS

***PRE 0 to 255**

PARALLEL POLL ENABLE sets parallel poll enable register to the value indicated. Query *PRE? returns the contents of the parallel poll enable register in decimal form.

***RST**

RESET sets the device to a defined default status. The default setting is indicated in the description of the commands.

***SRE 0 to 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 out the contents of the status byte in decimal form.

***TRG**

TRIGGER triggers the same actions as the INITiate:CONM[:IMMediate] command.

***TST?**

SELFTEST QUERY triggers the module state test and yields a figure which is to be interpreted as the bit field:

Result = 0 -> all modules ok

Result ≠ 0 -> fault in one or several modules. The information about the possible error can be queried by means of the `SYSTem:ERRor?` command:

***WAI**

WAIT-to-CONTINUE only permits the servicing of the subsequent commands after all preceding commands have been executed and all signals have settled (also see "Status reporting system" on page 134 and "*OPC").

4.5.3 ABORt subsystem

ABORt

Stop command for measurement. This command stops an active scan.

Parameters:
none

**RST state:*
none, as command is an event

Example:
```
ABORt
```

4.5.4 CALCulate subsystem

CALCulate
. :IFPan
. . :AVERage
. . . :TIME <numeric_value>

Sets the averaging time for the averaging process SCALar

Parameter:
`<numeric_value>` averaging time in steps of 0, 100, 500 ms

Remark:
For MAIN CPU versions > 1.18 this command not only has effect on the averaging time of the IF-panorama but also on the global measuring time. Thus the original time grading (0, 100, 500 ms) is discarded (see "MEASure subsystem" on page 40").

For reasons of compatibility with versions ≤ 1.18, entering the averaging time = 0 means the same as the command `CALCulate:IFPan:AVERage:TYPE OFF`.

**RST state:*
`0`

Example:
```
CALCulate:IFPan:AVERage:TIME 0.1
```

. . . :TIME?

Queries the set averaging time for the averaging process SCALar.

Parameter:
none

Result:
Averaging time in seconds.

Remark:
For reasons of compatibility, for MAIN CPU versions > 2.31 this command reports the global measuring time unless `CALCulate:IFPan:AVERage:TYPE?` is set to `OFF`.

Example:
```
CALCulate:IFPan:AVERage:TIME? -> 0.1
```

. . . :TYPE MINimum|MAXimum|SCALar|OFF

Setting of the averaging procedure for the IF-panorama data

Parameters:

MINimum	MIN hold function is on
MAXimum	MAX hold function is on
SCALar	AVG averaging function is on
OFF	Switching on the Clear Write function

Note:
For the SCALar averaging procedure the averaging time and measuring time can be set by commands CALCulate:IFPan:AVERage:TIME and MEASure:TIME, respectively.

**RST state:*
OFF

Example:
```
CALCulate:IFPan:AVERage:TYPE MAXimum
```

. . . :TYPE?

Query of the averaging process of the IF-panorama data

Result:

MIN	MIN hold process is running
MAX	MAX hold process is running
SCAL	AVG averaging process is running
OFF	Switching on the Clear Write function

Example:
```
CALCulate:IFPan:AVERage:TYPE? -> MAX
```

. . :CLEar

Restart of the MIN or MAX hold function for the IF-panorama data

Parameters:
none

Example:
```
CALCulate:IFPan:CLEar
```

. . :MARKer:MAXimum[:PEAK]

Centering of the IF-panorama spectrum to the absolute level maximum

Parameters:
none

Example:
`CALCulate:IFPan:MARKer:MAXimum`

. . :MARKer:MAXimum:LEFT

Centering of the IF-panorama spectrum to the next relative level maximum left of the marker when the squelch is off. When it is on the center frequency is set to the next level maximum to the left which is above the squelch line.

Parameters:
none

Example:
`CALCulate:IFPan:MARKer:LEFT`

. . :MARKer:MAXimum:RIGHt

Centering of the IF-panorama spectrum to the next relative level maximum right of the marker when the squelch is off. When it is on the center frequency is set to the next level maximum to the right which is above the squelch line.

Parameters:
none

Example:
`CALCulate:IFPan:MARKer:RIGHt`

. :DSCan
. . :AVERage
. . . :TYPE MAXimum|OFF

Setting of the display mode of the DSCan spectrum

Parameters:

MAXimum	indication of maximum values
OFF	indication of current values

**RST state:*
OFF

Example:
```
CALCulate:DSCan:AVERage:TYPE MAXimum
```

. . . :TYPE?

Query of the display mode of the DSCan spectrum

Result:

MAX	indication of maximum values
OFF	indication of current values

Example:
```
CALCulate:DSCan:AVERage:TYPE? -> MAX
```

. . :CLEar

Clears the DSCan spectrum. If the display has been selected to be MAXimum, maximum value generation restarts.

Parameters:
none

Example:
```
CALCulate:DSCan:CLEar
```

. . :MARKer:MAXimum[:PEAK]

The frequency marker jumps to the absolute level maximum in the DSCan spectrum.

Parameters:
none

Example:
`CALCulate:DSCan:MARKer:MAXimum`

. . :MARKer:MAXimum:NEXT

The frequency marker jumps to the next relative level maximum right of the marker within the DSCan spectrum when the squelch is off. When it is on the frequency marker is set to the next level maximum to the right that is above the squelch line. If there is no further level maximum right of the current level maximum, the frequency marker jumps to the first level maximum to the left within the DSCan spectrum.

Parameters:
none

Example:
`CALCulate:IFPan:MARKer:RIGHt`

4.5.5 DIAGnostic subsystem

DIAGnostic[:SERVice]
. :INFO
. . :SDATe<numeric_suffix>?

Query of software-generation date
If a module is not available, a zero string ("") is returned and the error message `HW MISSING` will be generated.

Parameters:
The processor is selected via the `<numeric suffix>`:

1 or no `<numeric suffix>`	main processor (EB200P1)
2	DSP IF Section (EB200Z1)
3	DSP IF-panorama (EB200SU)
4	Front Panel Control Unit (EB200F1)

Result:
`<year>,<month>,<day>`
`<year>` = **1900** to
`<month>` = **1 to 12**
`<day>` = **1 to 31**

Example:
```
DIAGnostic:INFO:SDATe1? -> 1998,10,2
```

. . :SVERsion<numeric_suffix>?

Query of software version
If a module is not available, a zero string ("") is returned and the error message `HW MISSING` will be generated.

Parameters:
The parameter is selected via the `<numeric suffix>`:

1 or no `<numeric suffix>`	main processor (EB200P1)
2	DSP IF Section (EB200Z1)
3	DSP IF-panorama (EB200SU)
4	Front Panel Control Unit (EB200F1)

Result:
Software version and identification number of software in format Vxx.yy-aaaa.bbbb.cc (also see `*IDN?`)

Example:
```
DIAGnostic:INFO:SVERsion1? -> V01.00-4055.3671.00
```

. :MONitor? <module>

Output of test point information of one or all modules recognized.

Parameters:

<module> information relating to module to be queried:

P1	Processor
V1	Preselection VHF/UHF
S1	Standard frontend 1 VHF/UHF
S2	Standard frontend 2 VHF/UHF
Z1	IF section
DC	DC/DC converter
SU	IF-panorama
VH	Preselection HF
FH	Frontend HF
ALL	Output of test point information of all modules

Result:
If the output format is set to ASCII, all information relating to the test points of a known module are output in a table.
The table comprises the following columns:
module identification, test point name, symbol for test point state, current voltage in mV, lower limit, upper limit

Meaning of symbols for the test point state:
" " = OK, test point voltage within limits
"^ " = test point voltage is greater than the upper limit
"v" = test point voltage is less than the upper limit

If the limits are irrelevant in the current operation mode, no limits will be output.

Example:

```
DIAGnostic:MONitor? S2 ->
S2      TP_2ND_IF        2583   (   2300 /   2800 )
S2      TP_3RD_IF        2407   (   2120 /   2600 )
S2      TP_SAM_LEV       2179   (    200 /   4080 )
S2      TP_2NDLOLEV      1534   (    700 /   3200 )
S2      TP_3RDLOLEV       977   (    300 /   1300 )
S2      TP_2NDLOPLL      1882   (   1000 /   3000 )
S2      TP_VXO_PLL  v       1   (    200 /   3400 )
S2      TP_EXT_REF  v       1   (   2000 /   4000 )
```

If the output format is set to binary format, a binary data block will be output which is similar to the structure described under "4.4.5 Preparation for Use" followed by the test point descriptions with:

2 bytes module identifiers
12 bytes test point name
2 bytes current value in mV
1 byte OK flag for test point voltage (0= OK, 1 = too low, 2 = too high)
1 byte validity flag for limit values (0 = invalid, 1 = valid)
2 bytes minimum value in mV
2 bytes maximum value in mV

Example:

```
DIAGnostic:MONitor? S2 -> #3180xxxxxx
```

. :TPOint[<numeric_suffix>]? <module>

Output of test point voltage of a module. The test point (1 to 8) on the particular module is selected via `<numeric suffix>`:

Parameters:

`<module>` information relating to module to be queried:

P1	Processor
V1	Preselection
S1	Standard frontend 1
S2	Standard frontend 2
Z1	IF section
DC	DC/DC converter
SU	IF-panorama
VH	Preselection HF
FH	Frontend HF

Result:

Current test point voltage in mV

Example:

```
DIAGnostic:TPOint3? S2 -> 2163
```

4.5.6 DISPlay subsystem

DISPlay
. :BRIGhtness <numeric_value>|MINimum|MAXimum

Controls the brightness of the display backlighting

Parameters:

`<numeric_value>`	brightness of backlighting from 0 to 1 0 = backlighting off 1 = full backlighting
`MINimum|MAXimum`	backlighting off|full backlighting

Note:
The brightness can be set in 7 discrete steps. Intermediate values are therefore rounded to the nearest discrete value.

**RST state:*
1.0

Example:
```
DISPlay:BRIGhtness 0.5
```

. :BRIGhtness? [MINimum|MAXimum]

Query of brightness of display backlighting

Parameter:

none	query of current brightness
`MINimum|MAXimum`	query of lowest|highest brightness

Result:
Brightness of backlighting from 0 to 1

Example:
```
DISPlay:BRIGhtness? -> 0.5
```

. :BRIGhtness:DWELl <numeric_value>|MINimum|MAXimum|INFinity

Controls the switch-on time of display backlighting. When the switch-on time has elapsed, the backlighting is switched off. The switch-on time is started again after every keystroke.

Parameter:

`<numeric_value>`	switch-on time in seconds (it is rounded to values 30,60,180,300,600,1200)
`MINimum|MAXimum`	lowest or highest switch-on time
`INFinity`	backlighting is never switched off.

Note:
The switch-on time can be set in 7 discrete steps (30, 60, 120, 180, 300, 600, 1200 seconds). The parameter is therefore rounded to the nearest discrete value.

**RST state:*
`INFinity`

Example:
```
DISPlay:BRIGhtness:DWELl 45
```

. :BRIGhtness:DWELl? [MINimum|MAXimum]

Query of switch-on time of display backlighting

Parameters:

none	query of current switch-on time
`MINimum|MAXimum`	query of lowest|highest switch-on time

Result:
Switch-on time in seconds. 9.9E37 is output as an infinite number.

Example:
```
DISPlay:BRIGhtness:DWEll? -> 3.0
```

. :ENABle <Boolean>

Enable or disable the manual control and display (display, rollkey and keys).
`CONTROLLED BY REMOTE` is displayed on the front panel in the "disable" state. The string can be configured by means of the `DISPLAY:ENABLe:LABel` command. This command is advantageous if, in systems, ESMB is exclusively controlled by Remote.
When the front-panel controls are switched off, additional computing power becomes available in the processor and time-critical operations (scans, transmission of large volumes of data) run much more quickly.

Parameters:

`ON`	enable manual control
`OFF`	disable manual control

**RST state:*
`ON`

Example:
```
DISPlay:ENABle ON
```

. :ENABle?

Query of state of manual control

Parameters:
none

Result:

1	manual control enabled
0	manual control disabled

Example:
```
DISPlay:ENABle? -> 1
```

. :ENABle:LABel<string>

Entry of a user-defined information string displayed on the front panel in the DISPlay:ENABle OFF state. The user is informed why the system under remote control has switched the display off and why manual control is currently disabled.

Parameters:

<string>	ASCII string with 30 characters max.

**RST state:*
```
"CONTROLLED BY REMOTE"
```

Example:
```
DISPlay:ENABle:LABel "THIS IS A TEST"
```

. :ENABle:LABel?

Query of currently set information string

Parameters:
none

Result:

<String>	ASCII string	with 30 characters max.

Example:
```
DISPlay:ENABle:LABel? -> "THIS IS A TEST"
```

. :MENU[:NAME] <menu_name>

Selection of a specific display representation from the given list

Parameters:

<menu_name>	DEFAULT	display of frequency, offset and level
	IFPAN	starts the option EB200SU (IF-panorama) and preferably the display of the IF-panorama data
	LEVEL	preferably level meter display
	TONE	zoomed level display
	FREQ	full-screen of frequency
	BANDW	representation for bandwidth measurement
	MVALUE	representation of all measured values

**RST state:*
DEFAULT

Example:
```
DISPlay:MENU LEVEL
```

. :MENU[:NAME]?

Query of currently selected display.

Parameters:
none

Result:

<menu_name>	List (see above)

Example:
```
DISPlay:MENU? -> LEVEL
```

. :CMAP:DEFault

Selection of normal display representation

Parameters:
none

**RST state:*
NORMal

Example:
```
DISPlay:CMAP:DEFAULT
```

. :CMAP NORMal|INVerted

Selection of normal or inverted display representation

Parameters:

NORMAL	background white, letters and lines black
INVERTED	background black, letters and lines white

**RST state:*
NORMal

Example:
```
DISPlay:CMAP NORMAL
```

. :CMAP?

Query of the currently selected display representation

Parameters:
none

Result:

NORMAL	background white, letters and lines black
INVERTED	background black, letters and lines white

Example:
```
DISPlay:CMAP? -> NORMAL
```

4.5.7 FORMat subsystem

FORMat
. :BORDer NORMal|SWAPped

Specifies whether binary data is first to be transferred with low or high byte.

Note:
This command only has an effect upon the trace data. For UDP data there is a separate setting possibility, described in Annex F (Datagram Communication).

Parameters:

`NORMal`	MSB -> ... -> LSB
`SWAPped`	LSB ->... -> MSB

**RST state:*
`NORMal`

Example:
```
FORMat:BORDer SWAPped
```

. :BORDer?

Query of output order for binary data

Parameters:
none

Result:
```
NORM, SWAP
```

Result:
```
FORMat:BORDer? -> SWAP
```

. [:DATA] ASCii|PACKed

Specifies the output format of the following queries:
```
SENSe:DATA?
TRACe:DATA?
```

Parameters:

`ASCii`	output with ASCII format
`PACKed`	output with internal binary data format

**RST state:*
`ASCii`

Example:
```
FORMat PACKed
```

. [:DATA]?

Query of output format of the above-mentioned queries

Parameters:
none

Result:
`ASC, PACK`

Example:
`FORMat? -> PACK`

. :DIAGnostic:MONitor ASCii|PACKed

Sets the output format for the query `DIAGnostic:MONitor?`

Parameters:

`ASCii`	`output in` ASCII format
`PACKed`	output in internal binary data format

**RST state:*
`ASCii`

Example:
`FORMat:DIAGnostic:MONitor PACKed`

. :DIAGnostic:MONitor?

Query of the above stated output format

Parameters:
none

Result:
`ASC, PACK`

Example:
`FORMat:DIAGnostic:MONitor? -> PACK`

. :MEMory ASCii|PACKed

Specifies the output format of the queries `MEMory:CONTents?`

Parameters:

`ASCii`	output in ASCII format
`PACKed`	output in internally binary data format

**RST state:*
`ASCii`

Example:
```
FORMat:MEMory PACKed
```

. :MEMory?

Query of output format of above-mentioned queries

Parameters:
none

Result:
```
ASC, PACK
```

Example:
```
FORMat:MEMory? -> PACK
```

. :SREGister ASCII|BINary|HEXadecimal

Specify with which data format the queries of all `CONDition`, `EVENt`, `ENABle`, `PTRansition`, `NTRansition` registers and all IEEE-488.2 status registers are to be carried out.

Parameters:

`ASCii`	output as decimal figure in ASCII code (eg 128)
`BINary`	output as binary figure in ASCII code (eg #B1000000000000000)
`HEXadecimal`	output as hexadecimal figure in ASCII code (eg #H8000)

**RST state:*
`ASCii`

Example:
```
FORMat:SREGister HEXadecimal
```

. :SREGister?

Query with which data format the above-mentioned queries are carried out

Parameters:
none

Result:
`ASC, BIN, HEX`

Example:
```
FORMat:SREGister? -> HEX
```

4.5.8 INITiate subsystem

INITiate
. [:IMMediate]

Start command to initiate measurement. Is also used as a start command for different SCAN types.

If `SENSe:FREQuency:MODE` is set to `CW|FIXed`, with every `INITiate`-command a measurement is carried out and the result is stored in `MTRACE` or `ITRACE`.

If `SENSe:FREQuency:MODE` is set to `SWEep|MSCan`, the particular scan is started and a measurement is carried out for every step.

If eg command `TRACE:FEED:CONTrol MTRACE, ALWays` is used to enable the path to the buffer `MTRACE`, the results are stored in `MTRACE`.

Parameters:
none

Example:
`INITiate`

. :CONM
. . [:IMMediate]

Command to **CON**tinue a **M**easurement. Is also used as continue command for different SCAN types. `MTRACE` and `ITRACE` data sets are not deleted and are filled with measurement results according to setting. I.e.:
If `SENSe:FREQuency:MODE` is set to `CW|FIXed`, a measurement is carried out and possibly stored in `MTRACE` or `ITRACE`.
If `SENSe:FREQuency:MODE` is set to `SWEep|MSCan`, a measurement is carried out for each step and stored in `MTRACE` or `ITRACE`. As an alternative, the command `*TRG` or the interface message Group Execute Trigger (`GET`) can be used. The response time is the shortest for a `GET` which is why a `GET` should always be used for time-critical measurements.

Parameters:
none

Example:
`INITiate:CONM`

4.5.9 INPut subsystem

INPut
. :ATTenuation
. . :AUTO <Boolean>

Setting attenuation so that the best dynamic range is obtained; explicit switch on/off of attenuator sets AUTO to OFF

Parameters:

ON	attenuation is coupled to input-signal strength
OFF	attenuation is manually switched

**RST state:*
ON

Example:
```
INPut:ATTenuation:AUTO ON
```

. . :AUTO?

Query of the automatic attenuation setting

Parameters:
none

Result:
Attenuation is automatically switched 1
Attenuation is manually switched 0

Example:
```
INPut:ATTenuation:AUTO? -> 1
```

. . :MODE LOWNoise|LOWDistort|NORMal

Selection of operation modes for different receiving conditions

On the module "Preselection" there is one selectable amplifier in front of and behind each of the partly tuned range filters.

When "Normal" is selected, the amplifier behind the filter is being cut in. This achieves a good noise figure and at the same time good high-level signal characteristics because the receiving bandwidth is limited in front of the amplifier. This setting is recommended for normal receiving conditions.

When "Low Noise" is selected, the amplifier in front of the filter is being cut in. The 2nd amplifier will be cut off. This achieves the best noise figure but the amplifier will get the full signal power of the antenna input. This weakens the large-signal immunity especially with 2nd degree interference. This setting is strongly recommended for the use of mobile antennas.

When "Low Distortion" is selected, both amplifiers are being cut off. This achieves the best linearity but the noise figure will be correspondingly higher. This setting is especially recommended for areas with a lot of strong signals.

Parameters:

`LOWNoise`	low-noise reception
`LOWDistort`	low-distortion reception
`NORMal`	normal reception

**RST state:*
`NORMal`

Example:
```
INPut:ATTenuation:MODE LOWDistort
```

. . :MODE?

Queries the selection of operation modes for different receiving conditions.

Parameters:
none

Result:

`LOWN`	low-noise reception
`LOWD`	low-distortion reception
`NORM`	normal reception

Example:
```
INPut:ATTenuation:MODE? -> LOWD
```

. . :STATe <Boolean>

Switch on/off of input attenuator

Parameters:

`ON`	attenuator on
`OFF`	attenuator off

**RST state:*
level-dependent (because of `INPut:ATTenuation:AUTO ON` after `*RST`)

Example:

```
INPut:ATTenuation:STATe ON
```

. . :STATe?

Query of the input attenuator setting

Parameters:
none

Result:

Attenuator on	1
Attenuator off	0

Example:

```
INPut:ATTenuation:STATe? -> 1
```

4.5.10 MEASure subsystem

MEASure

. :BANDwidth:MODE XDB|BETA

Selection of bandwidth measurement method

Parameters:

XDB	bandwidth measurement method x dB
BETA	bandwidth measurement method Beta %

**RST state:*
XDB

Example:
```
MEASure:BANDwidth:MODE  XDB
```

. :BANDwidth:MODE?

Query of the selected bandwidth measurement method

Result:

XDB	bandwidth measurement method x dB
BETA	bandwidth measurement method Beta %

Example:
```
MEASure:BANDwidth:MODE? ->  XDB
```

. :BANDwidth:XDB<numeric_value>

Configuration of bandwidth measurement method x dB

Parameter:

<numeric_value>	0.0 to 100.0 dB

**RST state:*
26.0 dB

Example:
```
MEASure:BANDwidth:XDB 31
```

. :BANDwidth:XDB?

Query of configuration of bandwidth measurement method x dB

Result:
dB value of bandwidth measurement method x dB.

Example:
```
MEASure:BANDwidth:XDB? -> 31.0
```

. :BANDwidth:BETA<numeric_value>

Configuration of bandwidth measurement method Beta %

Parameter:

`<numeric_value>`	0.1 to 99.9 %

**RST state:*
`1.0 %`

Example:
```
MEASure:BANDwidth:BETA 10
```

. :BANDwidth:BETA?

Query of configuration of bandwidth measurement method Beta %

Result:
% value of bandwidth measurement method Beta %.

Example:
```
MEASure:BANDwidth:BETA? -> 10.0
```

. :MODE CONTinuous|PERiodic

Setting of continuous or periodic measuring mode

In the **PERiodic** measurement mode all detectors are discharged after the measuring time has elapsed, and the next measurement is started. Only the individual measured values per measuring period are displayed.
If the path to the result buffer `MTRACE` is enabled by command `TRACE:FEED:CONTrol MTRACE, ALWays`, a measured value is stored in `MTRACE` each time the measuring time has elapsed.

In the **CONTinuous** measuring mode the measuring detector is read out every 200 msec, irrespective of the measuring time. These current measured values are displayed.
The measuring time has an effect on the level detectors. With AVG the measuring time determines the averaging time. With PEAK the measuring time determines the fall time. With FAST the measuring time does not have any impact since it is only the current value which is measured.
If the path to the result buffer `MTRACE` is enabled by command `TRACE:FEED:CONTrol MTRACE, ALWays`, a current measured value can be stored in `MTRACE`.

Parameters:

`CONTinuous`	continuous measurement
`PERiodic`	periodic measurement

**RST state:*
`CONTinuous`

Example:
```
MEASure:MODE PERiodic
```

. :MODE?

Query of the set measuring mode

Parameters:
none

Result:

CONT	continuous measurement
PER	periodic measurement

Example:
```
MEASure:MODE? -> PER
```

. :TIME <numeric_value>|MINimum|MAXimum|DEFault

Setting the duration for all measurement functions (see also annex E: ESMB Measurement Functions)
The set measuring time also has an impact on the averaging time of the IF-panorama data (see also "CALCulate subsystem" on page 19).

Note:
Selecting a measuring time which really makes sense is the user's responsibility. Too short a measuring time will give rise to incorrect results.

Parameters:

<numeric_value>	time span in seconds
MINimum|MAXimum	min/max time span
DEFault	default time span

**RST state:*
DEFault

Example:
```
MEASure:TIME 200 ms
```

. :TIME? [MINimum|MAXimum]

Query of the set measuring time

Parameters:

none	queries the current time span
MINimum|MAXimum	queries the min/max time span

Result:
Time span in seconds; the default time span is indicated by DEF

Example:
```
MEASure:TIME? -> 0.2
```

4.5.11 MEMory subsystem

This subsystem contains all the functions necessary to operate the ESMB memory locations. The memory locations are addressed with the text (see "Parameters" on page 9) MEM0 to MEM999 (memory location 0 to memory location 999). Some commands allow the receiver (data set of receiver settings) to be addressed by Character Data RX, the currently set memory location by CURRENT and the next free memory location by NEXT .

The number of the currently active memory location can also be queried by the MSCAN:CHAnel? command.

MEMory

. :CLEar <name> [,<count>|MAXimum]

Clearing the contents of a memory location. A certain number of memory locations to be cleared may also be specified.

Parameters

<name>	MEM0 to MEM999 | CURRENT
<count>	number of memory locations to be cleared from memory location <name>; as a default value <count> = 1 is accepted
MAXimum	clearing all memory locations from <name> to the last memory location

Example:

```
MEMory:CLEar MEM123
```

. :COPY <src_name>, <dest_name>

Copy the memory contents from src to dest

Parameters:

<src_name>|RX	MEM0 to MEM999 |RX | CURRENT
<dest_name>|RX	MEM0 to MEM999 |RX | CURRENT|NEXT

Example:

```
MEMory:COPY MEM123, MEM10
```

. :CONTents <name>,<mem_paras>|<packed_struct>

Loading a memory location.
As an alternative to the parameter filed (<mem_paras>) a <Definite Length Block> can be transferred with binary data.

Parameters:

<name>	MEM0 to MEM999 | RX | CURRENT | NEXT
<mem_paras>	<F>, <THR>, <DEM>, <BW>, <ANT>, <ATT>, <ATTA>, <SQUC>, <AFC>,<ACT>
<F>	frequency (see SENS:FREQ:CW)
<THR>	squelch threshold (see OUTP:SQU:THR)
<DEM>	type of demodulation (see SENS:DEM)
<BW>	bandwidth (see SENS:BWID)
<ANT>	antenna number (see ROUT:SEL)
<ATT>	attenuator (see INP:ATT:STAT)
<ATTA>	attenuator auto (see INP:ATT:AUTO)
<SQUC>	squelch function (see OUTP:SQU:STAT)
<AFC>	AFC function (see (SENS:FREQ:CW:AFC)
<ACT>	setting/resetting the memory to scan (ON/OFF or 1/0)
<packed_struct>	binary data set as <Definite Length Block> with the following structure:
Frequency in Hz	4 bytes = unsigned long integer
Squelch threshold in 1/10 dBuV	2 bytes = signed integer
Demodulation type	2 bytes = meaning: 0 = FM, 1 = AM, 2 = PULSe, 3 = PM, 4 = IQ, 5 = ISB, 6 = CW, 7 = USB, 8 = LSB,
Bandwidth	2 bytes = meaning: 0 = 0.15 kHz, 1 = 0.3 kHz, 2 = 0.6 kHz, 3 = 1.0 kHz, 4 = 1.5. kHz, 5 = 2.5 kHz, 6 = 3 kHz, 7 = 4 kHz, 8 = 6 kHz, 9 = 8 kHz, 10 = 9 kHz, 11 = 15 kHz, 12 = 30 kHz, 13 = 100 kHz, 14 = 120 kHz, 15 = 150 kHz, 16 = 250 kHz, 17 = 300 kHz
Antenna number	1 byte = unsigned character 0 to 99
Attenuator	1 byte = unsigned character (1 = on / 0 = off)
Attenuator auto	1 byte = unsigned character (1 = on / 0 = off)
Squelch function	1 byte = unsigned character (1 = on / 0 = off)
AFC function	1 byte = unsigned character (1 = on / 0 = off)
Set/Reset memory	1 byte = unsigned character (1 = set / 0 = reset)

Total number of bytes = 16

Notes:

- *When loading the receiver data set (RX) the parameter <ACT> is ignored. It must nevertheless be specified.*
- *When loading with <packed_struct> the byte order within the 2- and 4-byte elements is determined by the setting command FORMat:BORDer.*

**RST state:*

The contents of the memory locations is kept after *RST.

Example:

```
MEMory:CONTents     MEM1,98.5 MHz,34, FM ,100 kHz,(@1),1,OFF,ON,OFF,ON
```

. :CONTents? <name>|RX

Query of contents of memory location

Parameters:

<name> MEM0 to MEM999 | RX | CURRENT

Result:

Depending on the setting by the command FORMat:MEMory either an ASCII data set or a binary data set is output:

The ASCII data set has the following structure:

<F>,<THR>,<DEM>,<BW>,<ANT>,<ATT>,<ATTA>,<SQUC>,<AFC>,<ACT>

<F> frequency (see SENS:FREQ:CW?)
<THR> squelch threshold (see OUTP:SQU:THR?)
<DEM> demodulation type (see SENS:DEM?)
<BW> bandwidth (see SENS:BWID?)
<ANT> antenna number (see ROUT:CLOS:STAT?)
<ATT> attenuator (see INP:ATT:STAT?)
<ATTA> attenuator auto (see INP:ATT:AUTO?)
<SQUC> squelch function (see OUTP:SQU:STAT?)
<AFC> AFC function (see (SENS:FREQ:CW:AFC?)
<ACT> set/reset for scan (1/0)

The binary data set is transferred as a <Definite Length Block> and has to be interpreted according to the above-mentioned format.

Notes:

- *During query of the receiver data set (RX) the parameter <ACT> is not defined and has to be ignored.*
- *When trying to read out an empty memory location the error message "MEMORY EMPTY" is generated.*

Example:

MEMory:CONTents? MEM1 -> 98500000,34,FM,100000,#14(@1),0,1,1,0,1

. . :MPAR <name>,<ACT>

Setting the memory location parameter (MPAR = MemoryPARameter) <ACT>

Parameters:

<name> MEM0 to MEM999 | CURRENT
<ACT> setting/resetting the memory to the scan (ON/OFF or 1/0)

Example:

MEMory:CONTents:MPAR MEM1, OFF

. . :MPAR? <name>

Query of memory-location parameter <ACT>

Parameters:

<name>	MEM0 to MEM999 | CURRENT

Result:

<ACT>	set/reset for scan (1/0)

Example:

```
MEMory:CONTents:MPAR? MEM1 -> 0
```

. :EXCHange <name1>, <name2>

Exchange of contents of two memory locations

Parameters:

<name1>	MEM0 to MEM999 | RX | CURRENT
<name2>	MEM0 to MEM999 | RX | CURRENT

Example:

```
MEMory:EXCHange MEM123, RX
```

4.5.12 OUTPut subsystem

OUTPut
. :AUXMode FREQuency|ANTCtrl

The switch "AUXMode" determines whether the frequency in BCD or the antenna number in BCD and the CTRL byte are output via connector X8 "AUX".
"FREQuency" is used for direction finder EBD 190.

Parameters:

`FREQuency`	frequency output at "AUX" 4-digit BCD (1, 10, 100, 1000 MHz)
`ANTCtrl`	output of antenna number in 2-digit BCD (ANTA1 to ANTA80) output of CTRL byte, binary (CTRL1 to CTRL8)

**RST state:*
`ANTCtrl`

Example:
```
OUTPut:AUXMode FREQuency
```

. :AUXMode?

Queries the setting of "AUXMode".

Parameters:
`none`

Result:
`FREQuency` (frequency output) or `ANTCtrl` (output of antenna number and CTRL byte)

Example:
```
OUTPut:AUXMode? → FREQuency
```

:BITAux [<numeric_suffix>]
. . [:STATe] <Boolean>

Sets the AUX bits at the rear panel

<numeric_suffix>

1	byte 1 corresponds to CTRL1 at X8.8'AUX'
2	byte 2 corresponds to CTRL2 at X8.27'AUX'
3	byte 3 corresponds to CTRL3 at X8.9'AUX'
4	byte 4 corresponds to CTRL4 at X8.28'AUX'
5	byte 5 corresponds to CTRL5 at X8.10'AUX'
6	byte 6 corresponds to CTRL6 at X8.29'AUX'
7	byte 7 corresponds to CTRL7 at X8.11'AUX'
8	byte 8 corresponds to CTRL8 at X8.30'AUX'

**Parameters:*

ON	Bit set to high level
OFF	Bit set to low level

RST state
OFF

Example:
```
OUTPut3 : BITAux2 ON
```

. . [:STATe] ?

Query of AUX bits at the rear panel.

Parameters:
none

Result:

1	Bit set = "high" level
0	Bit cleared = "low" level

Example:
```
OUTPut : BITAux2? → 1
```

. :BYTAux
. . [:STATe] <numeric_value>

Sets the 8 AUX bits by a single byte command

Parameters:

<numeric_value>	value of the AUX bytes (0 to 255, #H00 to #HFF or #B0 to #B11111111)

**RST state:*
0

Example:
```
OUTPut : BYTAux 7
```

. :BYTAux
. . [:STATe]?

Query of the 8 AUX bits by a single byte command

Parameters:
none

Result:
Depending on the settings by the FORMat : SREGister command, the contents of the register is transferred in decimal, binary or hexadecimal form in the ASCII code.

Example:
```
OUTPut : BYTAux? → 7
```

:SQUelch
. . [:STATe] <Boolean>

Switch on/off of squelch

Parameters:

ON	squelch on
OFF	squelch off

**RST state:*
OFF

Example:
```
OUTPut:SQUelch ON
```

. . [:STATe]?

Query of squelch setting

Parameters:
none

Result:

1	squelch on
0	squelch off

State:
`OUTPut:SQUelch? -> 1`

. . :CONTrol MEMory|NONE

Selection of the source for the operating state after switching the unit on, when reading the memory locations by the MEMory:COPY command, when using the RCL key or when running memory scan.

Parameters:

`MEMory`	squelch state and squelch value are read out of the memory locations
`NONE`	squelch state and squelch value are **not** read out of the memory locations

**RST state*
`MEMory`

Example:
```
OUTPut:SQUelch:CONTrol  NONE
```

. . :CONTrol?

Query of the source of squelch setting when reading memory locations

Parameters:
none

Result:
`MEM, NONE`

Example:
`OUTPut : SQUelch : CONTrol? → MEM`

. . :THReshold
. . . [:UPPer] <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting of squelch threshold

Parameters:

`<numeric_value>`	squelch threshold in dBuV
`UP|DOWN`	increase|decrease of squelch threshold by the value set with the command `OUTPut:SQUelch:THReshold[:UPPer]:STEP[:INCRement]`.
`MINimum|MAXimum`	sets the lowest/highest squelch threshold

**RST state:*
10 dBuV

Example:
```
OUTPut:SQUelch:THReshold 35 dBuV
```

. . . ? [MINimum|MAXimum]

Query of squelch threshold

Parameters:

none	query of current squelch threshold
`MINimum|MAXimum`	query of lowest/highest squelch threshold

Result:
Level tone reference value in dBuV

Example:
```
OUTPut:SQUelch:THReshold? -> 35
```

. . . . :STEP
. . . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the command `OUTP:SQU:THR[:UPP] UP|DOWN`

Parameters:

`<numeric_value>`	stepwidth of squelch threshold in dBuV
`MINimum|MAXimum`	sets the smallest|largest stepwidth

**RST state:*
`1 dBuV`

Example:
```
OUTP:SQU:THR:STEP 10 dBµV
```

. . . . . [:INCRement]? [MINimum|MAXimum]

Query of stepwidth

Parameters:

none	query of currently set stepwidth
`MINimum|MAXimum`	query of smallest|largest stepwidth

Result:
Stepwidth of squelch threshold in dBµV

Example:
```
OUTP:SQU:THR:STEP? -> 10
```

:TONE

. . [:STATe] <Boolean>

Switch on/off of level tone function. With level tone function switched on a tone is output depending on the level magnitude.

Parameters:

`ON`	level tone on
`OFF`	level tone off

**RST state:*
`OFF`

Example:
```
OUTPut:TONE ON
```

. . [:STATe]?

Query of the TONE mode

Parameters:
none

Result:

`1`	level tone on
`0`	level tone off

Example:
```
OUTPut:TONE? -> 1
```

. . :CONTrol ONLY|WITHaf

It can be selected whether, in the TONE mode, only the level tone or also the AF is output via the audio channel.

Parameters:

`WITHaf`	level tone and AF is output.
`ONLY`	only level tone is output.

**RST state:*
`ONLY`

Example:
```
OUTPut:TONE:CONTrol ONLY
```

. . :CONTrol?

Query of whether, in the TONE mode, only the level tone or also the AF is output via the audio channel.

Parameters:
none

Result:
`ONLY, WITH`

Example:
```
OUTPut:TONE:CONTrol? -> ONLY
```

. . :THReshold <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting the level tone reference threshold. Based on this value, the level scale is zoomed in the range -15 to +15 dB and the level magnitude is output as a tone (0 dB corresponds to approx. 400 Hz)

Parameters:

`<numeric_value>`	level tone reference threshold in dBuV
`UP|DOWN`	increase|reduction of level tone reference threshold by the value set in the `OUTPut:TONE:THReshold:STEP[:INCRement]` command.
`MINimum|MAXimum`	sets the lowest/highest level tone reference threshold

**RST state:*
15 dBuV

Example:
```
OUTPut:TONE:THReshold 35 dBuV
```

. . . :THReshold? [MINimum|MAXimum]

Query of level tone reference threshold

Parameters:

none	query of current level tone reference threshold
`MINimum|MAXimum`	query of lowest/highest level tone reference threshold

Result:
Level tone reference threshold in dBuV

Example:
```
OUTPut:TONE:THReshold? MIN -> 6
```

. . . . :STEP
. . . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the `OUTP:TONE:THR UP|DOWN` command

Parameters:

`<numeric_value>`	stepwidth for level tone reference threshold in dBµV
`MINimum|MAXimum`	sets the smallest/largest stepwidth

**RST state:*
1 dBuV

Example:
```
OUTP:TONE:THR:STEP 10 dBµV
```

. . . . . [:INCRement]? [MINimum|MAXimum]

Query of stepwidth

Parameters:

none	query of currently set stepwidth
`MINimum|MAXimum`	query of smallest/largest stepwidth

Result:
Stepwidth for level tone reference threshold in dBµV

Example:
```
OUTP:TONE:THR:STEP? -> 10
```

4.5.13 ROUTe subsystem

ROUTe

. :CLOSe <channel_list>

Selection of an antenna; the previous antenna has to be switched off with `ROUTe:OPEN:ALL` (also see ROUTe:SELect)

Error message:
If more than one antenna is to be selected, an execution error `-221,"Settings conflict"` will be generated.

Parameters:
`<channel_list>` allowed to contain only one number (0 to 99)

**RST state:*
`@1`

Example:
```
ROUTe:CLOSe (@23)
```

. :CLOSe? <channel_list>

Query of whether the corresponding antenna has been selected

Parameters:
`<channel_list>` contains a value for each antenna number to be queried

Result:
0 for each non-selected antenna number
1 for each selected antenna number

Example:
```
ROUTe:CLOSe? (@2, 10:12, 23) -> 0,0,0,0,1
```

. . :STATe? [MINimum|MAXimum]

Query of the antenna that has been selected

Parameters:
none query of currently selected antenna
`MINimum|MAXimum` query of lowest|highest antenna number

Result:
Antenna number as a `<Definite Length Block>`

Example:
```
ROUTe:CLOSe:STATe? -> #15(@23)
```

. :HF ANTHf|ANTVuhf

Selection of connector X3 (ANT HF) or X13 (ANT V/UHF), whichever the HF antenna (0 to 30 MHz) will be connected to.

Parameters:

`ANTHf`	HF signal is fed in via connector X3 (ANT HF)
`ANTVuhf`	HF signals is fed in via connector X13 (ANT V/UHF)

**RST state:*
`ANTHf`

Example:
```
ROUTe:HF ANTVuhf
```

. :HF?

Query of connector X3 (ANT HF) or X13 (ANT V/UHF) at the rear panel which was selected to feed in the HF signal.

Parameters:
`none`

Result:

`ANTH`	Connector X3 (ANT HF) is used to feed in the HF signal
`ANTV`	Connector X13 (ANT V/UHF) is used to feed in the HF signal

Example:
```
ROUTe:HF? ANTV
```

. OPEN
. . :ALL

Do not select antenna (antenna number 0 is set)

Parameters:
none

**RST state:*
none, as command is an event

Example:
```
ROUTe:OPEN:ALL
```

. :PATH
. . :CATalog?

Requesting a list of the currently defined antenna names
If the option EB200FS (Field Strength Measurement) is fitted, specific names are assigned to antenna numbers 1 to 5 (see example below).

Parameters:
none

Result:
For each antenna name there is one string separated with a comma.
`<name_string1>,<name_string2>,...`
If no antenna name is defined, a zero string ("") is output.

Example:
```
ROUTe:PATH:CATalog? ->  "HE200 HF      ", "HE200 20-200M", "HE200 .2-0.5G",
"HE200 .5-3GHZ", "GENERIC DIPOL", "ANT06", "ANT07",.....
```

. . [:DEFine] <path_name>, <channel_list>

Allocation of antenna name to antenna number.

Parameters:

`<path_name>`	This is a `<Character Data>` with up to 13 characters which contains the antenna name. The path name may also be put in inverted commas to allow the use of blanks.
`<channel_list>`	see `ROUTe:CLOSe`

**RST state:*
All names are kept even after *RST.

Example:
```
ROUTe:PATH HE110, (@10)
```

. . [:DEFine]? <path_name>

Query of the antenna number belonging to the antenna name indicated

Parameters:
<path_name> see ROUTe:PATH:DEFine
Error message:
If the <path_name> cannot be found in the list of names, an execution error -292, "Referenced name does not exist" will be generated.

Result:
Antenna number as a <Definite Length Block>

Example:
ROUTe:PATH? HE110 -> #15(@10)

. . :DELete
. . . :ALL

Deletes all allocations of antenna name to antenna number.

Parameters:
none

**RST state:*
No action, as command is only an event

Example:
ROUTe:PATH:DELete:ALL

. . . [:NAME] <path_name>

Deletes the allocation of antenna name to antenna number.

Parameters:
<path_name> see ROUTe:PATH:DEFine

Error message:
If the <path_name> cannot be found in the list of names, an execution error -292, "Referenced name does not exist" will be generated.

**RST state:*
No action, as command is only an event

Example:
ROUTe:PATH:DELete HE110

. SELect <channel_list>|UP|DOWN|MINimum|MAXimum

Corresponds to the following combination:
`ROUTe:OPEN:ALL`
`ROUTe:CLOSe <channel_list>`

Parameters:

`<channel_list>`	allowed to contain only one number (0 to 99)
`UP|DOWN`	goes in the list of antennas one position up or down
`MINimum|MAXimum`	selects antenna with the smallest or the biggest number

**RST state:*
see `ROUTe:CLOSe`

Example:
`ROUTe:SELect (@23)`

4.5.14 SENSe subsystem

[SENSe]
. :BANDwidth|BWIDth
. . [:RESolution] <numeric_value>|UP|DOWN|MINimum|MAXimum

Selection of bandwidth

Parameters:

`<numeric_value>`	value of bandwidth
`UP|DOWN`	to next|previous bandwidth
`MINimum|MAXimum`	sets the narrowest|widest bandwidth

**RST state:*
100 kHz or the nearest bandwidth

Example:
```
BANDwidth 2.4 kHz
```

. . [:RESolution]? [MINimum|MAXimum]

Query of current IF bandwidth

Parameters:

none	query of current bandwidth
`MINimum|MAXimum`	query of narrowest|widest bandwidth

Result:
IF bandwidth in Hz without unit specified

Example:
```
BANDwidth? -> 2400
```

. :CORRection:ANTenna ACTive|PASSive

Selection of k-factor table with respect to currently selected antenna

Parameters:

`ACTive`	passive antennae (eg HE200 without amplifier)
`PASSive`	active antennae (eg HE200 with amplifier)

**RST state:*
`PASSive`

Example:
```
CORRection:ANTenna ACTive
```

. . CORRection:ANTenna?

Query of selected k-factor table with respect to selected antenna

Result:

`ACT`	passive antennae (eg HE200 without amplifier)
`PASS`	active antennae (eg HE200 with amplifier)

Example:
```
CORRection:ANTenna?  -> ACT
```

. :DATA? [<data_handle>]

Query of the current measured values of active sensor functions.
When only the command `SENSe:DATA?` is used to query measured values, the measured values reported back may be as old as 200 ms. For display on the unit measured values are captured every 200 ms and put into a buffer.

When a complete measurement is to be started, possibly by using a predefined measuring time, for instance the command combination `INIT;:SENSe:DATA?` should be used. As a result, the measurement history is reset, i.e. the detectors are discharged, a measurement is started and the result is reported back when the measuring time has elapsed.

In order not to block remote-control communication during longer measuring times, the measured value should only be queried when the measurement has been completed and not right after starting.
The measured value thus obtained is stored in `MTRACe`, provided that the path to the result buffer `MTRACE` was enabled with command `TRACE:FEED:CONTrol MTRACE, ALWays`.
The unit may actively report the end of measurement (MEASUring bit in operation status register becomes inactive) via SRQ if the status register has been configured accordingly (see also "Status reporting system" on page 134). Then the measured value can be queried by using command `TRACE? MTRACE`.

Note:
For this command the keyword `SENSe` must not be omitted as `DATA?` can be mixed up with the subsystem `TRACe/DATA`.

Parameters:

none	output of the measured values of all active sensor functions; if no function is switched on, an error `-221, "Settings Conflict"` will be generated
`"[SENSe:]FREQuency:OFFSet"`	output of offset value or error
`"[SENSe:]VOLTage:AC"`	output of level value or error `-221, "Settings Conflict"`
`"[SENSe:]FSTRength"`	output of measured field strength value or error `-221, "Settings Conflict"`
`"AM"`	output of AM modulation index measurement value
`"AM:POSitive"`	output of AM positive modulation index measurement value
`"AM:NEGative"`	output of AM negative modulation index measurement value
`"FM"`	output of FM frequency deviation measurement value
`"FM:POSitive"`	output of FM positive frequency deviation measurement value
`"FM:NEGative"`	output of FM negative frequency deviation measurement value
`"PM"`	output of PM phase deviation measurement value
`"BANDwidth"`	output of band width measurement value

Note:
The sensor function `FSTRength` will only provide results if the SW option EB200FS is fitted. Also see Annex H.

Result:
Level in dBuV, offset in Hz
Level in dBuV, offset in Hz, field strength in 1/10 dBµV/m, AM modulation depth in 1/10 %, AM positive modulation depth in 1/10 %, AM negative modulation depth in 1/10 %, FM frequency deviation in Hz, positive frequency deviation in Hz, negative frequency deviation in Hz, phase deviation in 1/100 rad, bandwidth in Hz

The output format is generated depending on the programming with command `FORMat:DATA`:

`ASCii`	normal ASCII output
`PACKed`	`<Definite Length Block>`: level in 1/10 dBuV (2 bytes), offset in Hz (4 bytes) field strength in 1/10 dBµV/m (2 bytes) AM-modulation index in 1/10 % (2 bytes), AM-positive modulation index in 1/10 % (2 bytes), AM-negative modulation index in 1/10 % (2 bytes), FM frequency deviation in Hz (4 bytes), positive frequency deviation in Hz (4 bytes), negative frequency deviation in Hz (4 bytes), phase deviation in 1/100 rad (2 bytes), bandwidth in Hz (4 bytes)

Examples:
```
SENSe:DATA? -> 23.4, -2500
SENSe:DATA? "VOLT:AC" -> 23.4
SENSe:DATA? "FREQuency:OFFSet" -> -2500
SENSe:DATA? "FSTRength" -> 45.4
```

. :DEModulation AM|FM|PULSe|PM|A0|IQ|ISB|A1|CW|LSB|USB

Switchover of type of demodulation

Note:
For SSB demodulation (CW, LSB and USB,) the frequency stepwidth is set to 1 Hz.

Error message:
If the set bandwidth exceeds 9 kHz at CW, LSB and USB, an error `-221,"Settings conflict"` will be generated if one of the SSB operation modes is to be switched on.

Parameters:

`FM`	switch on FM demodulator
`AM`	switch on AM demodulator
`PULSe`	switch on pulse demodulator
`PM`	switch on PM demodulator
`IQ or A0`	switch on IQ demodulator
`ISB`	switch on ISB demodulator
`CW or A1`	switch on SSB demodulator 1-kHz beat
`USB`	switch on SSB demodulator upper sideband
`LSB`	switch on SSB demodulator lower sideband

*RST state:
`FM`

Example:
```
DEModulation FM
```

. :DEModulation?

Query of demodulation type

Parameters:
none

Result:
```
FM, AM, PULS, PM, ,IQ ,ISB, CW, USB, LSB
```

Example:
```
DEModulation? -> FM
```

. :DETector

. . [:FUNCtion] POSitive|PAVerage|FAST|RMS

Switching over the level-measuring process

Parameters:

POSitive	measuring the peak value (PEAK)
PAVerage	measuring the average value of the voltage (AVG)
FAST	measuring the current value (FAST)
RMS	measuring the average value of the power (RMS)

**RST state:*
PAVerage

Example:
DETector POSitive

. . [FUNCtion]?

Query of the current set level-measuring process

Parameters:
none

Result:
POS,PAV,FAST FAST or RMS

Example:
DETector? → POS

. :DSCan

. . :COUNt <numeric_value>|MINimum|MAXimum|INFinity

Setting the number of DSCan runs

Parameters:

`<numeric_value>`	number of runs
`MINimum|MAXimum`	minimum/maximum number
`INFinity`	infinite number

**RST state:*
`INFinity`

Example:
```
DSCan:COUNt 100
```

. . :COUNt? [MINimum|MAXimum]

Inquiry of the number of DSCan runs

Parameters:

none	inquiry of current number of runs
`MINimum|MAXimum`	inquiry of minimum/maximum number of runs

Result:
Inquiry of number of runs; if it is infinite the number 9.9E37 is output.

Example:
```
DSCan:COUNt? -> 100
```

. :FREQuency

. . :AFC <Boolean>

Switching on/off the AFC function

Parameters:

`ON`	AFC function on
`OFF`	AFC function off

**RST state:*
`OFF`

Example:
```
SENSe:FREQuency:AFC ON
```

. . :AFC?

Query of AFC function

Parameters:
none

Result:

AFC function on	`1`
AFC function off	`0`

Example:
```
SENSe:FREQuency:AFC? -> 1
```

. . [:CW|FIXed] <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting of receiver frequency

Parameters:

`<numeric_value>`	frequency value
`UP|DOWN`	increase|decrease of receiver frequency by the value set in the command `SENS:FREQuency[:CW|FIX]:STEP[:INCRement]`
`MINimum|MAXimum`	sets the lowest|highest receiver frequency

**RST state:*
98.5 MHz

Example:
```
FREQuency 98.5 MHz
```

. . [:CW|FIXed]? [MINimum|MAXimum]

Query of receiver frequency

Parameters:

none	query of current receiver frequency
`MINimum|MAXimum`	query of lowest|highest receiver frequency

Result:
Frequency value in Hz

Example:
```
FREQuency? -> 98500000
```

. . :DSCan

If the `STARt` and/or `STOP` frequency is changed then `CENTer` or `SPAN` is adjusted.
If `CENTer` of `SPAN` is changed, then the `STARt` or `STOP` frequency is adjusted.

Either CENTer and SPAN or STARt and STOP frequency can be changed in a command at the same time. Other parameter combinations will be rejected.

Note:
In the frequency range of the HF modules (9 kHz to 30 MHz), the maximal speed of the Digiscan is limited by the 10-kHz IF bandwidth. When exceeding the 150-kHz frequency limit a delay will become effective due to the switch-over time of a relay.

. . . :CENTer <numeric_value>|MINimum|MAXimum

Setting the center frequency of Digiscan
Correcting STARt and STOP frequency

Parameter:

`<numeric-value>`	frequency value
`MINimum | MAXimum`	sets min/max center frequency

**RST state:*
`97.5 MHz`

Example:
```
FREQuency : DSCan : CENTer  118 MHz
```

. . . :CENTer? [MINimum|MAXimum]

Query of the center frequency of Digiscan

Parameters:

none	query of the current center frequency
`MINimum | MAXimum`	query of the min/max center frequency

Result:
Frequency value in Hz

Example:

```
FREQuency : DSCan : CENTer? → 118000000
```

. . . :MARKer <numeric_value>|MINimum|MAXimum

Setting the marker frequency of Digiscan

Parameters:

`<numeric_value>`	frequency value
`MINimum | MAXimum`	sets min/max marker frequency

**RST state*
98.5 MHz

Example:

```
FREQuency : DSCan : MARKer  120 MHz
```

. . . :MARKer? [MINimum|MAXimum]

Query of the marker frequency of Digiscan

Parameters:

none	query of the current marker frequency
`MINimum | MAXimum`	query of min/max marker frequency

Result:
Frequency value in Hz

Example:

```
FREQuency : DSCan : MARKer? -> 120000000
```

. . . :RESolution:AUTO<Boolean>

Setting BW ZOOM on and off. When the BW ZOOM is set on in DSCAN, the start and stop frequency as well as span and center frequency are coupled (see 3.18.3 D-SCAN (option)):

Parameters:

ON	BW ZOOM mode on
OFF	BW ZOOM mode off

**RST state:*
OFF

Example:
```
FREQuency:DSCan:RESolution:AUTO ON
```

. . . :RESolution:AUTO?

Query of BW ZOOM mode.

Parameter:
none

Result:

BW ZOOM mode on	1
BW ZOOM mode off	0

Example:
```
FREQuency:DSCan:RESolution:AUTO -> 1
```

. . . :SPAN <numeric_value>|MINimum|MAXimum

Setting the display range of Digiscan
Correcting STARt and STOP frequency

Parameters:

<numeric_value>	frequency value
MINimum | MAXimum	sets min/max display range

**RST state:*
25 MHz

Example:
```
FREQuency : DSCan : SPAN  10 MHz
```

. . . :SPAN? [MINimum|MAXimum]

Query of the display range of Digiscan

Parameters:

none	query of the current display range
`MINimum | MAXimum`	query of min/max display range

Result:
frequency value in Hz

Example:
```
FREQuency : DSCan : SPAN? -> 10000000
```

. . . :STARt <numeric_value>|MINimum|MAXimum

Setting the start frequency of Digiscan

Parameters:

<numeric_value>	frequency value
`MINimum | MAXimum`	sets min/max start frequency

**RST state:*
85 MHz

Example:
```
FREQuency : DSCan : STARt  118 MHz
```

. . . :STARt? [MINimum|MAXimum]

Query of the start frequency of Digiscan

Parameters:

none	query of the current start frequency
`MINimum | MAXimum`	query of min/max start frequency

Result:
frequency in Hz

Example:
```
FREQuency : DSCan : STARt? → 118000000
```

. . . :STOP <numeric_value>|MINimum|MAXimum

Setting the stop frequency of Digiscan

Parameters:

`<numeric_value>`	frequency value
`MINimum | MAXimum`	sets min/max stop frequency

**RST state*
110 MHz

Example:
```
FREQuency : DSCan : STOP  136 MHz
```

. . . :STOP? [MINimum|MAXimum]

Query of the stop frequency of Digiscan

Parameters:

none	query of the current stop frequency
`MINimum | MAXimum`	query of min/max stop frequency

Result:
frequency in Hz

Example:
```
FREQuency : DSCan : STOP? → 136000000
```

. . :DSCan:SPEed LOW|NORMal|HIGH|MTIMe

Selection of DSCan speed.
The digital scan cannot be slowed down while it is running. Generated data may therefore be lost if they are not collected fast enough at the remote control interface. The maximum data throughput at the remote control interface can be fixed indirectly by setting the DSCan speed.

The `NORMal` setting corresponds to a medium speed at which with all probability all the results can be transferred to an application via the Ethernet interface with the aid of TCP. This is the standard setting after power-up of the unit and corresponds to the DSCan speed with firmware versions up to V02.22.

The `LOW` setting corresponds to a speed which is about 10 times less than that of the `NORMal` setting. The maximum data rate is limited to approx. 6 Kbyte/sec. This setting enables the transfer of all data via the RS232 PPP interface with the aid of UDP.

The `HIGH` setting gives the highest speed. The data rate can be as much as 320 Kbyte/sec. The results can be transferred to an application only via the Ethernet interface with the aid of UDP.

In position `MTIMe` it is not the hardware-supported sweep mechanism of the DSCAN which is used but incremental frequency stepping as in F-SCAN. This permits level measurement to be carried out for each channel in a specific measuring time. This mode is particularly suitable when it comes to measure impulse noise and simultaneously indicate the spectrum on the display. The speed depends on the measuring time.

Parameter:

`LOW`	slow speed
`NORMal`	medium speed (default after power-on)
`HIGH`	fastest speed
`MTIMe`	speed depends on measuring time

**RST state:*
`NORMal`

Example:
```
FREQuency:DSCan:SPEed NORMal
```

. . :DSCan:SPEed?

Query of the selected DSCan speed

Parameters:
none

Result:
```
LOW , NORM, HIGH, MTIM
```

Example:
```
FREQuency:DSCan:SPEed? → NORM
```

. . :MODE CW|FIXed|SWEep|MSCan|DSCan|FASTlevcw|LIST

Switchover of receiver operating mode

Parameters:

`CW|FIXed`	receiver monitors a frequency (CW and FIXed are equivalent)
`SWEep`	receiver is in frequency sweep mode (see `SENSe:SWEep`)
`MSCan`	receiver is in memory scan mode (see `SENSe:MSCan`)
`DSCan`	receiver is in Digiscan mode with data set
`FASTlevcw`	receiver is in Fastlevcw mode (fast triggered level measurement on one frequency)
`LIST`	receiver is in List mode (fast triggered level measurement on frequencies of a frequency list)

Remark:
The receiver remains on a CW frequency until scanning starts!
Digiscan mode can only be selected after the SW option EB200DC has been enabled.

Remarks referring to FASTlevcw and LIST mode:
The FASTlevcw and LIST modes can only be set after the EB200CM (Coverage Measurement) option has been enabled. (This SW option is available from V1.18 onwards.)
When changing to mode FASTlevcw or LIST, display and operation will both be disabled automatically since in these two modes there is no useful indication available. After changing to a different mode such as eg CW the display must be re-activated by using command `DISPlay:ENABle`.
In LIST mode, the continuous self-test of the unit is switched off after activation with command INIT and only switched on again after deactivation with command ABORt.

**RST state:*
`CW`

Example:
```
FREQuency:MODE SWEep
```

. . :MODE?

Inquiry of receiver operating mode

Parameters:
none

Result:
```
CW, SWE, MSC, DSC, FAST, LIST
```

Example:
```
FREQuency:MODE? -> SWE
```

. . [:CW|FIXed]:RANGe:HF[:UPPer] <numeric_value>|MINimum|MAXimum

Sets the upper receive frequency to be received by the HF tuner.
Frequencies above this setting will be received by the V/UHF tuner.
If there is no HF tuner installed this setting will be without effect.

Parameters:

`<numeric_value>`	upper receive-frequency limit of the HF tuner
`MINimum|MAXimum`	sets the lowest/highest HF tuner receive frequency

**RST state:*
30.0 MHz

Example:
```
FREQuency:RANGe:HF 20 MHz
```

. . [:CW|FIXed]:RANGe:HF[:UPPer]? [MINimum|MAXimum]

Queries the upper receive frequency to be received by the HF tuner.

Parameters:

none	queries the current HF tuner receive frequency
`MINimum|MAXimum`	queries the lowest/highest HF tuner receive frequency

Result:
frequency value in Hz

Example:
```
FREQuency:RANGe:HF? → 20000000
```

. . :SPAN<numeric_value>|UP|DOWN |MINimum|MAXimum

Selection of frequency range with option IF-panorama.
The following ranges are available in addition to the IF bandwidths: 25, 50, 100, 200, 500, 1000 kHz. If a frequency range is entered it will be brought up to the next higher range.

Parameters:

`<numeric_value>`	frequency range
`UP|DOWN`	taking the range after|before the current bandwidth
`MINimum|MAXimum`	sets the minimum|maximum frequency range

**RST state:*
`1000 kHz`

Example:
`FREQuency:SPAN 25 kHz`

. . :SPAN? [MINimum|MAXimum]

Query of frequency range with option IF-panorama

Parameters:

none	query of current frequency range
`MINimum|MAXimum`	query of minimum|maximum frequency range

Result:
Frequency value Hz

Example:
`FREQuency:SPAN? → 25000`

. . :STARt <numeric_value>|MINimum|MAXimum

Setting of start frequency of a frequency scan

Parameters:

`<numeric_value>`	frequency
`MINimum|MAXimum`	sets the lowest|highest start frequency

**RST state:*
`20 MHz`

Example:
`FREQuency:STARt 118 MHz`

. . :STARt? [MINimum|MAXimum]

Query of start frequency of a frequency scan

Parameters:

none	query of current start frequency
`MINimum|MAXimum`	query of lowest|highest start frequency

Result:
Frequency in Hz

Example:
`FREQuency:STARt? -> 118000000`

. . :STEP
. . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the command `SENSe:FREQuency[:CW|FIXed] UP|DOWN`

Note:
For SSB demodulation (CW, LSB and USB), the frequency stepwidth will be set to 1 Hz.

Parameters:

`<numeric_value>`	frequency stepwidth
`MINimum|MAXimum`	sets the smallest|largest stepwidth

**RST state:*
`1 kHz`

Example:
`FREQuency:STEP 25 kHz`

. . . [:INCRement]? [MINimum|MAXimum]

Query of stepwidth

Parameters:

none	query of currently set stepwidth
`MINimum|MAXimum`	query of smallest|largest stepwidth

Result:
Frequency stepwidth in Hz
Example:
FREQuency:STEP? -> 25000

. . :STOP <numeric_value>|MINimum|MAXimum

Setting the stop frequency of a frequency scan

Parameters:

`<numeric_value>`	frequency
`MINimum|MAXimum`	sets the lowest|highest stop frequency

**RST state:*
`650 MHz`

Example:
```
FREQuency:STOP 136 MHz
```

. . :STOP? [MINimum|MAXimum]

Query of a stop frequency of a frequency scan

Parameters:

none	query of current stop frequency
`MINimum|MAXimum`	query of lowest|highest stop frequency

Result:
Frequency in Hz

Example:
```
FREQuency:STOP? -> 136000000
```

. :FUNCtion

If the sensor function(s) is (are) changed, the trace data set `MTRACE` is always deleted.

. . :CONCurrent <Boolean>

Determines whether several sensor functions can at the same time be switched or not. If CONCurrent = OFF, the command `SENSe:FUNCtion[:ON]` has the effect of a 1-out-of-n selection (one is switched on, the previously activated is automatically switched off). If CONCurrent = ON, the command `SENSe:FUNCtion[:ON]` switches the corresponding function on, while all the other functions remain unchanged. If CONCurrent is switched from ON to OFF, the function `"VOLTage:AC"` is switched on and all other functions are switched off.

Parameters:

`ON`	CONCurrent on
`OFF`	CONCurrent off

**RST state:*
`ON`

Example:
```
FUNCtion:CONCurrent ON
```

. . :CONCurrent?

Query of several sensor functions that, at the same time, can be switched or not

Parameters:
none

Result:

CONCurrent switched on	`1`
CONCurrent switched off	`0`

Example:
```
FUNCtion:CONCurrent? -> 1
```

. . :OFF <sensor_function> {,<sensor_function>}

Switch-off of one or several sensor functions

Parameters:
see `SENSe:FUNCtion[:ON]`

**RST state:*
`"FREQ:OFFS"`

Example:
```
FUNCtion:OFF "FREQ:OFFS"
```

. . :OFF?

Query of the sensor functions being switched off

Parameters:
none

Result:
List of the sensor functions being switched off. For strings see `SENSe:FUNCtion[:ON]`.

Example:
```
FUNCtion:OFF? -> "FREQ:OFFS"
```

. . . :COUNt?

Query of the number of sensor functions being inactive

Parameters:
none

Result:
Number of sensor functions being inactive

Example:
```
FUNCtion:OFF:COUNt? -> 2
```

. . [:ON] <sensor_function> {,<sensor_function>}

Switch-on of one or several sensor functions

Error message:
If CONCurrent = OFF, an error `-108, "Parameter not allowed"` will be generated for ten or more parameters.

Parameters:
`<sensor_function>` is one of the following strings:

`"VOLTage:AC"`	switch on level measurement
`"FREQuency:OFFSet"`	switch on offset measurement
`"FSTRength"`	switch on field strength measurement
`"AM"`	switch on AM modulation index measurement
`"AM:POSitive"`	switch on AM positive modulation index measurement
`"AM:NEGative"`	switch on AM negative modulation index measurement
`"FM"`	switch on FM frequency deviation measurement
`"FM:POSitive"`	switch on FM positive frequency deviation measurement
`"FM:NEGative"`	switch on FM negative frequency deviation measurement
`"PM"`	switch on PM phase deviation measurement
`"BANDwidth"`	switch on bandwidth measurement

Note:
The sensor function `FSTRength` will only provide results if the SW option EB200FS is fitted. Also see Annex H.

**RST state:*
`"VOLTage:AC"`

Example:
```
FUNCtion "VOLT:AC", "FREQ:OFFS"
```

. . [:ON]?

Query of sensor functions being switched on

Parameters:
none

Result:
List of sensor functions switched on. If no function is active, a zero string ("") is output. The list has a specific order:
1. level measurement function
2. offset measurement function
3. field strength measurement function
4. AM modulation index measurement function
5. AM positive modulation index measurement function
6. AM negative modulation index measurement function
7. FM frequency deviation measurement function
8. FM positive frequency deviation measurement function
9. FM negative frequency deviation measurement function
10. PM phase deviation measurement function
11. bandwidth measurement function

The following strings are to be expected:

`"VOLT:AC"`	level measurement switched on
`"FREQ:OFFS"`	offset measurement switched on
`"FSTR"`	field strength measurement switched on
`"AM"`	AM modulation index measurement switched on
`"AM:POS"`	AM positive modulation index measurement switched on
`"AM:NEG"`	AM negative modulation index measurement switched on
`"FM"`	FM frequency deviation measurement switched on
`"FM:POS"`	FM positive frequency deviation measurement switched on
`"FM:NEG"`	FM negative frequency deviation measurement switched on
`"PM"`	PM phase deviation measurement switched on
`"BAND"`	bandwidth measurement switched on

Example:
```
FUNCtion? -> "VOLT:AC", "FREQ:OFFS"
```

. . . :COUNt?

Query of the number of sensor functions being active

Parameters:
none

Result:
Number of sensor functions being active

Example:
```
FUNCtion:Count? -> 2
```

. :GCONtrol

. . [:FIXed|MGC] <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting of MGC value

Parameters:

`<numeric_value>`	gain control factor in dBµV -30 dBµV = no gain control -> maximum sensitivity 110 dBµV = maximum gain control -> minimum sensitivity
`UP|DOWN`	increase|decrease of the MGC value by the value set in the command `SENSe:GCONtrol[:FIXed|MGC]:STEP[:INCRement].`
`MINimum|MAXimum`	sets the smallest|largest MGC value

**RST state:*
`50 dBuV`

Example:
```
GCONtrol 50
```

. . [:FIXed|MGC]? [MINimum|MAXimum]

Query of the MGC value

Parameters:

none	query of current MGC value
`MINimum|MAXimum`	query of smallest|largest MGC value

Result:
Gain control

Example:
```
GCONtrol? -> 50
```

. . . :STEP
. . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the command `SENSe:GCONtrol[:FIXed|MGC] UP|DOWN`

Parameters:

`<numeric_value>`	MGC stepwidth
`MINimum|MAXimum`	smallest|largest stepwidth

**RST state:*
1 dB

Example:
```
GCONtrol:STEP 10
```

. . . . [:INCRement]? [MINimum|MAXimum]

Query of the MGC stepwidth

Parameters:

none	query of currently set stepwidth
`MINimum|MAXimum`	query of smallest|largest stepwidth

Result:
MGC stepwidth in dB

Example:
```
GCONtrol:STEP? -> 10
```

. . :MODE FIXed|MGC|AUTO|AGC

Type of gain control

Parameters:

`FIXed|MGC`	control is determined by MGC value
`AUTO|AGC`	control is automatically generated (AGC)

**RST state:*
`AUTO`

Example:
```
GCONtrol:MODE AUTO
```

. . :MODE?

Query of type of gain control

Parameters:
none

Result:

`FIX, AUTO`	see above

Example:
```
GCONtrol:MODE? -> AUTO
```

. :MSCan

The MSCan system controls the frequency function of the device, provided the memory scan has been activated by SENSe:FREQuency:MODE MSCan. Each scan is started by INITiate[:IMMediate]. The memory locations are placed in the MEMory subsystem and are set for query during the scan.

. . :CHANnel <name>

Setting of current memory location
The memory locations are addressed by the text (see "Parameters" on page 9) MEM0 to MEM999 (memory location 0 to memory location 999) and the next free memory location by ACTUAL.
During the memory scan, this command is not permitted.

Parameters:
<name> MEM0 to MEM999 | NEXT

**RST state:*
MEM0

Example:
MSCan:CHANnel MEM357

. . :CHAnnel?

Output of current memory location

Parameters:
none

Result:
Number of current memory location

Example:
MSCan:CHANnel? → 357

. . :CONTrol
. . . :[ON]<control_function> {,<control_function>}

Command for switch-on of the 'STOP:SIGNal' functions

With 'STOP:SIGNal' the disappearance of the signal during the dwell time causes the dwell time to be aborted. The hold time after the disappearance of the signal is set with SENSe:MSCan:HOLD:TIME.

Parameters:
<control_function> is the following string:
'STOP:SIGNal' switches the signal-controlled dwell time on

**RST state*
After *RST there is no control function running

Example:
MSCan:CONTrol 'STOP:SIG'

. . . [:ON]?

Query of scan-control mechanism that is switched on

Parameters:
none

Result:
A list of the scan-control mechanisms that are switched on is output. If there is nothing switched on then a zero string ("") is output.

The following strings can be expected:

" "	no mechanism switched on
"STOP:SIGN"	signal-controlled dwell time is switched on

Example:
```
MSCan:CONTrol?→"STOP:SIGN"
```

. . . :OFF <control_function> {,<control_function}

Switches off one or more scan-control mechanisms

Parameters:
see `SENSe:MSCan:CONTrol [:ON]`

**RST state:*
After *RST there is no control function enabled.

Example:
```
MSCan:CONTrol:OFF "STOP:SIGN"
```

. . . :OFF?

Query of scan-control mechanisms that are switched off

Parameters:
none

Result:
A list of the scan-control mechanisms that are switched off is output. For strings see `SENSe:MSCan:CONTrol[:ON]`.

Example:
```
MSCan:CONTrol:OFF?→"STOP:SIGN"
```

. . :COUNt <numeric_value>|MINimum|MAXimum|INFinity

Information about the number of MSCans

Parameters:

`<numeric_value>`	number of scans
`MINimum|MAXimum`	minimum|maximum number
`INFinity`	infinite number

**RST state:*
INFinity

Example:
```
MSCan:COUNt 100
```

. . :COUNt? [MINimum|MAXimum]

Query of number of MSCans

Parameters:

none	query of current number of scans
`MINimum|MAXimum`	query of minimum|maximum number of scans

Result:
Number of scans; 9.9E37 is output for an infinite number

Example:
```
MSCan:COUNt? -> 100
```

. . :DIRection UP|DOWN

Setting of scan direction

Parameters:

`UP`	scans in direction of descending memory numbers
`DOWN`	scans in direction of ascending memory numbers

**RST state*
`UP`

Example:
```
MSCan:DIRection DOWN
```

. . :DIRection?

Query of scan direction

Parameters:
none

Result:
`UP, DOWN`

Example:
`MSCan:DIRection?→DOWN`

. . :DWELl <numeric_value>|MINimum|MAXimum|INFinity

Setting the dwell time with the hold criterion fulfilled (T-DWELL in MSCAN-CONFIG menu)

Note:
According to the SCPI standard, this command is used to set the dwell time per scan step, i.e. the time required by a step. This definition is met in ESMB, if the squelch is switched off. The hold criterion is then fulfilled for each step.

Parameters:

`<numeric_value>`	dwell time in seconds
`MINimum|MAXimum`	lowest|highest dwell time
`INFinity`	infinite dwell time

**RST state:*
0.5 s

Example:
`SWEep:DWELl 10 ms`

. . :DWELl? [MINimum|MAXimum]

Query of dwell time

Parameters:

none	query of current dwell time
`MINimum|MAXimum`	query of lowest|highest dwell time

Result:
Dwell time in seconds; 9.9E37 is output for an infinite number

Example:
`MSCan:DWELl? 0.010`

. . :HOLD
. . . :TIME <numeric_value>|MINimum|MAXimum

Setting the hold time during signal-controlled scan continuation (T_NOSIG in MSCAN-CONFIG menu). If the signal disappears during the dwell time, the hold time is started. After completion of the hold time, the scan is continued with the next frequency even if the dwell time has not yet been completed. If the signal during the hold time exceeds the squelch threshold, the hold time is reset and the end of the dwell time or the renewed disappearance of the signal is awaited. The hold time is only important if the control function `"STOP:SIGNal"` (see `SENSe:MSCan:CONTrol`) is switched on.

Parameters:

`<numeric_value>`	hold time in seconds
`MINimum|MAXimum`	lowest|highest hold time

**RST state:*
0 s

Example:
```
SWEep:HOLD:TIME 10 ms
```

. . . :TIME? [MINimum|MAXimum]

Query of hold time

Parameters:

none	query of current hold time
`MINimum|MAXimum`	query of lowest|highest hold time

Result:
Hold time in seconds

Example:
```
MSCan:HOLD:TIME? 0.010
```

. :LIST

Within ESMB the LIST subsystem is used to define a list of frequencies. Provided that the EB200CM SW option is fitted, in `FREQuency:MODE LIST` mode triggered level measurements can be carried out on up to 50 frequencies.

. . :FREQuency <numeric_value>, <numeric_value>, ...

Input of list of frequencies on which levels are to be measured in LIST mode.

Parameters:

`<numeric_value>`	frequency value

Note:
The number of possible frequency values can be queried by using command `SENSe:LIST:FREQuency:POINts?`.

**RST state:*
`935200000, 935400000, 935600000`

50 frequencies altogether in increments of 10 kHz

Example:
```
LIST:FREQuency 935.8 MHz, 936.0 MHz, 936.2 MHz
```

. . LIST:FREQuency?

Query of list of frequencies on which levels are to be measured in LIST mode

Parameters:
none

Result:
`<numeric_value>, <numeric_value>, ...`

Example:
```
LIST:FREQuency? -> 935800000, 936000000, 936200000
```

. . LIST:FREQuency:POINts? MINimum|MAXimum

Query of the number of frequencies covered by command `LIST:FREQuency`

Parameters:

`none`	query of current number of frequencies
`MINimum|MAXimum`	query of minimum/maximum number of frequencies

Example:
```
LIST:FREQuency:POINts? MAX -> 50
```

. :ROSCillator

Control of reference oscillator

. . :EXTernal
. . . :FREQuency?

Query of given external reference frequency

Parameters:
none

Result:
10000000

Example:
```
ROSCillator:EXTernal:FREQuency? -> 10000000
```

. . [:INTernal]
. . . :FREQuency?

Query of internal reference frequency

Parameters:
none

Result:
10000000

Example:
```
ROSCillator:FREQuency? -> 10000000
```

. . :SOURce INTernal|EXTernal

Setting whether external or internal reference frequency is to be used.

Parameters:

INTernal	internal reference oscillator
EXTernal	external reference oscillator

**RST state:*
INTernal

Example:
```
ROSCillator:SOURce EXTernal
```

. . :SOURce?

Query of reference oscillator to be used

Parameters:
none

Result:

INT	internal reference oscillator
EXT	external reference oscillator

Example:
```
ROSCillator:SOURce? -> EXT
```

. :SWEep

The SWEep system controls the frequency function of the device if the frequency scan has been activated by the SENSe:FREQuency:MODE SWEep command. Each scan is initiated by INITiate[:IMMediate].

. . :CONTrol

. . . :[ON] <control _function> {,<control_function>}

Command for switch-on of the STOP:SIGNal functions
With "STOP:SIGNal" the disappearance of the signal during the dwell time causes the dwell time to be aborted. The hold time after the disappearance of the signal is set with SENSe:SWEep:HOLD:TIME.

Parameters:
<control_function> is one of the following strings:
"STOP:SIGNal" switch-on signal-controlled scan continuation

**RST state:*
After *RST no control function is switched on.

Example:
SWEep:CONTrol "STOP:SIGN"

. . . [:ON]?

Query of switched-on scan-control functions

Parameters:
none

Result:
List of switched-off control functions. If no function is active, a zero string ("") is output.

The following strings are to be expected:
"STOP:SIGN" signal-controlled scan continuation switched on
"" zero string: none of the two functions is active

Example:
SWEep:CONTrol? -> "STOP:SIGN"

. . . :OFF <control_function>{,<control_function}

Switch-off of one or several scan-control functions

Parameters:
see `SENSe:SWEEp:CONTrol [:ON]`

**RST state:*
After *RST there is no control function running.

Example:
```
SWEep:CONTrol:OFF "STOP:SIGN"
```

. . . :OFF ?

Query of switched-off scan-control functions

Parameters:
none

Result:
List of switched-off control functions. Strings see `SENSe:SWEep:CONTrol [:ON]`.

Example:
```
SWEep:CONTrol:OFF? ->"STOP:SIGN"
```

. . :COUNt <numeric_value>|MINimum|MAXimum|INFinity

Information about the number of sweeps

Parameters:

`<numeric_value>`	number of sweeps
`MINimum|MAXimum`	minimum|maximum number
`INFinity`	infinite number

**RST state:*
INFinity

Example:
```
SWEep:COUNt 100
```

. . :COUNt? [MINimum|MAXimum]

Query of number of sweeps

Parameters:

none	query of current number of sweeps
`MINimum|MAXimum`	query of minimum|maximum sweeps

Result:
Number of sweeps; 9.9E37 is output for an infinite number

Example:
```
SWEep:COUNt? -> 100
```

. . :DIRection UP|DOWN

Setting the scan direction

Parameters:

`UP`	scan with increasing frequency
`DOWN`	scan with decreasing frequency

**RST state:*
`UP`

Example:
```
SWEep:DIRection DOWN
```

. . :DIRection?

Query of scan direction

Parameters:
none

Result:
```
UP, DOWN
```

Example:
```
SWEep:DIRection? -> DOWN
```

. . :DWELl <numeric_value>|MINimum|MAXimum|INFinity

Setting the dwell time with the hold criterion fulfilled (T-DWELL in FSCAN-CONFIG menu).

Note:
According to the SCPI standard, this command is used to set the dwell time per scan step, i.e. the time required by a step. This definition is met in ESMB, if the squelch is switched off. The hold criterion is then fulfilled for each step.

Parameters:

`<numeric_value>`	dwell time in seconds
`MINimum|MAXimum`	lowest|highest dwell time
`INFinity`	infinite dwell time

**RST state:*
0.5 s

Example:
```
SWEep:DWELl 10 ms
```

. . :DWELl? [MINimum|MAXimum]

Query of dwell time with hold criterion fulfilled

Parameters:

none	query of current dwell time
MINimum|MAXimum	query of lowest|highest dwell time

Result:
Dwell time in seconds; 9.9E37 is output for an infinite number.

Example:
```
SWEep:DWELl? 0.010
```

. . :HOLD
. . . :TIME <numeric_value>|MINimum|MAXimum

Setting the hold time during signal-controlled scan continuation (T_NOSIG in FSCAN-CONFIG menu). If the signal disappears during the dwell time, the hold time is started. After completion of the hold time, the scan is continued with the next frequency even if the dwell time has not yet been completed. If the signal during the hold time exceeds the squelch threshold, the hold time is reset and the end of the dwell time or the renewed disappearance of the signal is awaited. The hold time is only important if the control function `"STOP:SIGNal"` (see `SENSe:SWEep:CONTrol`) is switched on.

Parameters:

`<numeric_value>`	hold time in seconds
`MINimum|MAXimum`	lowest|highest hold time

**RST state:*
0 s

Example:
```
SWEep:HOLD:TIME 10 ms
```

. . . :TIME? [MINimum|MAXimum]

Query of hold time during signal-controlled scan continuation

Parameters:

none	query of current hold time
`MINimum|MAXimum`	query of lowest|highest hold time

Result:
Hold time in seconds

Example:
```
SWEep:HOLD:TIME? 0.01
```

. . :STEP<numeric_value>|MINimum|MAXimum

Setting the frequency stepwidth for the frequency scan

Parameters:

<numeric_value>	frequency value
`MINimum|MAXimum`	sets the smallest/biggest frequency stepwidth

**RST state:*
`10 kHz`

Example:
```
SWEep:STEP 25 kHz
```

. . :STEP? [MINimum|MAXimum]

Query of frequency stepwidth of a frequency scan

Parameters:

none	query of current frequency stepwidth
`MINimum|MAXimum`	query of smallest|largest frequency stepwidth

Result:
Stepwidth in Hz

Example:
```
SWEep:STEP? -> 25000
```

. . :SUPPress

Inserting current frequency into suppress list. The range is obtained from the bandwidth according to the following formulae:

```
SSTARTn = SENSn: FREQ - SENSn:BAND/2
SSTOPn  = SENSn: FREQ + SENSn:BAND/2
```

The frequency pair is inserted into an empty space of the trace. Free spaces (gaps) are characterized by a frequency pair with the values 0.0.

Error message:
If the corresponding suppress trace has no free space, an error `-223 "Too much data"` is generated.

Note:
Suppress list 1 to 100 corresponds to 0 to 99 on front panel

Parameters:
none

**RST state:*
none, as command is an event

Example:
```
SWEep:SUPPress
```

. . . :SORT

Sorting and condensing suppress list. The frequency pairs are sorted to an ascending order of the start frequency. Overlapping is eliminated by extending the frequency pair. The other frequency pair is then deleted. Gaps within the suppress list are put to the end of the list.

Parameters:
`none`

**RST state:*
none, as command is an event

Example:
```
SWEep:SUPPress:SORT
```

. :VOLTage:AC:RANGe

. . [:UPPer]<numeric_value>UP|DOWN|MINimum|MAXimum

This command is used in the DSCAN mode to set the reference level. In order to avoid overdriving of the receiver, the reference level is set to the highest expected positive signal level.

Parameters:

`<numeric_value>`	reference level in dBµV
`UP|DOWN`	|increase | decrease of the reference level by the value that was set by command `VOLTage:AC:RANGe:STEP[:INCRement]`
`MINimum|MAXimum`	minimum|maximum reference level

**RST state:*
`50 dBµV`

Example:
```
VOLTage:AC:RANGe 90 dBµV
```

. . . :RANGe? [MINimum|MAXimum]

Query of reference level

Parameters:

none	query of current reference level
`MINimum|MAXimum`	query of lowest|highest reference level

Result:
Reference level in dBµV.

Example:
```
VOLTage:AC:RANGe? -> 90
```

. . . . :STEP
. . . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the command `VOLTage:AC:RANGe UP|DOWN`

Parameters:

`<numeric_value>`	stepwidth of reference level in dBuV
`MINimum|MAXimum`	sets the minimum|maximum stepwidth

**RST state:*
`1 dBuV`

Example:
```
VOLTage:AC:RANGe:STEP 10 dBuV
```

. . . . . [:INCRement]? [MINimum|MAXimum]

Query of stepwidth

Parameters:

none	query of current stepwidth
`MINimum|MAXimum`	query of minimum|maximum stepwidth

Result:
Stepwidth of reference level in dBuV

Example:

```
VOLTage:AC:RANGe:STEP? -> 10
```

4.5.15 STATus subsystem

The following `STATus` register commands are possible according to SCPI standard:

```
STATus
.   :OPERation
.   .   :CONDition?
.   .   :ENABle <numeric_value>
.   .   :ENABle?
.   .   [:EVENt]?
.   .   :NTRansition <numeric_value>
.   .   :NTRansition?
.   .   :PTRansition <numeric_value>
.   .   :PTRansition?
.   .   :SWEeping
.   .   .   :CONDition?
.   .   .   :ENABle <numeric_value>
.   .   .   :ENABle?
.   .   .   [:EVENt]?
.   .   .   :NTRansition <numeric_value>
.   .   .   :NTRansition?
.   .   .   :PTRansition <numeric_value>
.   .   .   :PTRansition?

.   :QUEStionable
.   .   :CONDition?
.   .   :ENABle <numeric_value>
.   .   :ENABle?
.   .   [:EVENt]?
.   .   :NTRansition <numeric_value>
.   .   :NTRansition?
.   .   :PTRansition <numeric_value>
.   .   :PTRansition?
```

Extended STATus register commands:

```
STATus
.   :EXTension
.   .   :CONDition?
.   .   :ENABle <numeric_value>
.   .   :ENABle?
.   .   [:EVENt]?
.   .   :NTRansition <numeric_value>
.   .   :NTRansition?
.   .   :PTRansition <numeric_value>
.   .   :PTRansition?

STATus
.   :TRACe
.   .   :CONDition?
.   .   :ENABle <numeric_value>
.   .   :ENABle?
.   .   [:EVENt]?
.   .   :NTRansition <numeric_value>
.   .   :NTRansition?
.   .   :PTRansition <numeric_value>
.   .   :PTRansition?
```

Exemplifying all STATus register commands, for example the STATus:OPERation:SWEeping register, the commands of the STATus:OPERation register are explained as follows.

STATus
. OPERation
. . :CONDition?

Query of the condition section of the OPERation status register

Parameters:
none

Result:
Depending on the setting by the `FORMat:SREGister` command, the contents of the register is transferred as a decimal, binary or hexadecimal value in the ASCII code.

Example:
`STATus:OPERation:CONDition? -> #H0008`

. . :ENABle <numeric_value>

Setting the enable section of the OPERation status register

Parameters:

`<numeric_value>`	value of the enable section (`0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111`)

**RST state:*
will not be changed by *RST

Example:
`STATus:OPERation:ENABle #H0008`

. . :ENABle?

Query of the enable section of the OPERation status register

Parameters:
none

Result:
Depending on the setting by the `FORMat:SREGister` command, the contents of the register is transferred in decimal, binary or hexadecimal format in the ASCII code.

Example:
`STATus:OPERation:ENABle? -> #H0008`

. . [:EVENt]?

Query of the event section of the OPERation status register

Parameters:
none

Result:
Depending on the setting by the `FORMat:SREGister` command, the contents of the register is transferred as a decimal, binary or hexadecimal value in ASCII code.

Example:
```
STATus:OPERation? -> #H0008
```

. . :NTRansition <numeric_value>

Setting the negative transition filter of the OPERation status register

Parameters:

`<numeric_value>`	value of the NTRansition section (`0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111`)

**RST state:*
will not be changed by *RST

Example:
```
STATus:OPERation:NTRansition #H0000
```

. . :NTRansition?

Query of the negative transition filter of the OPERation status register

Parameters:
none

Result:
Depending on the setting by the `FORMat:SREGister` command, the contents of the register is transferred as a decimal, binary or hexadecimal value in ASCII code.

Example:
```
STATus:OPERation:NTRansition? -> 0
```

. . :PTRansition <numeric_value>

Setting the positive transition filter of the OPERation status register

Parameters:

`<numeric_value>`	value of the PTRansition section (`0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111`)

**RST state:*
will not be changed by *RST

Example:
```
STATus:OPERation:PTRansition #B11111111
```

. . :PTRansition?

Query of the positive transition filter of the OPERation status register

Parameters:
none

Result:
Depending on the setting by the `FORMat:SREGister` command, the contents of the register is transferred as a decimal, binary or hexadecimal value in ASCII code.

Example:
```
STATus:OPERation:PTRansition? -> 255
```

Other STATus commands described below do not directly influence the STATus registers.

. :PRESet

Setting the STATus registers with default values:

Register	ENABle/PTR/NTR	PRESet value
STATus:OPERational	ENABle	0
	PTR	65535
	NTR	0
STATus:QUEStionable	ENABle	0
	PTR	65535
	NTR	0
STATus:TRACe	ENABle	65535
	PTR	65535
	NTR	0
STATus:EXTension	ENABle	65535
	PTR	65535
	NTR	0
STATus:OPERation:SWEep	ENABle	65535
	PTR	65535
	NTR	0

Parameters:
none

**RST state:*
none, as command is an event

Example:
```
STATus:PRESet
```

. :QUEue?
. . [:NEXT]?

Reads the next entry from the Error Queue.

Parameters:
none

Result:
Next entry of Error Queue

Example:
```
STATus:QUEue? -> 0, "No Error"
```

4.5.16 SYSTem subsystem

SYSTem:AUDIo:BALance <numeric_value> MINimum|MAXimum

Setting the balance of AF for the headphones

Parameters:

`<numeric_value>`	balance of AF from -0.5 to +0.5
	-0.5 = only left channel
	0 = mid-position
	0.5 = only right channel
`MINimum|MAXimum`	only left AF channel | only right AF channel

Note:
The parameter is rounded to the next internally settable discrete value.

**RST state:*
0

Example:
```
SYSTem:AUDio:BALance 0.5
```

. :AUDio:BALance? MINimum|MAXimum

Query of AF balance

Parameters:
none

`MINimum|MAXimum`	minimum|maximum value

Example:
```
SYSTem:AUDio:BALance? -> 0.5
```

. :AUDio:REMote:MODe <numeric_value>

Sets the mode of the digital AF that is transferred via the remote control interface per UDP. See also Appendix F.

Parameter:
<numeric_value> Mode 0 to 13 of digital AF

Mode	Sampling rate [kHz]	Bits per sample	Channels	Data rate [kbyte/s]	Length per frame [bytes]
0	-	-	-	0	
1	32	16	2	128	1
2	32	16	1	64	2
3	32	8	2	64	2
4	32	8	1	32	1
5	16	16	2	64	4
6	16	16	1	32	2
7	16	8	2	32	2
8	16	8	1	16	1
9	8	16	2	32	4
10	8	16	1	16	2
11	8	8	2	16	2
12	8	8	1	8	1
13	GSM 6.10	-	1	1.625	65

GSM 6.10 is a standard for the compression of AF data

**RST status:*
0

Example:
```
SYSTem:AUDio:REMote:MODe 5
```

. :AUDio:REMote:MODe?

Query of the set digital AF mode.

Parameter:
None

Example:
```
SYSTem:AUDio:REMote:MODe? -> 5
```

. :AUDio:VOLume <numeric_value>|MINimum|MAXimum

Setting the volume of AF for loudspeakers and headphones

Parameters:

`<numeric_value>`	volume of AF from 0 to 1
	0 = no AF
	1 = full volume of AF
`MINimum|MAXimum`	no AF | full volume of AF

Note:
The parameter is rounded to the next internally settable discrete value.

**RST state:*
0.2

Example:
```
SYSTem:AUDio:VOLume 0.5
```

. :AUDio:VOLume? [MINimum|MAXimum]

Query of AF volume

Parameters:
none

`MINimum|MAXimum`	min. | max. volume

Example:
```
SYSTem:AUDio:VOLume? -> 0.5
```

. :BEEPer:VOLume <numeric_value>|MINimum|MAXimum

Setting the volume of the beeper

Parameters:

`<numeric_value>`	volume of beeper from 0 to 1 0 = beeper off 0.01 to 0.5 = beeper soft 0.51 to 1 = beeper loud
`MINimum|MAXimum`	beeper off|beeper loud

Note:
The volume of the beeper can be set in 3 discrete steps only. The parameter is therefore rounded to the next discrete value.

**RST state:*
1

Example:
```
SYSTem:BEEPer:VOLume 0.3
```

. :BEEPer:VOLume? [MINimum|MAXimum]

Query of volume of beeper

Parameters:
none

`MINimum|MAXimum`	min. | max. volume

Example:
```
SYSTem:BEEPer:VOLume? -> 0.5
```

. :COMMunicate:SERial:BYTeesc <Boolean>

Switching the Byte-Escaping mechanism for serial transmission on or off. See also annex A.

Parameters

ON	Byte-Escaping on
OFF	Byte-Escaping off

**RST state*
OFF

Example:
```
SYSTem:COMMunicate:SERial:BYTeesc ON
```

. :COMMunicate:SERial:BYTeesc?

Querying the state of the Byte-Escaping mechanism whether it's set on or off for serial transmission.

Parameters:
none

Example:
```
SYSTem:COMMunicate:SERial:BYTeesc? -> 1
```

. :ERRor?

Reading the next input from Error Queue

Parameters:
none

Result:
Next entry of Error Queue. If the Error Queue is empty, `0, "No Error"` is output.

Example:
```
SYSTem:ERRor? -> 0, "No Error"
```

. :KLOCK<Boolean>

Unlocking and locking the keyboard and the rollkey. In the locked state, `!KEYBOARD LOCKED BY REMOTE!` is indicated on the front-panel display. The string can be configured by means of the `SYSTem:KLOCK:LABel` command.
This command is advantageous if ESMB in systems is controlled via remote and the setting of parameters via the front-panel control should be prevented.

Parameters:
`ON` keyboard and rollkey are locked
`OFF` keyboard and rollkey are unlocked

**RST state:*
`OFF`

Example:
```
SYSTem:KLOCk ON
```

. :KLOCk?

Query of state of keyboard and rollkey.

Parameter:
none

Result:
`1` keyboard and rollkey are locked
`0` keyboard and rollkey are unlocked

Example:
```
SYSTem:KLOCk? -> 0
```

. :KLOCk:LABel <string>

Entry of user-defined information string indicated on the front-panel display in the state SYSTem:KLOCk ON state. The user can be informed why manual control is currently not allowed by the system under remote control.

Parameters:
<string> ASCII string with 30 characters at max.

**RST state:*
"KEYBOARD LOCKED BY REMOTE! "

Example:
SYSTem:KLOCk:LABel "THIS IS A TEST"

. :KLOCk:LABel?

Query of currently set information string

Parameters:
none

Result:
<String> ASCII string with 30 characters at max.

Example:
SYSTem:KLOCk:LABel? -> "THIS IS A TEST"

. :SECurity
. . :OPTion <name>

A special optional software (eg DSCAN) can be activated by entering a certain option code. The unit must be switched on anew to activate this optional firmware.

Parameters:
<name> 8-digit number input

**RST state*
none

Example:
SYSTem:SECurity:OPTion "12345678"

. :SPEaker
. . :STATe <Boolean>

Switching the built-in loudspeaker on or off

Parameters:

ON	loudspeaker on
OFF	loudspeaker off

**RST state:*
ON

Example:
```
SYSTem:SPEaker:STATe ON
```

. . :STATe?

Query of loudspeaker

Parameters:
none

Result:

1	loudspeaker on
0	loudspeaker off

Example:
```
SYSTem:SPEaker:STATe? -> 1
```

. :VERSion?

Query of SCPI standard used by the device

Parameters:
none

Result:
Version in format YYYY.V, where YYYY stands for the corresponding version year and V for the corresponding revision number of this year.

Example:
```
SYSTem:VERSion? -> 1996.0
```

4.5.17 TEST subsystem

The selftest can be run with two different test routines. The basic test runs continuously in the background and tests the test points inside the module. Based on this test, a "short test" or a "long test" can be triggered. In the short test, a line spectrum is fed in at the antenna input and the receiver is set to the line frequency nearest to the receive frequency. The complete receive path from the antenna input of the tuner to the level evaluation is then measured and evaluated. In the long test, each line frequency of the test spectrum is set and measured.

TEST? SHORt|LONG, REPort|QUIet

Triggering the "short test" or "long test"

Parameters:

`SHORt|LONG`	carry out short test | long test
`REPort|QUIet`	error messages in plain text are generated | not generated

Note:
When the test was triggered with `REPort` plain text error messages will be stored in the error queue. They can be queried with `SYStem:ERRor?`.

Result:

0	no error detected
≠ 0	error detected

Example:

```
TEST? LONG, QUIET -> 1
```

4.5.18 TRACe subsystem

Traces are used for summarizing data. The following traces are available:

Result trace:

For the results, two predefined traces (MTRACE = Measurement Trace and ITRACE = Information Trace) are available. They cannot be deleted.

Via the control instruction, a condition can be defined which can preselect the data to be written into the MTRACE or ITRACE. If the control conditions of the two traces are identical, each TRACE value has a corresponding information value in the ITRACE. When the maximum data set length is attained, MTRACE and ITRACE are closed down. Any subsequent data are thus lost.

MTRACE receives its data from the SENSe:FUNCtion block. All sensor functions switched on deliver their measured values to the MTRACE where they are stored.

ITRACE receives its data from the SENSe:FREQuency block. In addition to the current receiver frequency the corresponding channel number is also stored.

The start command to initiate measurement (INITiate[:IMMediate]) clears the MTRACE (or ITRACE) data set.

IF-panorama Trace IFPAN

If the hardware option EB200SU (IF-panorama) is installed, spectrum data can be queried via Trace IFPAN.

The command

```
TRACe:FEED:CONTrol IFPAN, ALWays
```

starts loading of the IFPAN Trace. The command

```
DISPlay:MENU IFPAN
```

starts the IF-panorama.

The data will be output in a raw form, i.e. like they are calculated by the DSP. The spectrum length depends on the bandwidth chosen and will be between 770 and 1230 pixels. The current number of pixels can be queried by the command

```
TRACe:POINts? IFPAN
```

Suppress trace:

Remote sees the suppress lists as predefined traces. Each data set contains two traces with the names `SSTART` (= Suppress START) and `SSTOP` (=Suppress STOP).

The suppress list has 100 elements with each element consisting of two frequencies. The frequency pair specifies a frequency range which is suppressed during the scan. It is irrelevant that the 1st frequency is lower than the 2nd frequency. The sequence in the list is irrelevant, too. Gaps are specified by the frequency pair 0.0. If one frequency of the frequency pair is 0, the other frequency of the pair is seen as a single frequency.

Examples:

1st Frequency	2nd Frequency	Description
118000000	136000000	Suppression of range 118 to 136 MHz
98550000	98450000	Suppression of range 98.450 to 98.550 MHz
0	0	Empty frequency pair (irrelevant)
118375000	0	Suppress single frequency 118.375 MHz
0	123400000	Suppress single frequency 123.400 MHz
127675000	127675000	Suppress single frequency 127.675 MHz

In the status reporting system the states of the traces are coded in status bits (see "Status reporting system" on page 134).

TRACe? SSTART|SSTOP

This query causes that the data will be taken from the already corrected table.

1st frequency	2nd frequency
118000000	136000000
98450000	98550000
0	0
118375000	118375000
123400000	123400000
127675000	127675000

Clearing the suppress lists must always include both commands (TRAC SSTART, 0; TRAC SSTOP, 0).

TRACe|DATA

Note:
Instead of command word `TRACe` *also* `DATA` *can be used.*

. :CATalog?

Query of all defined trace names

Parameters:
none

Result:
`"MTRACE", "ITRACE", "IFPAN", "SSTART", "SSTOP"`

TRACe
. [:DATA] <trace_name>, <numeric_value> {, <numeric_value>} | <block>

Writing data to a trace.

Note:
Only the suppress traces can be written to.

Error messages:
If the trace name is unknown or not identical with a suppress trace, error -141 "Invalid character data" is generated.
If too many data are loaded in a suppress trace, error -223 "Too much data" is generated.

Parameter:

`<trace-name>`	name of the trace to be written to as `<Character Data>` `SSTART`
`<numeric_value>`	list of frequencies. If the list is not complete, the rest of the trace is filled with 0. ***Note:*** *In contrast to the SCPI standard a single value is not used for the complete trace!*
`<block>`	As an alternative to the frequency list a `<Definite Length Block>` can be transmitted with the following structure: Frequency list with frequencies in Hz, 4 bytes per frequency.

**RST state:*
No change of trace contents at *RST.

Example:
```
TRACe SSTART, 123.475 MHz, 118000000, 98550 kHz
```

. [:DATA] <trace_name>

Query of trace data
Error message:
If the trace name is unknown, an error `-141,"Invalid character data"` will be generated.

Parameters:
`<trace_name>` name of desired trace as `<Character Data>` (`MTRACE, ITRACE, IFPAN` or `SSTART, SSTOP`)

Result:
The following is valid for `MTRACE`:
Output of measured values of all sensor functions switched on. If no function is switched on, `NaN` (Not a Number) is output.
If `FREQ:OFFS` is switched on, only the offset value is output. If `VOLT:AC` is switched on, only the level value is output. If `FREQ:OFFS` and `VOLT:AC` are switched on, first the level value and then the offset value are output.
The INF value 9.9E37 is entered into the result buffers MTRACE and ITRACE for MSCAN, FSCAN or DSCAN to identify the range limit.
If measurements can't be carried out due to current settings (eg offset measurement with IQ, CW, ISB or SSB), it is indicated by the NINF value –9.9E37 (see also annex E Measurement Functions).

The following is valid for `ITRACE`:
Output of channel number and receive frequency.

Depending on the setting, the output format is defined by the `FORMat:DATA` command:
`ASCii` -> normal ASCII output:

- level in dBuV
- offset in Hz signed
- field strength in dBµV/m with sign
- AM modulation index in %
- AM positive modulation index in %
- AM negative modulation index in %
- FM frequency deviation in Hz
- positive frequency deviation in Hz
- negative frequency deviation in Hz
- phase deviation in rad
- bandwidth in Hz
- channel number without unit
- frequency in Hz

`PACKed` -> `<Definite Length Block>`: (see **"Block data"** on page 11)

- level in 1/10 dBuV (2 bytes)
- offset in Hz (4 bytes)
- AM - modulation index in 1/10 % (2 bytes)
- AM - positive modulation index in 1/10 % (2 bytes)
- AM - negative modulation index in 1/10 % (2 bytes)
- FM frequency deviation in Hz (4 bytes)
- positive frequency deviation in Hz (4 bytes)
- negative frequency deviation in Hz (4 bytes)
- phase deviation in 1/100 rad (2 bytes)
- bandwidth in Hz (4 bytes)
- channel number (2 bytes)
- frequency in Hz (4 bytes)

Note:
The sensor function `FSTRength` *will only provide results if the SW option EB200FS is fitted. Also see Annex H.*

Notes:
- *INF (end-of-range code) will be coded in the PACKed format as follows:*
  INF level = 2000
  INF offset = 10000000
  INF FSTR = 0x7FFF
  INF AM = 0x7FFF
  INF FM = 0x7FFF FFFF
  INF PM = 0x7FFF
  INF BW = 0x7FFF FFFF
  INF freq = 0
  INF channel = 0

- *NINF (measurement not possible) will be coded in the PACKed format as follows:*
  NINF Offset = 10000000-1
  NINF FSTR = 0x7FFE no k-factor defined on this frequency
  NINF AM = 0x7FFE
  NINF FM = 0x7FFF FFFE
  NINF PM = 0x7FFE
  NINF BW = 0x7FFF FFFE
  The level can be measured any time.

- *NaN is output as #110 in the* `PACKed format`

- *To ensure that for the two traces the same number of points is output, the two queries have to be one directly behind the other in the same command line (eg* `TRACE? MTRACE;TRACE? ITRACE`*).*

Example:
```
TRACe? MTRACE -> 23.4, -2500, 18.5, 1500
```

The following is valid for the IFPAN trace:

Output of the spectrum data. If there are no data available then a `NaN` (Not a Number) will be output.

The output format of the IFPAN trace depends on the settings made by command `FORMat:DATA`.

`ASCii ->` normal ASCII output:
- level in dBµV

`PACKed -> <Definite Length Block>:`
- level in 1/10 dBµV (2 bytes)

The following is valid for the suppress trace:

List of frequencies contained in the trace. The suppress-trace output format is defined, according to the relevant setting, through command `FORMat:DATA:`

`ASCii` ->Normal ASCII output:
- list of frequencies in Hz

`PACKed` -> `<Definite Length Block>`
- list of frequencies in Hz, 4 bytes per frequency

Example:
```
TRACE? SSTART -> 123475000, 118000000, 98550000
```

. :FEED? <trace_name>

Query of data block connected with the trace
Error message:
If the trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Parameters:
`<trace_name>` see `TRACe[:DATA]?`

Result:
Name of the block coupled to the trace.
The following is valid for `MTRACE`: `"SENS"`
The following is valid for `ITRACE`: `"FREQ"`
The following is valid for `IFPAN`: `"SENS"`

Example:
```
TRACe:FEED? MTRACE -> "SENS"
```

. . :CONTrol <trace_name>, ALWays|SQUelch|NEVer

Control of trace loading
Error message:
If trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Note:
For IFPAN `Trace`, *only* `ALWays` *or* `NEVer` *can be selected.*

Parameters:

`<trace-name>`	see `TRACe[:DATA]?`
`ALWays`	all data are stored
`SQUelch`	data are first stored, if the signal has exceeded the squelch threshold defined in the `OUTPut:SQUelch` subsystem
`NEVer`	do not store any data in the trace.

**RST state:*
`NEVer`

Example:
```
TRACe:FEED:CONTrol MTRACE, ALWays
```

. . :CONTrol? <trace_name>

Query of trace loading
Error message:
If the trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Parameters:
`<trace_name>` see `TRACe[:DATA]?`

Result:
`ALW, SQU, NEV`

Example:
```
TRACe:FEED:CONTrol? MTRACE -> ALW
```

. :LIMit
. . [:UPPer] <trace_name>, <numeric_value>|MINimum|MAXimum

Setting the limit of a trace. If the limit is exceeded, the `Limit exceeded Flag` will be set in the `STATus:TRACe` register.
Error message:
If the trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Parameters:

`<trace_name>`	see `TRACe[:DATA]?`
`<numeric_value>`	limit in percent of the maximum trace length
`MINimum|MAXimum`	sets the least|greatest limit

**RST state:*
50 PCT

Example:
```
TRACe:LIMit MTRACE, 50 PCT
```

. . [:UPPer]? <trace_name>[,MINimum|MAXimum]

Query of trace limit
Error message:
If the trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Parameters:

`<trace_name>`	see `TRACe[:DATA]?`
no further parameter	query of current limit
`MINimum|MAXimum`	query of least|greatest limit

Result:
Limit in percent of maximum trace length

Example:
```
TRACe:LIMit? MTRACE -> 50
```

. :POINts? <trace_name>[,MINimum|MAXimum]

Query of number of values stored in a trace
The number of values stored in the suppress traces is always 100. Thus, the MAXimum and MINimum value is also 100.
The number of values stored under IFPAN depends on the IF bandwidth and is between 770 and 1230.

Error message:
If the trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Parameters:

`<trace_name>`	see `TRACe[:DATA]?`
no further parameter	query of current number
`MINimum|MAXimum`	query of lowest|highest number

Result:
Number of values

Example:
```
TRACe:POINts? MTRACE, MAX -> 2048
```

. . :AUTO? <trace_name>

Query of trace length (auto-adjust)
A 0 (no auto-adjust for trace length) is always output for a suppress trace.

Error message:
If the trace name is unknown, an error `-141, "Invalid character data"` will be generated.

Parameters:

`<trace_name>`	see `TRACe[:DATA]?`

Result:

0	no auto-adjust for trace length
1	auto-adjust for trace length

Example:
```
TRACe:POINts:AUTO? MTRACE;AUTO? ITRACE -> 1;1
```

. . :VALue? <trace_name>, <index>, <numeric_value>

Setting an element of a trace

Note:
Only suppress traces can be set.

Error message:
If the trace name is unknown or not equal to a suppress trace name, an error `-141, "Invalid character data"` is generated.

Parameters:

`<trace_name>`	name of the trace to be set as `<Character Data>` `SSTART1,SSTOP`
`<index>`	Index of the element within the trace that is to be set. The first element of a trace has the index 1.
`<numeric _value>`	frequency value of the element

**RST state:*
see `TRACe:DATA`

Example:
```
TRACe:VALue SSTART, 13, 98.550 MHz
```

. . :VALue? <trace_name>, <index>

Query of an element of a trace

Note:
Only elements of the suppress traces can be queried.

Error message:
If the trace name is unknown or not equal to a suppress trace name, an error `-141 "Invalid character data "` is generated.

Parameters:

`<trace_name>`	name of the trace to be read as `<Character Data>` `SSTART,SSTOP`
`<index>`	Index of the element within the trace that is to be set. The first element of a trace has the index 1.

Result:
Frequency value of the element of a trace in Hz

Example:
```
TRACe:Value? SSTART, 13 -> 98550000
```

4.5.19 TRIGger subsystem

The trigger subsystem is used to synchronize actions within the unit with events.

With SW option EB200CM (Coverage Measurement) triggered level measurements can be carried out. The trigger source is selected by using command `TRIGer:SOURce EXTernal|INTernal|TIMer`.

TRIGger[:SEQuence]

. :SLOPe POSitive|NEGative

Setting of the slope initiating a trigger via rear-panel connector X8, pin 12 in FASTlevcw and LIST modes

Parameters:

`POSitive`	trigger at positive slope
`NEGative`	trigger at negative slope

**RST state:*
`POSitive`

Example:
```
TRIGger:SLOPe NEGative
```

. :SLOPe?

Query of the slope initiating a trigger via rear-panel connector X8, pin 12 in FASTlevcw and LIST modes

Parameters:
`none`

Result:
`NEG, POS`

Example:
```
TRIGger:SLOPe? -> NEG
```

:SOURce EXTernal|INTernal|TIMer

Selection of the trigger source in modes FASTlevcw and LIST

Parameters:

`EXTernal`	Trigger is performed via an impulse to rear-panel connector X8, pin 12. The trigger slope can be selected with command `TRIGger:SLOPe`.
`INTernal`	Trigger is performed internally as quickly as possible. As soon as a measurement is completed the next one begins.
`TIMer`	Trigger is initiated by a periodic timer. The timer period can be set with command `TIMer`.

**RST state:*
`INTernal`

Example:
```
TRIGger:SOURce EXTernal
```

. :SOURce?

Query of currently set trigger source

Parameters:
`none`

Result:
`EXT, INT, TIM`

Example:
```
TRIGger:SOURce? -> EXT
```

:TIMer<numeric_value>|MINimum|MAXimum

Setting the period of the timer which in timer-triggered measuring mode is the trigger source

Note:
The timer period is rounded to internally adjustable values. The rounded value is output when a query with command `TRIGger:TIMer?` *is started.*

Parameters:

`<numeric_value>`	measuring time in seconds
`MINimum|MAXimum`	minimum/maximum measuring time

**RST state:*
`MAXimum`

Example:
```
TRIGger:TIMer 10 ms
```

. :TIMer? [MINimum|MAXimum]

Query of set trigger period

Parameters:

none	query of current trigger period
`MINimum|MAXimum`	query of shortest/longest trigger period

Result:
Trigger periods in seconds

Example:
```
TRIGger:TIMer? -> 0.099986
```

4.6 Device model and command processing

The following figure shows the basic structure of the unit under firmware aspects. The actual receiver is isolated from the front control panel and the remote control units by a central data memory. This memory is at the core of the ESMB firmware and deals with the following tasks:

- Administration of connected modules (receiver, front control panel, remote clients)
- Making data available to the receiver (eg receive frequency, scan parameters, etc.)
- Sequentialization of settings for simultaneous manual and remote control
- Sending messages on parameter changes to all modules.
- Storing data in the CMOS RAM for protection against power failure

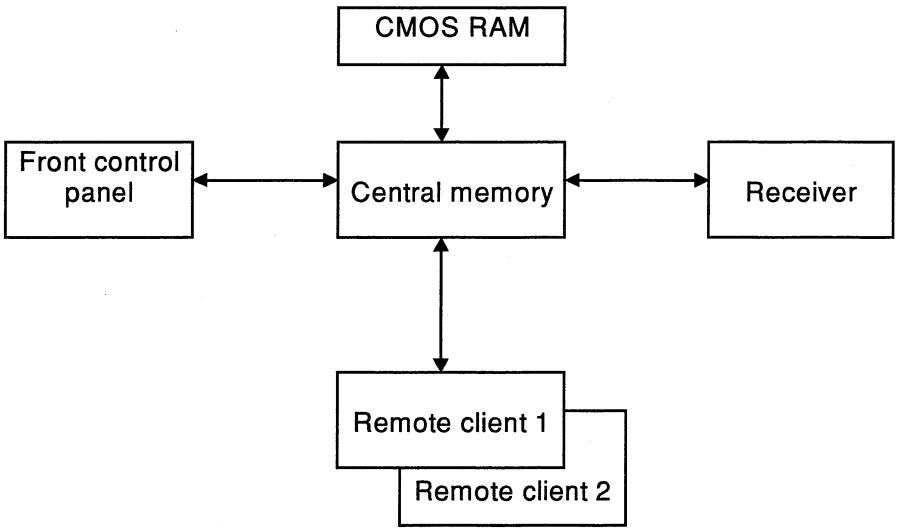


Fig. 4-2: Device model with remote control

As mentioned under 4.3, the unit can be controlled from the front panel and one or several remote control units – the remote clients – simultaneously (competitive control). Upon system start, the front control panel and the receiver are logged in to the data memory automatically. These modules are therefore always connected. The remote clients are logged in if a host computer sets up a link to the ESMB.

The receiver obtains the required data (receive frequency, bandwidth, etc.) from the memory. It has no data storage facility of its own and therefore has direct access to the central memory.

Due to the principle of competitive control, different clients can modify the same parameters. The central memory sequentializes the access procedures (last client wins) and sends messages to the other users that a parameter has been changed.

Example 1:

Remote client 1 modifies the frequency value. The central memory signals to the receiver that a new frequency is to be set. The front control panel is supplied with the new frequency. Remote client 2 (if connected) receives a modification report (see "STATus:EXTension register" on page 145).

Example 2:

If the receive frequency is changed by the receiver due to a scanning procedure or an AFC correction, this is reported to remote clients 1 and 2. The front control panel receives the new receive frequency and displays it.

A large number of parameters have to be stored power-failure-proof. This is ensured by the central memory: it stores all modifications of the relevant parameters in the CMOS RAM and assigns them to checksums. Upon switching on the unit, the checksums are checked, and the data are retrieved from the CMOS RAM or default values are used.

4.6.1 Remote client

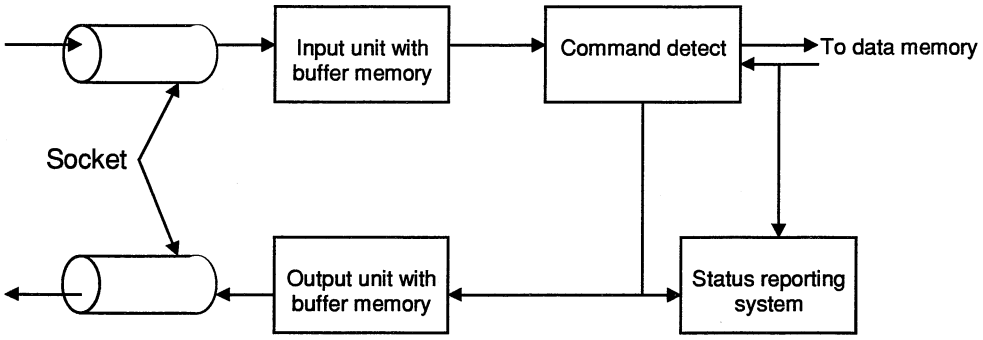
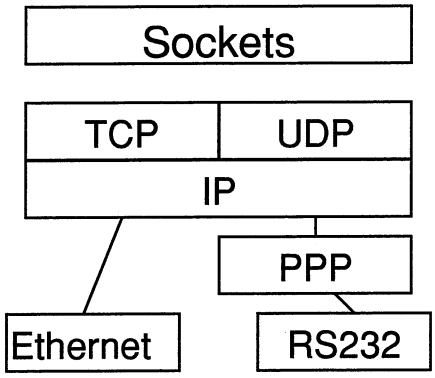


Fig. 4-3: Structure of a remote client within the firmware

Sockets:

The remote clients are connected to the host computer by so-called sockets. These are logic point-to-point links that are independent of the transmission medium used. Sockets are based on the Transmission Control Protocol (TCP) or the User Datagram Protocol (UDP, not used in ESMB). These two protocols are in turn based on the Internet Protocol (IP). Following figure shows the layer model of the sockets.



The transmission media are located beneath the IP layer. IF the ESMB is fitted with an RS232-compatible interface (option) it is coupled to the IP layer by means of the Point-to-Point Protocol (PPP). This is necessary because IP is a packet-oriented protocol. This is not necessary if the LAN interface (standard) is used, because the Ethernet protocol of this interface is already packet-oriented

The use of sockets has several advantages:

- the protocols used (PPP, IP, TCP, UDP) are standardized and implemented on all customary operating systems (WindowsNT, Windows95, Windows 3.1, UNIX, SunOS, and many more).
- TCP links are protected against transmission errors.
- Host software can be generated independent of the transmission medium used (LAN or RS232).
- Several logic links may use the same transmission medium.
- IP routing enables access also to remote units also over great distances (eg via the Internet).

When the unit is started, a so-called list socket is generated. It functions as the unit's "receptionist". Each host wishing to remote-control the ESMB has to log in with the list socket first. The list socket then generates a new remote client and allocates the link to a new socket so the list socket remains free to receive further hosts.

For login at the list socket, the host needs to have the address and port number of the unit. This can be set in the Setup Remote menu.

Input unit:

Data transmission via sockets is packet-oriented. Each packet received is handed over to command recognition.

Command detect:

Command detect analyzes the data received from the input unit. Data are processed in the sequence they have been received. The data received consist of strings that have to be in accordance with the SCPI standard. The SCPI standard is based on the IEEE 488 standard. Normally, this standard only applies to IEC/IEEE bus (also referred to as IEC625, HPIB or GPIB). Another IEEE standard, IEEE 1174, is a supplement to IEEE 488, making it applicable also to LAN and serial links (RS232). The ESMB uses this standard as a basis for SCPI commands via sockets.

Each identified setting command contained in an SCPI string is first stored in a buffer memory. Only a <Program Message Terminator> (line feed) or a query command will cause the setting commands to be sent to the data memory, where they are checked for consistency. If the commands are consistent, they will be executed at once, and the other modules will be informed. Query commands generate a request to the memory. The memory sends back the data, which will then be processed according to the SCPI standard by the command detect. Finally, the SCPI response strings are sent to the output unit.

Output unit:

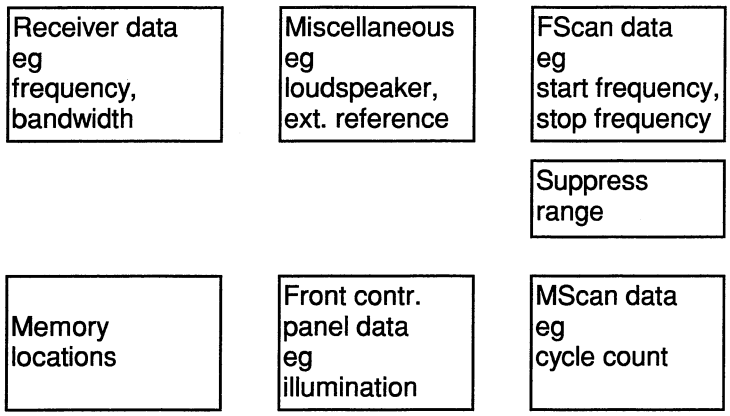
The output unit collects all data in the output buffer that were generated in response to query commands. If the command detect identifies the end of an SCPI command (by the <Program Message Terminators>), it causes the output unit to send the data in the output buffer to the host computer via the socket.

Status Reporting System:

The Status Reporting System gathers information on the device status and makes it available to the output unit on request. The Status Reporting System may be used for messaging asynchronous events (eg error statuses, availability of results, data modifications by other users, etc.) to the host computer.

4.6.2 Data memory

This figure shows the classification of data into data groups. These groups are also reflected by the Status Reporting System of the remote clients in the extension register status.



4.7 Status reporting system

The status reporting system (see Fig. 4-5) stores all the information on the present operating state of the device, eg that the device presently carries out a SWEeping, and on errors which have occurred. This information is stored in the status registers and in the error queue. For each remote client there is a separate status reporting system and access to all registers of the error queue.

The information is of 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, the registers STATus:TRACe and STATus:EXTension not specified by SCPI as well as the two queues error queue and message queue.

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 device status in a single bit. The PPE fulfills a function for the IST flag as the SRE does for the service request.

The message queue contains the messages the device sends back to the controller. It is not part of the status reporting system but determines the value of the MAV bit in STB and is thus shown in Fig. 4-5.

4.7.1 Structure of an SCPI status register

Each SCPI register consists of 5 sections each having a width of 16 bits and different functions (see Fig. 4-4). The individual bits are independent of each other, i.e. a bit number being valid for all five sections is assigned to each hardware status. Bit 3 of the STATus:OPERation register for example is assigned to the hardware status "SWEeping" in all five sections. Bit 15 (the most significant bit) is set to zero for all sections. Thus the contents of the register sections can be processed by the controller as positive integers.

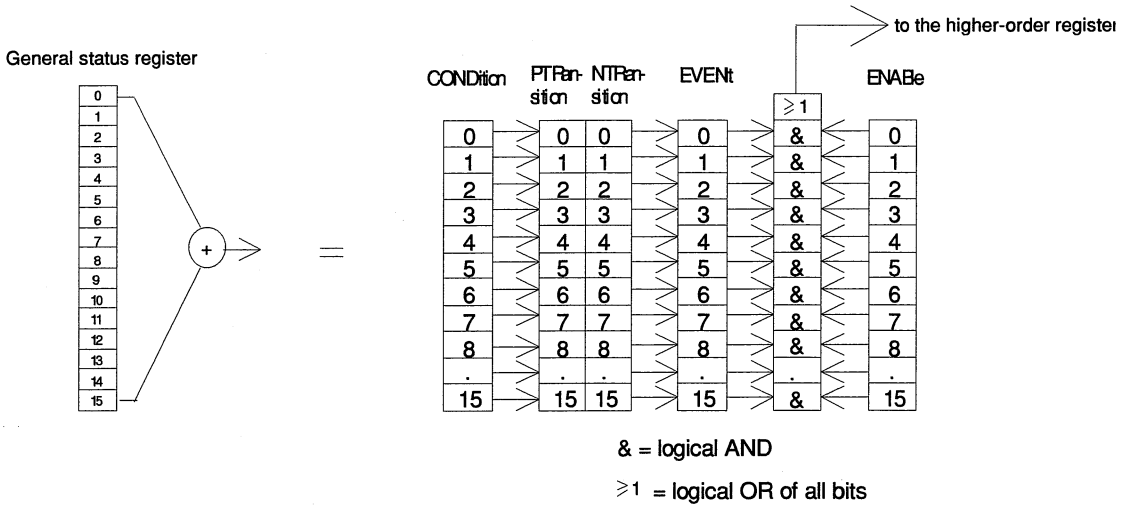


Fig. 4-4 : Status register model

CONDition section the CONDition section of a register reflects directly the state of the hardware. This register section can only be read. Its contents is not changed during reading.
As an alternative, a bit in a CONDition register can also contain the summary information of a further status register connected in front. In this case, the bit is cleared on reading out the status register.

PTRansition section the Positive-TRansition section acts as an edge detector. When a bit of the CONDition section 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 section can be written into and read in any way. Its contents is not changed during reading.

NTRansition section

the Negative-TRansition section also acts as an edge detector. When a bit of the CONDition section 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 section can be written into and read in any way. Its contents is not changed during reading.

with these two edge register sections the user can define which state transition of the condition section (none, 0 to 1, 1 to 0 or both) is stored in the EVENt section.

EVENt section

the EVENt section indicates whether an event has occurred since the last reading, it is the "memory" of the CONDition section. It only indicates events passed on by the edge filters. The EVENt section is permanently updated by the device. This part can only be read. During reading, its contents is set to zero. This section is often regarded as the entire register.

ENABle section

the ENABle section determines whether the associated EVENt bit contributes to the summary bit (see below). Each bit of the EVENt section is ANDed with the associated ENABle bit (symbol '&'). The results of all logical operations of this section are passed on to the summary bit via an OR function (symbol ' ≥ 1').

ENABle bit = 0: the associated EVENt bit does not contribute to the summary bit

ENABle bit = 1: if the associated EVENT bit is "1", the summary bit is set to "1" as well.

This section can be written into and read by the user in any way. Its contents is not changed during reading.

Summary bit

as indicated above, the summary bit is obtained from the EVENt and ENABle section for each register. The result is then entered into a bit of the CONDition section of the higher-order register.

The device automatically generates the summary bit for each register. Thus an event, eg a PLL that has not locked, can lead to a service request through all the hierarchy levels.

Note:
The service request enable register SRE defined in IEEE 488.2 can be taken as ENABle section of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABle section of the ESR.

4.7.2 Overview of the status registers

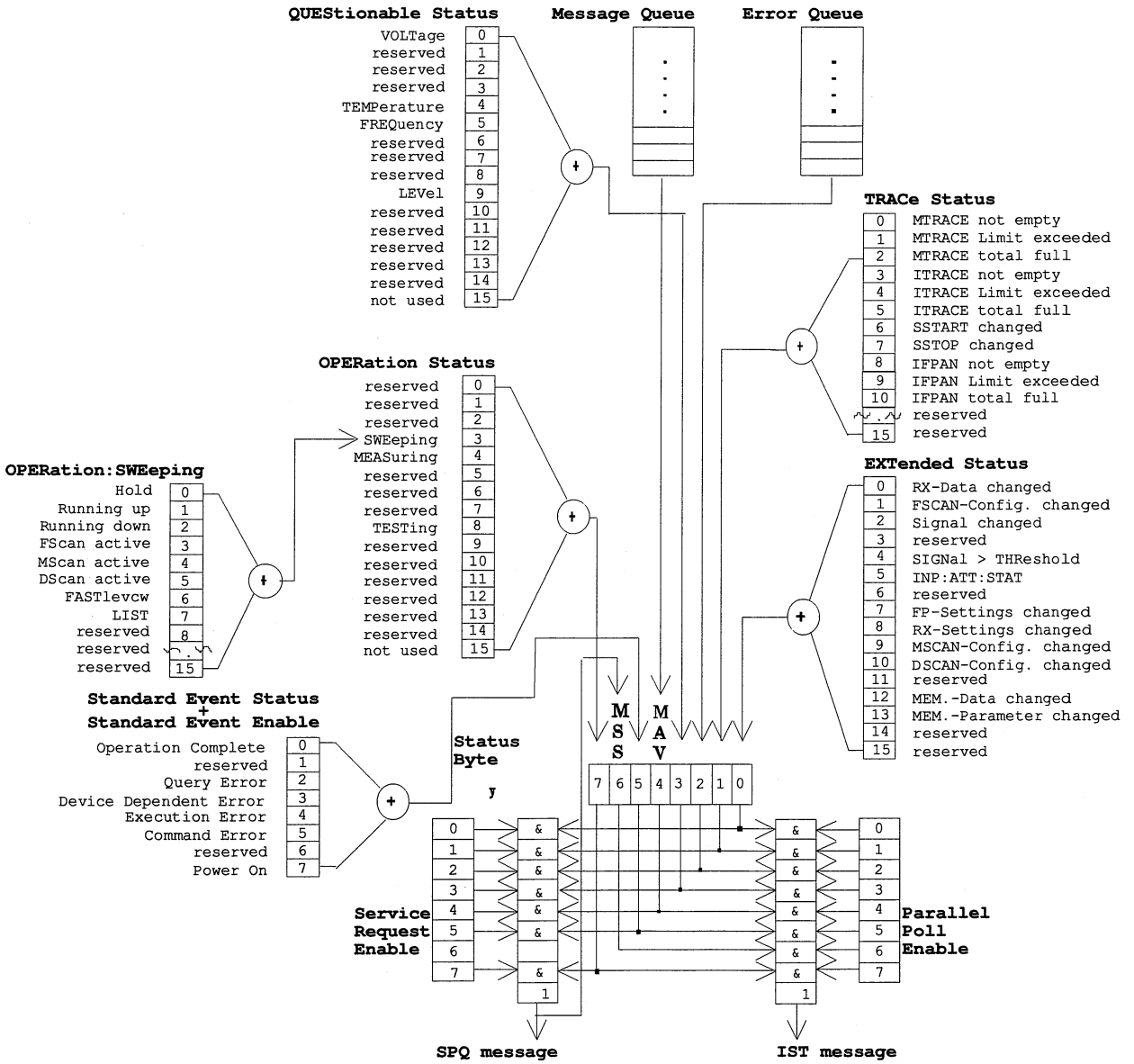


Fig. 4-5: Overview of status registers

4.7.3 Description of the status registers

4.7.3.1 Status Byte (STB) and Service Request Enable (SRE) register

The STB is already defined in IEEE 488.2. It provides an overview of the device status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDition section of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the summary 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 implies the SRE. As to its function, it corresponds to the ENABle section of the SCPI register. A bit in the SRE is assigned to each bit of the STB. 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, which triggers an interrupt in the controller if this is appropriately configured.

The SRE can be set using command "`*SRE`" and read using "`*SRE?`".

Table 4-2 Bit allocation of status byte

Bit no.	Meaning
0	**EXTended status register summary bit** The bit is set if an EVENt bit is set in the EXTended status register and if the corresponding ENABle bit is set to 1. The states of the hardware functions and change bits are combined in the EXTended status register.
1	**TRACe status register summary bit** The bit is set if an EVENt bit is set in the TRACe status register and if the corresponding ENABle bit is set to 1. The states of the TRACes MTRACE, ITRACE, SSTART and SSTOP are represented in the TRACe status register.
2	**Error Queue not empty** The bit is set when the error queue contains an entry. If this bit is enabled by the SRE, an entry into the empty 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 recommended since it considerably reduces the problems involved with the control.
3	**QUEStionable status register summary bit** The bit is set if an EVENt bit is set in the QUEStionable status register and the corresponding ENABle bit is set to 1. A set bit indicates a questionable device status which can be specified in greater detail by polling the QUEStionable status register.
4	**MAV bit (message available)** No meaning
5	**ESB bit** Summary 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.

Bit no.	Meaning
6	**MSS bit** (master status summary bit) The bit is set if the device 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 summary bit** The bit is set if an EVENt bit is set in the OPERation status register and the corresponding ENABle bit is set to 1. A set bit indicates that the device is just performing an action. The type of action can be determined by polling the QUEStionable status register.

4.7.3.2 IST flag and Parallel Poll Enable (PPE) register

Analogous to the SRQ, the IST flag combines the entire status information in a single bit. It can be queried by 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. In contrast to SRE bit 6 is also used here. The IST flag results from the ORing of all results. The PPE can be set using the "`*PRE`" commands and read using the "`*PRE?`" command.

4.7.3.3 Event Status Register (ESR) and Event Status Enable (ESE) register

The ESR is already defined in IEEE 488.2. It can be compared with the EVENt section of an SCPI register. The EVENt status register can be read out using the "*ESR?" command .

The ESE is the associated ENABle section. It can be set using the "*ESE" command and read using the "*ESE?" command .

Table 4-3 Bit allocation of event status register

Bit No.	Meaning
0	**Operation Complete** This bit is set on receipt 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 device without having sent a query, or if it does not fetch requested data and sends new instructions to the device 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 denoting the error in greater detail is entered into the error queue (see Annex B, Error Messages).
4	**Execution Error** This bit is set if a received command is syntactically correct but cannot be performed for different reasons. An error message with a number between -200 and -299 denoting the error in greater detail is entered into the error queue (see Annex B, Error Messages).
5	**Command Error** This bit is set if an undefined and syntactically incorrect command is received. An error message with a number between -100 and -199 denoting the error in greater detail is entered into the error queue (see Annex B, Error Messages).
7	**Power On** (supply voltage on) This bit is set when the device is switched on.

4.7.3.4 STATus:OPERation register

In the CONDition section, this register contains information about the type of actions currently being executed by the device. In the EVENt section, it also contains information about the type of actions having been executed since the last reading. It can be read using the commands

"STATus:OPERation:CONDition?" or

"STATus:OPERation[:EVENt]?".

Table 4-4 Bit allocation of STATus:OPERation register

Bit No.	Meaning
3	**SWEeping** This bit is set if the summary bit of the STATus:OPERation:SWEeping bits is set.
4	**MEASuring** This bit is set as long as a measurement is carried out.
8	**TESTing** This bit is set if the self-test has been triggered.

4.7.3.5 STATus:OPERation:SWEeping register

This register contains further information about the status of the device. The device is either in normal reception (fixed frequency) or in one of several scan modes (FSCAN, MSCAN, DSCAN, FASTLEVCW, LIST).

The state is determined by the `SENSe:FREQuency:MODE` command with the `CW|FIXed` state being characterized by deleting bits 3 to 7 in the `STATus:OPERation:SWEeping` register.

Table 4-5 Bit allocation of STATus:OPERation:SWEeping register

Bit No.	Meaning
0	**Hold** This bit is set if a FSCAN or MSCAN was interrupted by a fulfilled hold condition.
1	**Running up** This bit is set if scanning is to be carried out to increasing frequency values or memory locations.
2	**Running down** This bit is set if scanning is to be carried out to decreasing frequency values or memory locations.
3	**FSCAN active** This bit is set if FREQ:MODE is on SWEep.
4	**MSCAN active** This bit is set if FREQ:MODE is on MSCan.
5	**DSCAN active** This bit is set if FREQ:MODE is on DSCan (software option ESMBDS).
6	**FASTlevcw active** This bit is set if FREQ:MODE is on FASTlevcw (software option EB200CM).
7	**LIST active** This bit is set if FREQ:MODE is on LIST (software option EB200CM).

4.7.3.6 STATus:QUEStionable register

This register contains information on ambiguous device states. They can occur, for example if the device is operated outside its specification range. It can be queried using the commands `STATus:QUEStionable:CONDition?` or `STATus:QUEStionable[:EVENt]?`.

Table 4-6 Bit allocation of STATus:QUEStionable register

Bit No.	Meaning
0	**VOLTage** This bit is set if an ambiguous supply voltage occurs. The following voltage test points are to be checked: T-5V, T+3.3V, T+5VD, T+5VSTDFE, T+5VA, T+25V, T5VINT.
4	**TEMPerature** This bit is set if the internal temperature is too high. The test point TEMP in module S1 will be checked.
5	**FREQuency** This bit is set if an internal oscillator frequency is ambiguous. The following voltage test points are to be checked: 1ST LO ST, SWP VCO ST, TP 2NDLOPLL, TP_SAM_LEV, TP_VXO_PLL, LDET, TEXREF, TLEVREF
9	**LEVel** This bit is set if the IF section is overdriven by a too high input level. The result of the level measurement is questionable in this case.

4.7.3.7 STATus:TRACe register

This register contains information on ambiguous states of the traces MTRACE, ITRACE, IFPAN, SSTART and SSTOP.

It can be queried with the commands `STATus:TRACe:CONDition?` or `STATus:TRACe[:EVENt]?`.

Table 4-9 Bit allocation of STATus:TRACe register

Bit No.	Meaning
0	MTRACE not empty This bit is set if the MTRACE contains at least one measured value.
1	**MTRACE limit exceeded** This bit is set if the number of measured values contained in the MTRACE exceeds the threshold given by the command `TRACe:LIMit[:UPPer] MTRACE`.
2	**MTRACE total full** This bit is set if the MTRACE is loaded with the maximum number of measured values.
3	**ITRACE not empty** This bit is set if the ITRACE contains at least one information value.
4	**ITRACE limit exceeded** This bit is set if the number of measured values contained in the ITRACE exceeds the threshold given by the command `TRACe:LIMit[:UPPer] ITRACE`.
5	**ITRACE total full** This bit is set if the ITRACE is loaded with the maximum number of information values.
6	**SSTART changed** This bit is set if one or several start frequencies of the current suppress table have changed.
7	**SSTOP changed** This bit is set if one or several stop frequencies of the current suppress table have changed.
8	**IFPAN not empty** This bit is set if at least one measured value is stored under IFPAN.
9	**IFPAN Limit exceeded** This bit is set if the number of measured values stored under IFPAN exceeds the threshold set by `TRACe:LIMit[:UPPer] IFPAN`.
10	**IFPAN total full** This bit is set if the maximal number of measured values is stored under IFPAN.

4.7.3.8 STATus:EXTension register

This register contains in the CONDition part information on different receiver states which cannot be assigned to the other registers. Information about the actions the unit had carried out since the last read out are stored in the EVENt part. The corresponding registers can be queried with the commands `STATus:EXTension:CONDition?` or `STATus:EXTension[:EVENt]?`.

Table 4-10 Bit allocation of STATus:EXTension register

Bit No.	Meaning
0	**RX data changed** This bit is set if the receiver data set "1" ("job data set") is changed by manual control or by another remote client (see also "Data memory" on page 133).
1	**FSCAN configuration changed** This bit is set if the FSCAN data set "1" ("job data set") is changed by manual control or by another remote client (see also "Data memory" on page 133).
2	**Signal changed** This bit is set if the received signal changes in level or offset.
3	**COR active** This bit is set if the COR relay becomes active.
4	**SIGNal > THReshold** This bit is set if the signal level is above the squelch threshold (precondition: squelch is switched on).
5	**INPut:ATTenuation:STATe** This bit is set if the input attenuator is switched on.
7	**FP settings changed** This bit is set if the front-panel data set is changed by manual control or by another remote client.
8	**RX settings changed** This bit is set if a parameter was changed by manual control or by another remote client in the data set "miscellaneous".
9	**MSCAN configuration changed** This bit is set if the MSCAN data set is changed by manual control or by another remote client .
10	**DSCAN configuration changed** This bit is set if the DSCAN data set is changed by manual control or by another remote client (DSCAN is an option).
12	**MEMory data changed** This bit is set if a memory data was changed by manual control or by another remote client.
13	**MEMory parameter changed** This bit is set if the query bit was changed by manual control or by another remote client.

With bits 0 to 2 and 7 to 10 and 12 to 13, the host can be informed via an SRQ about parameter changes. Cyclical polling of the settings by the host is thus stopped during manual operation or if the signal parameters are to be indicated. In the CONDition section of the register, the change bits are set after manual control or signal change and are reset by special query commands. Changes done by front panel or by another remote client affect the change bits equally.

Table 4-11 Allocation of change bits in STATus:EXTension register

Bit No.	Set by change of	Reset by one of the commands
0	frequency, demodulation, bandwidth, threshold value, MGC value, control mode, antenna no., attenuation, detector mode, squelch actuation, squelch control, sensor function, AFC, TONE mode, Aux bit(s), AUX output mode, IF-panorama display span, IF-panorama display mode, measuring time	FREQ?, DEM?, BAND?, OUTP:SQU:THR?, GCON?, GCON:MODE?, ROUTe:CLOSe:STATe?, INP:ATT:STAT?, DET?, OUTP:SQU?, OUTP:SQU:CONT?, FUNC?, FREQ:AFC?, MEM:CONT? RX, OUTP:TONE?, OUTP:TONE:THR?, OUTP:BITAx?, OUTP:BYTAx?, OUTP : AUX?, FREQ:SPAN?, CALC:IFPAN:TYPE?, CALC:IFPAN:AVER:TIME?, MEAS:TIME?
1	FSCAN: start frequency, stop frequency, step width, number of scans, synchronization time, listening time, scan mode	FREQ:STAR?, FREQ:STOP?, SWE:STEP?, SWE:COUN?, SWE:DWEL?, SWE:HOLD:TIME?, SWE:DIR?, SWE:CONT?
2	signal level, offset	SENS:DATA?
7	display variations, display mode, display lock, antenna name, switch-off time of backlighting, illumination	DISP:MENU?, DISP:CMAP?, DISP:ENAB?, ROUT:PATH[:DEF]?, DISP:BRIG?, DISP:BRIG:DWEL?
8	volume, balance, external reference, tone control	SYST:AUD:VOL?, SYST:SPE:STAT?, SYST:AUD:BAL?, ROSC:SOUR?, OUTP:TONE:CONT?
9	MSCAN: number of scans, synchronization time, listening time, search mode	MSC:COUN?, MSC:DWEL?, MSC:HOLD:TIME?, MSC:DIR?; MSC:CONT?
10	DSCAN: center frequency, marker frequency, span frequency, start frequency, stop frequency, BWZOOM, number of runs, display mode, speed, reference level	FREQ:DSC:CENT?, FREQ:DSC:MARK?, FREQ:DSC:SPAN?, FREQ:DSC:STAR?, FREQ:DSC:STOP?, FREQ:DSC:RES?, DSC:COUNT?, CALC:DSC:AVER:TYPE?, FREQ:DSC:SPEED?,VOLT:AC:RANG?
12	frequency, demodulation, bandwidth, threshold value, antenna no., attenuation, squelch actuation, AFC	MEM:CONT? MEM0 ... MEM999 MEM: CONT: MPAR? MEM0 ... MEM999
13	query bit (set, set back)	MEM:CONT? MEM0 ... MEM999 MEM: CONT: MPAR? MEM0 ... MEM999

4.7.4 Use of the status reporting system

In order to be able to effectively use the status reporting system, the information contained there has to be transmitted to the host where it is further processed. There are several methods which are described in the following. Detailed programming examples are to be found in Annex D.

4.7.4.1 Service request, making use of the hierarchy structure

Under certain circumstances, the device can send a "service request" (SRQ) to the host. As Fig. 4-5 shows, an SRQ is always initiated if one or several bits of bits 0, 1, 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. By setting the ENABle sections of the status registers correspondingly it can be achieved that any bits in any 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 (also see Fig. 4-5):

Use command "`*OPC`" to generate an SRQ

- Set bit 0 in the `ESE` (Operation Complete)
- Set bit 5 in the `SRE`

After completion of the settings, the device generates an SRQ.

Indication of a signal during a sweep by means of an SRQ at the host

- Set bit 7 in the SRE (summary bit of the STATus:OPERation register)
- Set bit 3 (SWEeping) in the STATus:OPERation:ENABle.
- Set bit 3 in the STATus:OPERation:NTRansition so that the change of SWEeping bit 3 from 0 to 1 is also recorded in the EVENt section.
- Set bit 0 in STATus:OPERation:SWEeping:ENABle
- Set bit 0 in STATus:OPERation:SWEeping:PTRansition so that the change of hold bit 0 from 0 to 1 is also recorded in the EVENt section.

The device generates an SRQ after a signal has been found.

The SRQ is the only possibility for the device to become active on its own. Each host program should set the device so that a service request is initiated in case of malfunction. The program should react appropriately to the service request. A detailed example for a service request routine can be found in Annex D, Programming Examples.

4.7.4.2 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 "Description of the status registers" on page 138. Only one number is returned which represents the bit pattern of the register queried. The format of the number can be set by the `FORMat:SREGister` command.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

4.7.4.3 Error-queue query

Each error state in the device results in an entry in the error queue. The entries of the error queue are detailed plain-text error messages which can be queried via the IEC/IEEE bus using the 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 device 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 during the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the device are recorded there as well.

4.7.5 Resetting values of the status reporting system

Table 4-12 sums up the different commands and events causing the status reporting system to be reset. None of the commands, except for *RST, influences the functional device settings. In particular, DCL does not change the device settings.

Table 4-12 Resetting device functions

Event	Switching on supply voltage	DCL, SDC			
		(Device Clear, Selected Device Clear)	*RST	STATus:PRESet	*CLS
Effect					
Clear STB, ESR	yes	—	—	—	yes
Clear SRE, ESE	yes	—	—	—	—
Clear PPE	yes	—	—	—	—
Clear EVENTt sections of the registers	yes	—	—	—	yes
Clear ENABle section of all OPERation and QUEStionable registers, Fill ENABle sections of all other registers with "1".	yes	—	—	yes	—
Fill PTRansition sections with "1" , Clear NTRansition sections	yes	—	—	yes	—
Clear error queue	yes	—	—	—	yes
Clear output buffer	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	—	—	yes

1) The first command in a line, i.e. immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

5 Maintenance and Troubleshooting

5.1 Maintenance

5.1.1 Alignment of the 10-MHz reference oscillator crystal in the IF section

In order to ensure accurate receiver frequencies the internal 10-MHz reference oscillator crystal must be trimmed every year.

⇒ Remove the covers (see "Opening the unit" on page 6)

At the left side there is a sheet metal (see "Modules and speaker jumper" on page 7) where there is an 3-mm hole. Behind that hole there is the trimmer (part of EB200Z1) for the frequency of the reference oscillator.

A 1.5-mm screwdriver for cheese head screws is required.

⇒ Connect a frequency counter with a tolerance ≤ 1×10^{-8} to X4 REF EXT/INT at the rear panel.

⇒ Start the internal reference.

⇒ Trim the frequency to 10 MHz ± 0.5 Hz at room temperature.

5.1.2 Re-establishing the original state, coldstart

A coldstart can be carried out be resetting the unit. All device settings (parameters, memory locations and UDP configuration) will thus be reset to the original state (factory setting). This may become necessary after a firmware update when certain versions are changed. A reset is made on the switched-on unit by briefly connecting connector X8, pin 31 on the rear panel to ground (eg by using a pair of tweezers).

5.2 Troubleshooting

5.2.1 Accessories

(not included in shipment)

	Crosstip screwdriver #1
	1.3-mm Allen key

5.2.2 Error messages

Error message	Cause	Module
Backup LI-Battery low	The lithium backup battery for storing parameters in the CMOS RAM is low.	LI-Battery
DC Converter defective	The DC/DC converter indicates an error.	A110
DSP IF Section defective	The IF section (EB200Z1) indicates an error.	A8
Front Panel defective	The front panel control unit (EB200F1) indicates an error.	A3
Frontend HF defective	The frontend HF (EB200FH, option) indicates an error.	A170
Frontend VHF/UHF defective	The frontend V/UHF (EB200FU) indicates an error.	A7
Frontend1 defective	The frontend V/UHF (EB200FU) indicates an error.	A7
Frontend2 defective	The frontend V/UHF (EB200FU) indicates an error.	A7
IF-panorama defective	The IF-panorama module (EB200SU) indicates an error.	A9
IF Prefilter narrow defective	The IF section (EB200Z1) indicates an error.	A8
IF Prefilter wide defective	The IF section (EB200Z1) indicates an error.	A8
IF Section defective	The IF section (EB200Z1) indicates an error.	A8
Preselector VUHF 20..80 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	A6
Preselector VUHF 80..200 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	A6
Preselector VUHF 200..650 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	A6
Preselector VUHF 650..1500 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	A6
Preselector VUHF 1500..2000 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	A6
Preselector VUHF 2000..3000 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	A6
Preselector HF 9...150 kHz defective	The preselection HF (EB200VH, option) indicates an error.	A160
Preselector HF 0.15...3 MHz defective	The preselection HF (EB200VH, option) indicates an error.	A160

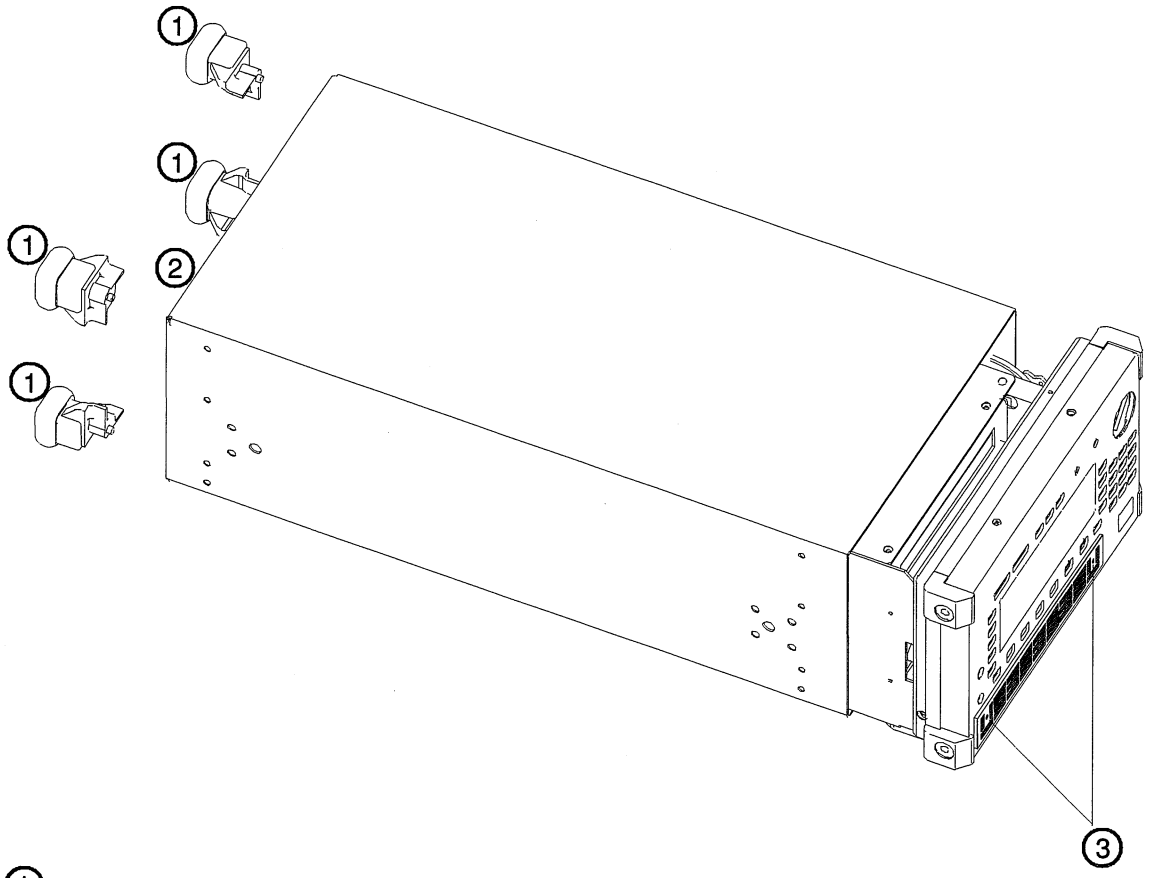
Error message	Cause	Module
Preselector HF 3...7 MHz defective	The preselection HF (EB200VH, option) indicates an error.	A160
Preselector HF 7...15 MHz defective	The preselection HF (EB200VH, option) indicates an error.	A160
Preselector HF 15...30 MHz defective	The preselection HF (EB200VH, option) indicates an error.	A160
Remote Interface defective	The remote control interface (eg EB200R4) indicates an error.	A12
Testgenerator defective	The preselection V/UHF (EB200VU) indicates an error.	A6

5.2.3 List of modules

Module	Description	Order Number
LI-Battery	Lithium battery (type: CR2477) in A5	4052.5673.00
A3	Front Panel Control Unit EB200F1	4052.2600.02
A5	Processor EB200P1	4052.2800.02
A6	Preselection V/UHF EB200VU	4055.2200.02
A7	Frontend V/UHF EB200FU	4055.2300.02
A8	IF Section EB200Z1	4052.3106.03
A9	IF-panorama EB200SU	4052.3235.02
A10	Junction Panel	4055.2800.02
A12	LAN Interface EB200R4	4052.4402.02
A100	Power Unit EB200N1	4055.2900.00
A12	RS232 Interface ESMBR2 (option)	4052.9056.02
A160	Preselection HF EB200VH (option)	4055.3207.02
A170	Frontend HF EB200FH (option)	4055.3307.02
H1	LCD module	4052.5009.00
	Fan	2058.6762.00

5.2.4 Module exchange

5.2.4.1 Opening the unit, cleaning the filter mat

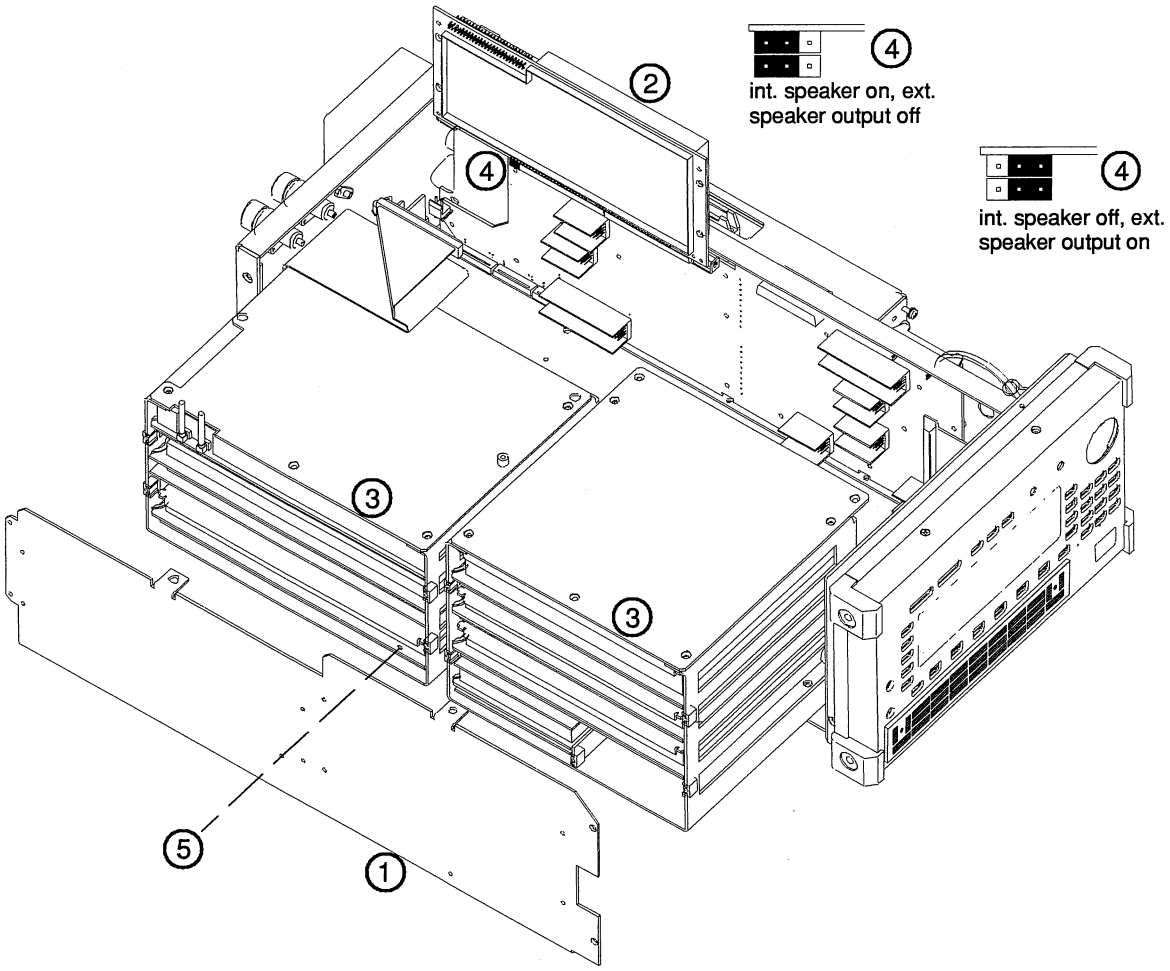


① Unscrew feet.

② Pull off cover to the rear.

③ For cleaning purposes, unscrew the filter cover (2 screws) and take it off together with the filter mat.

5.2.4.2 Modules and speaker jumper



① Unscrew plate.

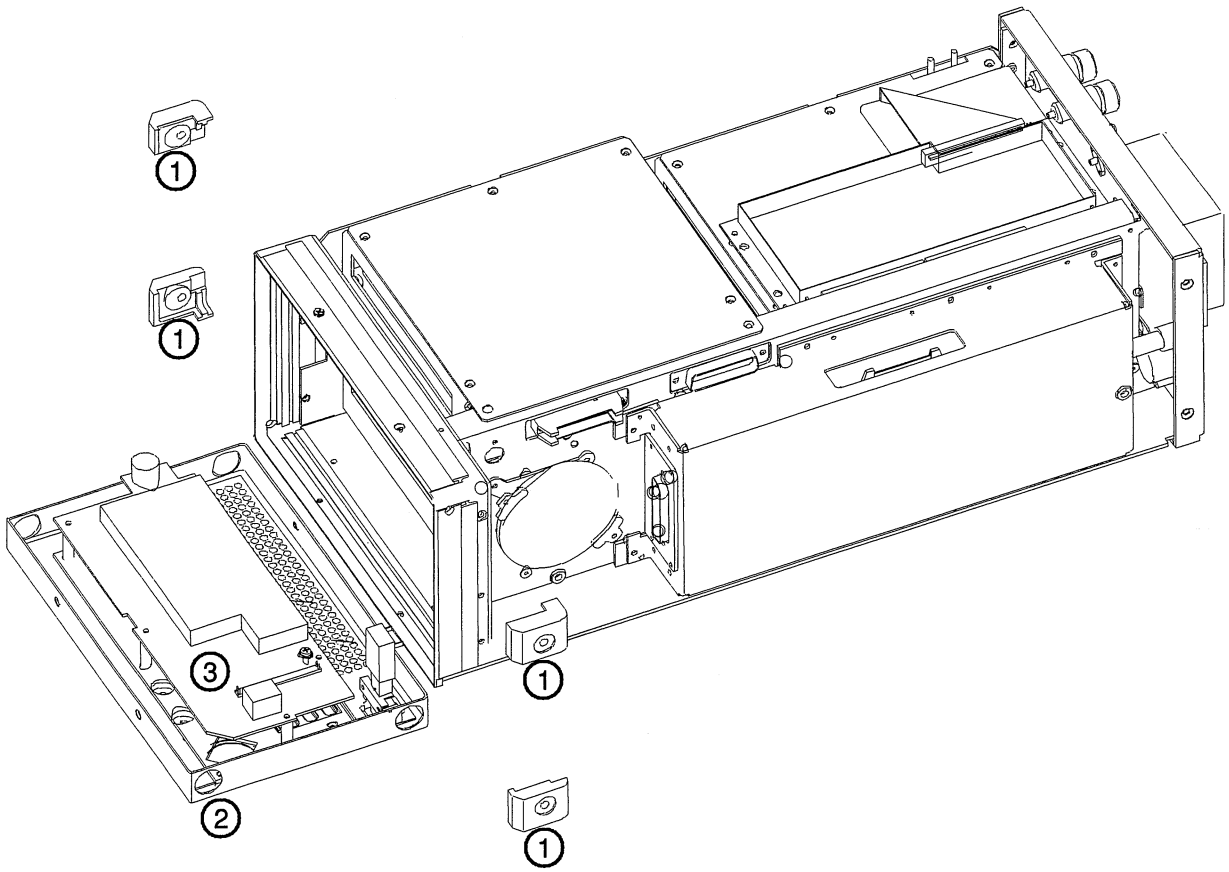
② Unscrew processor board and pull off plug.

③ Unscrew the module housings off of the unit's bottom and pull them out together. (**Caution:** Modules of both housings are interconnected by HF lines and the processor board as well as the HF lines coming from the rear panel may interfere with the proceedings). See also cabling plan 4053.4606 in the annex.

④ This is the location of the speaker jumper where it can be switched over from the internal speaker (default) to the external speaker output.

⑤ This dashed line indicates the position of the screwdriver while trimming the reference oscillator

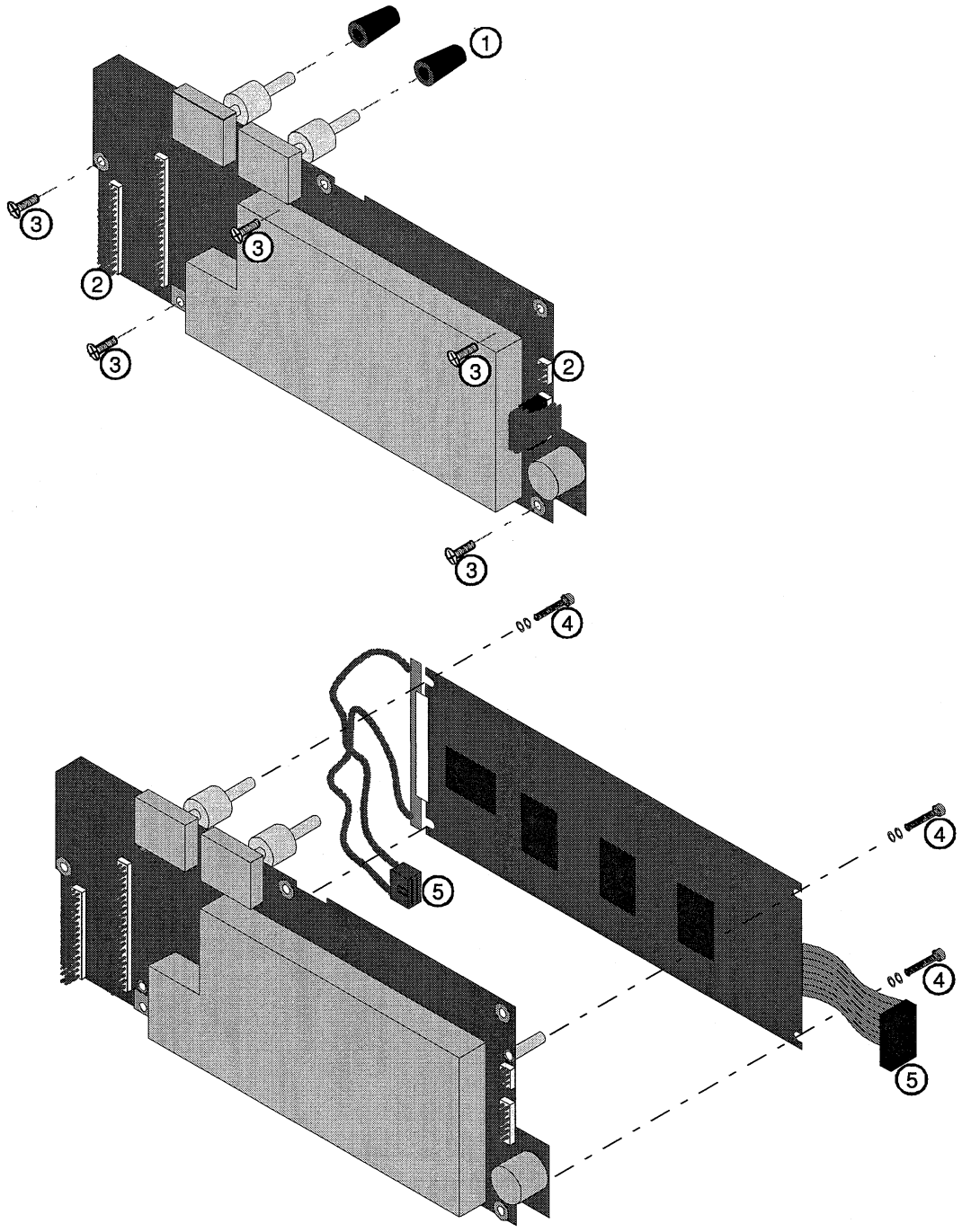
5.2.4.3 Front panel control unit and LCD



① Unscrew corner covers.

② Unscrew the front panel and open it (**Caution:** Don't use too much force on the cable connections).

③ Remove front panel control unit (see next figure).



① Loosen knobs (1.3-mm Allen key) and pull them off.

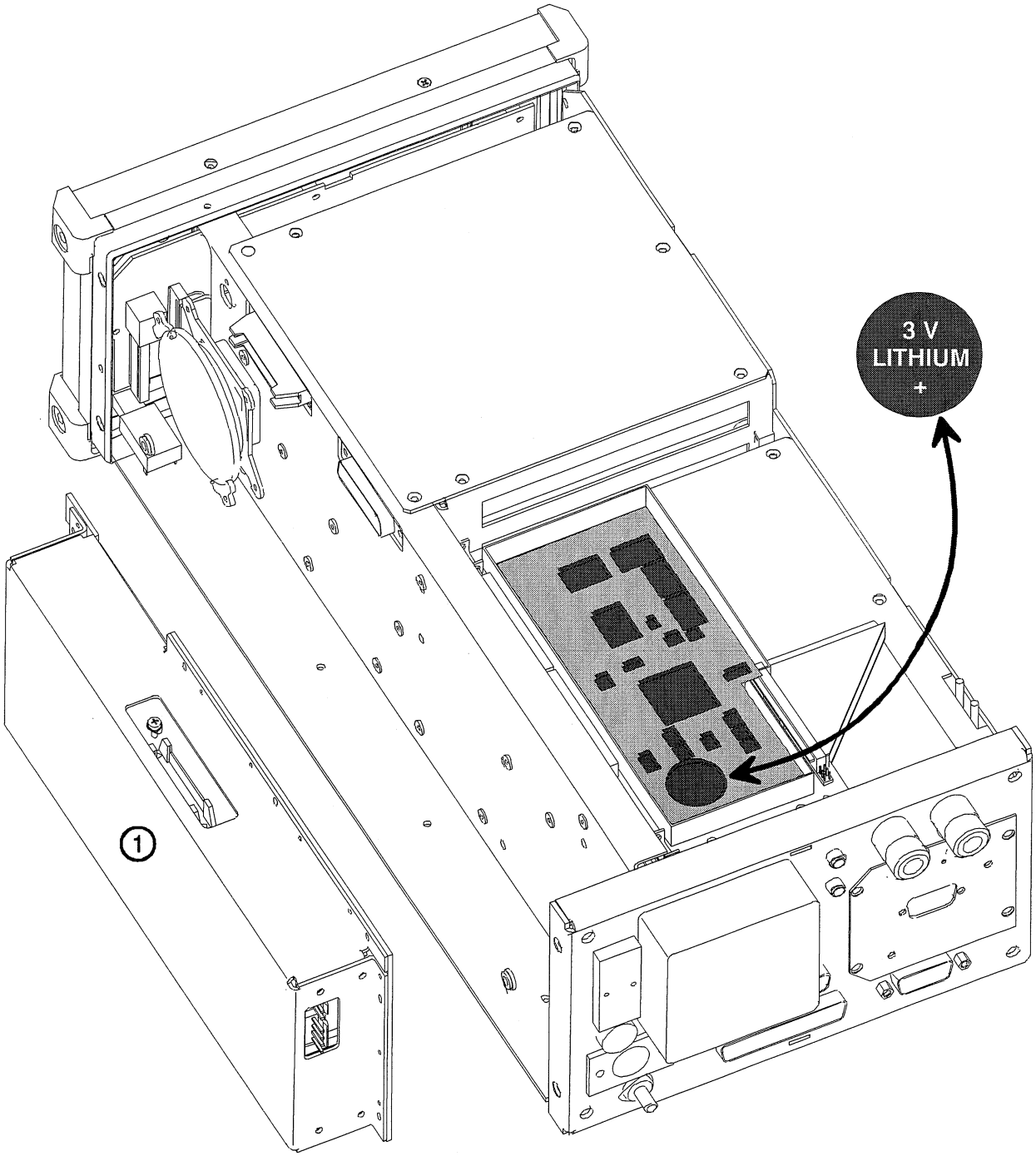
② Pull off plugs.

③ Unscrew front panel control unit and take it out.

④ Unscrew LCD board (4 screws).

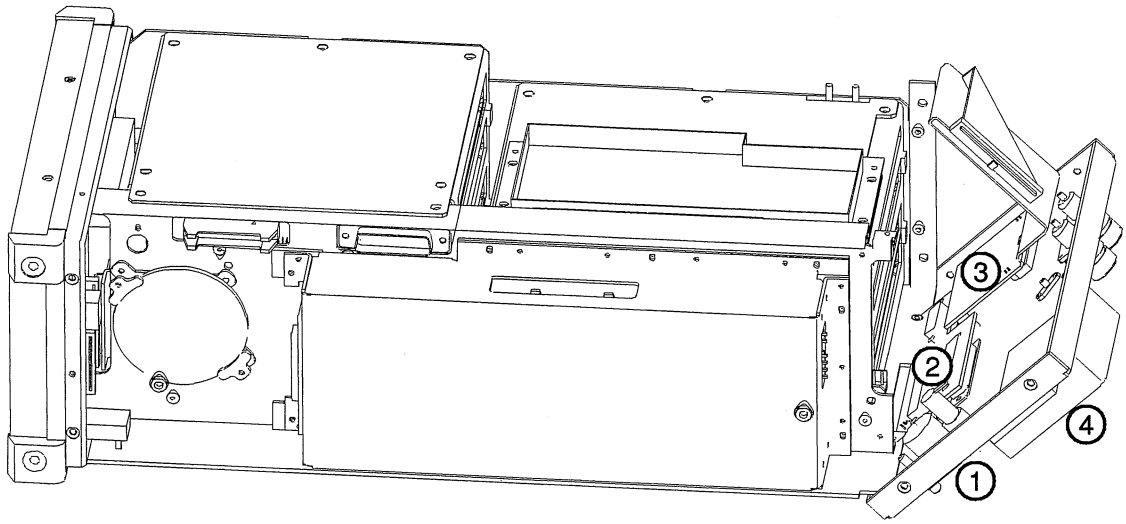
⑤ Pull off plugs.

5.2.4.4 DC/DC converter / Li-battery



① Unscrew DC/DC converter and pull off the plugs.

5.2.4.5 Rear panel, junction panel, LAN interface and fan



① Pull the plug off of the processor board, unscrew the rear panel and open it (**Caution:** Don't use too much force on the cable connections).

② Unscrew junction panel and pull off its plug.

③ Unscrew LAN interface and pull of its plug.

④ Take the fan out of its snap-in retaining cap by bending up the retaining parts from the outside (**Caution:** Too much bending may brake these parts) and at the same time pulling the fan out to the inside. Pull off its plug.

5.2.5 Maintenance support

For a complete maintenance service put the unit back into the original packing material and send it to the following service address.

Rohde & Schwarz GmbH & Co. KG

Zentralservice

Mühldorfstr. 15

D-81671 München

Phone: (89) 4129 12263

Fax: (89) 4129 13275

Annex A (RS232 Interface, Option)

Characteristics of the RS232 interface

The unit can be provided with an RS232 interface. The 9-pole RS232 connector will then be at the rear panel. A computer can be connected there to allow remote control. The connection is accomplished by null modem cable.

When the RS232 control interface is installed one can choose between the modes **RS232 Standard** and **RS232 PPP** and select the corresponding parameters via menu SETUP:REMOTE(RS232). See also 3.18.6.5 REMOTE.

RS232 standard mode

Being in this mode the unit is able to recognize and process simple ASCII command strings that are terminated by <LF>. A termination by <CR><LF> is also acceptable. Messages by the unit are always terminated by <CR><LF>.

The RS232-standard mode allows communication with simple terminals by simple applications even on operating systems without TCP/IP Stack. Please note that these applications must ensure the transmission.

Setting parameters

Apart from the different handshake modes, the following parameters can be set in menu SETUP:REMOTE (RS232):STANDARD:

- Baud rate (150 to 115200)
- Number of data bits (7 or 8)
- Number of stop bits (1 or 2)
- Parity (NONE, EVEN or ODD)

After changes have been made to the settings the unit has to be switched off and on again.

Null modem cable

The requirements for the null-modem cable depend on the selected handshake. For NO and XON-XOFF handshake it is sufficient to have RX and TX lines crossed. For RTS-CTS handshake, RTS and CTS lines must be crossed too.

Binary transmission with byte-escaping

Binary data can be transmitted when Byte-Escaping has been switched on via remote control by command `SYSTem:COMMunicate:SERial:BYTeesc ON`. See also chapter "Description of commands". In this sense all ASCII characters below 20_{hex} and the character 7D will become "byte-escaped". The escape character will be put in front of the character. The character itself will be recoded by an exclusive-or operation with the value 20_{hex}. The escape character has the value $7D_{hex}$.

Example:

0	->	7D 20
1	->	7D 21
10	->	7D 30
1F	->	7D 3F
20	->	20
21	->	21
7C	->	7C
7D	->	7D 5D
7E	->	7E
7F	->	7F
80	->	80
81	->	81

RS232 PPP mode

In this mode the TCP/IP protocol with PPP (Point to Point Protocol) is used on the RS232 interface. For simple communication with ESMB a Telnet terminal suffices.

Setting parameters

In the SETUP-REMOTE submenu, the parameters baud rate, IP address and port number can be set.

The IP-address and port number settings will take effect instantaneously. After changing the baud rate the unit has to be switched off and on again.

Null modem cable

If you wish to connect the ESMB to a computer directly by means of a serial link, the cable used must be wired as follows:

Please note that customary null modem cables may not be wired correctly.

Connection layout for a 9-pin null modem cable

Serial interface of the computer	Serial interface of ESMB		
Signal	Signal		
3	2	TxD	Transmit data
2	3	RxD	Receive data
7	8	RTS	Request to send
8	7	CTS	Clear to send
6,1	4	DSR	Data set ready and Carrier detect
5	5	SG	Signal ground
4	6, 1	DTR	Data terminal ready

Installation of a PPP connection under WindowsNT

The installation described here refers to the Window NT V4.0 setup procedures.

Other Windows versions may vary.

Step 1: Installing the TCP/IP network protocol

If you have already installed TCP/IP, skip this step.

⇒ One after the other click on **Start**, **Settings** and **Control Panel**.

⇒ Double-click on **Network.**

⇒ Click on tab **Protocol.**

⇒ Click on **Add**, then select **TCP/IP** and click **OK.**

After TCP/IP has been installed, the system must be restarted.

Step 2: Installing the Remote Access Service and the virtual ESMB modem

⇒ One after the other click on **Start**, **Settings** and **Control Panel**.

⇒ Double-click on **Network.**

⇒ Click on tab **Services.**

⇒ Click on **Add**, then select **Remote Access Service** and click **OK.**

Now you need to insert the WindowsNT Installation CD.

⇒ Enter the CD-ROM drive location.

The computer updates the system files on hard disk from your Windows NT CD (RAS Setup).

⇒ In the window "Add RAS Service", click on **Install Modem** and check **Do not detect my modem....** Click on **Next**.
If the RAS service is already installed then the modem with the icon "Modem" will be installed in the Control Panel.

⇒ Click on **Have Disk...** and insert your ESMB Utility Disk. Let the computer read the setup file from the appropriate directory by clicking on **Browse**. Select the file EB200.inf ("Open"). Confirm the next dialog with **OK**. The description of this configuration is: "PPP connection to ESMB via nullmodem".

⇒ Click on **Next**. Now the appropriate COM interface needs to be selected. Click on **Next**, then click on **Finish**.

In the next dialog, a pull-down list of RAS devices appears.

⇒ Select the "PPP connection to ESMB via nullmodem" and click on **OK**.

⇒ In the "Remote Access Setup" window, select your ESMB port and click on **Continue**.

⇒ The final prompt "Restart computer" can be answered with **No** because the following step requires a reboot of the system anyway.

Step 3: Installing the service pack

Following each installation of a new service, the current service pack has to be installed anew to update all programs. Otherwise, the programs and services may not function properly. For simple operating procedures Service Pack 5 suffices. In the event that large amounts of data are to be transferred to ESMB (with the Nagle algorithm being off) Service Pack 6 needs to be installed.

⇒ Use the WindowsNT Explorer to start UPDATE.EXE in subdirectory I386 on the service pack CD. Answer deinstallation query with "No" to restart the computer.

Step 4: Generating icon for link setup

⇒ Copy the file EB200.PBK from the ESMB Utility Disk to a folder on your hard disk.

⇒ Use the right mouse button to drag the file EB200.PBK from your folder to the desktop. Thus a link is generated.

Step 5: Connecting to the ESMB

⇒ Ensure that the serial port of your computer is connected to the EB 200 via null modem cable.

⇒ Complete the configuration under
- **More**
- **Edit entry and modem properties**
- **Server**

Only **TCP/IP** should be activated. IPX/SPX-compatible, NetBEUI, software compression and LCP-expansions for PPP should be off.

⇒ Double-click the icon EB200.PBK to start the remote data transmission network. Click on **Dial** without entering a subscriber number.

⇒ As a password, enter any string or leave the field empty.

⇒ Check in the login window whether TCP/IP has been started successfully. Protocols other than IPX are irrelevant.

⇒ Click on **Do not request failed protocols** and **Accept**.

⇒ Click on **Do not show** in the "Link is being set up" window.

Installation of a PPP connection under Windows 95/98/ME

Step 1: Installing the TCP/IP network protocol

If you have already installed TCP/IP, skip this step.

⇒ One after the other click on **Start**, **Settings** and **Control Panel**.

⇒ Double-click on **Network.**

⇒ Click on tab **Protocol.**

⇒ Click on **Add**, then select **Microsoft**, then select **TCP/IP** and click **OK.**

After TCP/IP has been installed, the system must be restarted.

Step 2: Installing the virtual ESMB modem

⇒ One after the other click on **Start**, **Settings**, **Control Panel** and **Modems.**

⇒ Click on **Add**, then select **Don't detect my modem...** and click on **Next.**

⇒ In the next dialog, click on **Have Disk.**

⇒ Use **Browse** to find the **EB200W95.INF** or the **EB200W98.INF** file on your hard disk or on your ESMB Utility Disk and click on **OK.**

⇒ Click on **OK** once again.

⇒ Select **ESMB Connection via Nullmodem** and click on **Next.**

⇒ Select a serial port you wish to use for ESMB remote control and click on **Next.**

The messages "Please wait while Windows installs your modem" and "Your modem has been set up successfully" appear.

⇒ Click on **Finish.**

⇒ Close the modem properties dialog.

Step 3: Creating a new dial-up networking connection for the ESMB remote control

⇒ Click on **Dial-Up Networking.**

⇒ Click on **Make New Connection.**

⇒ Enter any name for the new connection to be made (example: "EB200 Connection").

⇒ In the pull-down list "Select a modem:", select **ESMB Connection via Nullmodem.**

⇒ Click on **Next.**

⇒ In the next dialog, enter any **area code** (must be entered), **telephone number** (must be entered) and **country code.**

⇒ Click on **Next.**

The message "You have successfully created a new Dial-Up Networking connection called ..." appears.

⇒ Click on **Finish.**

Step 4: Connecting to the ESMB

⇒ Ensure that the serial port of your computer is connected to the ESMB via null modem cable.

⇒ Clear the entry in the routing table if one is available. For this open the DOS box (click on **Start** and **Execute...** and enter **COMMAND**.
The entry is cleared by entering, in the command line, the command `route delete <IP-address>`. <IP-address> corresponds to the IP-address set in ESMB (default 192.0.0.2), and possibly also to the network address 192.0.0.0 .
eg: `route delete 192.0.0.2`

⇒ Click on **Dial-Up Networking.**

⇒ In the Dial-Up Networking window double-click on the connection entry for the ESMB you have created within step 3 (example: "ESMB Connection").

You can create a shortcut by dragging this entry on the desktop.

A "Connect To" dialog appears.

⇒ Complete the configuration under **Properties - Server:** Only **TCP/IP** should be activated. IPX/SPX-compatible, NetBEUI, software compression and LCP-expansions for PPP should be off.

⇒ Enter any **phone number** and click on **Connect** without entering any other parameters.

If the protocol is established, a message window appears

Connected to "(place holder for ESMB Conn)"

Connected at 115200 bps

Duration: xxx:xx:xxx

Now the system is ready to send and receive data via PPP if an appropriate program such as Telnet is used.

If the error 650 is reported back this may be due to different baud rate settings on the two sides.

If the error 651 is reported back this may be due to the fact that the cable used differs from the one stipulated.

Installation of a PPP connection under Linux

In order to establish a PPP connection between a Linux system and the ESMB via null modem cable just enter the following command (superuser/root rights for the system are required):

```
$ pppd /dev/cua0 115200 crtscts defaultroute
```

Description of parameters:

`/dev/cua0`	for COM1:
`/dev/cua1`	for COM2:
`115200`	transmission rate in baud
`crtscts`	sets the H/W flow check on (`nocrtscts` sets the H/W flow check off). If nothing is specified, the current settings are used for the serial interface.
`defaultroute`	specifies the "channel" which addresses computers or networks that were not explicitly entered into the routing tables

Testing the protocol on the low-level

⇒ Open a DOS box (click on **Start** and **Run...** and enter **COMMAND**).

⇒ On the Command line prompt, type

```
ping 192.0.0.2
```

192.0.0.2 being the IP address of your ESMB.

This may differ from your specific settings (see --> SETUP --> REMOTE --> IP-ADDRESS).

When the protocol is established, the ESMB sends following message:

```
Reply from 192.0.0.2: bytes=32 time=16ms TTL=64
```

If the protocol could not be established, the following error message will appear:

```
Destination host unreachable
```

At this time it seems that there is a protocol conflict in Windows 95 which does not allow the protocol to be disconnected correctly. If you have problems with establishing the connection, try a power-down/power-up cycle with the ESMB.

Testing the protocol on the ESMB command level

The established link can now be used for controlling the ESMB via a terminal program such as Telnet or another application program which is capable of doing PPP. Setup the host name (IP address) and the port number in your remote control program according to the settings in the ESMB (menu: SETUP:REMOTE). The ESMB default settings are:

BAUDRATE:	115.2 k
IP ADDRESS:	192.0.0.2
PORT:	5555

For testing the link, the ESMB identification string may be checked.

In your terminal program enter ***idn?**

Following this entry, the response string

ROHDE&SCHWARZ,ESMB,xxx.xxx/xxx,V0x.xx-4052.4654.00

will be displayed.

Annex B (Error Messages)

Warnings, component failures and device-dependent info

Warnings (W) and component failures (CF) are messages displayed on the front panel. Each one of the two error channels can be switched on and off in the menu SETUP-MESSAGE. Some of the warnings and component failures are added to the remote error messages as device-dependent info. Messages that are only coming from the remote interface as device dependent info are labeled with an R.

Error string	Description	Code
Bandwidth not installed	This bandwidth cannot be selected.	R
Bandwidth too high with CW	CW cannot be done on bandwidths above 9 kHz.	W
Bandwidth too high with SSB	SSB cannot be done on bandwidths above 9 kHz.	W
Check external reference	The synthesizer cannot be synchronized with the reference frequency. The externally fed in reference signal does not exist or its specifications do not apply. Switch over to internal reference and try again.	CF
Communication error to DC Converter	An error occurred in the data traffic in reference to the DC/DC converter.	CF
DC Converter defective	The DC/DC converter (EB200-N1) indicates an error.	CF
DSP IF Section defective	The IF section (EB200Z1) indicates an error.	CF
Front Panel defective	The front panel control unit (EB200F1) indicates an error.	CF
Frontend defective	Frontend 1 or frontend 2 (EB200FU) indicates an error.	CF
Frontend1 defective	Frontend 1 (EB200FU) indicates an error.	CF
Frontend2 defective	Frontend 2 (EB200FU) indicates an error.	CF
IF-panorama defective	The IF-panorama (EB200SU) indicates an error.	CF
IFPAN: Sensitivity out of range	The level of the test signal measured at the IF-panorama is out of range.	CF
IF Prefilter narrow defective	The narrow-band IF prefilter in the IF section EB200Z1 indicates an error.	CF
IF Prefilter wide defective	The broad-band IF prefilter in the IF section EB200Z1 indicates an error.	CF
IF Section defective	The IF section EB200Z1 indicates an error.	CF
Level too high at ...	The signal level at the current frequency is too high for Longtest.	CF
Level too low at ...	The signal level at the current frequency is too low for Longtest.	CF

Error string	Description	Code
Maximum length exceeded!	No more characters can be entered in the EDIT window.	W
Memory empty	Memory location is empty (eg RCL).	W
Memory index too high	The highest memory location number is 999.	W
More than 4 frequencies out of range	At Longtest the signal level of more than 4 frequencies is outside the tolerance.	CF
No AFC with SSB	AFC does not work with SSB.	W
No password active	An attempt to delete the password was made despite the fact that no password was active.	W
Not during BITE	The selected function does not work during the test run.	W
Not during memory scan	The selected function does not work during memory scan.	W
Not during digi scan	The selected function does not work during digi scan.	W
Not during scan	The selected function does not work while scanning.	W
Not installed	The selected function is not installed.	CF
Not with MGC	This function works only with AGC.	W
Password changed!	Confirmation of the password being changed.	W
Password not changed!	Password remains unchanged	W
Password deleted!	Confirmation of the password being deleted.	W
Power down required for new settings	The unit must be switched off and on again to make the changed settings effective.	CF
Preselector VUHF 20...80 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	CF
Preselector VUHF 80...200 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	CF
Preselector VUHF 200...650 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	CF
Preselector VUHF 650...1500 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	CF
Preselector VUHF 1500...2000 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	CF
Preselector VUHF 2000...3000 MHz defective	The preselection V/UHF (EB200VU) indicates an error.	CF
Preselector HF 9...150 kHz defective	The preselection HF (EB200VH, option) indicates an error.	CF

Error string	Description	Code
Preselector HF 0.15...3 MHz defective	The preselection HF (EB200VH, option) indicates an error.	CF
Preselector HF 3...7 MHz defective	The preselection HF (EB200VH, option) indicates an error.	CF
Preselector HF 7...15 MHz defective	The preselection HF (EB200VH, option) indicates an error.	CF
Preselector HF 15...30 MHz defective	The preselection HF (EB200VH, option) indicates an error.	CF
Preselector not installed	The preselector V/UHF (EB200VU) is not installed.	CF
Processor defective	The processor (EB200P1) indicates an error.	CF
Remote Interface defective	The remote interface (ESMBR2 or EB200R4) indicates an error.	CF
Sensitivity out of range	The measured level of the test signal is out of the effective range.	CF
Span too low	A too small frequency value was entered which caused the span to become too small	W
Stop freq lower than start freq	The stop frequency is lower than the start frequency (eg FSCAN).	R
Suppress index too high	The max. index of the suppress table is 99.	W
Synthesizer unlocked at ...	The synthesizer did not lock at this specific frequency.	CF
Temperature too high	The temperature of the unit is too high.	CF
Test ok, signal path	No error was detected during the (quick) test.	CF
Test ok, RF range and signal paths	No error was detected during Longtest.	CF
Testgenerator defective	The test generator in the preselector section V/UHF (EB200VU) indicates an error.	CF
Value too high	The input value is too high.	R
Value too low	The input value is too low.	R
Wrong center/span combination	The input frequency value cannot be combined with the current span or center frequency	W
Wrong Password, try again!	Wrong password was entered.	W
Wrong numeric syntax!	The input in the EDIT window is not valid.	W

Error messages of the queue query

The following list contains all error messages for errors occurring in the instrument. The meaning of negative error codes is defined in SCPI (Standard Commands for Programmable Instruments), positive error codes mark errors specific for the instrument.

In the left column the table contains the error text which is entered in the error/event queue. In the right column there is an explanation regarding the respective error.

For some errors, a so-called device-dependent info is added to the error message. It gives further information about the error source (eg. -222, "Data out of range", frequency too high).

SCPI-specific error messages

No Error

Error Code from Queue Query	Error Explanation
0,"No error"	This message is output if the error queue does not contain entries.

Command Error - Faulty command; sets bit 5 in the ESR register

Error Code from Queue Query	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, "`SENSe &`".
-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 SENSe:FREQuency permits only one frequency indication.

Error Code from Queue Query	Error Explanation
-109,"Missing parameter"	The command contains too few parameters. Example: Command SENSe: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 signs.
-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: SENSe9 does not exist in the instrument.
-121,"Invalid character in number"	A number contains an impermissible character.
-123,"Exponent too large"	The absolute value of the exponent is larger than 32000.
-124,"Too many digits"	The number contains too many digits.
-128,"Numeric data not allowed"	The command contains a number which is not allowed at this position. Example: Command SENSe:FREQuency:MODE requires the 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 signs.
-138,"Suffix not allowed"	A suffix is not allowed for this command or at this position of the command.
-141,"Invalid character data"	The text parameter either contains an invalid sign or it is invalid for this command. Example: spelling mistakes during parameter indication; SENSe:FREQuency:MODE FIXed.
-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.
-151,"Invalid string data"	The command contains a faulty character string. Example: An END message was received before the final apostrophe.
-158,"String data not allowed"	The command contains a valid character string at a position which is not allowed. Example: A text parameter is set in quotation marks, SENSe:FREQuency:MODE "FIXed"

Error Code from Queue Query	Error Explanation
-161,"Invalid block data"	The command contains faulty block data. Example: An END message was received before the expected number of data had been received.
-168,"Block data not allowed"	The command contains valid block data at an impermissible position.
-171,"Invalid expression"	The command contains an impermissible mathematical expression. Example: The expression contains an uneven number of brackets.
-178,"Expression data not allowed"	The command contains an expression at an impermissible position.

Execution Error - Error in executing the command; sets bit 4 in the ESR register

Error Code from Queue Query	Error Explanation
-200,"Execution error"	Error during execution of the command.
-211,"Trigger ignored"	Trigger not possible or trigger rate exceeded.
-221,"Settings conflict"	There is a settings conflict between two parameters. Example: bandwidth 100 kHz and USB cannot be switched on at the same time.
-222,"Data out of range"	The parameter value is outside the permissible range of the instrument.
-223,"Too much data"	Trace length was exceeded. Example: command SWE:SUPP, if all 100 frequency pairs are already assigned.
-240,"Hardware error"	Hardware error is not further specified.
-241,"Hardware missing"	The command cannot be executed due to missing hardware. Example: An option is not installed.
-292,"Referenced name does not exist"	An unknown name was sent as a parameter. Example: An unknown antenna name is to be deleted, `ROUTe:PATH:DELete Hase`
-293,"Referenced name already exists"	The name is defined twice. Example: An antenna name already known is defined again.

Device-specific Error; sets bit 3 in the ESR register

Error Code from Queue Query	Error Explanation
-300,"Device-specific error"	Some data in memory not valid.
-350,"Queue overflow"	This error code is entered into 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.
-361,"Parity error in program message"	A parity error has occurred in the RS232-Standard mode. The parity bit might not be set correctly.
-362,"Framing error in program message"	A framing error has occurred in the RS232-Standard mode. Data bits or stop bits might not be set correctly.
-363,"Input buffer overrun"	An overrun error has occurred in the RS232-Standard mode.

Query Error ; ets bit 2 in the ESR register

Error Code from Queue Query	Error Explanation
-400,"Query error"	General error which is not further specified during data request 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 the operation.

Device-specific error

Device-dependent Error; sets bit 3 in the ESR register.

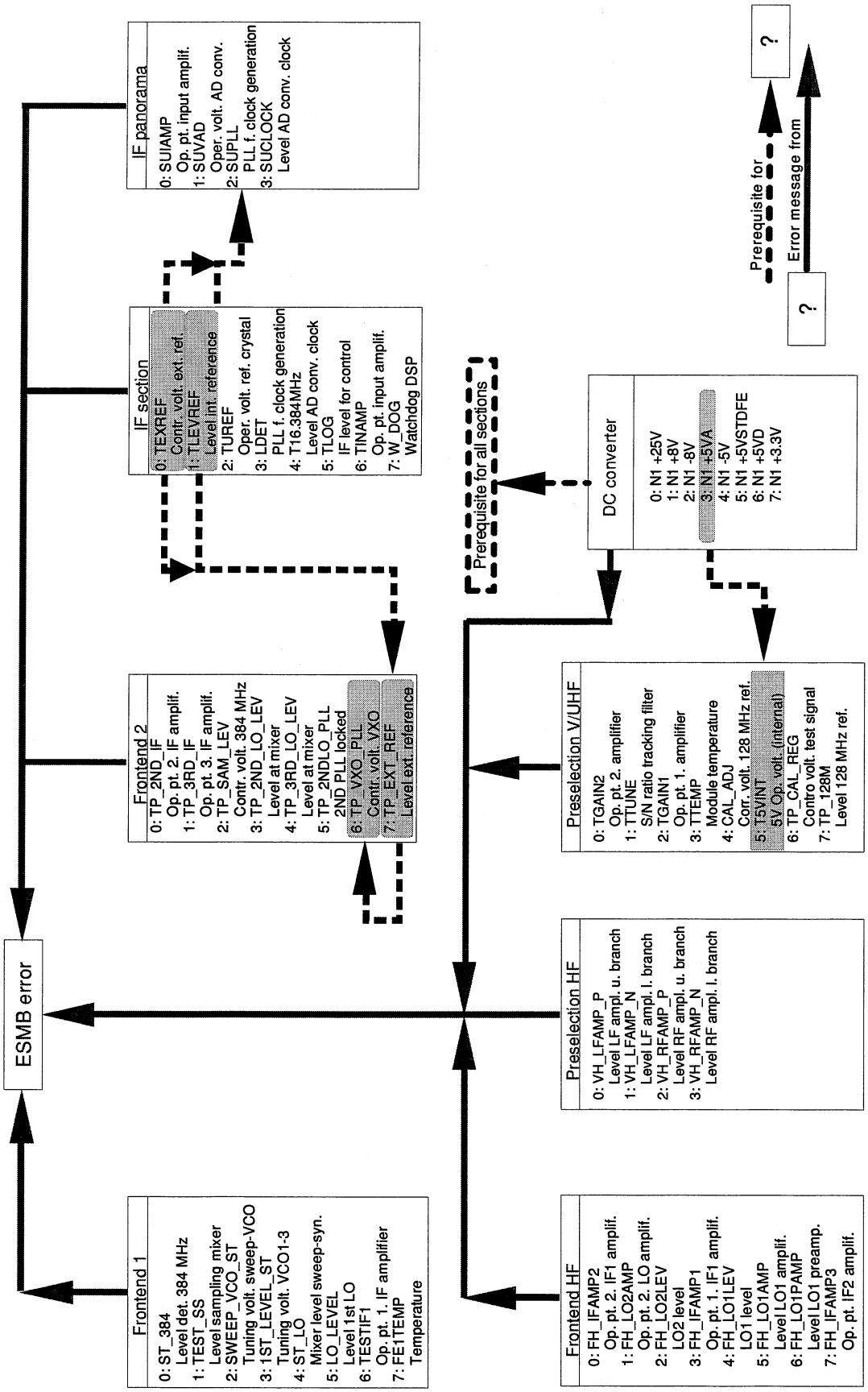
Error Code from Queue Query	Error Explanation
1,"Device dependent error"	The ESMB error is not further specified.
2,"I^2C-Bus error"	Error at I^2C bus has been recognized.
10,"Component failure"	A component indicates an error..
200,"Temperature too high"	The internal temperature of the unit is too high.
300,"Power fail"	One of the internal ESMC-FE supply voltages is out of tolerance.

System errors

Errors of this kind are signalled when impermissible states are detected within the operating software. After a system error has occurred manual operation is not possible any longer, and the unit must be restarted. In general, errors of this nature are very rare indeed. In the event that such an error does occur nonetheless, we kindly ask you to report the error number and circumstances to the Rohde & Schwarz Support Center.

An exception to this is System Error 7617 for which there is a simple explanation. This message means that the lithium battery in Processor EB200P1 is dead. This battery serves for backing up the setting parameters in the CMOS RAM. The conventional lithium battery (type CR2477) (R&S part no. 4052.5673.00) is plugged into a socket and therefore can be easily replaced. It has a service life of 2 to 5 years depending on operating cycles and ambient temperature.

Error hierarchy



Annex C (Functions and Commands)

Remote and manual control functions

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Basic functions								
Offset correction	[SENSe:]FREQuency[:CW | FIXed]:AFC	ON | OFF	OFF	SCPI	68	Hardkey: AFC 2fold toggle ON | OFF	every	16
Bandwidth	[SENSe:]BANDwidth | BWIDth[:RESolution]	UP | DOWN | MIN | MAX bandwidth in Hz	120 kHz	SCPI	61	Hardkey: BW + and -	every	13
Attenuation display	INPut:ATTenuation:STATe?		depending on level	SCPI	39	Indirect by scaling of level bar meter	with level bar display	8
Attenuation selection	INPut:ATTenuation:AUTO INPut:ATTenuation:STATe	ON | OFF ON | OFF	ON	SCPI	37	Hardkey: ATT 3fold toggle: OFF |ON |AUTO	every	8
Receive frequency	[SENSe:]FREQuency	Frequency 9 kHz to 3 GHz	98.5 MHz	SCPI	68	Rollkey if FRQ active or entry of value and acknowledgement by FRQ	every	6
Volume	SYSTem:AUDio:VOLume	0...1 | MIN | MAX	0.2	no SCPI	109	VOL digital potentiometer	every	21
Modulation mode	[SENSe:]DEModulation	AM | FM | PULSe | A1 | CW | LSB | USB	FM	no SCPI	65	Hardkey: MOD + and -	every	13
Level measurement	[SENSe:]DETector[:FUNCtion]	PAVerage | POSitive | FAST	PAVerage	SCPI	66	Hardkey: LEV 3fold toggle AVG|PEAK|FAST	every	16
Squelch ON/OFF	OUTPut:SQUelch[:STATe]	ON | OFF	OFF	no SCPI	50	Hardkey: SQU 2fold toggle ON | OFF	every	14
Squelch value	OUTPut:SQUelch:THReshold[:UPPer]	-30 to +110[dBuV] | MIN | MAX	10 dBµV	no SCPI	52	MST digital potentiometer: if SQU active, value displayed below hardkey	every	21
Squelch value increment	OUTPut:SQUelch:THReshold[:UPPer] :STEP[:INCRement]	0.1 to 10[dB] | MIN | MAX	1 dB	no SCPI	52	Stepwidth for manual control always 1 dB		21
Test key	no direct equivalent		none			Loop test as long as key is pressed	every	21

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Tone ON/OFF	OUTPut:TONE	ON | OFF	OFF	no SCPI	53	Hardkey: TONE 2fold toggle ON | OFF	every	15
Tone value	OUTPut:TONE:THReshold	-14 to +94[dBuV] | MIN | MAX	15 dBµV	no SCPI	54	MST digital potentiometer: if TONE active, value displayed below hardkey	every	15
Tone value increment	OUTPut:TONE:THR:STEP	0 to 10[dB] | MIN | MAX	1 dB	no SCPI	56	Stepwidth for manual control always 1 dB		15
Gain control mode	[SENSe:]GCONtrol:MODE	FIXed | MGC | AUTO | AGC	AUTO	no SCPI	85	Hardkey: MGC 2fold toggle ON | OFF	every	14
Gain control value	[SENSe:]GCONtrol[:FIXed | MGC]	-30 to +110[dBuV] | MIN | MAX	50 dBµV	no SCPI	84	MST digital potentiometer: if MGC active, value displayed below hardkey	every	21
Increment of gain control value	[SENSe:]GCONtrol[:FIXed | MGC]:STEP[:INCRement]	1 to 10[dB] | MIN | MAX	1 dB	no SCPI	84	Stepwidth for manual control always 1 dB	every	21
MSCAN								
Number of scans	[SENSe:]MSCan:COUNt	1 to 1000 | INFinity | MINimum | MAXimum	INFinity	no SCPI	88	Hardkey SEL: CYCLES Rollkey: 1 to 1000	M-SCAN :CONFIG	27
Erase all memories	MEMory:CLEar	MEM0, MAXimum	none	no SCPI	43	Softkey: DELETE...ALL	M-SCAN :CONFIG	27
Erase specific memory	MEMory:CLEar	<name><name>: MEM0 to MEM999	none	no SCPI	43	Softkey: DELETE...CURRENT	M-SCAN :CONFIG	27
Reset memory for MSCAN	MEMory:CONTents:MPAR	<name>,<ACT> ON<name>: MEM0 to MEM999	none	no SCPI	46	Softkey: SUPP	M-SCAN :CONFIG	27
Set memory for MSCAN	MEMory:CONTents:MPAR	<name>,<ACT> ON <name>: MEM0 to MEM999	none	no SCPI	46	Softkey: ACTIVATE	M-SCAN :CONFIG	27
Replace contents of memory by receiver settings	MEMory :EXCHange	<name>| RX, <name> | RX <name>: MEM0 to MEM999	none	no SCPI	47	Softkey: RX<->MEM	M-SCAN :CONFIG	27

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Squelch from memory	OUTPut:SQUelch:CONTrol	MEMory | NONE	MEMory	no SCPI	51	Hardkey SEL: SQ FROM MEM ON/OFF	M-SCAN :CONFIG	27
Start scan downwards from stop frequency	[SENSe:]FREQuency:MODE [SENSe:] MSCan:DIRection INITiate:CONM[:IMMediate] or *TRG	MSCan DOWN	CW UP	SCPI	75	Softkey: RUN- receive frequency outside scan range	M-SCAN and M-SCAN :CONFIG	26
Start scan upwards from start frequency	[SENSe:]FREQuency:MODE [SENSe:] MSCan:DIRection INITiate:CONM[:IMMediate] or *TRG	MSCan UP	CW UP	SCPI	75	Softkey: RUN+ receive frequency outside scan range	M-SCAN and M-SCAN :CONFIG	26
Stop scan	ABORt		none	SCPI	18	Softkey: STOP	M-SCAN	26
Continue scan downwards from current frequency	[SENSe:]FREQuency:MODE [SENSe:] MSCan:DIRection INITiate:CONM[:IMMediate] or *TRG	MSCan DOWN	CW UP	SCPI	75	Softkey: RUN- receive frequency in scan range	M-SCAN and M-SCAN :CONFIG	26
Continue scan upwards from current frequency	[SENSe:]FREQuency:MODE [SENSe:] MSCan:DIRection INITiate:CONM[:IMMediate] or *TRG	MSCan UP	CW UP	SCPI	75	Softkey: RUN+ receive frequency in scan range	M-SCAN and M-SCAN :CONFIG	26
Dwell time	[SENSe:]MSCan:DWELl	0 to 10[s] | INFinity	0.5 s	no SCPI	89	Hardkey SEL: T_DWELL Rollkey: 0.0 to 10.0/infinite sec	M-SCAN :CONFIG	27
Continue scan under signal control	[SENSe:]MSCan:HOLD:TIME [SENSe:]MSCan:CONTrol[:ON]	0 to 10[s] "STOP:SIGNal" "STOP:SIGNal"	0.0 " "	no SCPI	90	Hardkey SEL: T_NOSIG Rollkey: combination of ON/OFF function and value: 0.0 to 10.0 sec	M-SCAN :CONFIG	27

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Memory functions								
Instrument settings -> memory	MEMory:COPY	<src_name> | RX, <dest_name> | RX especially: RX, <dest_name> dest_name: MEM0...MEM999	none	no SCPI	40	Hardkey: SAVE acts on current memory or: editor entry of memory number and then hardkey: SAVE	every	16
Memory -> instrument settings	MEMory:COPY	<src_name> | RX, <dest_name> | RX especially: <src_name>, RX src_name: MEM0...MEM999	none	no SCPI	40	Hardkey: RCL acts on current memory or: editor entry of memory number and then hardkey: SAVE	every	16
Contents of memories	MEMory:CONTents	<name>, <mem_paras> | <packed_struct>name: MEM0 to MEM999 | RX | CURRENT	none	no SCPI	42	Cannot be edited directly	M-SCAN :CONFIG	27
Number of memory	MSCan:CHANnel	<dest_name> dest_name: MEM0 to MEM999	MEM0	no SCPI	79	Rollkey: if MEM active or entry of number to be confirmed by MEM or entry of number and then hardkey: SAVE or RCL or : by means of MSCAN	every	18
Status of memory	MEMory:CONTents	<ACT>	none		42	Symbolic display beside memory number: '[ ]' = data in memory '[+]' = data in memory and set for query ' + ' empty and set for query ' ' empty and not set	every	11
Define target memory	MEMory:COPY	RX, CURRENT | NEXT	none	no SCPI	40	Hardkey SEL: KEYS SAVE Rollkey: CURRENT MEM / NEXT FREE / CURRENT MEM+ACT / NEXT FREE+ACT	SETUP : KEYS	16

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
FSCAN								
Number of sweeps	[SENSe:]SWEep:COUNt	1 to 1000 | INFinity | MINimum | MAXimum	INFinity	SCPI	95	Hardkey SEL: CYCLES Rollkey: 1 to 1000	F-SCAN :CONFIG	30
Start frequency	[SENSe:]FREQuency:STARt	9 kHz to 3 GHz	20 MHz	SCPI	72	Hardkey SEL: F-START "|<-" Rollkey: 9 kHz to 3GHz	F-SCAN :CONFIG	30
Step frequency	[SENSe:]SWEep:STEP	100 Hz to 10 MHz	10 kHz	SCPI	98	Hardkey SEL: F-STEP "<->" Rollkey: 100 Hz to 10 MHz	F-SCAN :CONFIG	30
Stop frequency	[SENSe:]FREQuency:STOP	9 kHz to 3 GHz	650 MHz	SCPI	79	Hardkey SEL: F-STOP " ->" Rollkey: 9 kHz to 3 GHz	F-SCAN :CONFIG	30
Start sweep downwards from stop frequency	[SENSe:]FREQuency:MODE [SENSe:]SWEep:DIRection INITiate[:IMMediate]	SWEep DOWN	CW UP	SCPI	75	Softkey: RUN- receive frequency outside of sweep range	F-SCAN and F-SCAN :CONFIG	29
Start sweep upwards from start frequency	[SENSe:]FREQuency:MODE [SENSe:]SWEep:DIRection INITiate[:IMMediate]	SWEep UP	CW UP	SCPI	75	Softkey: RUN+ receive frequency outside of sweep range	F-SCAN and F-SCAN :CONFIG	29
Stop sweep	ABORt		none	SCPI	18	Softkey: STOP	F-SCAN	29
Continue sweep downwards from current frequency	[SENSe:]FREQuency:MODE [SENSe:]SWEep:DIRection INITiate:CONM[:IMMediate]	SWEep DOWN	CW UP	SCPI	75	Softkey: RUN- receive frequency in sweep range	F-SCAN and F-SCAN :CONFIG	29
Continue sweep upwards from current frequency	[SENSe:]FREQuency:MODE [SENSe:]SWEep:DIRection INITiate:CONM[:IMMediate]	SWEep UP	CW UP	SCPI	75	Softkey: RUN+ receive frequency in sweep range	F-SCAN and F-SCAN :CONFIG	29
Dwell time	[SENSe:]SWEep:DWELl	0 to 10[s] | INFinity	0.5 s	no SCPI	97	Hardkey SEL: T_DWELL Rollkey: 0.0 to 10.0/infinite sec	F-SCAN :CONFIG	30
Continue sweep under signal control	[SENSe:]SWEep:HOLD:TIME [SENSe:]SWEep:CONTrol[:ON]	0 to 10[s] "STOP:SIGNal" "STOP:SIGNal"	0.0 " "	no SCPI	97	Hardkey SEL: T_NOSIG Rollkey: combination of ON/OFF function and value: 0.0 to 10.0 sec	F-SCAN :CONFIG	30

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
FSCAN SUPP								
Number of suppressed ranges	no command		none			SUPPRESSED FREQUENCY RANGES: 0 to 100, only display parameter	F-SCAN :CONFIG :SUPP	31
Index of suppress table	TRACe:POINts?	SSTART | SSTOP the result is always 100	none	SCPI	124	Hardkey SEL: INDEX Rollkey: 0 to 99	F-SCAN :CONFIG :SUPP	31
Suppress channel	[SENSe:]SWEep:SUPPress		none	no SCPI	99	Softkey: SUPP suppresses a frequency range depending on the current bandwidth	F-SCAN	29
Erase all entries in suppress table	TRACe[:DATA] TRACe[:DATA]	SSTART, 0 SSTOP,0	none	SCPI	118	Softkey: DEL ALL	F-SCAN :CONFIG :SUPP	31
Erase a line in suppress table	TRACe:VALue	SSTART, index, 0	none	SCPI	125	Softkey: DELETE	F-SCAN :CONFIG :SUPP	31
Sort frequency ranges	[SENSe:]SWEep:SUPPress:SORT		none	no SCPI	99	Softkey: SORT	F-SCAN :CONFIG :SUPP	31
Start frequency of suppressed frequency range	TRACe:VALue	SSTART, index, frequency value	none	SCPI	125	Hardkey SEL: F-START Rollkey: 10 kHz to 3GHz	F-SCAN :CONFIG :SUPP	31
Stop frequency of suppressed frequency range	TRACe:VALue	SSTOP, index, frequency value	none	SCPI	125	Hardkey SEL: F-STOP Rollkey: 10 kHz to 3GHz	F-SCAN :CONFIG :SUPP	31

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
DSCAN								
Speed selection	[SENSe:]FREQuency:DSCan:SPEed	LOW | NORMal | HIGH	NORMal	no SCPI	74			
Start frequency	[SENSe:]FREQuency:DSCan:STARt	9 kHz to 2.999985750 GHz	85 MHz	no SCPI	72	Hardkey SEL: F-START "|<-" Rollkey: 9 kHz to 2.999986 GHz	D-SCAN	32
Stop frequency	[SENSe:]FREQuency:DSCan:STOP	23.250 kHz to 3 GHz	110 MHz	no SCPI	73	Hardkey SEL: F-STOP " ->" Rollkey: 23 kHz to 3GHz	D-SCAN	32
Mark frequency	[SENSe:]FREQuency:DSCan:MARKer	9 kHz to 3 GHz	98.5 MHz	no SCPI	70	Hardkey SEL: F-STOP " ->" Rollkey: 9 kHz to 3GHz	D-SCAN	32
Center frequency	[SENSe:]FREQuency:DSCan:CENTer	16.125 kHz to 2.999992875 GHz	97.5 MHz	no SCPI	69	Hardkey SEL: F-START "|<-" Rollkey: 16 kHz to 3GHz	D-SCAN	32
Span frequency	[SENSe:]FREQuency:DSCan:SPAN	14.250 kHz to 2.999991000 GHz	25 MHz	no SCPI	71	Hardkey SEL: F-STOP " ->" Rollkey: 14 kHz to 2.999993 GHz	D-SCAN	32
Start DSCAN	[SENSe:]FREQuency:MODE INITiate[:IMMediate]	DSCan	CW	SCPI	75	Softkey: RUN / STOP	D-SCAN	32
Stop DSCAN	ABORt		none	SCPI	18	Softkey: RUN / STOP	D-SCAN	32
Normal or differential mode	no command		NORM			Softkey: NORM / DIFF	D-SCAN [:CONFIG]	33
Bandwidth zoom mode	[SENSe:]FREQuency:DSCan :RESolution:AUTO[?]	ON | OFF	OFF	no SCPI	71	Softkey: BW ZOOM	D-SCAN	33
Marker frequency to next signal peak	CALCulate:DSCan:MARKer:MAXimum :NEXT		none	no SCPI		Softkey: MARK TO PEAK	D-SCAN	33
Marker frequency to absolute signal peak	CALCulate:DSCan:MARKer:MAXimum :[PEAK]		none	no SCPI				
Reference level	[SENSe:]VOLTage:AC:RANGe	UP | DOWN | MIN | MAX | 0 to +110[dBuV]	50 dBµV	SCPI	100	Softkey: REF	D-SCAN	33
Spectrum display max. or current values	CALCulate:DSCan:AVERage:TYPE[?]	MAXimum|OFF		no SCPI		Softkey: MAX / CLRWRT	D-SCAN :CONFIG	33

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Clear spectrum	CALCulate:DSCan:CLEar		none	no SCPI	22	none		
Start, stop, marker frequency or span, center, marker frequency	no command					Softkey: <-> ->|<-	D-SCAN :CONFIG	33
Spectrum display range in dB	no command		60 [dB]			Softkey: RNG 20 | RNG 40 | RNG 60 | RNG 80	D-SCAN [:CONFIG]	33
DSCAN speed	[SENSe]:FREQuency:DSCan:SPEed[?]	LOW|NORMal|HIGH|MTIMe	NORMal	no SCPI	74	Hardkey SEL:D-SCAN SPEED Rollkey: MTIME PER CHANNEL | LOW | NORMAL | HIGH	D-SCAN :CONFIG	33
Number of scans	[SENSe]:DSCan:COUNt[?]	1 to 1000 | MINimum|MAXimum | INFinity	INFinity	SCPI	67	Hardkey SEL: CYCLES Rollkey: 1 to 1000	D-SCAN :CONFIG	33
Measuring time	MEASure:TIME[?]	0.5 to 900 sec | MINimum | MAXimum |DEFault	DEFault	SCPI	42	Hardkey SEL: MEASURE TIME Rollkey: DEFAULT 0.5 to 900	D-SCAN :CONFIG	33
Receiver configuration								
Antenna name	ROUTe:PATH:CATalog? ROUTe:PATH[:DEFine] ROUTe:PATH:DELete:ALL ROUTe:PATH:DELete[:NAME] ROUTe:SELect	<name>, <channel_list> <name>, <channel_list>	none	SCPI	58	Hardkey SEL: ANTENNA CODE Softkey: <- | -> Rollkey: ABCDEFGHIJKLM (13 characters)	RX-CONF :ANT /ATT	38
Antenna number	ROUTe:CLOSe ROUTe:CLOSe:STATe? ROUTe:OPEN:ALL	<channel_list>	0	SCPI	56	Hardkey SEL: ANTENNA NUMBER Rollkey: 0 to 99	RX-CONF :ANT / ATT	38
AUX connector X8	OUTPut:AUXMode	FREQuency | ANTCtrl	ANTCtrl		48			
AF balance left-right	SYSTem:AUDIo:BALAnce	-0.5 to 0.5	0.0	no SCPI	38	Hardkey SEL: BALANCE Rollkey: bar –50 to +50	RX_CONF :AF	39
Operation mode selector	INPut:ATTenuation:MODE[?]	LOWNoise | LOWDistort | NORMal	none	no SCPI	57	Softkey: LOW NOISE | NORMAL | LOW DIST	RX_CONF :ANT / ATT	

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
HF antenna connector X3 or X13	ROUTe:HF	ANTHf | ANTVuhf	ANTHf	no SCPI	76			
HF-tuner receive frequency	SENSe:FREQuency:RANGe:HF	<numeric-value> | MINimum | MAXimum	30.0 MHz	no SCPI	62			38
K-factor table antenna passive or active	[SENSe]:CORRection:ANTenna[?]	ACTive | PASSive	PASSive	SCPI	107	Softkey: ANT PAS | ANT ACT	RX_CONF :ANT / ATT	37
Balance AF left-right	SYSTem:AUDIo:BALAnce	-0.5 to 0.5	0.0	no SCPI	114	Hardkey SEL: BALANCE Rollkey: bar –50 to +50	RX_CONF :AF	37
Loudspeaker	SYSTem:SPEaker:STATe	ON | OFF	ON	no SCPI	92	Hardkey SEL: SPEAKER Rollkey: ON / OFF	RX_CONF :AF	55
Reference frequency	[SENSe:]ROSCillator:EXTernal :FREQuency? [SENSe:]ROSCillator[:INTernal] :FREQuency? [SENSe:]ROSCillator:SOURce	Answer always 10 MHz Answer always 10 MHz INTernal | EXTernal	10 MHz INTernal	SCPI	54	Switchover INTERNAL / EXTERNAL	SETUP :REF	37
Tone operation mode	OUTPut:TONE:CONTrol	ONLY | WITHaf	ONLY	no SCPI	51	Hardkey SEL: TONE Rollkey: ONLY / WITH AF	RX_CONF :AF	35
Measurement functions								
Measuring time	MEASure:TIME[?]	0.5 to 900 sec | MINimum | MAXimum |DEFault	DEFault	SCPI	42	Hardkey SEL: MEASURE TIME Rollkey: DEFAULT 0.5 to 900	RX_CONF :MEASURE	39
Measuring mode	MEASure:MODE[?]	CONTinuous | PERiodic	CONTinuous	SCPI	42	Softkey: CONTIN | PERIODIC	RX_CONF :MEASURE	39
Bandwidth measurement	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"BANDwidth"	"VOLTage :AC"	SCPI	82	Numerically displayed in kHz	DISPLAY :BANDW	50
Bandwidth measure-ment method x dB or BETA %	MEASure:BANDwidth:MODE	XDB	XDB	no SCPI	40	Softkey: XDB | ß%	RX_CONF :MEASURE	39

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Configuration of measurement method x dB	MEASure:BANDwidth:XDB	0.0 to 100.0 [dB]	26.0 [dB]	no SCPI	40	Hardkey SEL: X dB Rollkey: 0.0 to 100.0 dB	RX_CONF :MEASURE	39
Configuration of measurement method BETA %	MEASure:BANDwidth:BETA	0.1 to 99.9 [%]	1.0 [%]	no SCPI	41	Hardkey SEL: ß % Rollkey: 0.1 to .99.9 %	RX_CONF :MEASURE	39
AM modulation index	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"AM"	"VOLTage :AC"	SCPI	82	Numerically displayed in %	DISPLAY :MVALUE	51
AM positive modulation index	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"AM:POSitive"	"VOLTage :AC"	SCPI	82	Numerically displayed in %	DISPLAY :MVALUE	51
AM negative modulation index	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"AM:NEGative"	"VOLTage :AC"	SCPI	82	Numerically displayed in %	DISPLAY :MVALUE	51
AM modulation index	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"AM"	"VOLTage :AC"	SCPI	82	Numerically displayed in %	DISPLAY :MVALUE	51
FM frequency deviation	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"FM"	"VOLTage :AC"	SCPI	82	Numerically displayed in kHz	DISPLAY :MVALUE	51
FM positive frequency deviation	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"FM:POSitive"	"VOLTage :AC"	SCPI	82	Numerically displayed in kHz	DISPLAY :MVALUE	51
FM negative frequency deviation	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"FM:NEGative"	"VOLTage :AC"	SCPI	82	Numerically displayed in kHz	DISPLAY :MVALUE	51
PM-frequency deviation	[SENSe:]FUNCtion[:ON] [SENSe:]DATA?	"PM"	"VOLTage :AC"	SCPI	82	Numerically displayed in rad	DISPLAY :MVALUE	51

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
System								
Hardware options	*OPT?	-> SU -> BP -> ER -> HF -> CM -> FS	none	SCPI	16	IF_PAN BATTERY PACK ERAM HF-Preselection/ Frontend Coverage Measurement Field Strength	Start screen and RX-CONF :SYSTEM	40
Enter option code	SYSTem:SECurity:OPTion	<option_code>	none	no SCPI	113	Softkey: INSTALL	RX-CONF :SYSTEM :SW OPT	42
Software options	*OPT?	-> DS	none	SCPI	16	DIGI SCAN OPTION	RX-CONF :SYSTEM :SW OPT	42
Erase password			none			Softkey: DEL PW	RX-CONF :SYSTEM : PROTECT	41
Enter password			none			Softkey: EDIT PW entry of an 8-digit numeral	RX-CONF :SYSTEM :PROTECT	41
Password status			none			PASSWORD STATUS display: ON | OFF	RX-CONF :SYSTEM :PROTECT	41
Reset -> default setting	*RST		none	SCPI	3	Softkey: RESET	RX-CONF :SYSTEM	40
Serial number	*IDN?		none	SCPI	16	Display only	RX-CONF :SYSTEM	40
Software date	DIAGnostic:INFO:SDATe?		none	SCPI	24	Display only	RX-CONF :SYSTEM	40
Software version	DIAGnostic:INFO:SVERsion? or : *IDN?	<numeric suffix>: 1 to 5	none	SCPI	24	Display only	RX-CONF :SYSTEM	40

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Test								
Module status	Indirect by error message, partly by Event Status Register				140	Display for every module: "-" = not fitted "?" = not identifiable "FAIL" = defective "OK" = good	Startup screen and RX-CONF: TEST	43
Short test	TEST? or *TST?	SHORt, REPort | QUIet	none	SCPI	115	Test key	every	21
Long test	TEST?	LONG, REPort | QUIet	none	SCPI	115	Triggering an overall test Softkey: LONGTEST	RX-CONF :TEST	43
Test point limit violation	DIAGnostic[:MEASure]:TPOint? DIAGnostic:MONitor? (symbol in ASCII output)	P1 | V1 | S1 | S2 | Z1 | DC | SU | ALL	none	SCPI	26	Symbolic display: value too large, value too small	RX-CONF :TEST	43
Test point selection						Hardkey SEL: TEST POINT	RX-CONF :TEST	43
Test point limits	DIAGnostic:MONitor?	P1 | V1 | S1 | S2 | Z1 | DC | SU | ALL	none	no SCPI	25	Display: MIN and MAX Lower and upper limit	RX-CONF :TEST	43
Test point values (modules)	DIAGnostic:MONitor?	P1 | V1 | S1 | S2 | Z1 | DC | SU | ALL	none	no SCPI	25	Display of module and test point in a window	every	44
Test point values (single test points)	DIAGnostic:[SERVice]:TPOint?	P1 | V1 | S1 | S2 | Z1 | DC | SU | VH | FH	none	no SCPI	26	Display of module and test point in a window	every	

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Display								
Offset display	[SENSe:]FUNCtion[:ON] SENSe:DATA?	"FREQuency:OFFSet"	VOLTage :AC	SCPI	82	Symbolic display: value in HZ in range +_1/2 BW or: numeric x.xx kHz	DEFAULT	9
Type of offset display	no command		none			Hardkey SEL: TUNING AID, Rollkey: SYMBOLIC |NUMERIC | IF PAN	DISPLAY :CONFIG	45
Remote control light	active in case of data traffic		none			DATA: display at the bottom left	if KEYBOARD LOCKED	10
Display mode LCD: normal/inverse	DISPlay:CMAP: DEFAULT DISPlay:CMAP	DEFAULT NORMal|INVerted	NORMal	SCPI	31	Hardkey SEL:DISPLAY MODE Rollkey: NORMAL, INVERSE	DISPLAY :DEFAULT :CONFIG	45
Display types	DISPlay:MENU[:NAME]	<menu_name>menu_name: DEFAULT, IFPAN, LEVEL, FREQ, BANDW, MVALUE	DEFAULT	SCPI	30	Softkeys :DEFAULT, IF-PAN, LEVEL, TONE, FREQ, BANDW, MVALUE (display also maintained in basic menu)	DISPLAY	45
Backlighting switch-off time	DISPlay:BRIGhtness:DWELl	30|60|120|180|600| 1200|INF[sec]	INFinity	no SCPI	28	Hardkey SEL: SWITCH OFF Rollkey: NEVER, ½ MIN....20 MIN	DISPLAY :DEFAULT :CONFIG	45
Backlighting intensity	DISPlay:BRIGhtness	0..1	1.0	SCPI	27	Hardkey SEL: ILLUMINATION Rollkey: OFF, STEP1 to STEP6	DISPLAY :DEFAULT :CONFIG	45
Level display	[SENSe:]FUNCtion[:ON] [SENSe:]FUNCtion[:ON]:COUNt? [SENSe:]DATA?	VOLTage:AC	VOLTage :AC	SCPI	82	Symbolic display as a bar: -10 to 80 dBµV (or 20 to 110 dBµV with ATT ON) or numeric -10 to 110 dµV	DISPLAY :LEVEL :CONFIG	8
Field strength display only with software option EB200FS	[SENSe:]FUNCtion[:ON] SENSe:DATA?	"FSTRength"	"VOLTage :AC"	SCPI	82	Numerical display in dBµV/m	DISPLAY :LEVEL :CONFIG	8

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
IFPAN								
Frequency range of panorama display	FREQuency:SPAN	UP | DOWN | MIN | MAX | frequency range 0.15 to 1000 kHz	none		77	Hardkey SEL: PAN RANGE Rollkey: ±12.5, 25, 50, 100, 250, 500 kHz	DISPLAY :CONFIG	45
Selection of the averaging process for the IF-panorama data	CALCulate:IFPan:AVERage:TYPE	MINimum | MAXimum | SCALar | OFF	SCALar	SCPI	20	Softkeys: MIN | MAX | AVG | CLRWRT	DISPLAY :IFPAN :CONFIG	46
Setting the averaging time for the IF-panorama data	CALCulate:IFPan:AVERage:TIME or: MEASure:TIME[?]	0.5 to 900 [s]	0.2 [s]	SCPI	19		DISPLAY :IFPAN :CONFIG	46
Restart of the process MIN- or MAX-Hold	CALCulate:IFPan:CLEar		none	SCPI	20	Softkeys: MIN or MAX	DISPLAY :IFPAN :CONFIG	46
Scaling of the IF panoramic display by REF and RNG on the LCD	no command		REF: 60 dBµV RNG: 80 dB			Hardkey SEL:REF or RNG Rollkey: xx dB	DISPLAY :IFPAN :CONFIG	46
Centering on absolute max. level	CALCulate:IFPan:MARKer:MAXimum:[PEAK]		none	SCPI	21	none	DISPLAY :IFPAN :CONFIG	
Centering on left max. level	CALCulate:IFPan:MARKer:MAXimum:LEFT		none	SCPI	21	Softkeys: left Max to Mark	DISPLAY :IFPAN :CONFIG	46
Centering on right max. level	CALCulate:IFPan:MARKer:MAXimum:RIGHt		none	SCPI	21	Softkeys: right Max to Mark	DISPLAY :IFPAN :CONFIG	46
Large IF-panorama	no command		none			DISPLAY: IF-PAN		10
Small IF-panorama	no command		none			TUNING AID IF-PAN		10

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Messages								
Error beep	SYSTem:BEEPer:VOLume	0 to 1 (OFF | 0.5 | 1)	1	SCPI	110	Hardkey SEL: MESSAGE BEEP Rollkey: OFF / QUIET / LOUD	SETUP :MESSAGE	54
Error display time	no command		none			Hardkey SEL: MESSAGE DISPLAY Rollkey: DURATION 1 to 5 SEC / infinite	SETUP :MESSAGE	54
Error messages	SYSTem:ERRor? STATus:QUEue[:NEXT]?		none	SCPI	111	Display covers softkeys, 40 characters	every	6
Component error	no command		none			Hardkey SEL: COMPONENT FAILURE Rollkey: ON OFF	SETUP :MESSAGE	54
Warnings	no command		none			Hardkey SEL: USER WARNINGS Rollkey: ON / OFF	SETUP :MESSAGE	54

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Operating elements								
Disable display	DISPlay:ENABle	ON | OFF	ON	SCPI	28	No manual control, no dynamic display => increase in performance	REMOTE CON-TROLLED	59
Info string display lock	DISPlay:ENABle: :LABel	"string with 24 characters max"	"CON-TROLLED BY REMOTE"	no SCPI	29	No manual control, display of string entered via remote interface	REMOTE CON-TROLLED	59
Info string key lock	SYSTem:KLOCK:LABel	"string with 34 characters max"	"KEY-BOARD LOCKED BY RE-MOTE!"	no SCPI	113	No manual control, display of string entered via remote interface	KEYLOCK	59
Key click	no command		none			Hardkey SEL: KEYS KEYCLICK Rollkey: OFF, SOUND1 to 3, QUIET/ LOUD	SETUP :KEYS	53
Rollkey progression	no command		none			Hardkey SEL: ROLLKEY PROGRESSION Rollkey: OFF to Step1 to 9	SETUP :KEYS	53
Rollkey stepwidth	[SENSe:]FREQuency:STEP	<numeric value>numeric value: 1 Hz to 1MHz	1 kHz	SCPI	78	Hardkey SEL: ROLLKEY INCR VALUE Rollkey: 1 Hz to 1MHz	SETUP :KEYS	53
Lock keyboard	SYSTem:KLOCK	ON | OFF	OFF	SCPI	112	No manual control, only display	KEYLOCK	59

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
LAN interface								
LAN gateway	none		none			Hardkey SEL: GATEWAY Rollkey: xxx.xxx.xxx.xxx	SETUP :REMOTE	56
LAN IP address	none		none			Hardkey SEL: IP-ADDRESS Rollkey: xxx.xxx.xxx.xxx	SETUP :REMOTE	56
LAN port	none		none			Hardkey SEL: PORT Rollkey: xxx.xxx.xxx.xxx	SETUP :REMOTE	56
LAN subnet mask	none		none			Hardkey SEL: SUBNETMASK Rollkey: xxx.xxx.xxx.xxx	SETUP :REMOTE	56
RS232 interface (PPP)								
Baud rate	no command	150 | 300 |600 |1200 |2400 |4800 |9600 | 19200 |38400 |57600 |115200	none			Hardkey SEL: BAUDRATE Rollkey: 50 to 115k	SETUP :REMOTE :RS232	57
IP address	none		none			Hardkey SEL: IP-ADDRESS Rollkey: xxx.xxx.xxx.xxx	SETUP :REMOTE :RS232	57
Port	none		none			Hardkey SEL: PORT Rollkey: xxx.xxx.xxx.xxx	SETUP :REMOTE :RS232	57
Apply	none					Softkey: APPLY	SETUP :REMOTE :PPP	57
Standard	none					Softkey: STANDARD	SETUP :REMOTE :PPP	57
User-programmable byte at rear-panel connector	OUTPut:BITaux[1 | 2 | 3 | 4| 5| 6 | 7 | 8][:STATe] OUTPut:BYTaux[:STATe]	ON | OFF 0 to 255 | #B0...#B11111111 | #Q0 to #Q377 | #H0 to #H0FF	0	no SCPI	49	CTRL	SETUP :AUX	57

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
RS232 interface (standard)								
Baud rate	no command	150 | 300 |600 |1200 |2400 |4800 |9600 | 19200 |38400 |57600 |115200	none			Hardkey SEL: BAUDRATE Rollkey: 50 to 115k	SETUP :REMOTE :RS232	58
Frame	none					Hardkey SEL: FRAME Rollkey: 7 | 8 BIT 1 | 2 STOP	SETUP :REMOTE :STANDARD	58
Parity	none					Hardkey SEL: PARITY Rollkey: NO | ODD | EVEN	SETUP :REMOTE :STANDARD	58
Handshake	none					Hardkey SEL: HANDSHAKE Rollkey: NO | ODD | EVEN	SETUP :REMOTE :STANDARD	58
Apply	none					Softkey: APPLY	SETUP :REMOTE :STANDARD	58
PPP	none-					Softkey: PPP	SETUP :REMOTE :STANDARD	58
Binary transmission with byte-escaping	`SYSTem:COMMunicate:SERial:BYTeesc` `SYSTem:COMMunicate:SERial:BYTeesc?`	ON | OFF	OFF		111			
Data formats								
Memory data formats	FORMat:MEMory	ASCii | PACKed	ASCii	no SCPI	34			
Status register format	FORMat:SREGister	ASCii | BINary | HEXadecimal	ASCii	SCPI	34			

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Trace								
Query trace data	TRACe[:DATA]?	MTRACE | ITRACE | IFPAN | SSTART | SSTOP	none	SCPI	119			
Set trace data source	TRACe:FEED:CONTrol	MTRACE | ITRACE, ALWays | SQUelch | NEVer	NEVer	SCPI	122			
Set trace data source	TRACe:FEED:CONTrol	IFPAN, ALWays | NEVer	NEVer	SCPI	122			
Set trace element	TRACe:VALue	SSTART | SSTOP, index, frequency value	none	SCPI	125			
Trace configuration	TRACe:FEED?	MTRACE | ITRACE | IFPAN | SSTART | SSTOP	none	SCPI	122			
Load trace	TRACe[:DATA]	SSTART | SSTOP, frequency value(s)	none	SCPI	118			
Adapt trace length	TRACe:POINts:AUTO?	MTRACE | ITRACE| IFPAN | SSTART | SSTOP	none	SCPI	124			
Query trace warning limit	TRACe:LIMit[:UPPer]?	MTRACE | ITRACE| IFPAN | SSTART | SSTOP	none	no SCPI	123			
Set trace warning limit	TRACe:LIMit[:UPPer]	MTRACE | ITRACE, 0..100[PCT]	50 PCT	no SCPI	123			
Number of trace results	TRACe:POINts?	MTRACE | ITRACE | SSTART | SSTOP	none	SCPI	124			
Trace name	TRACe:CATalog?		none	SCPI	118			

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Status reporting - operation								
Main register Condition section	STATus:OPERation:CONDition?		none	SCPI	103			
Main register Enable section	STATus:OPERation:ENABle	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	103			
Main register Event section	STATus:OPERation[:EVENt]?		none	SCPI	104			
Main register Negative Transition filter	STATus:OPERation:NTRansition	0 to 32767 | #H0 to.#H7FFF | #B0 to #B111111111111111	none	SCPI	104			
Main register Positive Transition filter	STATus:OPERation:PTRansition	0 to 32767 | #H0 to #H7FFF | #B0..#B111111111111111	none	SCPI	105			
Set status register to default values	STATus:PRESet		none	SCPI	106			
Status reporting - operation - sweep								
Sweep status Condition section	STATus:OPERation:SWEeping:CONDition?		none	SCPI	142			
Sweep status Enable section	STATus:OPERation:SWEeping:ENABle	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	142			
Sweep status Event section	STATus:OPERation:SWEeping[:EVENt]?		none	SCPI	142			
Sweep status Negative Transition filter	STATus:OPERation:SWEeping:NTRansition	0 to 32767 | #H0 to #H7FFF | #B0 to .#B111111111111111	none	SCPI	142			
Sweep status Positive Transition filter	STATus:OPERation:SWEeping:PTRansition	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	142			

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Status reporting - extension								
Receiver status Condition section	STATus:EXTension:CONDition?		none		145			
Receiver status Enable section	STATus:EXTension:ENABle	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	145			
Receiver status Event section	STATus:EXTension[:EVENt]?		none	SCPI	145			
Receiver status Negative Transition filter	STATus:EXTension:NTRansition	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	145			
Receiver status Positive Transition filter	STATus:EXTension:PTRansition	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	145			

Function	Remote Control Command	Remote Control Parameter	*RST Value	SCPI Info	Page 4.	Manual Control	Menu	Page 3.
Status reporting - questionable								
Questionable status Condition section	STATus:QUEStionable:CONDition?		none	SCPI	143			
Questionable status Enable section	STATus:QUEStionable:ENABle	0 to 32767 | #H0 to .#H7FFF | #B0 to .#B111111111111111	none	SCPI	143			
Questionable status Event section	STATus:QUEStionable[:EVENt]?		none	SCPI	143			
Questionable status Negative transition filter	STATus:QUEStionable:NTRansition	0 to 32767 | #H0 to .#H7FFF | #B0 to #B111111111111111	none	SCPI	143			
Questionable status Positive transition filter	STATus:QUEStionable:PTRansition	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	143			
Status reporting - trace								
Trace status Condition section	STATus:TRACe:CONDition?		none	SCPI	144			
Trace status Enable section	STATus:TRACe:ENABle	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	144			
Trace status Event section	STATus:TRACe[:EVENt]?		none	SCPI	144			
Trace status Negative transition filter	STATus:TRACe:NTRansition	0 to 32767 | #H0 to #H7FFF | #B0 to #B111111111111111	none	SCPI	144			
Trace status Positive transition filter	STATus:TRACe:PTRansition	0 to 32767 | #H0 to #H7FFF | #B0..#B111111111111111	none	SCPI	144			

Annex D (Programming Examples)

The following section explains step by step how to program ESMB as seen from the controller's end. The examples are written in the programming language C and may be used as a basis for control programs. They are based on Microsoft Windows Sockets. Importing to other operating systems should be possible with little effort, as all socket calls used are defined by the Berkeley Institute.

This section deals exclusively with the programming of ESMB. The basics of socket programming and network engineering are not explained. For information on these topics, consult the comprehensive relevant literature, eg TCP/IP Illustrated, volume1, by W. Richard Stevens.

1. Setting up a connection

Before remote-controlling the ESMB, the PPP connection must be set up, as described in annex A (not required if the LAN option is used). If a TCP connection is to be set up, the IP address of the TCP server and its service number (also referred to as port number) must be known. They can be set in the ESMB menu SETUP – REMOTE. The default address for the PPP connection is 192.0.0.2 with port number 5555. When the PPP connection is set up, the host computer is assigned an IP address consisting of EB200I IP address + 1.

Example:

EB200I IP address: 192.0.0.2 -> host IP address: 192.0.0.3

The assigned IP address is only valid for the PPP channel. The IP address of a built-in network card is a different one.

If the ESMB is connected to a LAN, the IP network numbers (including sub-network numbers) of the host computer and the ESMB must be the same. Some examples:

IP host computer	Sub-network mask of host computer	IP ESMB	Sub-network mask of ESMB	Network class
89.10.6.53	255.0.0.0	89.17.11.23	255.0.0.0	Class A
89.10.6.53	255.255.0.0	89.10.11.23	255.255.0.0	Class A
89.10.6.53	255.255.255.0	89.10.6.23	255.255.255.0	Class A
132.2.3.4	255.255.0.0	132.2.20.21	255.255.0.0	Class B
132.2.3.4	255.255.255.0	132.2.3.21	255.255.255.0	Class B
192.3.4.1	255.255.255.0	192.3.4.2	255.255.255.0	Class C

For the ESMB to be controlled from outside the local sub-network, a suitable gateway must be made known to it. The relevant gateway IP address can be set in the SETUP – REMOTE menu (only for LAN option; for PPP, the PPP partner is always used as gateway).

The following should always be observed: **Each IP address must be unambiguous.** If an IP address is used for more than one component, the possible consequences are highly unpredictable and may bring a network down entirely. For this reason, the IP addresses are normally assigned for all components by the network administrator. The network administrator knows which IP addresses have already been assigned and how to make the remaining network settings (sub-network mask and gateway).

The following programming example describes the making of a socket connection to an ESMB unit with IP address 192.0.0.2 and port number 5555.

```
struct sockaddr_in  addr;
int err;
SOCKET nSocketID;

/* create a new socket descriptor */
nSocketID = socket(AF_INET, SOCK_STREAM, 0);
if (nSocketID != -1)
{
        /* we have got a valid socket descriptor.
        now setup a connection request to ESMB */
        memset(&addr, 0, sizeof(addr));
        addr.sin_family      = AF_INET;
        /* fill out IP-Address */
        addr.sin_addr.s_addr = inet_addr("192.0.0.2");
        addr.sin_port        = htons(5555);

        /* now do the connection */
        err = connect(nSocketID, (struct sockaddr *)&addr, sizeof(addr));
        if (!err)
        {
                /* Connection has been accepted by ESMB.
                Now do some initialisations */

                /* Disable nagle algorithm to get better realtime responses */
                int i=1;
                setsockopt(nSocketID, IPPROTO_TCP, TCP_NODELAY, (char*)&i, sizeof(i));
                /* Do something with ESMB */
        }
```

The routine following the connect call serves for improving the response time. This is done by switching off the Nagle algorithm. Normally, the Nagle algorithm groups smaller data packets to a larger packet, which results in a higher data throughput. However, in remote-control applications this may lead to undesirable delays, as there is usually interaction between commands and polls.

2. Initializing the unit

At first, the device should be brought into a defined status. The command *CLS deletes the status reporting system, while the command *RST loads default values for all setting parameters.

3. Transmitting device setting commands

The following example illustrates the setting of receive frequency, bandwidth and demodulation type.

```
send(nSocketID, "FREQ 98.5E6\n", 12, 0);
send(nSocketID, "BAND 150 khz\n", 13, 0);
send(nSocketID, "DEM FM\n", 7, 0);
```

4. Reading out device settings

The parameters set in the examples under 3 are read out again. This is done by sending three polling commands in an SCPI string. The response is then read in and printed out.

```
char cBuffer[100];     /* Buffer for device response */
int len;
send(nSocketID, "FREQ?;:BAND?;:DEM?\n", 19, 0);
len = recv(nSocketID, cBuffer, sizeof(cBuffer)-1, 0);
cBuffer[len] = 0;
printf("frequency;bandwidth;demodulation: %s\n", cBuffer);
```

When device responses are to be read in, it should be noted that the response packets to recv calls can be smaller than expected. In this case, the remaining data has to be read in via a renewed call of this function. The delimiter (linefeed) may be used as a criterion. The above example is extended as follows:

```
char cBuffer[100];     /* Buffer for device response */
int len;
int totallen = 0;
send(nSocketID, "FREQ?;:BAND?;:DEM?\n", 19, 0);
do
{
        len = recv(nSocketID, &cBuffer[totallen], sizeof(cBuffer)-1-totallen, 0);
        totallen += len;
} while (cBuffer[totallen-1] != '\n');
cBuffer[totallen] = 0;
printf("frequency;bandwidth;demodulation: %s\n", cBuffer);
```

5. Processing SRQs

SRQs serve for signaling asynchronous events (error messages, results, etc.). For this purpose, IEEE488 systems (IEC-625, IEC/IEEE bus) are equipped with a hardware line connecting the unit with the controller. ESMB simulates these activities by sending the string &SRQ<CR><LF> via the socket. This string can be sent completely asynchronously to a device response. It therefore has to be taken into account that the host computer may receive SRQ messages in the middle of a response string. Bearing this in mind, the above example can be extended as follows:

```
int bSrq = 0;
char *pSRQ;
do
{
        len = recv(nSocketID, &cBuffer[totallen], sizeof(cBuffer)-1-totallen, 0);
        totallen += len;
} while (cBuffer[totallen-1] != '\n');
cBuffer[totallen] = 0;
/* Look for SRQ message in string */
do
{
        pSRQ = strstr(cBuffer, "&SRQ\r\n");
        if (pSRQ != NULL)
        {
                /* SRQ message encountered */
                bSrq = 1;
                /* delete SRQ message from received string  */
                memmove(pSRQ, pSRQ+6, strlen(pSRQ)-5);
        }
} while (pSRQ != NULL);
```

Once the string has been read in including the delimiter, it is examined for SRQs. If the hardware line is simulated, only the changing of edges 0->1 is signaled, which means that SRQ messages must not be lost, as otherwise any SRQ-driven communication will be halted.

When an SRQ occurs, it will therefore be stored under Flag bSrq. This flag requires further processing. For this purpose, a serial poll (&POL) is transmitted to the device. The device response is &xyz<CR><LF>, xyz representing the value of the status byte from the status reporting system. It contains the cause of the SRQ in encoded form.

6. Program example

The supplied disk (Utility Disk) contains a short program for controlling the ESMB (CExample.c). It may be used by the user for generating programs of his own. The example is written in ANSI C and was tested by using Visual C 5.0. When configuring the project in Visual C the "wsock32.lib" library must be linked up to. A further program was made with programming language JAVA. It is also contained on the disk as source code (eb200.java and eb200example.java).

Both programs initialize a search between 118 MHz and 136 MHz with a stepwidth of 25 kHz. The search is then started and the measurement results are on the screen. To make the progress of the scan visible, the change in frequency is also displayed.

7. Program example UDP

If configured accordingly, the ESMB is able to send datagrams (UDP data). See Annex F.

The supplied Utility Disk contains a short UDP program (UDPExample.exe and the associated C-sources. This program shows how to configure EMSB for the transmission of datagrams. Irrespective of the operating mode (CW, FSCAN, MSCAN, DSCAN, FASTLEVCW, LIST, IFPAN, AUDIO), the program receives datagrams from ESMB, evaluates the data and continuously displays status information.

When for the call parameters in the UDPExample an audio mode ≠ 0 is selected (see also the table describing the command `SYSTem:AUDio:REMote:MODe`), the AF is transmitted via the remote-control interface in the data format selected and then reproduced via the sound card of the PC. Uninterrupted AF signal transfer via the RS232 remote-control interface is only possible at high baud rates and in audio mode 12 or 13. The LAN remote-control interface is able to handle AF signals in any data format or audio mode without any gaps. This application may be started in parallel to any remote-control application.

Annex E (Measurement Functions)

Thanks to its versatility the ESMB is able to handle very diverse measuring tasks. For this it offers two measuring modes, four level detectors and a user-selectable measuring time. In the following the fields of application and the differences between the individual parameters are described.

Detectors

In the ESMB the following level detectors can be activated:

Peak value detector (PEAK)

Average value detector (AVG)

Real-time detector (FAST)

Root-mean-square value detector (RMS)

All information given below by analogy also applies to the other sensor functions:

Offset measurement is carried out using an average value detector.

Deviation measurement is carried out using a peak value detector.

All detectors are implemented in the IF section DSP, i.e. they are realized by way of digital signal processing.

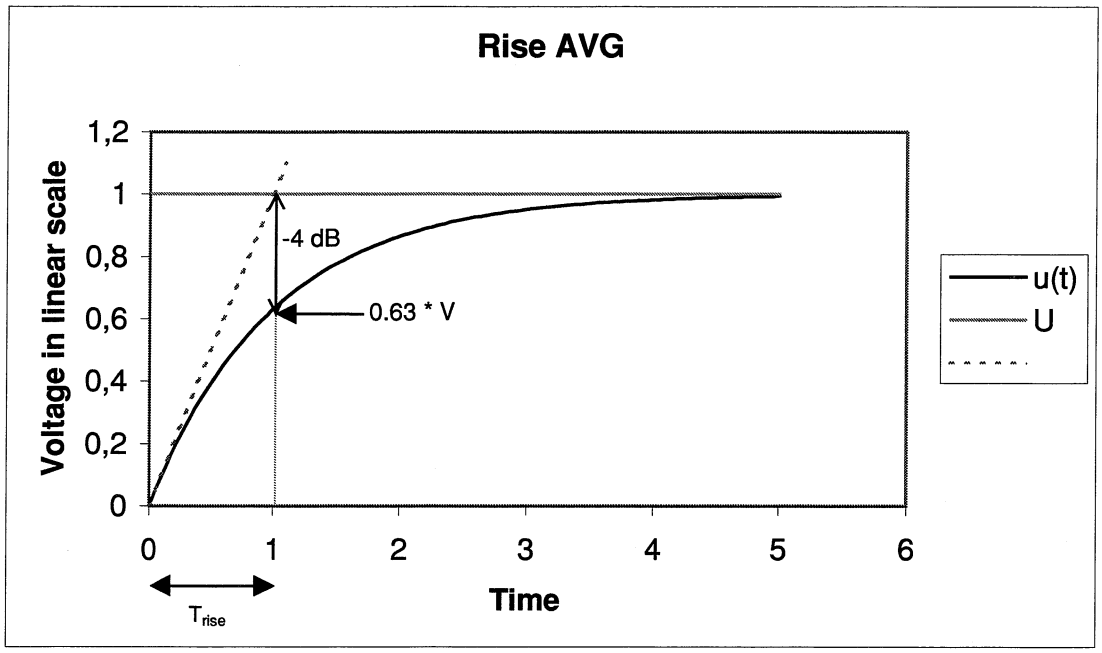
Each detector is characterized by its rise and fall constants (T_{rise}, T_{fall}). It is realized based on an exponential equation of the form:

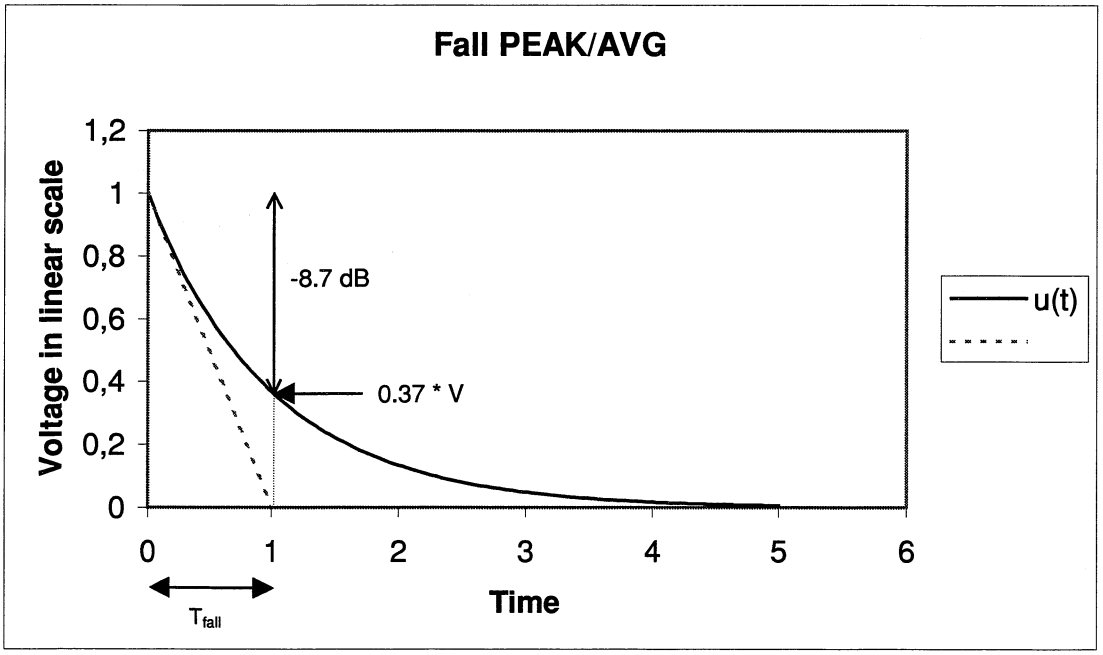
$V(t) = V * (1 - e^{t/Trise})$ for the rise and

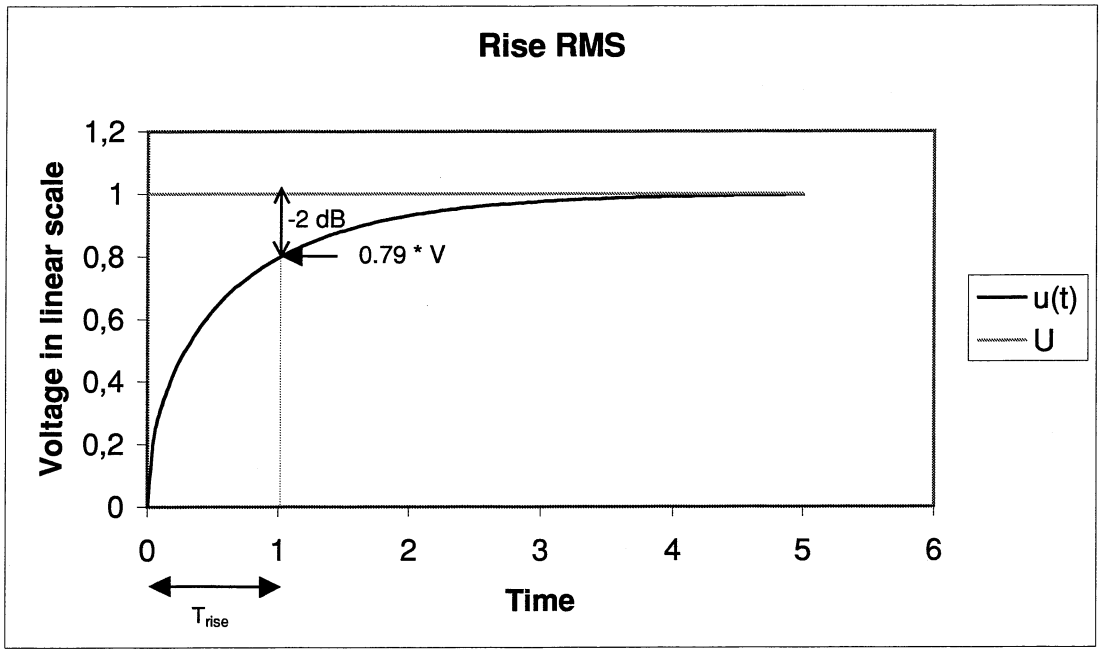
$V(t) = V * e^{t/Tfall}$ for the fall.

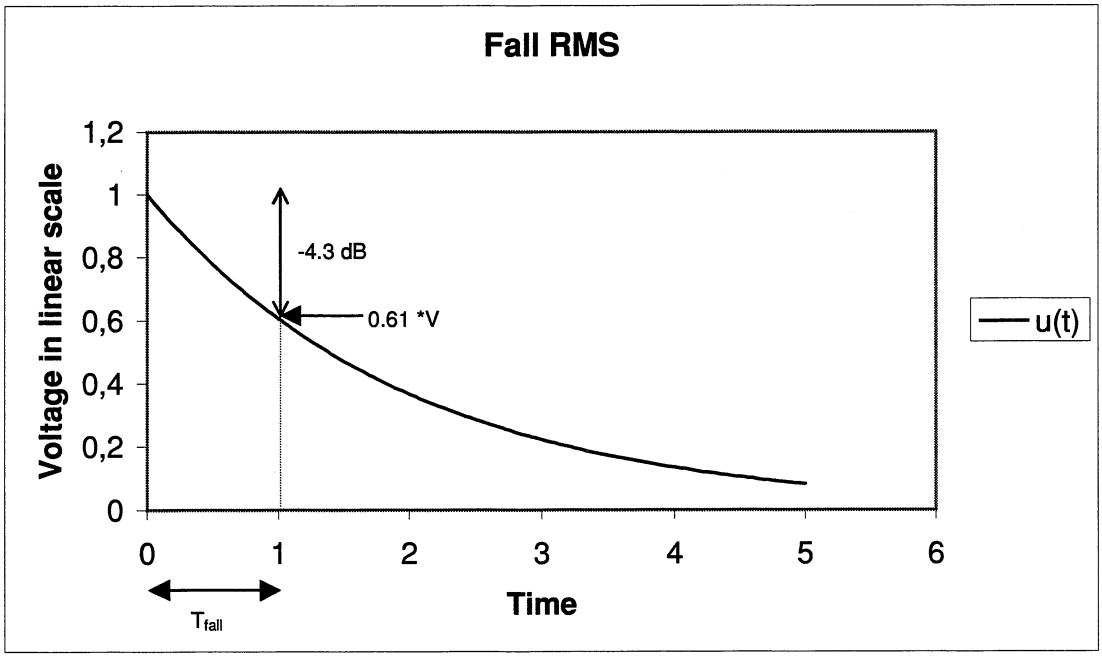
In analog technology this is equivalent to an RC section with the time constant T = R*C.

The FAST detector has $T_{rise} = T_{fall} = 0$. It thus follows the input voltage without any delays. The PEAK detector operates with the same rise time constant. So it also follows the input voltage when the latter increases. When it decreases, however, a distinctly longer fall time constant becomes active. With the AVG detector rise and fall time constants are identical. This also applies to the RMS detector in which case the input voltage is squared, fed to the RMS detector and then the root is extracted. In this way the instantaneous power is subjected to exponential averaging. So the different detectors show the following step responses:


Rise AVG
Voltage in linear scale
1,2
1
0,8
0,6
0,4
0,2
0
-4 dB
0.63 * V
0
1
2
3
4
5
6
Time
T_{rise}
u(t)
U


Fall PEAK/AVG
Voltage in linear scale
1,2
1
0,8
0,6
0,4
0,2
0
-8.7 dB
0.37 * V
0
1
2
3
4
5
6
Time
T_{fall}
u(t)


Rise RMS
Voltage in linear scale
1,2
1
0,8
0,6
0,4
0,2
0
-2 dB
0.79 * V
0
1
2
3
4
5
6
Time
T_{rise}
u(t)
U


Fall RMS
Voltage in linear scale
1,2
1
0,8
0,6
0,4
0,2
0
-4.3 dB
0.61 *V
0
1
2
3
4
5
6
Time
T_{fall}
u(t)

When powering up the unit for the first time and after a reset (command: `*RST`) the measuring time is set to DEFAULT. These predefined measuring times have been selected so that for the set bandwidth and level measurement mode normally correct measured values can be expected.
With DEFAULT measuring time, the following bandwidth-dependent rise and fall times are established with level detectors PEAK, AVG, RMS, and FAST.

Bandwidth [kHz]	T_{rise} PEAK [ms]	T_{fall} PEAK [ms]	T_{rise} AVG/RMS [ms]	T_{fall} AVG/RMS [ms]	T_{rise} FAST [ms]	T_{fall} FAST [ms]
300	0	1000	3	3	0	0
250	0	1000	3	3	0	0
150	0	1000	3	3	0	0
120	0	1000	3	3	0	0
100	0	1000	3	3	0	0
30	0	1000	3	3	0	0
15	0	1000	3	3	0	0
9	0	1000	6	6	0	0
8	0	1000	6	6	0	0
6	0	1000	12	12	0	0
4	0	1000	12	12	0	0
3	0	1000	25	25	0	0
2.4	0	1000	25	25	0	0
1.5	0	1000	50	50	0	0
1	0	2000	50	50	0	0
0.6	0	2000	100	100	0	0
0.3	0	2000	100	100	0	0
0.15	0	2000	200	200	0	0

With the detectors for offset, modulation depth and deviation measurement the default settings are as follows:

Bandwidth [kHz]	T_{rise} AM offset [ms]	T_{fall} AM offset [ms]	T_{rise} FM offset [ms]	T_{fall} FM offset [ms]	T_{rise} Deviation/ mod. depth [ms]	T_{fall} Deviation/ mod. depth [ms]
300	5	5	50	50	0.05	100
250	5	5	50	50	0.05	100
150	10	10	100	100	0.05	100
120	10	10	100	100	0.05	100
100	10	10	100	100	0.05	100
30	20	20	100	100	0.05	100
15	20	20	100	100	0.1	100 / 200
9	50	50	100	100	0.2	100 / 200
8	50	50	100	100	0.2	100 / 500
6	50	50	100	100	0.2	100 / 500
4	50	50	100	100	0.5	200 / 500
3	50	50	100	100	0.5	200 / 500
2.4	50	50	100	100	1	200 / 500
1.5	100	100	100	100	1	200 / 500
1	100	100	100	100	2	200 / 500
0.6	100	100	200	200	4	500
0.3	100	100	200	200	8	500
0.15	100	100	200	200	8	1000

CONTINUOUS measuring mode

In the `CONTINUOUS` mode, ESMB polls the current value of the level detector every 200 ms and displays it on the front panel. After entry of remote-control command `SENSe:DATA?` the last displayed value is output. That means that the detector is not explicitly queried by using `SENSe:DATA?` This command produces a value that may be as old as 200 ms!

By means of remote-control command `INITiate:IMMediate` or `INITiate:CONM` an explicit request for querying the detector can be put forward. In addition, the detectors are cleared.

When receive parameters are altered the detectors are reset (cleared), as is eg the case with each frequency change in FSCAN or MSCAN mode. The detectors then need to settle anew. In this context a new time parameter is introduced, namely the measuring time.

Measuring time

Besides the rise and fall times it is the measuring time which determines the detectors' behavior as a third parameter. The measuring time takes effect when detectors have been cleared and then need to settle anew. During the measuring time the detectors do not respond exponentially as usual but act as follows:

- PEAK detector: determines the maximum input voltage
- AVG detector: determines the linear average value of the input voltage
- RMS detector: determines the RMS value of the input voltage
- FAST detector: determines the current value of the input voltage when the measuring time has elapsed

Ex works the measuring time in ESMB is set to DEFAULT. Thus it follows the bandwidth (or demodulation mode) selected:

Bandwidth [kHz]	PEAK [ms]	AVG/RMS [ms]	FAST [ms]	Offset AM / FM [ms]	Deviation/mod. depth [ms]
300	1	3	0.3	5 / 50	100
250	1	3	0.3	5 / 50	100
150	2	3	0.3	10 / 100	100
120	2	3	0.3	10 / 100	100
100	2	3	0.3	10 / 100	100
30	5	3	0.3	20 / 100	100
15	10	3	0.3	20 / 100	100
9	20	6	0.6	50 / 100	100
8	20	6	0.6	50 / 100	100
6	30	12	0.6	50 / 100	100
4	50	12	1.1	50 / 100	200
3	60	25	1.1	50 / 100	200
2.4	60	25	2.2	50 / 100	200
1.5	100	50	2.2	100 / 100	200
1	150	50	4.5	100 / 100	200
0.6	200	100	9	100 / 200	500
0.3	400	100	18	100 / 200	500
0.15	500	200	18	100 / 200	1000

The following events cause the detectors to be cleared:

- Frequency change by remote control
- Frequency change with FSCAN, MSCAN
- Change of bandwidth or demodulation mode
- Change of type of detector
- Change of attenuator
- Remote-control command `INITiate:IMMediate` or `INITiate:CONM`
- Measuring mode PERIODIC

PERIODIC measuring mode

In `PERIODIC` mode the detectors a cleared in a cyclic fashion. The cycle depends on the measuring time. Whenever the measuring time is up the measured values are displayed and the detectors are cleared. The 200-ms display rate active in `CONTINUOUS` mode is deactivated. Remote control command `SENSe:DATA?` always calls the last measured value. When a parameter (eg frequency) is changed this value is marked as being invalid (`----` in the display). In the event that `MTRACE` is enabled (eg by using remote-control command `TRAC:FEED:CONT MTRACE,ALW`) the measured values are automatically stored in `MTRACE`.

Measuring time different from DEFAULT

All information given up to this stage referred to default measuring time. Certain measuring tasks, however, require the measuring time to be user-selectable. For instance pulse-shaped signals (eg ignition sparks) can be measured exactly only if the measuring time is longer than the signal pulse duration. With the measuring time being set to a value other than `DEFAULT`, the detectors' rise and fall times are also determined by this measuring time. In addition, the user-selectable measuring time does not depend on other parameters (eg bandwidth, demodulation mode).

All other information concerning step response, `CONTINUOUS` or `PERIODIC` mode continues to apply.

T_{rise} PEAK	0 ms
T_{fall} PEAK	Set measuring time
T_{rise} AVG/RMS	Set measuring time
T_{fall} AVG/RMS	Set measuring time
T_{rise} FAST	0 ms
T_{fall} FAST	0 ms
T_{rise} Offset	Set measuring time
T_{fall} Offset	Set measuring time
T_{rise} Deviation/mod. depth	See Default T_{rise} above
T_{fall} Deviation/mod. depth	Set measuring time

Simultaneous execution of measuring functions

All measurements configured by using command `SENSe:FUNCtion` are carried out almost simultaneously. When all measurements are completed the MEASuring bit in the OPERation Status register is reset.

Availability of measuring functions

Whether a measurement can be carried out or not, depends of the set demodulation mode.

			Measuring functions					
Demodulation mode	IF bandwidth	Digital baseband output	Level	Frequency	Mod. depth (AM)	Frequency deviation	Phase deviation	Bandwidth
AM	150 Hz to 300 kHz	AM/FM	x	x	x	x		x
FM	150 Hz to 300 kHz	AM/FM	x	x	x	x		x
PM	150 Hz to 300 kHz	AM/PM	x	x	x		x	x
Puls-AM	150 Hz to 300 kHz	AM/FM	x	x	x	x		x
I/Q	150 Hz to 300 kHz	I/Q	x					x
CW	150 Hz to 9 kHz	I/Q	x					x
SSB	150 Hz to 9 kHz	I/Q with offset	x					x
ISB	150 Hz to 15 kHz	I/Q	x					x

Annex F (Datagram Communication)

General

By contrast to TCP/IP data transmission, the datagram communication serves for higher performance in making trace data available. With a view to this, data are made available in a self-descriptive form. This should enable the evaluation of data by host applications without SCPI data interface. The required protocol is described in this section. The various data types are identified by means of tags and are provided with length information. Therefore, host applications can filter out and process specific data and need not implement the whole protocol. Also see "Program example UDP" in Annex C.

Addressing

The **"UdpPath"** concept is intended for the distribution of data. A UdpPath contains an IP address, a specific port number and configuration data. UdpPath is not the equivalent of a host since several hosts can be addressed simultaneously via the IP address (using broadcast / multicast addressing) and a host can also serve several UdpPaths (different port numbers with different configurations).

Configuration

The configuration of the various UdpPath entries contains first of all the type of the data. The different trace types can be configured by means of **tags. Flags** can specify the trace data more precisely.

Protocol

Each datagram (Udp packet) contains a **header** that clearly identifies a data item of the protocol. What follows is one or several data units denoted **GenericAttribute** which can be distinguished with the use of tags. A C-type notation is used for protocol specification. Generally all data are transferred to the network byte order, in other words to the Big-Endian order. This is especially important for host applications running on PC (Intel) base since in this case data first have to converted to the Little-Endian format. However, the actual useful data may also be transmitted in the Little-Endian order (see description of remote commands).

EB200Datagram {

EB200Header

GenericAttribute_1

GenericAttribute_2

...

GenericAttribute_n

}

Header

The header marks the beginning of each EB200 datagram.

EB200Header {

```
    unsigned long magic_number;              /* constant: 0x000EB200 */
    unsigned short minor_version_number;     /* 0x23 for this version */
    unsigned short major_version_number;     /* 0x02 for this version */
    unsigned short sequence_number;          /* increments by one */
    char[6] reserved;
```

}

Description of EB200 header:

- **magic_number**
  This is a constant value which never changes.
- **minor_version_number** and **major_version_number**
  The minor_version_number is incremented by appending tags or changing the tags in an upward-compatible form. The major_version_number is incremented by the non-compatible change of the tags or general structural changes (the latter will be extremely rare).
- **sequence_number**
  This starts at a certain value and is incremented by one for every new packet per UdpPath. When the highest value is attained, a wraparound takes place.
- **reserved**
  This element is left free for future extensions.

GenericAttribute

This describes the general structure of every subsequent data element (as GenericAttribute). All data types (i.e. all trace data are marked by tags) are of the same structure.

GenericAttribute {

```
    unsigned short tag;
    unsigned short length;
    char data[length];
```

}

- **tag**
  Determines the content of the GenericAttribute.
- **length**
  Specifies the length of the GenericAttributes in bytes but not of the elements "tag" and "length".
- **data**
  Contains useful data. The length of this data area is determined by the preceding data element "length".

The various tags are now described.

A common structure exists for the tags defined at present (FSCAN, MSCAN, DSCAN, AUDIO, IFPAN, FASTLEVCW, LIST and CW) and will be described below. This structure is contained in the element "data" of the GenericAttribute.

Symbolic tag name	*Numeric tag value (decimal)*
FSCAN	101
MSCAN	201
DSCAN	301
AUDIO	401
IFPAN	501
FASTLEVCW	601
LIST	701
CW	801

Table 1: Description of tags

TraceAttribute

The common structure of all trace data defined up to now is described here.

TraceAttribute {

```
short number_of_trace_items;          /* number of values per data type in PeriodicTraceData
                                         */
char reserved;
unsigned char optional_header_length; /* size of the optional header in bytes */
unsigned long selectorFlags;          /* exact specification of data */

OptionalHeader;                       /* this is described accurately for the corresponding
                                         trace*/

PeriodicTraceData;                    /* actual trace data */
                                      /* depending on SelectorFlags or tag and
                                         OptionalHeader */
```

}

The value in "optional_header_length" should always be referenced to access the actual trace data in the PeriodicTraceData. Upward compatibility is thus ensured even for "minor_version_number" modifications.

The "selectorFlags" are dealt with here in general but are only partly useful when applied to the individual traces.

SelectorFlag	*Hexadeci-mal value*	*Data type*	*Corresponding flags*	*Note*
LEVEL	0x01	short	"VOLTage:AC"	
OFFSET	0x02	long	"FREQuency:OFFSet"	
FSTRENGTH	0x04	short	"FSTRength"	only with EB200FS
AM	0x08	short	"AM"	
AM_POS	0x10	short	"AM:POSitive"	
AM_NEG	0x20	short	"AM:NEGative"	
FM	0x40	long	"FM"	
FM_POS	0x80	long	"FM:POSitive"	
FM_NEG	0x100	long	"FM:NEGative"	
PM	0x200	short	"PM"	
BANDWIDTH	0x400	long	"BANDwidth"	
CHANNEL	0x00010000	short	"CHANnel",	
FREQUENCY	0x00020000	unsigned long	"FREQuency:RX"	
SWAP	0x20000000		"SWAP"	
SIGNAL_GREATER_SQUELCH	0x40000000	-	„SQUelch"	
OPTIONAL_HEADER	0x80000000	-	"OPTional"	

Table 2: Description of SelectorFlags

The SelectorFlags describe the data to be found in the PeriodicTraceData, whether an OptionalHeader has been transmitted and whether the trace data are of "SIGNAL_GREATER_SQUELCH" data. If the SelectorFlag SWAP is set, the useful data are transmitted in the Little-Endian order. The sequence of the data in the PeriodicTraceData corresponds to the sequence of the above table, i.e. depends on the set SelectorFlags.

The flags are determined by the corresponding configuration command "TRAC:UDP:.....", the set sensor functions and whether this setting is at all allowed by the trace type. If all these settings allow a specific data item, the latter is sent in the datagram trace and the corresponding SelectorFlag set.

FScanTrace

All data specified in the SelectorFlags are relevant for this trace type.

Description of the OptionalHeader.

```
OptionalHeader {
    short cycleCount;
    short holdTime;
    short dwellTime;
    short directionUp;
    short stopSignal;
    unsigned long startFrequency;
    unsigned long stopFrequency;
    unsigned long stepFrequency;
}
```

Example of a complete attribute:

```
FScanAttribute {
    short number_of_trace_values;          /* corresponds to the number_of_trace_items */
    char reserved;
    unsigned char optional_header_length;  /* 0 or 22 */
    unsigned long selectorFlags;           /* see Table 2: Description of SelectorFlags */
    OptionalHeader;                        /* as described above of optional_header_length = 22 */

    short level-1;
    short level-2;
    short level-3;
    ....
    short level-number_of_trace_values;

    long offset-1;
    long offset-2;
    long offset-3;
    ....
    long offset-number_of_trace_values;
```

```
    short am-1;
    short am-2;
    short am-3;
    ....
    short am-number_of_trace_values;

    /* etc */
    /* see SelectorFlags table for sequence*/

    ....
    unsigned long frequency-1;
    unsigned long frequency-2;
    unsigned long frequency-3;
    ....
    unsigned long frequency- number_of_trace_values;
}
```

It may well be that in the future elements will be added to the OptionalHeader, more precisely appended. If an application with optional_header_length exceeds the optional header to get to the trace data, there will be no problems for the existing programs (upward compatibility).

MScanTrace

This trace has the same structure as FScanTrace with the exception of the OptionalHeader which do not contain some elements of the FScanTrace-OptionalHeader.

Description of the OptionalHeader.

```
OptionalHeader {
    short cycleCount;
    short holdTime;
    short dwellTime;
    short directionUp;
    short stopSignal;
}
```

The optional_header_length is thus either 0 or 10.

DScanTrace

SelectorFlags for DScanTrace can contain:

LEVEL

OFFSET

SIGNAL_GREATER_SQELCH

OPTIONAL_HEADER

Description of the OptionalHeader.

```
OptionalHeader {
    unsigned long startFrequency;
    unsigned long stopFrequency;
    unsigned long stepFrequency;
    unsigned long markFrequency;
    short bwZoom;
    short referenceLevel;
}
```

AUDio

SelectorFlags for audio data can only contain OPTIONAL_HEADER.

Description of the OptionalHeader.

```
OptionalHeader {
    short audio_mode;                   /* see remote command YSTem:AUDio:REMote:MODe
                                           */
    short frame_len;                    /* specifies the number of bytes per frame */
    unsigned long frequency;            /* current receive frequency */
    unsigned long bandwidth;            /* current IF bandwidth */
    unsigned short demodulation;        /* current demodulation type */
}
```

Example of a complete attribute:

```
AudioAttribute {
    short number_of_frames;             /* corresponds to the number_of_trace_items */
    char reserved;
    unsigned char optional_header_length;
    unsigned long selectorFlags;

    OptionalHeader; /                   * as described above */

    unsigned char data[frame_len * number_of_frames];
```

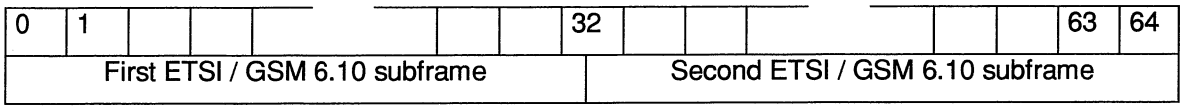
The AF data packets are transmitted internally in a cycle of 30 ms. The size of the UDP packets is between 325 bytes and 4 kbytes depending on the audio_mode.

Each UDP packet contains several complete frames. The definition of the audio_mode is given in the remote command SYSTem:AUDio:REMote:MODe.

In the PCM modes (audio_mode 1 to 12) a frame contains one or two channels and each channel is 16-bit wide. Thus each frame contains 1, 2 or 4 bytes, depending on the configuration.

In the GSM 6.10 mode (audio_mode 13) a frame contains 65 bytes. This 520-bit long frame contains two 260-bit long GSM subframes. The meaning of the bits can be looked in the ETSI standard (www.etsi.org).

Byte:



Allocation of bits and bytes in a frame:

		Bit designation corresponding to ETSI	Bits in frame	Bytes in frame
1st subframe	LSB	1	0	0
		2	1	0
		3	2	0
		4	3	0
		5	4	0
		6	5	0
		7	6	0
		8	7	0
		9	0	1
		10	1	1
		11	2	1
		.	.	.
		.	.	.
		.	.	.
		254	5	31
		255	6	31
		256	7	31
		257	0	32
		258	1	32
		259	2	32
	MSB	260	3	32
2nd subframe	LSB	1	4	32
		2	5	32
		3	6	32
		4	7	32
		5	0.	33.
		.	.	.
		.	.	.
		257	4	64
		258	5	64
		259	6	64
	MSB	260	7	64

Table 3: Description of GSM data format

SelectorFlag "SWAP" does not have any effect on the byte arrangement in the GSM 6.10 frame.

IFPan

SelectorFlags for IF-panorama can contain:

LEVEL

OPTIONAL_HEADER

Description of the OptionalHeader.

```
OptionalHeader {
    unsigned long frequency;
    unsigned long spanFrequency;
    short averageTime;
    short averageType;
}
```

FASTLEVCW

SelectorFlags for this mode must contain LEVEL:

There is no OPTIONAL_HEADER.

LIST

SelectorFlags for this mode must contain LEVEL:

There is no OPTIONAL_HEADER.

CW

With this trace type, as with FscanTrace, all data specified in the SelectorFlags are relevant.

Description of OptionalHeader:

```
OptionalHeader {
    unsigned long Frequency;
}
```

Remote commands

There is a fixed number of maximum configurable UdpPath entries. The first entry is always the default entry. This entry is saved in a CMOS RAM and retained on powering off and on again. **This means that scans initiated as a result of power-off (and subsequent power-on) can produce datagram packets without the user 'noticing' it.**

A UdpPath is always made up of the IP address (as string) and port number (as integer):

eg "192.168.1.1", 18457

Byte order of data to be transmitted:

The default byte order is Big Endian (native byte order of the device) which also corresponds to the network byte order used eg in the TCP/IP protocol. Using the "SWAP" flag described below this behavior can be altered. If this flag is set the wanted data are transmitted in Little-Endian order. This applies to the various OptionalHeaders as well as to the PeriodicTraceData, but not to the data "above" them which are used as protocol. The format of the GSM 6.10 audio data also remains unaffected by the SWAP flag.

Registration of tags for a specific UdpPath:

TRACe:UDP:TAG[:ON] IP-ADDR, PORT-NUM, tag [, tag ..]

TRACe:UDP:DEFault:TAG[:ON] IP-ADDR, PORT-NUM, tag [, tag ..]

The first command registers a specific UdpPath, the second one the default UdpPath (index 0).

Possible tags:

FSCan, MSCan, DSCan, AUDio, IFPan, FASTlevcw, LIST, CW

Example:

TRAC:UDP:DEF:TAG "89.10.20.30", 17222, FSC, MSC

Registration of flags for a specific UdpPath:

TRACe:UDP:FLAG[:ON] IP-ADDR, PORT-NUM, flag [, flag ..]

TRACe:UDP:DEFault:FLAG[:ON] IP-ADDR, PORT-NUM, flag [, flag ..]

The first command registers a specific UdpPath, the second one the default UdpPath (index 0).

Possible flags	*Data output*	*Remark*
"VOLTage:AC"	Level	
"FREQuency:OFFSet"	Offset	
"FSTRength"	Field strength	with EB200FS
"AM"	AM modulation depth	
"AM:POSitive"	AM – positive modulation depth	
"AM:NEGative"	AM - negative modulation depth	
"FM"	Frequency deviation	
"FM:POSitive"	Positive frequency deviation	
"FM:NEGative"	Negative frequency deviation	
"PM"	Phase deviation	
"BANDwidth"	Bandwidth	
"CHANnel",	Channel number	
"FREQuency:RX"	Frequency	
"SWAP"	in Little-Endian order	
„SQUelch"	Only level values above squelch threshold	
"OPTional"	Additional OptionalHeader	

Table 4: Description of flags

Note:
The sensor function "FSTRength" only provides results if the SW option EB200FS is fitted. Also see Annex H.

Note:
The flags are registered independent of the tags.

Example:

TRAC:UDP:FLAG "89.255.255.255", 18457, "AM", "AM:POSitive", "AM:NEGative", "OPT"

De-registration of tags for a specific path UdpPath:

TRACe:UDP:TAG:OFF IP-ADDR, PORT-NUM, tag [, tag ..]

TRACe:UDP:DEFault:TAG:OFF IP-ADDR, PORT-NUM, tag [, tag ..]

Tags, same as for registration.

Example:
TRAC:UDP:DEF:TAG:OFF "89.10.20.30", 17222, FSC

De-registration of flags for a specific UdpPath:

TRACe:UDP:FLAG:OFF IP-ADDR, PORT-NUM, flag [, flag ..]
TRACe:UDP:DEFault:FLAG:OFF IP-ADDR, PORT-NUM, flag [, flag ..]
Flags, same as for registration.

Example:
TRAC:UDP:FLAG:OFF "89.255.255.255", 18457, "OPT"

Delete of a UdpPath:

TRACe:UDP:DELete IP-ADDR, PORT-NUM

This command deletes a UdpPath from the list provided it can be found. The default UdpPath can be deleted in this way too.

Example:
TRACE:UDP:DELETE "89.255.255.255", 18457

Delete of all UdpPath:

TRACe:UDP:DELete ALL

This command deletes all UdpPath.

Example:
TRACE:UDP:DELETE ALL

Query of UdpPath:

TRACe:UDP? MINimum | MAXimum | DEFault

Query of the index of the first UdpPath, the highest UdpPath and the default UdpPath.

TRACe:UDP? <numeric_value>

Query of the UdpPath with the index <numeric_value>

Example:

TRAC:UDP? MAX -> 3
TRAC:UDP? 0 -> DEF "89.10.20.30", 18457, FSC, MSC, "VOLT:AC", "OPT"
TRAC:UDP? 3 -> 003 "255.255.255.255", 17222, DSC, "VOLT:AC", "OPT"

Annex G (Coverage Measurement)

If fitted with SW option EB200CM (Coverage Measurement) (R&S part no. 4052.9804.02), the ESMB is suitable for coverage measurements.

Thanks to this option, in the single-channel measurement mode up to 2000 triggered level measurements per second can be carried out on a single frequency. In the multi-channel measurement mode up to 200 measurements per second can be carried out on the frequencies contained in a list, the frequency hops being random. The trigger can be configured to be external, internal or to come from a timer. Addressing this option is only possible via remote control. In this mode manual operation is disabled and only the current operating mode will be displayed.

Operating modes

Single-channel measurement

For measurements on a single frequency the **FASTlevcw** mode has to be selected.

Before measuring the parameters bandwidth, demodulation mode, AGC, detector type and the measuring time must be set.

When DEFAULT measuring time is selected (command `MEAS:TIME DEF`) the measurement is carried out in a time which depends on the bandwidth and the type of detector. Also see Table Measuring times on page 3, column Default Measuring Times.

When the measuring time is set explicitly (command `MEAS:TIME <value>`) the measurement is carried out always within this time. The minimum adjustable measuring time is 500 µs (command `MEAS:TIME 0.5 ms`).

If triggering is faster (external or timer triggering) than permitted by the measuring time, the measurement in progress is aborted and the currently valid value is output. This allows the measuring time to be adapted implicitly to the measuring rate.

Before starting the measurement the attenuation must be explicitly set to ON or OFF.

Then the mode is to be set to FASTlevcw by using command `FREQ:MODE FASTlevcw`.

Caution:
For bandwidths ≤ 1 kHz, the maximum trigger rate with external triggering and timer triggering is approx. 400 trigger pulses per second.

Multi-channel measurement (triggered scan)

In order to be able to measure several channels the **LIST** mode (command `FREQ:MODE LIST`) was introduced. By using command `LIST:FREQ <freq1>,<freq2>,...` up to 50 frequencies can be defined. All other parameters (bandwidth, detector type, etc.) are set in the same way as for single-channel measurement.

Autoranging operation is deactivated. Before starting the measurement the attenuation must be explicitly set to ON or OFF.

With each trigger one run is covered. The overall time per channel is calculated based on the following formula:

$t_{channel} = t_{syn} + t_{IF} + t_{MEAS} + t_{cpu}$

With:

t_{syn} : synthesizer settling time for any hop = 3 ms

t_{IF} : IF section settling time (see Table "Measuring times" on page 3, column Settling times t_{IF})

t_{MEAS} : measuring time (see Table "Measuring times" on page 3, column Default measuring times t_{MEAS})

t_{cpu} : other processing time = 1.25 ms

Examples:

BW = 6 kHz, FM, FAST, MEAS:TIME DEF

$t_{channel}$ = 3 ms + 3.75 ms + 0.56 ms + 1.25 ms = 8.56 ms

With 5 frequencies this means that the trigger period must be < 42.8 ms (5*8.56 ms).

BW = 30 kHz, AM, AVG, MEAS:TIME DEF

$t_{channel}$ = 3 ms + 0.968 ms + 3 ms + 1.25 ms = 8.22 ms

With 5 frequencies this means that the trigger period must be < 41.1 ms (5*8.22 ms).

BW = 150 kHz, AM, PEAK, MEAS:TIME 1 ms

$t_{channel}$ = 3 ms + 0.468 ms + 1 ms + 1.25 ms = 5.72 ms

With 5 frequencies this means that the trigger period must be < 28.59 ms (5*5.72 ms).

BW = 150 kHz, AM, FAST, MEAS:TIME DEF

$t_{channel}$ = 3 ms + 0.468 ms + 0.281 ms + 1.25 ms = 5 ms

With 5 frequencies this means that the trigger period must be < 25 ms (5*5 ms).

To be on the safe side another 5 % should be added.

In LIST mode, with external and timer triggering the error message "Trigger ignored" will be generated if triggering was too fast.

Caution:

If the ESMB is fitted with the optional HF Section ESMBHF is fitted the following times must be added:

For each change from LF/HF range <-> V/UHF range: +10 ms

If the optional ESMBHF is connected to antenna connector X13, for each change LF/HF range <-> V/UHF range: another +500 ms

For each change LF <-> HF (at fin = 150 Hz): another +500 ms

Example:

The frequency list contains: 10 MHz, 100 MHz, 200 MHz
The HF section is connected at Ant X3.

The minimum trigger period is calculated by using the rule-of-thumb. To be added:

1 change HF -> VUHF: +10 ms
1 change VUHF -> HF: +10 ms

Measuring times

Depending on the bandwidth and demodulation mode selected the following settling times t_{IF} are obtained.

Depending on the type of detector used the following default measuring times t_{MEAS} are obtained.

	Overall settling times t_{IF}			**Default measuring times t_{MEAS}**			
Bandwidth [kHz]	AM,FM [us]	IQ,CW,SSB [us]	ISB [us]	Peak [us]	Average [us]	Fast [us]	RMS [us]
300	406.25	343.75	343.75	1000	3000	281.25	3000
250	406.25	343.75	343.75	1000	3000	281.25	3000
150	468.75	406.25	343.75	2000	3000	281.25	3000
120	468.75	406.25	406.25	2000	3000	281.25	3000
100	468.75	468.75	406.25	2000	3000	281.25	3000
30	968.75	750	750	5000	3000	281.25	3000
15	1656.25	1312.5	1250	10000	3000	281.25	3000
9	3187.5	2437.5	2625	20000	6000	562.5	6000
8	3187.5	2437.5	2750	20000	6000	562.5	6000
6	3750	3000	3312.5	30000	12000	562.5	12000
4	6000	4500	4500	50000	12000	1125	12000
3	7125	5625	5625	60000	25000	1125	25000
2.4	10500	7750	7750	60000	25000	2250	25000
1.5	14000	11000	11750	100000	50000	2250	50000
1	23500	17500	19000	150000	50000	4500	50000
0.6	37000	28000	28000	200000	100000	9000	100000
0.3	136000	100000	100000	400000	100000	18000	100000
0.15	82000	60000	56000	500000	200000	18000	200000

Triggering

There are three triggering possibilities.

External:	`TRIG:SOUR EXT`	-> trigger by external pulse
Internal:	`TRIG:SOUR INT`	-> measurement "as fast as possible"
Timer:	`TRIG:SOUR TIM`	-> trigger by timer

Externally triggered measurement

The trigger source has to be set to external by using command `TRIG:SOUR EXT`.

The trigger input is !INTRPT is located at the rear of ESMB at connector X8, pin 12. This input is TTL-compatible. The slope which is to trigger the measurement can be selected by using command `TRIG:SLO POS` or `TRIG:SLO NEG`, respectively.

After the `INIT` command the external trigger is enabled.

The maximum trigger rate of 2000 pulses per second must no be exceeded!

The measurement is aborted using the `ABORT` command. The external trigger input will then be inhibited again.

Internally triggered measurement

The trigger source has to be set to internal by using command `TRIG:SOUR INT`.

The `INIT` command starts the measurement which is carried out at a rate of either the default measuring time or the set measuring time. Thus the measurement is carried out "as fast as possible".

The `ABORT` command aborts the measurement.

Timer-triggered measurement

The trigger source has to be set to timer by using command `TRIG:SOUR TIM`.

The trigger period is set by using command `TRIG:TIM <value>` (eg `TRIG:TIM 20 ms`). The minimum value is 500 µs. The `INIT` command starts the measurement. The measurement is triggered by each timer pulse. Everything else is the same as with the externally triggered measurement.

The `ABORT` command aborts the measurement.

Data output

All measured values are transmitted as UDP packets via LAN or RS232 PPP.

The UDP path must be configured accordingly with the FASTlevcw attribute. See Annex F.

Simultaneous AF transmission via the remote-control interface is not possible.

Single-channel measurement

Only level values are transmitted. Transmission is binary in 1/10 dBµV.

Multi-channel measurement (triggered scan)

The measured values are output in the same way as in single-channel measurement. Only levels are transmitted. The individual runs are separated by wrap-around markers.

Example:

3 frequencies are to be measured. The UDP packet covers 3 runs with 3 frequencies each.
Level of 1st channel
Level of 2nd channel
Level of 3rd channel
Wrap-around marker (= 200 dBµV = 2000 binary)
Level of 1st channel
Level of 2nd channel
Level of 3rd channel
Wrap-around marker (= 200 dBµV = 2000 binary)
Level of 1st channel
Level of 2nd channel
Level of 3rd channel
Wrap-around marker (= 200 dBµV = 2000 binary)

Annex H (Field Strength Measurement)

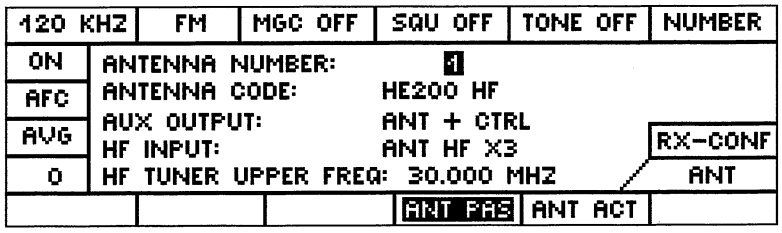
If fitted with SW option EB200FS (Field Strength) (R&S part no. 4052.9704.02), the ESMB is suitable for field strength measurements.

Thanks to this option, field strength measurements can be carried out by using calibrated antennae. Beside the level indication in dBµV the field strength is indicated in dBµV/m. To be able to properly take into account the antenna correction factors, the k-factors of the R&S Antenna HE200 and of a half-wave dipole are firmly stored. User-defined k-factor data sets can be loaded into the unit via remote control.

1. Manual operation

Selecting the antenna

The antenna is selected in submenu ANT. This menu is called by pressing the ANT/ATT softkey in the RX-CONF menu.



Displayed parameters

ANTENNA NUMBER: antenna numbers 0 to 99

With each antenna number there is the possibility of storing two k-factor tables. The associated data set can be selected by using softkey **ANT PAS** or **ANT ACT**, respectively.

If only one of the data sets is filled, this data set will be selected in any case, irrespective of which softkey has been actuated.

To antenna numbers 1 to 5 the following data sets are assigned ex works:

Antenna number	Designation	Data PASSIVE	Data ACTIVE	Frequency range
1	HE200 HF	yes	yes	9 kHz to 30 MHz
2	HE200 20-200M	yes	yes	20 MHz to 200 MHz
3	HE200 .2-0.5G	yes	yes	50 MHz to 500 MHz
4	HE200 .5-3GHZ	yes	yes	500 MHz to 3000 MHz
5	HALFWAVE DIP.	yes	no	9 kHz to 3000 MHz

The k-factors of the half-wave dipoles are calculated as follows:

k-factor = 20* log (2.53 * FREQ / 100 MHz)

ANTENNA CODE: 13-digit antenna name

When the **ANTENNA CODE** parameter is selected, always one letter of the antenna name can be set at a time by using softkey <- or ->, and stepping through the alphabet is possible by turning the spinwheel.

AUX OUTPUT: FREQ or ANT + CTRL (switchover by means of spinwheel)

HF INPUT: see ANT (antenna) on page 37

HF TUNER: see ANT (antenna) on page 37

Softkeys

The following two softkeys will only appear if the SW option EB200FS (Field Strength) is fitted.

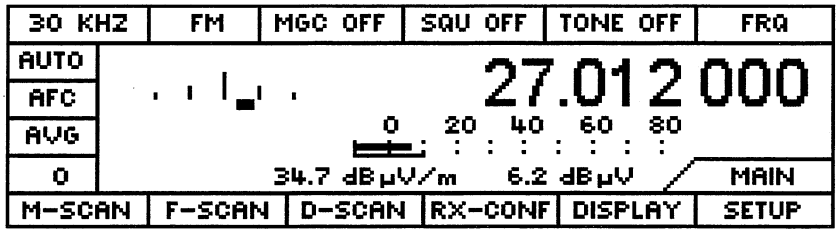
ANT PAS k-factor table for passive antennae (e.g. HE200 without amplifier)

ANT AKT k-factor table for active antennae (e.g. HE200 with amplifier)

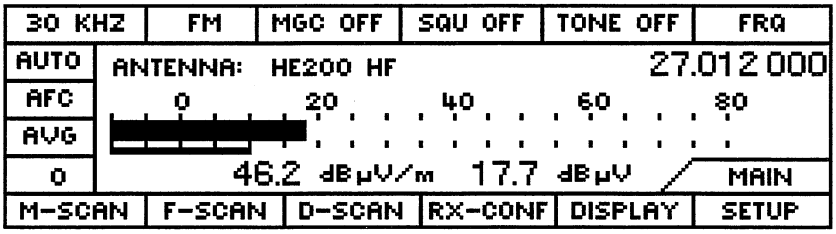
Numerical field strength display

When an antenna number was selected for which a k-factor data set is available, the field strength will be displayed in dBµV/m left of the numerical level indication. This implies that the receive frequency is within the range for which the k-factor data set was defined.

Field strength indication in the DISPAY-DEFAULT screen:

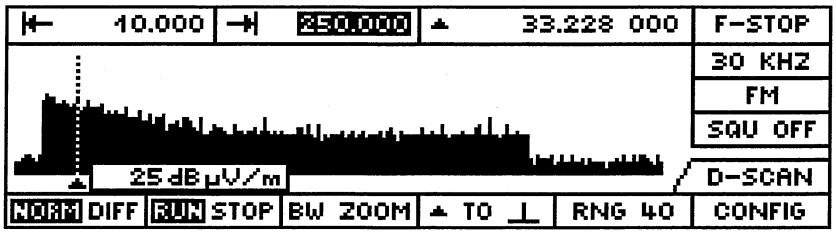


Field strength indication in the DISPAY-LEVEL screen:



Field strength display in DSCAN

DSCAN screen with antenna number 02 (HE200 20 MHz to 200 MHz):



In the DSCAN screen the corrected level values are displayed in dB.

The marker position is set off by a dotted line. Right or left of the marker, the level value measured at the marker position is shown in dBµV in a travelling window. When the marker is on a frequency for which a k-factor data set is defined and active, this window will show the field strength in dBµV/m instead of the level.

Note:
The squelch threshold and all associated functions such "Mark to Peak" and "Signal > Threshold" still only refer to level values in dBµV.

In the DSCAN-CONFIG submenu the parameter DISPLAY LIMITS can be set.

DISPLAY LIMITS spectrum display range: eg –20 dB to 60 dB

The upper value of the DISPLAY LIMIT can be configured independent of the reference level. It is adjustable in the range from 0 to 250 dB in increments of 10 dB. Shifting the display range to values near 250 dB is only necessary if the SW option EB200FS (Field Strength Measurement) is fitted and very high antenna k-factors are to be taken into account.

The lower value is calculated from the upper value of the DISPLAY limits minus the current RNG.

2. Remote control

2.1 Sensor functions

In remote control the field strength measurement is configured in just the same way as the level and offset measurements. When the field strength sensor function has been activated by using command `FUNCtion "FSTRength"`, measured field strength values in dBµV/m can be queried with `SENSe:DATA?`

2.2 Data output

A single data query is made using command `SENSe:DATA?`.

As with level output, block data are output via the trace buffers by using command `TRACE? MTRACE`. The sensor function and the data paths for MTRACE have to be configured beforehand.

`MTRACE` obtains its data from the `SENSe:FUNCtion` block. All activated sensor functions signal their respective measured values to `MTRACE` to be stored.

When the path to the buffer `MTRACE` is enabled using command `TRACE:FEED:CONTrol MTRACE, ALWays`, a measured value can be stored in `MTRACE` via command `INITiate:CONM`.

In remote control the field strength measurement is configured in just the same way as the level and offset measurements. When the field strength sensor function has been activated by using command `FUNCtion "FSTRength"`, measured field strength values in dBµV/m can be queried with `SENSe:DATA?`

The output format can be configured by using command `FORMat:DATA ASCii` or `FORMat:DATA PACKed`.

`ASCii ->`	normal ASCII output:	level in 1/10 dBµV/m (eg 45.3)
`PACKed ->`	`<Definite Length Block>:`	level in 1/10 dBµV/m (2 bytes)

When no k-factor is defined on the current frequency, i.e. no antenna with a frequency range covering the current frequency is selected, the NINF value will be output:

`ASCii ->`	–9.9E37	
`PACKed ->`	0x7FFE	(coded in PACKed format)

3. Tool for handling antenna factors

3.1 Starting up the tool

The application for handling of antenna factors was realized by using a Java applet. That means a web browser is needed to run the program. The browser is required to support the Java 2 standard. As this is not the case with conventional products, they must be upgraded accordingly. See chapter 3.3 at the end of this Annex H.

In the URL field of the browser enter the IP-address of the receiver:

eg: http://89.1.2.3/

Alternatively, the name may be entered instead of the 4-part number, provided that an appropriate name service is available in the network which is able to resolve this name.

Also think of proxy settings which may have been made in the browser.

In the browser a welcome screen comes up. Click on the link

Click here to start the Antenna Factor Application

and the antenna factor applet is loaded and started.

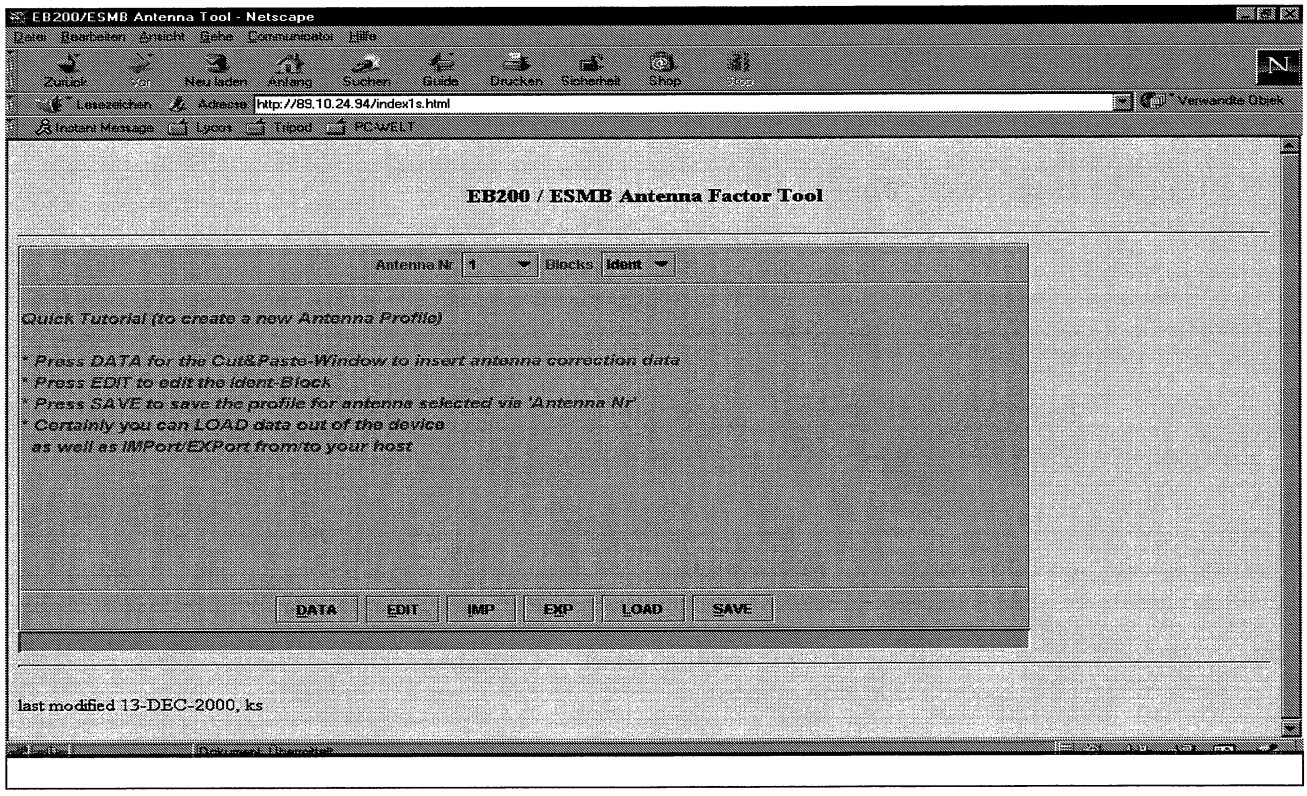


Fig. 1: Antenna factor tool within the browser

3.2 Description of functions

General functioning

Right after starting up the tool does not yet have any current antenna set. The current antenna set is the set currently handled by the tool and can be created as follows:

- Create manually with **DATA**
- Load from device with **LOAD**
- Load from host with **IMP**

This current antenna set can only be displayed / edited (see **EDIT**) or saved (see **SAVE** and **EXP**).

Creating a characteristic data set

By clicking on **DATA** the submenu for manual creation of characteristic data can be called up. In a table field manually enter the single frequency – k-factor points of the characteristic or insert them with copy and paste from eg an EXCEL table. The interpolation method used can be selected to be either linear or logarithmic. To save the data the entire characteristic may be saved together with the antenna name in an ASCII file by using the **EXP** function. When input has been completed with **OK**, several partial characteristic sections are created from the overall characteristic, the frequency stepwidth within these sections being constant. From this standardized ASCII format a corresponding binary format is generated before the data are stored in the device with **SAVE**.

Setting the antenna number

The selection field in the upper left is used to set the antenna number (1 to 99). If **None** is displayed here, that means that no antenna number has been selected so far, and for this reason the **LOAD** and **SAVE** keys are disabled. The antenna number setting exclusively concerns the communication with the device, i.e. the antenna slot from which the data are read with **LOAD** or to which the current data are written with **SAVE**.

Selecting a data block and brief description of blocks

The selection field in the upper right is used to select a particular block within the antenna data. Here a distinction is made between the ident block, the actual antenna data blocks and the end block. The latter is fixed and of no importance in this context. The ident block is available once per antenna data set and contains characteristic-independent information concerning the data set, such as name, date, etc. It can be modified with **EDIT**, irrespective of how the current antenna set was created. In addition, for each partial characteristic section one antenna block is available, with a separation for active and passive mode if the antenna is to support both.

Importing and exporting the antenna data - with IMP and EXP

With **IMP** antenna factors can be imported from the host - for instance a PC – and with **EXP** the current antenna data can be exported. However, this implies that a "certification procedure for signed Java applets" is carried out. A description of how to proceed and the files required for this are contained on the supplied Utility Disk in the "JavaZert" directory. The current version of the Utility Disk is loaded in the R&S ESMB Download Area.

Loading and saving the antenna data – with LOAD and SAVE

With **LOAD** the antenna data corresponding to the selected antenna number, if available in the device, are loaded, forming the **current antenna set**.

With **SAVE** a current antenna set is written to the device in accordance with the selected antenna number. Please note that the device is delivered with a certain number of fix antenna sets (antenna numbers 1 to 5) which are stored in the ROM. When one of these numbers is selected the associated predefined antenna set will be overwritten, i.e. the new data will be superimposed, and for the time being the original contents can only be restored by a cold start.

Displaying and editing the actual antenna data - with EDIT

The relevant partial characteristic section is set. The designation always begins with "Antenna", followed by the letter "P" for passive or "A" for active and the respective start frequency. By clicking on the **EDIT** button the frequency – antenna-factor pairs can now be displayed as a list. The factors can be edited, but the frequencies cannot. Neither can tupels be cleared or added. Altering the PassiveActive flag is nevertheless possible, if this really makes sense. Editing of the whole data set can only be performed on manually created antenna data by using the **DATA** function.

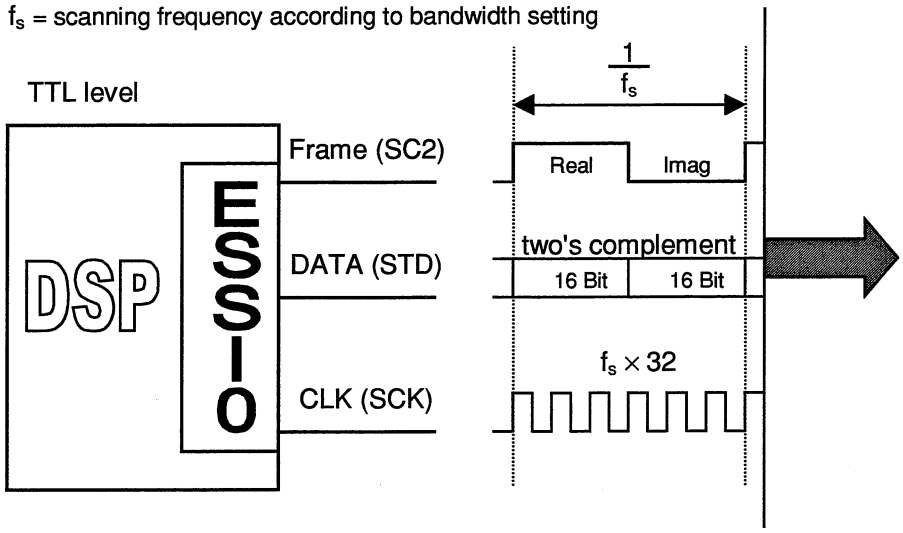
The tupel list may also be displayed as a graph by clicking on **VIEW**.

3.3 Upgrading the browser to Java 2 standard

The Netscape browser from Version 6 onwards already contains Java 2, provided that the entire package has been installed. With other browsers such as Netscape Communicator Version 4 and inferior or Internet Explorer a Java-capable plug-in must be installed. For details on how to proceed and for downloading please visit

http://java.sun.com/products/plugin/.

Annex I (Digital IF Output)



Scanning frequency f_s	IF bandwidth	Data rate Mbit/s
512 kHz	250 kHz, 300 kHz	16.384
256 kHz	100 kHz, 120 kHz, 150 kHz	8.192
64 kHz	30 kHz	2.048
32 kHz	15 kHz	1.024
16 kHz	6 kHz; 8 kHz; 9 kHz	0.512
8 kHz	3 kHz; 4 kHz;	0.256
4 kHz	1.5 kHz; 2.4 kHz	0.128
2 kHz	1 kHz	0.064
1 kHz	600 Hz	0.032
0.5 kHz	300 Hz	0.016
0.25 kHz	150 Hz	0.008

Schnittstellenbeschreibung
Interface Description

zu: **MONITORING RECEIVER ESMB** **Sach-Nr.: 4056.6000.02**
for: *Stock No.:*

Umweltbedingungen:

Hausvorschrift	HVA 149	Geräteklasse C
Nenntemperaturbereich	0 ... +45 °C	
Arbeitstemperaturbereich	0 ... +50 °C	
Lagertemperaturbereich	-40 ... +70 °C	

Environmental conditions:

In-house guideline	HVA 149	Equipment class C
Rated temperature range	0 to +45 °C	
Operating temperature range	0 to +50 °C	
Storage temperature range	-40 to +70 °C	

erstellt von: **Loh / 8GE1** **Datum:** **07.03.00**
issued by: *Date:*

Abt. / *Dpt.:* 8GE1	Name: Loh	Datum / *Date:* 26.10.00		Ä.I. / *C.I.:* 03.00
ROHDE & SCHWARZ	Benennung: MONITORING RECEIVER *Designation: MONITORING RECEIVER*			Bl. / *Sh.* 1 von / *of* 6
Typ / *Type*: ESMB	Sprache / *Language*: de / *en*		Sachnummer / Stock No. 4056.6000.01 SB	

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Eintragung in der Spalte A (Art) / *Entry in column T (type)*: **A** = Analog **D** = Digital **P** = Power
Eintragung in der Spalte PT (Prüf- und Trimmplan) / *Entry in column TI (test instructions)*: **P** = Prüfwert / *Test value* **T** = Trimmwert / *Trimming value* **D** = Typprüfwert / *Type test value* **E** = Einstellwert / *Setting value*

Signal Name Beschreibung / *Description*	R *D*	A *T*	Wertebereich *Range*	PT *TI*	Bild Nr. *Fig. No.*	Anschlußpunkt *Contact*	Bemerkung *Remarks*
ANT HF	I	A	9 kHz to 30 MHz Z = 50 Ω VSWR ≤ 3, typ. 1.5 -127 to +3 dBm P_{max}=100 mW	D D D D D		X 3	Only with HF Unit N socket With 30 dB atten. Connectable
ANT V/UHF	I	A	20 (30) MHz to 3 GHz Z = 50 Ω VSWR ≤ 3, typ. 1.8 -127 to +3 dBm P_{max}=100 mW	D D D D D		X 13	>30MHz with HFUnit, selectable N socket With 30 dB atten. Connectable
IFWB	O	A	f = 10.7 MHz 11 dB ± 6dB above level at X 3 or X 13 B = ± 5kHz (HF range) B = ± 1MHz (V/UHF range) Z = 50 Ω VSWR ≤ 3	P P D D D D		X 5	SMA female, NORMAL, ATT off, for f ≥ 50 kHz (HF)
REF EXT/INT	B	A	**external:** f=10 MHz ≤ ± 3×10^{-6} input voltage: 0.1 to 1 V input impedance: 500 Ω **internal:** f=10 MHz ≤ ± 1 ×10^{-6} (0 to +45°C) ≤ ± 0.5×10^{-6} ageing per year Z=50 Ω r ≤ 33% P = 0 dBm ± 3 dB	 P P D P P D D D P		X 4	SMA female
(HEADPHONE)	O	A	Vpp max = 5 V; Ri = 100 Ω f = 10Hz ... 12.5kHz f = 10-300Hz ... 12.5kHz	P D D D		X 11	3.5 mm stereo socket (front panel) with AM; dep. on BW

Abt. / *Dpt.:* 8GE1	Name: Loh	Datum / *Date:* 26.10.00		Ä.I. / *C.I.*: 03.00
ROHDE & SCHWARZ	Benennung: MONITORING RECEIVER *Designation: MONITORING RECEIVER*			Bl. / *Sh.* 2 von / *of* 6
Typ / *Type:* ESMB	Sprache / *Language*: de / *en*		Sachnummer / *Part No.:* 4056.6000.01 SB	

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Eintragung in der Spalte PT (Prüf- und Trimmplan) / *Entry in column TI (test instructions)*: **P** = Prüfwert **T** = Trimmwert **D** = Typprüfwert **E** = Einstellwert
P = *Test value* **T** = *Trimming value* **D** = *Type test value* **E** = *Setting value*

Signal Name Beschreibung / *Description*	R *D*	A *T*	Wertebereich *Range*	PT *TI*	Bild Nr. *Fig. No.*	Anschlußpunkt *Contact*	Bemerkung *Remarks*
AUDIO			15-pin SUB-D, female			**X 7**	
SPKR EXT1	O	A	⎫	D		X7.1	⎫ Internal. plug-in
Ext. Loudspeaker			⎬ 500 mW / 4 Ω				⎬ switches int.
SPKR EXT2	O	A	⎭	D		X7.9	⎭ loudspeaker off
AFGND	B		AUDIO ⊥	D		X7.2	
AFMONO	O	A	0.5 V ± 0.3 V for m = 0.5 Ri = 100 Ω f = 10Hz ... 12.5kHz f = 10-300Hz ... 12.5kHz	P D D		X7.10	With AM; dep. on BW
AFSYM1	O	A	⎫ m=0.5	P		X7.3	
			⎭ – 6 dBm ± 3 dB	P			
AFSYM2	O	A	⎫ Ri = 600 Ω ⎭ f = 10Hz ... 12.5kHz f = 10-300Hz ... 12.5kHz	D D		X7.11	With AM; dep.on BW
AFLINE_L	O	A				X7.4	
			0.5 V ± 0.3 V for m = 0.5 Ri = 100 Ω	P			
AFLINE_R	O	A				X7.12	
LOG	O	A	0 to 4.5 V Ri = 100 Ω	P		X7.5	Log signal level
SIGNAL	O	D	TTL level (3.3 V)	P		X7.6	Signal > threshold
+AUX5VD2	O	P	+5.1 V / max. 50 mA	P		X7.8	

Abt. / *Dpt.:* 8GE1	Name: Loh	Datum / *Date:* 26.10.00		Ä.I. / *C.I.*: 03.00
ROHDE & SCHWARZ	Benennung: MONITORING RECEIVER *Designation: MONITORING RECEIVER*			Bl. / *Sh.* 3 von / *of* 6
Typ / *Type:* ESMB	Sprache / *Language*: de / *en*		Sachnummer / *Part No.:* 4056.6000.01 SB	

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Eintragung in der Spalte R (Richtung) / *Entry in column D (direction)*: **O** = Ausgang / *Output* **I** = Eingang / *Input* **B** = Bidirektional / *Bidirectional*
Eintragung in der Spalte A (Art) / *Entry in column T (type)*: **A** = Analog **D** = Digital **P** = Power
Eintragung in der Spalte PT (Prüf- und Trimmplan) / *Entry in column TI (test instructions)*: **P** = Prüfwert / *Test value* **T** = Trimmwert / *Trimming value* **D** = Typprüfwert / *Type test value* **E** = Einstellwert / *Setting value*

Signal Name Beschreibung / *Description*	R *D*	A *T*	Wertebereich *Range*	PT *TI*	Bild Nr. *Fig. No.*	Anschlußpunkt *Contact*	Bemerkung *Remarks*
GND	B	-	⊥	D		X7.15	
FCHANGE	O	D	TTL level (3.3 V)	P		X7.13	(JO0)
COR	O	D	TTL level (3.3 V)	P		X7.14	(JO1)
OPTION			25-pin SUB-D, male			**X 6**	
GND	B		⊥	D		X6.1 /.7 /.13	
JTXD Transmit Data	O	D	RS232 level	D		X6.2	
JRXD Receive Data	I	D	RS232 level	D		X6.3	
JRTS Request To Send	O	D	RS232 level	D		X6.4	
JCTS Clear To Send	I	D	RS232 level	D		X6.5	
JDSR Data Set Ready	I	D	RS232 level	D		X6.6	
JDTR Data Terminal Ready	O	D	RS232 level	D		X6.20	
+AUX5VD1	O	P	+5.1 V / max. 50 mA	P		X6.14	
ARX Receive Data	I	D	TTL level (max. 3.3 V)	D		X6.9	
ATX Transmit Data	O	D	TTL level (3.3 V)	D		X6.23	
SFRAME	O	D	TTL level (3.3 V)	D		X6.12	⎫ IF = 0 kHz
SCLOCK	O	D	TTL level (3.3 V)	D		X6.24	⎬ 2x 16bit I/Q
SDATA	O	D	TTL level (3.3 V)	D		X6.25	⎭ max. 256 ksPS

Abt. / *Dpt.:* 8GE1	Name: Loh	Datum / *Date:* 26.10.00		Ä.I. / *C.I.*: 03.00
ROHDE & SCHWARZ	Benennung: MONITORING RECEIVER *Designation: MONITORING RECEIVER*			Bl. / *Sh.* 4 von / *of* 6
Typ / *Type:* ESMB	Sprache / *Language*: de / *en*		Sachnummer / *Part No.:* 4056.6000.01 SB	

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Eintragung in der Spalte A (Art) / *Entry in column T (type)*: **A** = Analog **D** = Digital **P** = Power
Eintragung in der Spalte PT (Prüf- und Trimmplan) / *Entry in column TI (test instructions)*: **P** = Prüfwert **T** = Trimmwert **D** = Typprüfwert **E** = Einstellwert
P = *Test value* **T** = *Trimming value* **D** = *Type test value* **E** = *Setting value*

Signal Name Beschreibung / *Description*	R *D*	A *T*	Wertebereich *Range*	PT *TI*	Bild Nr. *Fig. No.*	Anschlußpunkt *Contact*	Bemerkung *Remarks*
AUX			37-pin SUB-D, female			**X 8**	
GND	B	-	⊥	D		X8.1 /.16 /.20/ .37	
INA Input A	I	D	TTL level (max. 3.3 V)	D		X8.2	(JI0)
INB Input B	I	D	TTL level (max. 3.3 V)	D		X8.21	(JI1)
INC Input C	I	D	TTL level (max. 3.3 V)	D		X8.3	(JI2)
IND Input D	I	D	TTL level (max. 3.3 V)	D		X8.22	(JI3)
ANTA1 Antenna A1	O	D	TTL level (3.3 V)	P		X8.4	(JIO00)
ANTA2 Antenna A2	O	D	TTL level (3.3 V)	P		X8.23	(JIO01)
ANTA4 Antenna A4	O	D	TTL level (3.3 V)	P		X8.5	(JIO02)
ANTA8 Antenna A8	O	D	TTL level (3.3 V)	P		X8.24	(JIO03)
ANTA10 Antenna A10	O	D	TTL level (3.3 V)	P		X8.6	(JIO10)
ANTA20 Antenna A20	O	D	TTL level (3.3 V)	P		X8.25	(JIO11)
ANTA40 Antenna A40	O	D	TTL level (3.3 V)	P		X8.7	(JIO12)
ANTA80 Antenna A80	O	D	TTL level (3.3 V)	P		X8.26	(JIO13)
CTRL1 Control line 1	O	D	TTL level (3.3 V)	D		X8.8	(JIO20)
CTRL2 Control line 2	O	D	TTL level (3.3 V)	D		X8.27	(JIO21)
CTRL3 Control line 3	O	D	TTL level (3.3 V)	D		X8.9	(JIO22)
CTRL4 Control line 4	O	D	TTL level (3.3 V)	D		X8.28	(JIO23)
CTRL5 Control line 5	O	D	TTL level (3.3 V)	D		X8.10	(JIO30)
CTRL6 Control line 6	O	D	TTL level (3.3 V)	D		X8.29	(JIO31)
CTRL7 Control line 7	O	D	TTL level (3.3 V)	D		X8.11	(JIO32)
CTRL8 Control line 8	O	D	TTL level (3.3 V)	D		X8.30	(JIO33)
!RESET	I	D	TTL level (max. 3.3 V)	D		X8.31	
!INTRPT	I	D	TTL level (max. 3.3 V)	D		X8.12	

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P = *Test value* **T** = *Trimming value* **D** = *Type test value* **E** = *Setting value*

Signal Name Beschreibung / *Description*	R *D*	A *T*	Wertebereich *Range*	PT *TI*	Bild Nr. *Fig. No.*	Anschlußpunkt *Contact*	Bemerkung *Remarks*
+AUX5VD3	O	P	+5.1 V / max. 50 mA	P		X8.15	
+AUX3.3V	O	P	+3.3 V / max. 50 mA	P		X8.34	
AES/CLK	O	D	Vpp ≥ 3V Ri = 110 Ω	D		X8.17	⎫
AESMCLK	O	D	Vpp ≥ 3V Ri = 110 Ω	D		X8.18	⎬ Serial Digital Audio
AES/DATA	O	D	Vpp ≥ 3V Ri = 110 Ω	D		X8.35	⎪
AESFRAME	O	D	Vpp ≥ 3V Ri = 110 Ω	D		X8.36	⎭
DC 10...32 V			3pole connector, male, XLR			**X 1**	Case : GND
DC +	I	P	+ 10 ... 32 V	D		X1.1	Pmax ≤ 45 W
DC -	B	P	0 V	D		X1.2	
-			NC	D		X1.3	
LAN Port			Ethernet 10Base - T			**X 91**	
TD+ Transmit Data	O	D	10Base-T-Level (pos)	D		X91.1	
TD- Transmit Data	O	D	10Base-T-Level (neg)	D		X91.2	
RD+ Receive Data	I	D	10Base-T-Level (pos)	D		X91.3	
RD- Receive Data	I	D	10Base-T-Level (neg)	D		X91.6	

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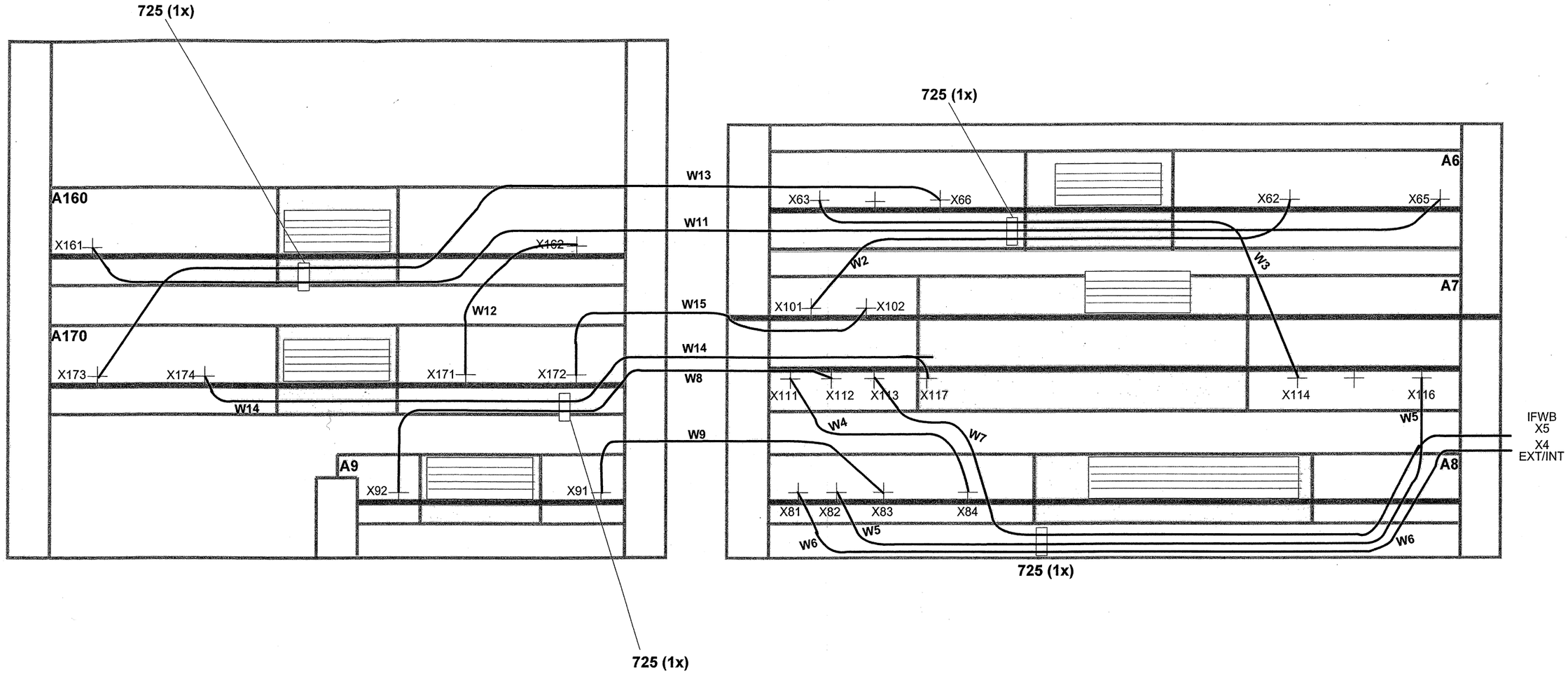

W2 A6.X62 - A7.X101
W3 A7.X114 - A6.X63
W4 A7.X111 - A8.X84
W5 A8.X82 - A7.X116
W6 A8.X81 - Buchse (socket) X4 (REF EXT/INT)
W7 A7.X113 - Buchse (socket) X5 (IFWB)
W8 A7.X112 - A9.X92
W9 A8.X83 - A9.X91
W11 A6.X65 - A160.X161
W12 A160.X162 - A170.X171
W13 A6.X66 - A170.X173
W14 A170.X174 - A7.X117
W15 A7.X102 - A170.X172

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ISO-Projektion
Methode E

R&S

Änd. Zust.	Änderungs-Mitteilung	Tag	Name
01			

Maße ohne Toleranzangabe

VG:

Maßstab

Halbzeug, Werkstoff

	Tag	Name
8GEK1		
Bearb.	01.00	Se
Gepr.		
Norm		

Benennung

ESMB

MONITORING RECEIVER

ROHDE&SCHWARZ

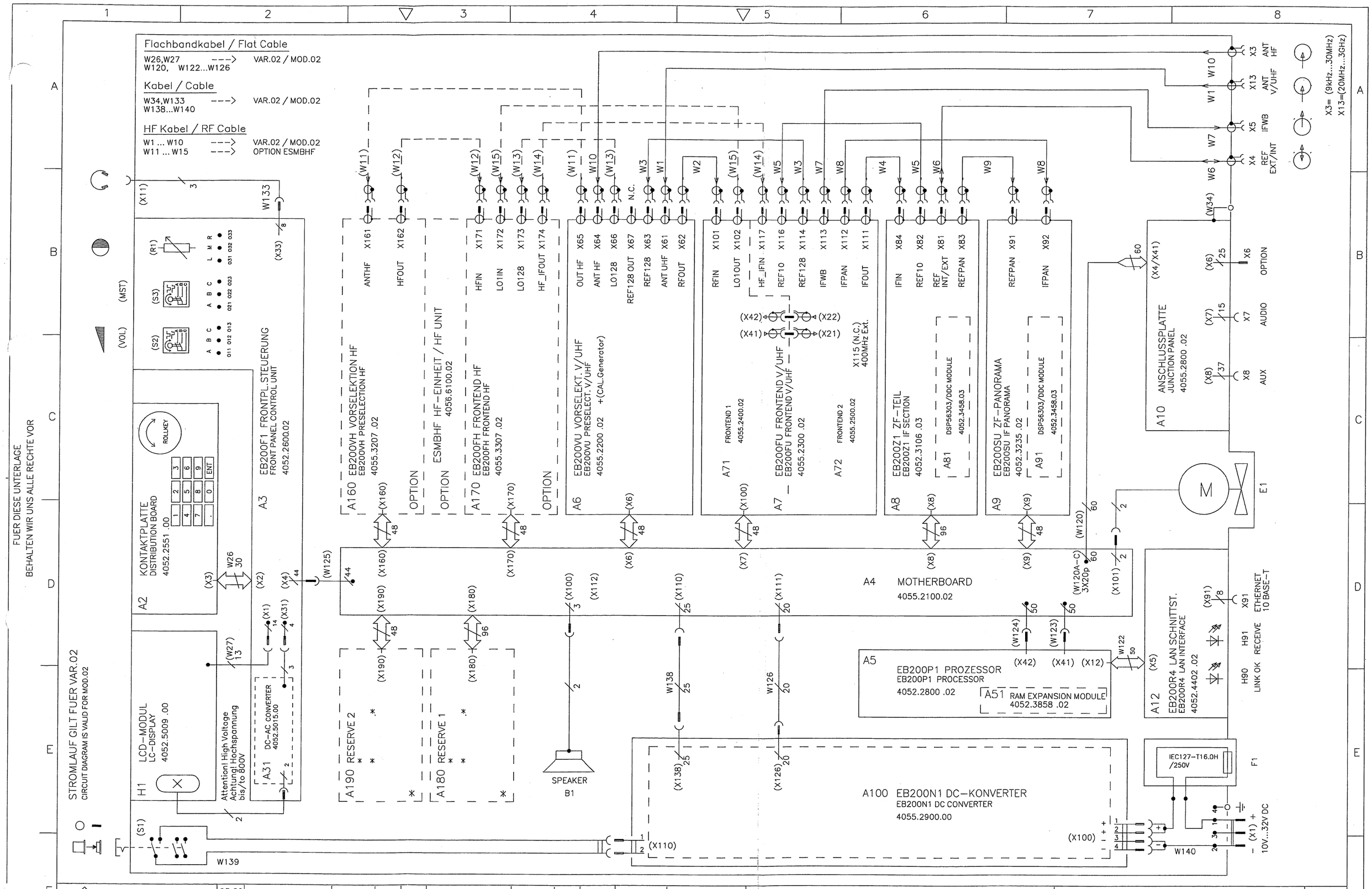
zu Gerät ESMB

Zeichn.-Nr. **4056.6000.01**

Blatt-Nr. 3 v. 3 Bl.

reg. i. V. 4056.6000.00

erste Z. 0000.0000.00



ROHDE&SCHWARZ	03.00		16.10.00	HM					8GEK	Datum	Name	Benennung	ESMB MONITORING RECEIVER	Zeichn.-Nr.	BLATT-NR.
									Bearb.		HARTMANN		ESMB MONITORING RECEIVER	4056.6000.01 S	1 +
	02.00		20.06.00	HM					Gepr.		HARTMANN	TOP/TOP.1			9
	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm			PLOTT: 00-10-17 HARTMANN	ZU GERAET ESMB	REG. I. V. 4056.6000	ERSTE Z. 4056.6000.01

FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR

OPTION ESMBHF HF-EINHEIT
ESMBHF HF UNIT
4056.6100.02

A160 EB200VH VORSELEKTION HF
EB200VH PRESELECTION HF
4055.3207.02

A170 EB200FH FRONTEND HF
EB200FH FRONTEND HF
4055.3307.02

W11 ANTHF X161
HFOUT X162
W12 HFIN X171
W13 LO128 X173
HF_IFOUT X174
W14
W15 LO1IN X172
Blatt 8 Sheet 8 (X160)
Blatt 9 Sheet 9 (X170)
A4/X160
A4/X170

A6 EB200VU VORSELEKT.V/UHF
EB200VU PRESELECTION V/UHF
4055.2200.02

X3 ANT HF (9kHz...30MHz) W10 ANT HF X64
X13 ANT V/UHF (20MHz...3GHz) W1 ANT UHF X61
OUTHF X65 W11
LO128 X66 W13
REF128 X63 W3
RFOUT X62 W2
Blatt 3 Sheet 3 (X6)

A7 EB200FU FRONTEND V/UHF
4055.2300.02

W14 HF_IFIN X117
W15 LO1OUT X102
REF128 X114
RFIN X101
Blatt 4 Sheet 4 (X100)

IFWB X113 W7
IFPAN X112 W8
IFOUT X111 W4
REF10 X116 W5

A8 EB200Z1 ZF-TEIL
EB200Z1 IF SECTION
4052.3106.03

IFIN X84
REF10 X82
Blatt 5 Sheet 5 (X8)

A9 EB200SU ZF-PANORAMA
EB200SU IF PANORAMA
4052.3235.02

IFPAN X92 W8
REFPAN X91
Blatt 6 Sheet 6 (X9)

REFPAN X83
REF INT/EXT X81 W6
W9

W7 X5 IFWB
W6 X4 REF EXT/INT

A160/X160
A170/X170

(X6) (X160) (X170) (X7) (X8) (X9)

A4 MOTHERBOARD
4055.2100.02

(X101) M E1

(W125) (X180) (X190) (X100) (W123) (W124) (X110) (X111) (W120)

(VOL) S2
(MST) S3
(CONTRAST) R1
(HEADPHONE) X11

A3 EB200F1 FRONTPL.STEUERUNG
FRONT PANEL CONTROL UNIT
4052.2600.02
(X4) (X33) (X1) (X2)

H1 LCD-MODUL
LC-DISPLAY 240X64
4052.5009.00

A2 KONTAKTPLATTE
DISTRIBUTION BOARD
4052.2551.00 (X3)

Blatt 7 Sheet 7

A180 RESERVE 1
A190 RESERVE 2

B1 SPEAKER

A100 EB200N1
DC-KONVERTER
DC CONVERTER
4055.2900.00
(X138) (X126) (X110) (X100)

S1 (POWER)

X1 10V...32V DC
F1

A10 ANSCHLUSSPLATTE
JUNCTION PANEL
4055.2800.02
(X4/X41)

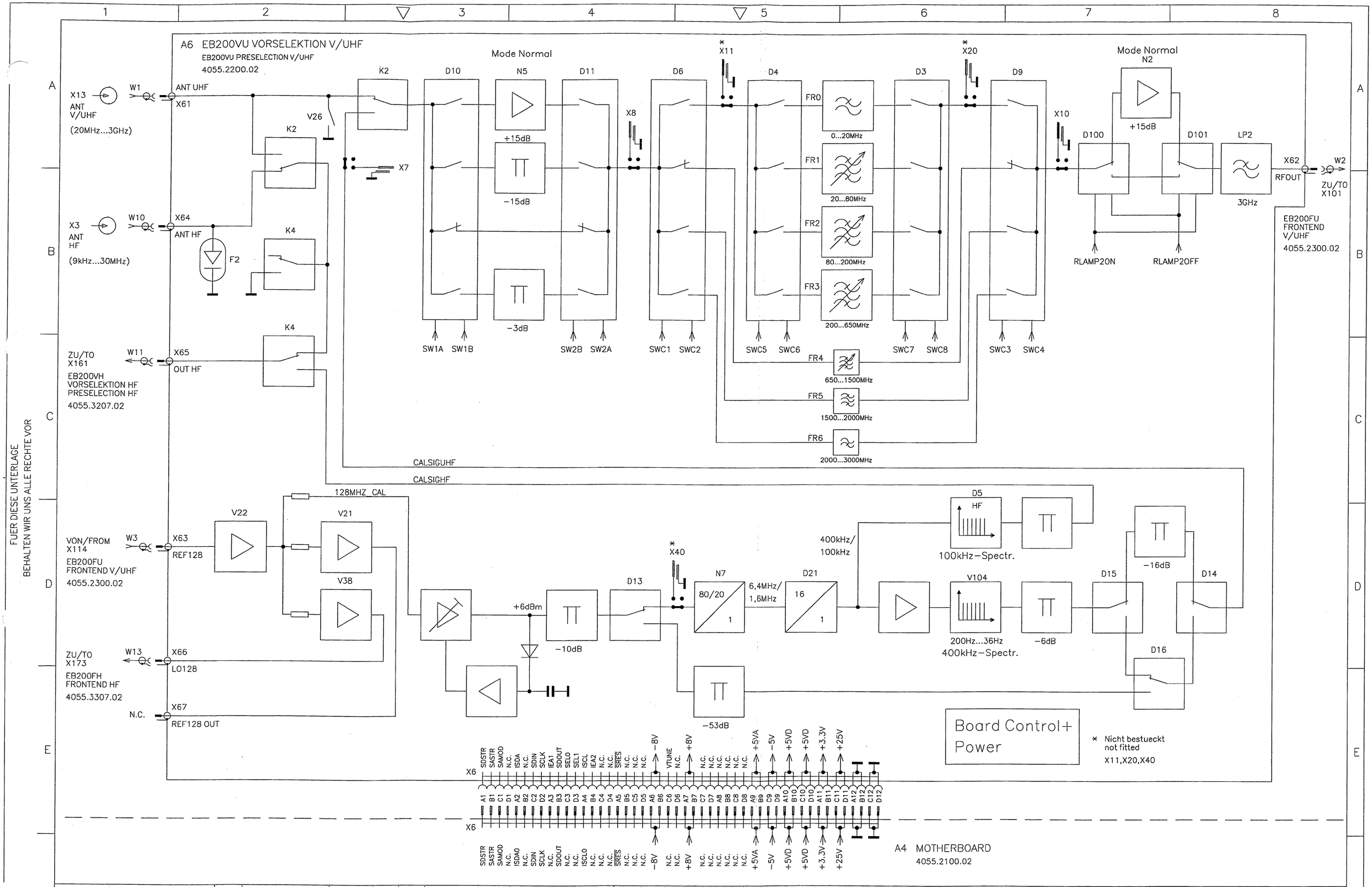
X6 OPTION
X7 AUDIO
X8 AUX

A5 EB200P1 PROZESSOR
EB200P1 PROCESSOR
4052.2800.02
(X41) (X42) (X12)

A12 EB200R4
LAN SCHNITTST.
EB200R4 LAN INTERFACE
4052.4402.02
(X5) (X91)

X91 ETHERNET 10 BASE-T

ROHDE&SCHWARZ	03.00		16.10.00	HM					8GEK	Datum	Name	Benennung	ESMB MONITORING RECEIVER	Zeichn.-Nr.	BLATT-NR.
									Bearb.		HARTMANN		ESMB MONITORING RECEIVER	4056.6000.01 S	2 + 9
	02.00		20.06.00	HM					Gepr.		HARTMANN	TOP/TOP.2			
	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm			PLOTT: 00-10-17 HARTMANN	ZU GERAET ESMB	REG. I. V. 4056.6000	ERSTE Z. 4056.6000.01



ROHDE&SCHWARZ	03.00		16.10.00	HM					8GEK	Datum	Name	Benennung	ESMB MONITORING RECEIVER	Zeichn.-Nr.	BLATT-NR.
									Bearb.		HARTMANN		ESMB MONITORING RECEIVER	4056.6000.01 S	3+
	02.00		20.06.00	HM					Gepr.		HARTMANN	TOP/TOP.3			9
	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm			PLOTT: 00-11-02 HARTMANN	ZU GERAET ESMB	REG. I. V. 4056.6000	ERSTE Z. 4056.6000.01

A7 EB200FU FRONTEND V/UHF
4055.2300.02

FRONTEND 1 (S1)

W2 / X101 RFIN 9 kHz...3 GHz — VON/FROM X62 — EB200VU VORSELEKTION V/UHF PRESELECTION V/UHF 4055.2200.02

TP1 — 1ST MIXER — DIPLEXER — 1ST_IF_AMP — ATTEN. — 1ST_IF_FILTER 3466.7 MHZ — SPUR_REJ_FILTER FG = 3600 MHZ — X41

W15 / X102 1ST LO AUX −3 DBM — ZU/TO X172 — EB200FH FRONTEND HF 4055.3307.02

VCO1 3.4 ... 4.5 GHZ
VCO2 4.5 ... 5.6 GHZ
VCO3 5.6 ... 6.6 GHZ
POWER COMBINER — AMP — AMP — 3.4–6.6 GHZ
D/A PRETUNING
ISO_AMP
SAMPLING MIXER — 19.2 ... 48 MHZ
LOOPFILTER BW = 1 MHZ
COMB_GENERATOR
SAMPL_IF (19.2 ... 48 MHZ)
1/M M= 4...11
384 MHZ REF FROM 2ND/3RD LO
FIPOL (318 ... 352 MHZ)
1/2
F = 384− 2×(384/N)
32...64 MHZ
2/1
ECL Divider — 1/N — 192 MHz — Low Phase Noise — Low Power
318 ... 352 MHZ
Gate Array — DIVIDER 1/N N= 16...32
LOOPFILTER 50...100 KHZ
from Inter-face — GATE ARRAY INTERFACE — DIVIDER CONTROL

X100 / X7

A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3	A4	B4	C4	D4	A5	B5	C5	D5	A6	B6	C6	D6
SDSTR	SASTR	SAMOD	LO_UNLOCK	ISDAO	SWCLK	SDIN	SCLK	N.C.	SDOUT	N.C.	N.C.	ISCLO	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	−8V	N.C.	N.C.	N.C.
SER_STROBE	ADR_STROBE	MOD_SEL	LO_UNLOCK	SDA	STEP_CLK	SER_DAT_IN	SER_CLOCK	EEPR_A1	SDATOUT	SEL0	SEL1	SCL	EEPR_A2	LOT_UNL	INPORT_VXO	RESET	EEPR_A1	N.C.	−5V_1	−8V	N.C.	+5V_1	+8V

A7	B7	C7	D7	A8	B8	C8	D8	A9	B9	C9	D9	A10	B10	C10	D10	A11	B11	C11	D11	A12	B12	C12	D12
+8V	N.C.	N.C.	N.C.	N.C.	N.C.	RF_OVR	N.C.	N.C.	N.C.	N.C.	−5V	+5VSTDFE	N.C.	N.C.	N.C.	+3.3V	N.C.	+25V	N.C.	N.C.	N.C.	N.C.	N.C.
+8V	N.C.	+25V_1	N.C.	N.C.	RF_OVR	RF_OVR−10	INTRES	N.C.	N.C.	−5V	+5V	+5V	+5V	+5/3V	+25V	GND_EEPR							

A4 MOTHERBOARD
4055.2100.02

FRONTEND 2 (S2)

N.C. — X115

DIPLEXER — 2ND_MIXER — DIPLEXER — 2ND_IF_AMP — DIPLEXER — 3RD_MIXER — DIPLEXER — 3RD_IF_AMP
2ND_IF_FILTER
OVERLOAD BUFFER — OVERLOAD DETECTOR
2.LO

X42
TO SYNTHESIZER LO1 384 MHZ — 384 MHZ 3RD LO

VCO — ISOLATION 60 DB — SAMPLING MIXER — 384 MHZ — 3/1 — 128 MHZ
BW: 200 KHZ

2 MHZ — 5/1 — TTL — 1/64 — TTL — VCXO 128 MHZ
D/A FOR USAGE WITHOUT EXTERNAL REFERENCE

X114 / W3 128 MHZ OUT — ZU/TO X63 — EB200VU VORSELEKTION V/UHF PRESELECTION V/UHF 4055.2200.02

X116 / W5 — VON/FROM X82 — EB200Z1 ZF−TEIL IF SECTION 4052.3106.03

X117 / W14 — VON/FROM X174 — EB200FH FRONTEND HF 4055.3307.02

BUFFER — X113 / W7 — (X5) IFWB

BUFFER — X112 / W8 — ZU/TO X92 — EB200SU ZF−PANORAMA IF PANORAMA 4052.3235.02

BUFFER — X111 / W4 — ZU/TO X84 — EB200Z1 ZF−TEIL IF SECTION 4052.3106.03

FUER DIESE UNTERLAGE BEHALTEN WIR UNS ALLE RECHTE VOR

AEND. IND.	AENDERUNGS−MITTEILUNG	DATUM	NAME
03.00		16.10.00	HM
02.00		20.06.00	HM

	DATUM	NAME
8GEK		
BEARB.		HARTMANN
GEPR.		HARTMANN
NORM		
PLOTT	00−10−17	HARTMANN

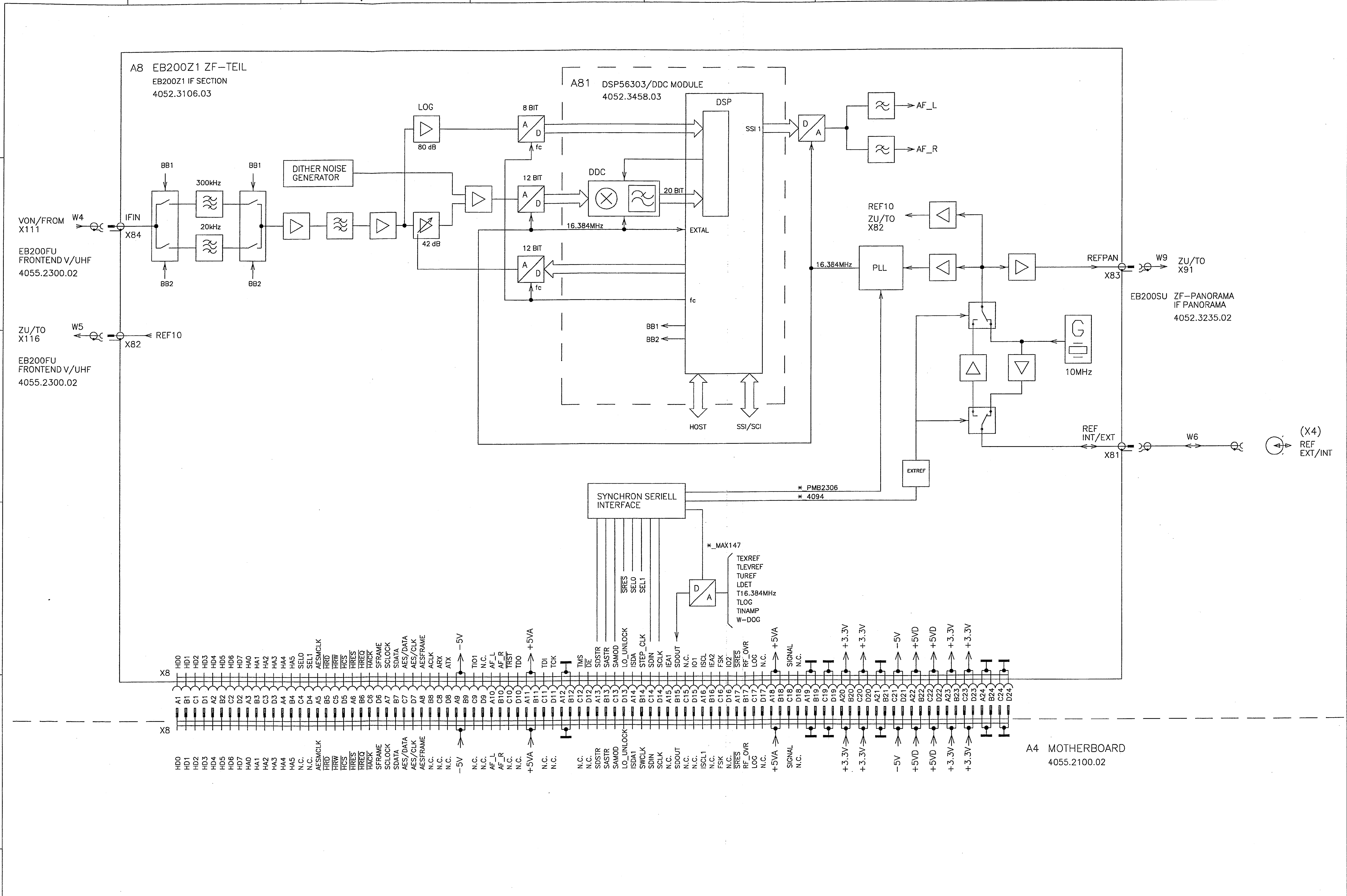
BENENNUNG
ESMB MONITORING RECEIVER
ESMB MONITORING RECEIVER
TOP/TOP.4

ROHDE&SCHWARZ

ZEICHN.−NR. 4056.6000.01 S
BLATT−NR. 4 +
V 9 BL.

ZU GERAET ESMB | REG.I.V. 4056.6000 | ERSTE Z. 4056.6000.01

FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR



03.00		16.10.00	HM					
02.00		20.06.00	HM					
Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	

8GEK	Datum	Name
Bearb.		HARTMANN
Gepr.		HARTMANN
Norm		

ROHDE&SCHWARZ

Benennung ESMB MONITORING RECEIVER
ESMB MONITORING RECEIVER
TOP/TOP.5
PLOTT: 00–10–17 HARTMANN
ZU GERAET ESMB

Zeichn.–Nr. 4056.6000.01 S

BLATT–NR. 5 + 9

REG. I. V. 4056.6000
ERSTE Z. 4056.6000.01

FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR

A9 EB200SU ZF-PANORAMA

EB200SU IF PANORAMA

4052.3235.02

A91 DSP56303/DDC MODULE
4052.3458.03

DSP

DDC

100kHz

DITHER NOISE GENERATOR

1MHz

② 12 BIT A/D

20 BIT

VON/FROM X112 W8

IFPAN X92

f=10.7MHz

① ▷

EB200FU
FRONTEND V/UHF
4055.2300.02

f=16.384MHz

EXTAL

③ f=32.768MHz

VON/FROM X83 W9

REFPAN X91

f=10MHz

PLL

④ f=32.768MHz

HOST

SSI/SCI

EB200Z1 ZF-TEIL
IF SECTION
4052.3106.03

PAN_ON

4094

*_4094

*_PMB2306

SYNCHRON SERIELL INTERFACE

*_MAX147

SRES

D/A

SUIAMP ①
SUVAD ②
SUPLL ③
SUCLOCK ④

HOST HOST

+5VD not used

X9

HD0 HD1 HD2 HD3 HD4 HD5 HD6 HD7 HA0 HA1 HA2 HA3 HA4 HA5 IO1 ASCO2 IEA1 HRD HWR HCS HRES HREQ HACK ASTDO SDSTR SASTR SAMOD ISCL ISDA SDOUT SDIN SCLK +5VA −5V +5VD SRES ASCKO +3.3V ARX ATX

A1 B1 C1 D1 A2 B2 C2 D2 A3 B3 C3 D3 A4 B4 C4 D4 A5 B5 C5 D5 A6 B6 C6 D6 A7 B7 C7 D7 A8 B8 C8 D8 A9 B9 C9 D9 A10 B10 C10 D10 A11 B11 C11 D11 A12 B12 C12 D12

X9

HD0 HD1 HD2 HD3 HD4 HD5 HD6 HD7 HA0 HA1 HA2 HA3 HA4 HA5 N.C. N.C. HRD HWR HCS HRES HREQ HACK N.C. SDSTR_D1 SASTR_D1 SAMOD_D1 ISCL1 ISDA1 SDOUT SDIN_D1 SCLK_D1 +5VA −5V +5VD SRES_D1 N.C. +3.3V ARX ATX

A4 MOTHERBOARD
4055.2100.02

03.00		16.10.00	HM					8GEK	Datum	Name	Benennung	ESMB MONITORING RECEIVER	Zeichn.-Nr. 4056.6000.01 S
								Beorb.		HARTMANN		ESMB MONITORING RECEIVER	BLATT-NR. 6+9
02.00		20.06.00	HM					Gepr.		HARTMANN	TOP/TOP.6		
Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm			PLOTT: 00-10-17 HARTMANN	ZU GERAET ESMB	REG. I. V. 4056.6000 / ERSTE Z. 4056.6000.01

ROHDE&SCHWARZ

FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR

A2 KONTAKTPLATTE
DISTRIBUTION BOARD
4052.2551.00

TONE SQU MGC MOD+ MOD- BW+ BW-
ATT AFC LEV SAVE RCL TEST
SOFT0 SOFT1 SOFT2 SOFT3 SOFT4 SOFT5 ESC SEL
LOCK 1 2 3 FRQ 4 5 6
7 8 9 MEM DP 0 ENT

COLUMN_0 COLUMN_1 COLUMN_2 COLUMN_3 COLUMN_4 COLUMN_5 COLUMN_6 COLUMN_7

ROLLKEY
HGEN_ST_S
HGEN_ST_N
HGEN_TR_S
HGEN_TR_N

X3

Keine 1:1 Verbindung
No 1 to 1 connection

W26

X2

(VOL) (S2) (MST) (S3) (R1)

C B A 013 012 011
C B A 023 022 021
L M R 031 032 033

H1 LCD-MODUL
LC-DISPLAY 240x64
4052.5009.00

LCD_CONTRAST LCD_VEE LCD_GND LCD+5V N.C. LCD_CL2 LCD_CL1 LCD_M LCD_FLM LCD_DATA3 LCD_DATA2 LCD_DATA1 LCD_DATA0

W27

X1

N.C. LCD_CONTRAST LCD-15V +5VLCD N.C. LCD_CL2 LCD_CL1 LCD_M LCD_FLM LCD_DATA3 LCD_DATA2 LCD_DATA1 LCD_DATA0

A31 DC/AC CONVERTER
4052.5015.00

N.C. BRIGHTNESS +5VD2

X31

(X11) C R L

W133

X33

PWROFF PWRON PWRC N.C. COD. HEADPHONE_GND HEADPHONE_R HEADPHONE_L

AGND

LCD CONTROL DC/DC
+5VD2 +5V ADJUST −8V...−15V

uC

DAC
uC PIEP PIEP

AF_R AF_L AF_GND AGND

SPKR_INT1 SPKR_INT2
SPEAKER_OFF
AFLINE_R AFLINE_R
AFSYM1 AFSYM2 AFMONO

PROGRAMMING BUS
HOST COM
+5V / +3.3V

A3 EB200F1 FRONTPL.STEUERUNG
FRONT PANEL CONTROL UNIT
4052.2600.02

X4

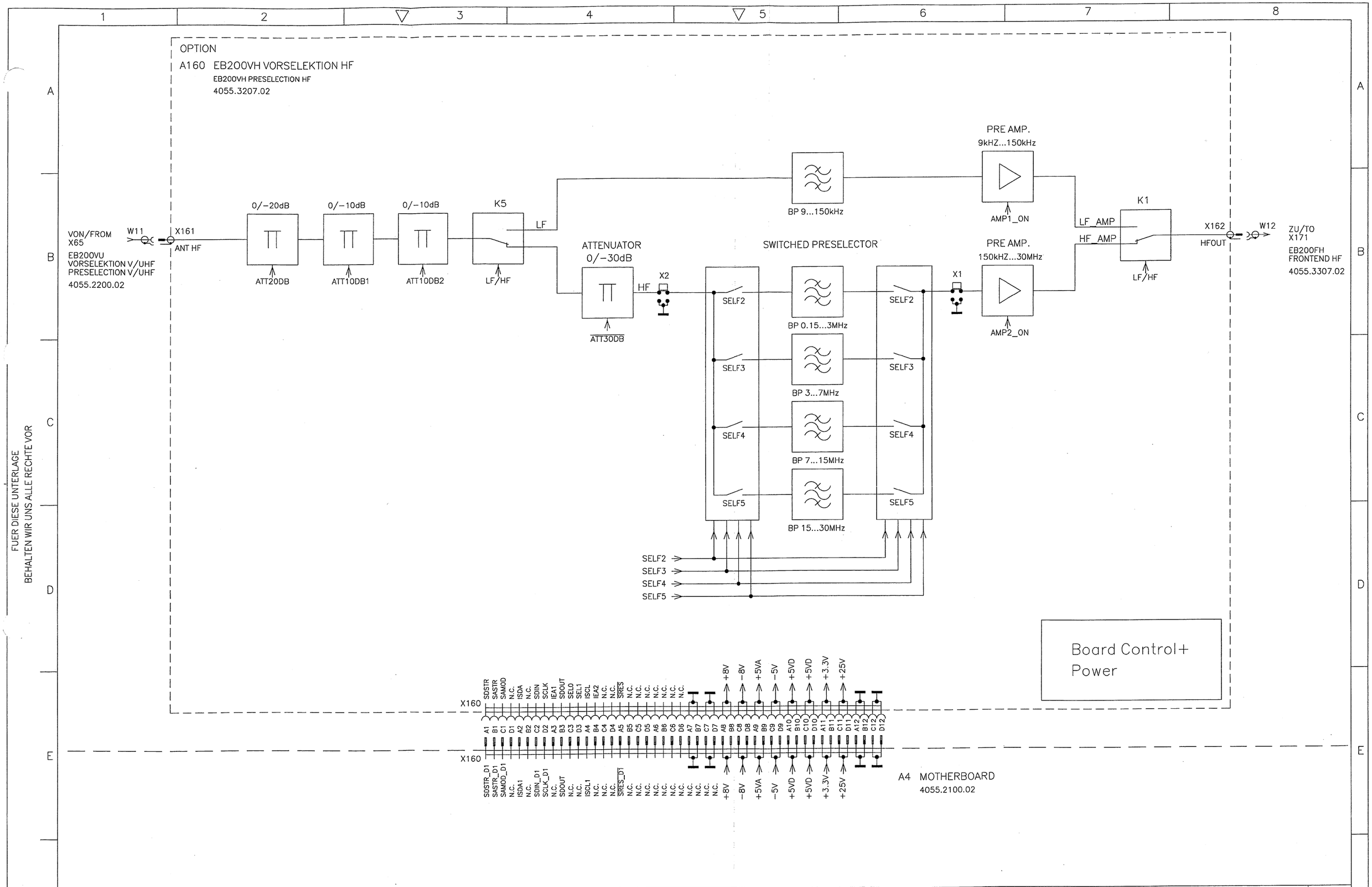
AF_L AF_R AFGND AFMONO AFSYM1 AFSYM2 AFLINE_L AFLINE_R SPKR_INT1 SPKR_INT2 PWRON PWROFF PWRC −5V +5VD +3.3V ISCL ISDA TMS TCK TDO TDI N.C. FRES FRXD FTXD FCL2 FCL1 FM FFLM FD3 FD2 FD1 FD0

GND GND AF_L AF_R AFGND AFMONO AFSYM1 AFSYM2 AFLINE_L AFLINE_R SPKR_INT1 SPKR_INT2 N.C. N.C. N.C. GND −5V +5VD +5VD +3.3V ISCL ISDA N.C. N.C. N.C. N.C. +5VA FRES FRXD FTXD GND GND FCL2 FCL1 FM FFLM FD3 FD2 FD1 FD0 GND GND GND

W125 ZU/TO MOTHERBOARD 4055.2100.02

FLACHBANDKABEL / FLAT CABLE

ROHDE&SCHWARZ	03.00		16.10.00	HM					8GEK	Datum	Name	Benennung	ESMB MONITORING RECEIVER	Zeichn.-Nr.	BLATT-NR.
									Bearb.		HARTMANN		ESMB MONITORING RECEIVER	4056.6000.01 S	7+9
	02.00		20.06.00	HM					Gepr.		HARTMANN	TOP/TOP.7			
	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm			PLOTT: 00-10-17 HARTMANN	ZU GERAET ESMB	REG. I. V. 4056.6000	ERSTE Z. 4056.6000.01



FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR

ROHDE&SCHWARZ	03.00		16.10.00	HM					8GEK	Datum	Name	Benennung ESMB MONITORING RECEIVER	Zeichn.-Nr. 4056.6000.01 S	BLATT-NR. 8+9
									Bearb.		HARTMANN	ESMB MONITORING RECEIVER		
	02.00		20.06.00	HM					Gepr.		HARTMANN	TOP/TOP.8		
	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm			PLOTT: 00-10-17 HARTMANN / ZU GERAET ESMB	REG. I. V. 4056.6000 / ERSTE Z. 4056.6000.01	

OPTION

A170 EB200FH FRONTEND HF

4055.3307.02

VON/FROM X162

W12

EB200VH VORSELEKTION HF PRESELECTION HF

4055.3207.02

X171

HFIN

9kHz...30MHz

30MHz

X31

A1 1. MIXER

X32

IF LOAD

X33

B1 53.3MHz BW:+/-5kHz

V1 IF1 AMPLIFIER

X51

V2

X53

U2 2. MIXER

X54

V5 IF2 AMPLIFIER

10.7MHz

X174

HF_IFOUT

10.7MHz

W14

ZU/TO X117

EB200FU FRONTEND V/UHF

4055.2300.02

LO1 POWER AMP.

X34

LO1 PREAMP 1+2

X52

LO2 64MHz

VON/FROM X102

W15

EB200FU FRONTEND V/UHF

4055.2300.02

X172

LO1IN

3411.84MHz... 5331.2MHz

N4 4/1

N8

N7 16/1

VON/FROM X66

W13

EB200VU VORSELEKTION V/UHF PRESELECTION V/UHF

4055.2200.02

X173

LO128

128MHz

D4 2/1

V12

Board Control+ Power

X170

A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3	A4	B4	C4	D4	A5	B5	C5	D5	A6	B6	C6	D6
SDSTR	SASTR	SAMOD	N.C.	ISDA	N.C.	SDIN	SCLK	IEA1	SDOUT	SELO	SEL1	ISCL	IEA2	N.C.	N.C.	SRES	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

A7	B7	C7	D7	A8	B8	C8	D8	A9	B9	C9	D9	A10	B10	C10	D10	A11	B11	C11	D11	A12	B12	C12	D12
N.C.	N.C.	N.C.	N.C.	+8V	-8V	+5VA	-5V	+5VD	+5VD	+3.3V	+25V												

X170

A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3	A4	B4	C4	D4	A5	B5	C5	D5	A6	B6	C6	D6
SDSTR_D1	SASTR_D1	SAMOD_D1	N.C.	ISDA1	N.C.	SDIN_D1	SCLK_D1	N.C.	SDOUT	N.C.	N.C.	ISCL1	N.C.	N.C.	N.C.	SRES_D1	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

A7	B7	C7	D7	A8	B8	C8	D8	A9	B9	C9	D9	A10	B10	C10	D10	A11	B11	C11	D11	A12	B12	C12	D12
N.C.	N.C.	N.C.	N.C.	+8V	-8V	+5VA	-5V	+5VD	+5VD	+3.3V	+25V												

A4 MOTHERBOARD

4055.2100.02

FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR

ROHDE&SCHWARZ

Aend. Zust.	Aenderunsmitteilung	Datum	Name	Aend. Zust.	Aenderunsmitteilung	Datum	Name	Norm
03.00		16.10.00	HM					8GEK
								Bearb.
02.00		20.06.00	HM					Gepr.

	Datum	Name
8GEK		
Bearb.		HARTMANN
Gepr.		HARTMANN

Benennung ESMB MONITORING RECEIVER

ESMB MONITORING RECEIVER

TOP/TOP.9

Zeichn.-Nr. 4056.6000.01 S

BLATT-NR. 9-9

PLOTT: 00-10-17 HARTMANN | ZU GERAET ESMB | REG. I. V. 4056.6000 | ERSTE Z. 4056.6000.01

FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR

A160/X160 EB200VH PRESELECTION HF

A170/X170 EB200FH FRONTEND HF

JUNCTION BUS

I2C BUS

HOST BUS

SERIAL BUS

AUDIO_BUS

SERIAL BUS

HOST BUS

I2C BUS

JUNCTION BUS

FRONT_BUS FD[0:3],FCL1,FCL2,FFLM,FM,~FTXD,~FRXD,~FRES

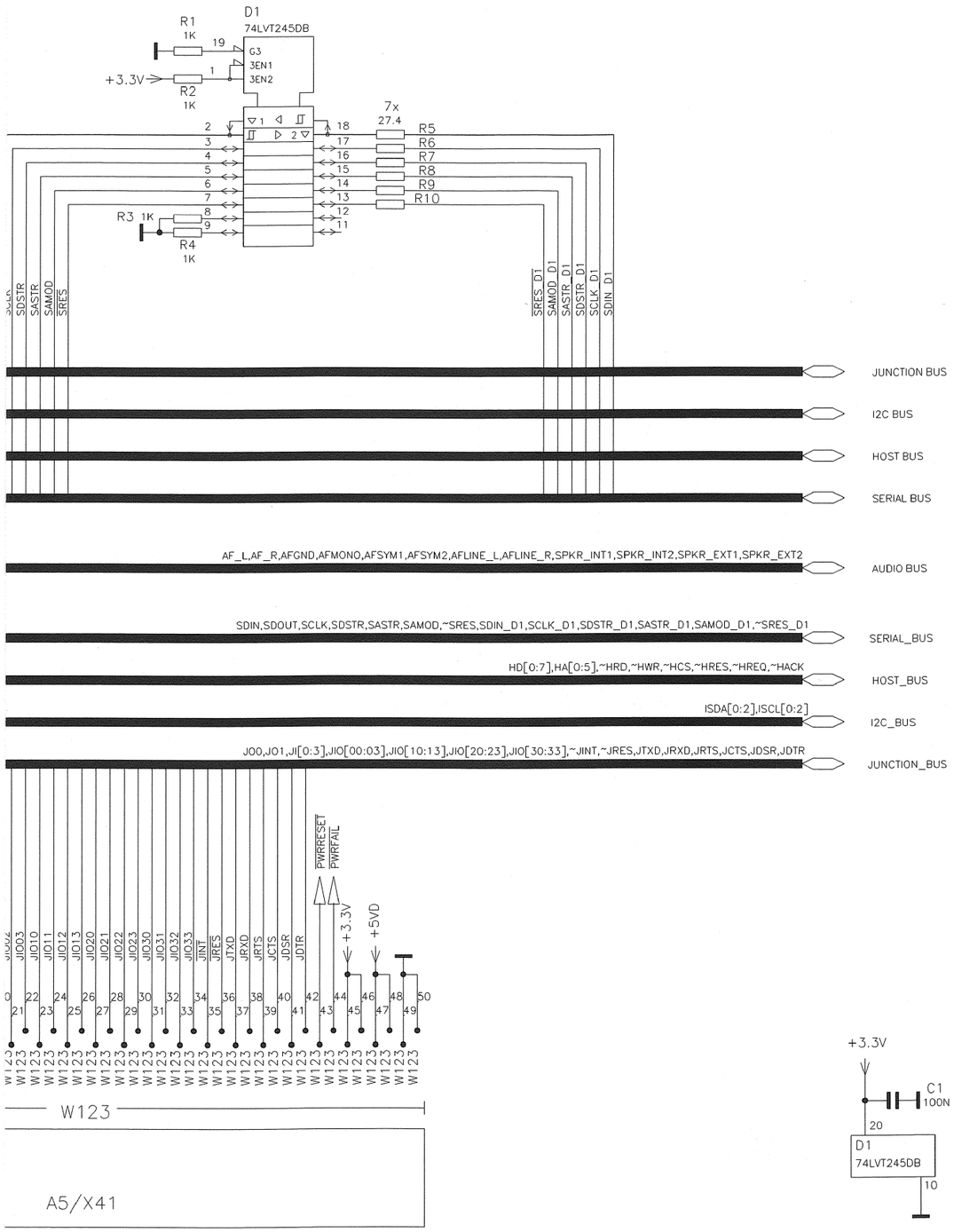
W125

W124

A3/X4 EB200F1 FRONT PANEL CONTROL UNIT

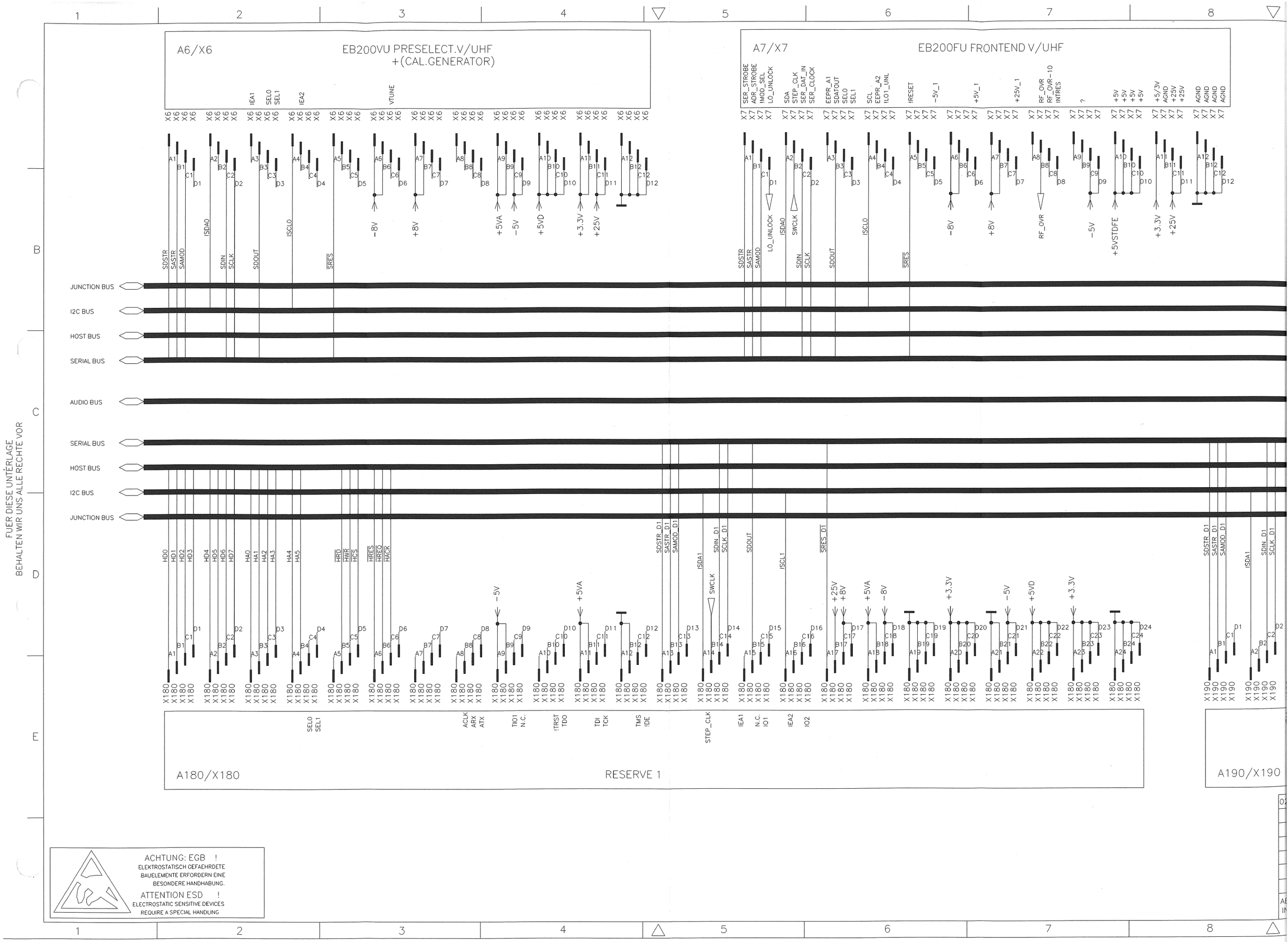
A5/X42 EB200P1 PROCESSOR

ACHTUNG: EGB !
ELEKTROSTATISCH GEFAEHRDETE
BAUELEMENTE ERFORDERN EINE
BESONDERE HANDHABUNG.
ATTENTION ESD !
ELECTROSTATIC SENSITIVE DEVICES
REQUIRE A SPECIAL HANDLING



.00				8GEK2	DATUM	NAME	BENENNUNG
				BEARB.		HM	MOTHERBOARD
				GEPR.		HM	
				NORM			MOTHERBOARD
				PLOTT	99-12-17	HANKE	TOP/TOP.1
				ROHDE&SCHWARZ			ZEICHN.-NR. 4055.2100.01 S
							BLATT-NR. 1 + 3
ND. ID.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET EB200I		REG.I.V. 4053.4606	ERSTE Z. 4053.4606.01

9 10 11 12


A6/X6
EB200VU PRESELECT.V/UHF
+(CAL.GENERATOR)
A7/X7
EB200FU FRONTEND V/UHF
JUNCTION BUS
I2C BUS
HOST BUS
SERIAL BUS
AUDIO BUS
SERIAL BUS
HOST BUS
I2C BUS
JUNCTION BUS
A180/X180
RESERVE 1
A190/X190
FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR
ACHTUNG: EGB !
ELEKTROSTATISCH GEFAEHRDETE
BAUELEMENTE ERFORDERN EINE
BESONDERE HANDHABUNG.
ATTENTION ESD !
ELECTROSTATIC SENSITIVE DEVICES
REQUIRE A SPECIAL HANDLING

A

E

C

D

E

F

J00,JO1,JI[0:3],JIO[00:03],JIO[10:13],JIO[20:23],JIO[30:33],~JINT,~JRES,JTXD,JRXD,JRTS,JCTS,JDSR,JDTR — JUNCTION_BUS

ISDA[0:2],ISCL[0:2] — I2C_BUS

HD[0:7],HA[0:5],~HRD,~HWR,~HCS,~HRES,~HREQ,~HACK — HOST_BUS

SDIN,SDOUT,SCLK,SDSTR,SASTR,SAMOD,~SRES,SDIN_D1,SCLK_D1,SDSTR_D1,SASTR_D1,SAMOD_D1,~SRES_D1 — SERIAL_BUS

AF_L,AF_R,AFGND,AFMONO,AFSYM1,AFSYM2,AFLINE_L,AFLINE_R,SPKR_INT1,SPKR_INT2,SPKR_EXT1,SPKR_EXT2 — AUDIO_BUS

SDIN,SDOUT,SCLK,SDSTR,SASTR,SAMOD,~SRES,SDIN_D1,SCLK_D1,SDSTR_D1,SASTR_D1,SAMOD_D1,~SRES_D1 — SERIAL_BUS

HD[0:7],HA[0:5],~HRD,~HWR,~HCS,~HRES,~HREQ,~HACK — HOST_BUS

ISDA[0:2],ISCL[0:2] — I2C_BUS

J00,JO1,JI[0:3],JIO[00:03],JIO[10:13],JIO[20:23],JIO[30:33],~JINT,~JRES,JTXD,JRXD,JRTS,JCTS,JDSR,JDTR — JUNCTION_BUS

SDOUT ISCL1 SRES_D1

+8V −8V +5VA −5V +5VD +3.3V +25V

D3 D4 D5 D6 D7 D8 D9 D10 D11 D12

C3 C4 C5 C6 C7 C8 C9 C10 C11 C12

B3 B4 B5 B6 B7 B8 B9 B10 B11 B12

A3 A4 A5 A6 A7 A8 A9 A10 A11 A12

X190

SEL0 SEL1 IEA2

RESERVE 2

.00				8GEK2	DATUM	NAME	BENENNUNG
				BEARB.		HM	MOTHERBOARD
				GEPR.		HM	MOTHERBOARD
				NORM			TOP/TOP.2
				PLOTT	99-12-17	HANKE	
ND. D.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ			ZEICHN.-NR. 4055.2100.01 S
				ZU GERAET EB200I		REG.I.V. 4053.4606	ERSTE Z. 4053.4606.01

BLATT-NR. 2 + 3

FUER DIESE UNTERLAGE BEHALTEN WIR UNS ALLE RECHTE VOR

A8/X8

EB200Z2 IF SECTION

A9/X9

SEL0 SEL1 — ACLK ARX ATX — TIO1 N.C. — !TRST TDO — TDI TCK — TMS !DE — STEP_CLK — IEA1 N.C. IO1 — IEA2 IO2 — N.C. — N.C.

HD0 HD1 HD2 HD3 — HD4 HD5 HD6 HD7 — HA0 HA1 HA2 HA3 — HA4 HA5 — HRD HWR HCS — HRES HREQ HACK — SFRAME — SCLOCK SDATA AES/DATA AES/CLK — AESFRAME — −5V — AF_L AF_R — +5VA — SDSTR SASTR SAMOD — LO_UNLOCK — ISDA1 — SDIN SWCLK SCLK — SDOUT — ISCL1 — FSK — SRES — RF_OVR LOG — +5VA SIGNAL — +3.3V — −5V — +5VD — +3.3V

I2C BUS

HOST BUS — HD[0:7],HA[0:5],~HRD,~HWR,~HCS,~HRES,~HREQ,~HACK

SERIAL BUS — SDIN,SDOUT,SCLK,SDSTR,SASTR,SAMOD,~SRES,SDIN_D1,SCLK_D1,SDSTR_D1,SAS

AUDIO BUS

SERIAL BUS — SDIN,SDOUT,SCLK,SDSTR,SASTR,SAMOD,~SRES,SDIN_D1,SCLK_D1,SDSTR_D1,SASTR_D1,SAMOD_D1,~SRES_D1

HOST BUS — HD[0:7],HA[0:5],~HRD,~HWR,~HCS,~HRES,~HREQ,~HACK

I2C BUS — ISDA[0:2],ISCL[0:2]

JUNCTION BUS — JO0,JO1,JI[0:3],JIO[00:03],JIO[10:13],JIO[20:23],JIO[30:33],~JINT,~JRES,JTXD,JRXD,JRTS,JCTS,JDSR,JDTR

+25V +8V −8V +5VA −5V N.C. +5VSTDFE +5VD N.C. +3.3V +3.3V N.C. GNDFAN +12VFAN

X110 … X110 — W138

ISDA2 ISCL2 — PWRRESET PWRFAIL — SDSTR_D1 SASTR_D1 SAMOD_D1 SDIN_D1 SCLK_D1 SDOUT SRES_D1

X111 … X111 — W126

SPKR_INT1 SPKR_EXT1 — SPEAKER EXTERN — X112A X112B — SPKR_EXT2 SPKR_INT2

SPKR_1 — SPEAKER INTERN — SPKR_2

X100 X100 X100 (Cod.)

+12VFAN GNDFAN

X101 X101

SFRAME SDATA SCLOCK JDTR JDSR JCTS

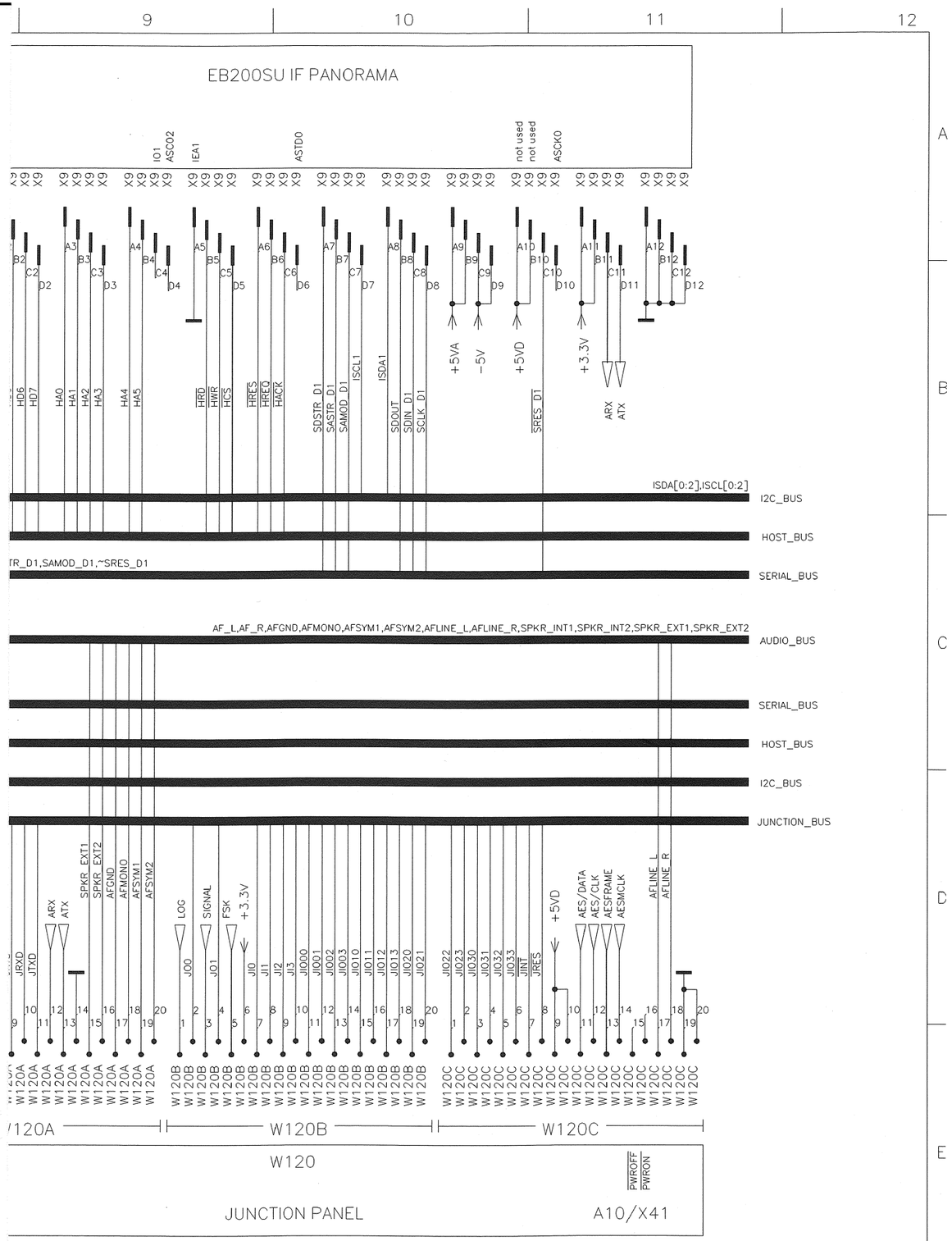
W120A … W120A — W

A10/X4

(TEST3) (TEST2) (TEST1) — IEA1 IEA2 — SEL0 N.C. SEL1

A100 EB200N1 POWER UNIT

ACHTUNG: EGB !
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD !
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING



2.00				8GEK2	DATUM	NAME	BENENNUNG
				BEARB.		HM	MOTHERBOARD
				GEPR.		HM	MOTHERBOARD
				NORM			TOP/TOP.3
				PLOTT	99-12-17	HANKE	
				ROHDE&SCHWARZ			ZEICHN.-NR. 4055.2100.01 S
END. / ND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET EB200I			REG.I.V. 4053.4606 ERSTE Z. 4053.4606.01

BLATT-NR. 3 - 3

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FROM MOTHERBOARD

OPTION

GND	X4	1		
GND	X4	2		
SFRAME	X4	3	SFRAME	
SDATA	X4	4	SDATA	
SCLOCK	X4	5	SCLOCK	
JDTR	X4	6	JDTR	
JDSR	X4	7	JDSR	
JCTS	X4	8	JCTS	
JRTS	X4	9	JRTS	
JRXD	X4	10	JRXD	
JTXD	X4	11	JTXD	
ARX	X4	12	ARX	
ATX	X4	13	ATX	
GND	X4	14		
SPKR EXT1	X4	15	SPKR_EXT1	
SPKR EXT2	X4	16	SPKR_EXT2	
AFGND	X4	17	AFGND	
AFMONO	X4	18	AFMONO	
AFSYM1	X4	19	AFSYM1	
AFSYM2	X4	20	AFSYM2	
LOG	X4	21	LOG	
JO0	X4	22	JO0	
SIGNAL	X4	23	SIGNAL	
JO1	X4	24	JO1	
FSK	X4	25	FSK	
+3.3V	X4	26	→ +3.3V	

AUDIO

AFGND

AUX

JI0	X41	27	JI0	
JI1	X41	28	JI1	
JI2	X41	29	JI2	
JI3	X41	30	JI3	
JIO00	X41	1	JIO00	
JIO01	X41	2	JIO01	
JIO02	X41	3	JIO02	
JIO03	X41	4	JIO03	
JIO10	X41	5	JIO10	
JIO11	X41	6	JIO11	
JIO12	X41	7	JIO12	
JIO13	X41	8	JIO13	
JIO20	X41	9	JIO20	
JIO21	X41	10	JIO21	
JIO22	X41	11	JIO22	
JIO23	X41	12	JIO23	
JIO30	X41	13	JIO30	
JIO31	X41	14	JIO31	
JIO32	X41	15	JIO32	
JIO33	X41	16	JIO33	
JINT	X41	17	JINT	
JRES	X41	18	JRES	
+5VD	X41	19	→ +5VD	
+5VD	X41	20		
AES/DATA	X41	21	AES/DATA	
AES/CLK	X41	22	AES/CLK	
AESFRAME	X41	23	AESFRAME	
AESMCLK	X41	24	AESMCLK	
N.C.	X41	25		
N.C.	X41	26		
AFLINE L	X41	27	AFLINE_L	C2 22N
AFLINE R	X41	28	AFLINE_R	C3 22N
GND	X41	29		
GND	X41	30		

X8 AUX

JI0	1	2	X8
JI2	3		X8
JIO00	4		X8
JIO02	5		X8
JIO10	6		X8
JIO12	7		X8
JIO20	8		X8
JIO22	9		X8
JIO30	10		X8
JIO32	11		X8
JINT	12		X8
N.C.	13		X8
N.C.	14		X8
+AUX5VD3 →	15		X8
AES/CLK	16		X8
AESMCLK	17		X8
N.C.	18		X8
JI1	19		X8
JI3	20		X8
JIO01	21		X8
JIO03	22		X8
JIO11	23		X8
JIO13	24		X8
JIO21	25		X8
JIO23	26		X8
JIO31	27		X8
JIO33	28		X8
JRES	29		X8
N.C.	30		X8
N.C.	31		X8
AUX3.3V →	32		X8
AES/DATA	33		X8
AESFRAME	34		X8
	35		X8
	36		X8
	37		X8

X7 AUDIO

C1 10N

SPKR_EXT1	1	2	X7
AFGND	2		X7
AFSYM1	3		X7
AFLINE_L	4		X7
LOG	5		X7
SIGNAL	6		X7
FSK	7		X7
+AUX5VD2 →	8		X7
SPKR_EXT2	9		X7
AFMONO	10		X7
AFSYM2	11		X7
AFLINE_R	12		X7
JO0	13		X7
JO1	14		X7
	15		X7

C4 22N

X6 OPTION

JTXD	1	2	X6
JRXD	3		X6
JRTS	4		X6
JCTS	5		X6
JDSR	6		X6
	7		X6
N.C.	8		X6
ARX	9		X6
N.C.	10		X6
N.C.	11		X6
SFRAME	12		X6
	13		X6
+AUX5VD1 →	14		X6
N.C.	15		X6
N.C.	16		X6
N.C.	17		X6
N.C.	18		X6
N.C.	19		X6
JDTR	20		X6
N.C.	21		X6
N.C.	22		X6
ATX	23		X6
SCLOCK	24		X6
SDATA	25		X6

+5VD →	F1	1 2	→ +AUX5VD1 zu/to X6
		0,A14	
	F2	1 2	→ +AUX5VD2 zu/to X7
		0,A14	
	F3	1 2	→ +AUX5VD3 zu/to X8
		0,A14	
+3.3V →	F4	1 2	→ +AUX3.3V zu/to X8
		0,A14	

ACHTUNG: EGB !
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD !
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

ROHDE&SCHWARZ	Benennung: / Designation: ANSCHLUSSPLATTE JUNCTION PANEL			Sprache: / Lang.: DE	Aei: / C.I.: 01.01	Blatt: / Sh.: 1–
Typ: / Type: EB2001	Datum: / Date: 99–07–19	Abteilung: / Dpt: 8GEK2	Name: / Name: HARTMANN	Zeichn. Nr.: / Drawing No.: 4055.2800.01 S		
1. Z.: / used in: 4053.4606.01	TOP/TOP.1					