R&S® EB500
Monitoring Receiver
Operating Manual

4072.8426.02 — 08

Radiomonitoring & Radiolocation

Operating Manual

ROHDE&SCHWARZ

This manual describes the following models and options:

- R&S®EB500 Monitoring Receiver 4072.5004.02 (without front control panel)
- R&S®EB500 Monitoring Receiver 4072.5004.03 (with front control panel)

The firmware of the R&S EB500 makes use of several valuable open source software packages. Please refer to the "Open Source Acknowledgement" document (4072.8561.02) for a summary of the packages and the verbatim license texts.
Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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The following abbreviations are used throughout this manual: R&S®EB500 is abbreviated to R&S EB500.

Contents

1 Characteristics

1.1 Use

The R&S EB500 has been designed for tasks such as signal searches, radio monitoring or spectrum monitoring in line with ITU recommendations. It is suitable for both mobile and stationary use. The R&S EB500 is ready to meet future requirements in signal receiver and analysis technology. With the available options, the R&S EB500 can be optimally adapted to the tasks to be performed. There is sufficient performance capability in signal processing which will allow the device to be expanded for future tasks. The R&S EB500 can be remote-controlled via its LAN interface. Since the protocol on the remote-control interface is compatible with other products from Rohde & Schwarz, the R&S EB500 can easily be integrated into any new or existing system.

1.2 Description

The basic version of the R&S EB500 covers the wide frequency range from 20 MHz to 3.6 GHz. An optional plug-in HF Preselector module makes it possible to expand the frequency range down to 9 kHz and an optional software option can expand the frequency range up to 6 GHz. The R&S EB500 is outstanding, particularly due to its wide frequency range, excellent receive characteristics, a real-time bandwidth of 20 MHz, and a wealth of functions, all accessible through its intuitive front panel and 5.7” color display.

Although operation has been optimized for monitoring tasks, its adaptable functions allow the R&S EB500 to be employed in other areas as well, especially where real time signal analysis is required. Because the R&S EB500 is equipped with extensive preselection functions, the signal sum load is reduced in scenarios that involve a large number of powerful transmitters. All the functions of the R&S EB500 can be remote-controlled via the LAN interface. All measurement results, including the spectrum data, are output via this interface.

The R&S EB500 lends itself particularly well to the following tasks (see also chapter 1.3, "Application Examples", on page 11):

- Quick overview of the activities in a user-definable frequency range
- Monitoring of predefined frequencies
- Storage of up to 10 000 frequencies
- Searches in the frequency range with user-definable start and stop frequency and fixed step width
- Searches for and analysis of interfering signals
- Detection of illegal transmitters
- Monitoring of radio and navigation services that are relevant to safety
- Monitoring of self-conducted radiocommunications training exercises in a specific frequency band

- Monitoring of selected emissions
- Radiomonitoring for tactical and strategic intelligence
- Radiomonitoring for internal and external security
- Monitoring in line with ITU recommendations
- Coverage measurements and monitoring of networks
- Storage of spectra or digital baseband data, internal and external
- Analysis of digital signals

Frontend

The frontend modules of the R&S EB500 consist of an RF converter module, a synthesizer module and an optional HF preselection module. There are two antenna inputs, HF/V/UHF and HF are fed into the RF converter module.

With the HF option installed, signals from 9 kHz to 32 MHz can be obtained (which covers the full HF range from 3 MHz to 30 MHz). The desired antenna input (HF/V/UHF or HF) is selected and routed to the HF preselection module for preselection. The HF preselected signal is then routed to the HF A/D Converter for further processing in the digital domain. The upper limit for the HF preselection module can be set in the antenna configuration menu.

Otherwise, for V/UHF signals above 20 MHz, the input is only obtained from the HF/V/UHF antenna input. This signal is then preselected and down-converted into the IF signal which is fed into the IF A/D Converter for further processing in the digital domain.

Digital signal processing

All signal processing is performed by means of powerful signal processors and field programmable gate arrays (FPGAs).

The incoming IF signal, which is approximately 57.4 MHz, or direct HF signal is fed to the respective 16 bit A/D converter and first converted to digital samples with a sampling rate of 76.8 MHz. These samples are then processed in two separate paths, namely, the IF Panorama path and the Demodulation path. The R&S EB500 features a real time bandwidth of 20 MHz. The IF Panorama path starts with a Digital Down Conversion block, digital low-pass filter and FFT block. The bandwidth of the spectrum can be configured by the user in the range of 1 kHz to 20 MHz. Before the IF spectrum is output on the display or via the LAN interface, results are post-processed by means of the AVERAGE, CLEARWRITE, MINHOLD or MAXHOLD function as selected by the user.

The Demodulation path starts with a second Digital Down Conversion block and low-pass filter, which are used to prepare the signal for level measurement, ITU measurement and demodulation. To process the different signals with the optimum signal-to-noise ratio, the receiver contains 29 IF filters with bandwidths from 100 Hz to 5 MHz, which can be selected independently of the IF panorama bandwidth. Prior to the level measurement, the magnitude of the level is determined and weighted by means of the AVERAGE, PEAK, RMS or FAST function, as selected by the user. Next, the measured level is output via the display or the LAN interface. For the demodulation of analog signals, the complex baseband data after the low-pass filter is fed to the AM, FM, USB, LSB, ISB, pulse or CW demodulation stage and then subjected to the automatic gain control (AGC) or manual gain control (MGC). The complex baseband data (I/Q data) representing the digitized signal or video data is output directly following the AGC/MGC block via the LAN interface. The results that are obtained are available in digital format and can be output as required via the LAN interface. The analog video/IF output is fed through the D/A converter and then output to the Video A/B output port. The digital audio data are output via the LAN and also reconverted to analog signals for output via the loudspeaker.

1.3 Application Examples

Quick search in the frequency range

The R&S EB500 "Panorama Scan" function is used to perform an ultra-quick scan of a user-definable frequency range. It thus provides a quick overview of the spectrum occupancy. Changes caused by illegal radio services, interferences, transient emissions etc can immediately be seen at a glance. The R&S EB500 can be switched to "listen" mode simply by pressing a key. The signal of interest can be selected, demodulated, and analyzed by using the demodulation frequency. The resolution of the FFT calculation can be set according to the channel spacing of various radio services. Thus, this FFT scan provides highest scan rates even with small resolution bandwidth, a big advantage when weak signals must be detected quickly.

Search using channel spacing

The "Frequency Scan" function is used to perform searches in the frequency range using fixed channel spacing. The receiver scans the frequency range and analyzes every channel for occupancy. If a signal is above the threshold, the R&S EB500 dwells at the signal's frequency for the predefined hold time, and the signal can be demodulated and processed. In the case of analog methods, the demodulated signal is audible on the loudspeaker or headphones.

The "Frequency Scan" function is specially designed for the monitoring of radio services that employ fixed frequency spacing (channel spacing).

Searches at specific frequencies

The "Memory Scan" function is used to scan a series of predefined channels and analyze them for occupancy. If a signal is above the threshold, the R&S EB500 dwells at the signal's frequency for the predefined hold time, and the signal can be demodulated and processed. In the case of analog methods, the demodulated signal is audible on the loudspeaker or headphones.

In this mode, parameters such as frequency, demodulation mode, bandwidth or squelch levels can be set individually for each channel. The content of each memory channel can be transferred to the receiver manually by using the MEM > "RCL" keys. The settings can also be changed and then stored in memory by means of the MEM > "SAVE" keys. The parameters for multiple channels can be set by calling up a display table.

This scan is especially useful when it is necessary to scan individual frequencies that do not have fixed channel spacing, or when frequency blocks need to be scanned at regular intervals (e.g. f1, f2, f3, f1, f2, f3, etc).

Demodulation and analysis

Analog modulated signals are demodulated in the R&S EB500. The signal is audible on the built-in loudspeaker or via headphones. A PC-based software application is available for analyzing complex signals. This application provides a large number of functions such as classification (detection of modulation mode), vector analysis, bit-stream analysis or decoding.

For online analysis, the digital data is transferred from the receiver to the PC via LAN in real time. For offline analysis, the software accesses data that was recorded in the R&S EB500 itself or externally.

Interference search

Owing to its compact design and many special functions, the R&S EB500 is ideally suited for detecting all kinds of radio interference. Special functions such as adjustable measurement time and continuous (averaged) or periodic (maximum value after timeout of the measurement) level output have been integrated for these tasks. Since these functions are also applied in the RF spectrum, even non-periodic interferers can be easily detected, which are otherwise easy to miss in a quick spectrum because they occur at erratic intervals. As a result, the source of interference can be quickly detected and eliminated – an aspect that is extremely important in security-critical radio communications (e.g. air-traffic communication).

Detection of frequency-agile signals, e.g. hoppers

Due to its wide real time bandwidth and high scan rates, the R&S EB500 can also reliably detect signals with quickly varying frequencies – even hoppers with hop rates up to 2000 hops/s. If the "MAXHOLD" function is selected, the occupied frequency range of the transmitter will be displayed very fast.

Detection of burst signals, radar emissions

Due to the wide real-time bandwidth of 20 MHz, even very narrow bursts such as emitted by radar equipment can be detected and analyzed. By means of the IF panorama, parameters such as pulse duration can be measured.

Data recording

The R&S EB500 provides the following capabilities for recording and storing data (only model 03 - front-panel control version):

- 3.8 gigabytes on internal flash memory
- External storage via USB 2.0 The digital data can also be output via the LAN interface in realtime, externally monitored on a PC and externally recorded (e.g. to a PC hard disk). The recording time primarily depends on the capacity of the storage medium. Recording can be done with various formats.

Civil monitoring in compliance with ITU guidelines

Owing to its performance, the R&S EB500 meets all requirements for measurements in line with the ITU-R recommendations and the ITU Spectrum Monitoring Handbook

(2002). If the R&S EB500-IM option is installed, the following measurements can be performed:

- Frequency and offset in line with ITU-R SM.377
- Field strength in line with ITU-R SM.378
- Modulation in line with ITU-R SM.328
- Spectrum occupancy on the control PC in line with ITU-R SM.182/SM.328
- Bandwidth in line with ITU-R SM.443
- Detection of mono and stereo transmissions in the case of FM broadcasting transmitters

Radio data system (RDS) analysis

The signal content is demodulated and decoded. The results are output on the display or external PC and are also made available via LAN. Messages such as station name, frequency lists, traffic information etc, can be seen at a glance.

Selective call/Pager analysis

The R&S EB500-SL option can be used to decode selective-call methods and to demodulate pagers. The following selective-call methods are supported: CCIR1, CCIR7, CCITT, EEA, EIA, EURO, DCS, DTMF, CTCSS, NATEL, VDEW, ZVEI1, ZVEI2. Other methods are available on request. The results are output on the display or on the user interface of the PC.

Direction finding of emissions

In addition to detection, the direction from which the signal originates is also an important criterion in radiomonitoring. When the DF upgrade R&S EB500-DF is added, the R&S EB500 can be used as a single-channel direction finder. If two or more stations are networked, the emitter location can also be determined. The DF upgrade consists of an installation kit for the receiver. The corresponding direction-finding antenna must be selected separately.

1.4 Specifications

1.4.1 Electrical Specification

The R&S EB500 requires DC input power: DC supply should be in the range 10 - 32 V / 12 A – 4A. AC supply should be in the range 100V -240 V, 50-60Hz via an external AC/DC adaptor.

1.4.2 Mechanical Specification

Dimensions (width x height x depth)	213 mm x 132 mm x 450 mm (w/o handles and feet) ½ 19" x 3 HU
Weight	approximately 7.5 kg

1.4.3 Environmental Specification

The R&S EB500 without display is classified as Class C and R&S EB500 with display as Class C2.

Environmental conditions	acc. to EN 60068-2-1, 60068-2-2
Nominal temperature range	-10 °C to 55 °C for R&S EB500 (model 02) 0 °C to 55 °C for R&S EB500 (model 03)
Operating temperature range	0 °C to 50 °C
Storage temperature range	-40 °C to 70 °C for R&S EB500 (model 02) -30 °C to 70 °C for R&S EB500 (model 03) -20 °C to 70 °C with AC-DC adaptor
Humidity	25 °C / 55 °C, 95 % relative humidity (model 02), non-condensing 25 °C / 40 °C, 80 % relative humidity (model 03), non-condensing
Shock	acc. to EN 60068-2-27 MIL-STD 810E, Method 516.4, Procedure I
Vibration (sine)	acc. to EN 60068-2-6 (5 Hz to 150 Hz)
Vibration (random)	acc. to EN60068-2-64 (10 Hz to 500 Hz)
Electromagnetic compatibility (EMC)	acc. to EN 300339, ETSI EN301489-1, ETSI EN301489-22
MTBF	>= 35 000 h for R&S EB500 (model 02) >= 17 000 h for R&S EB500 (model 03)

1.4.4 DF Specification

DF upgrade

Direction finding functions are only accessible with the installed DF upgrade R&S EB500-DF (Direction Finding).

WDF option

Wideband Direction finding functions are only accessible with the installed option R&S EB500-WDF.

In some literature, the term WDF is referred to as WFFM (Wideband Fixed Frequency Mode).

DF method	• In the VHF/UHF/SHF ranges • In the HF range	• Correlative interferometer • Wattson-Watt
Instrument DF accuracy	Throughout the entire frequency range	0.5° RMS
System DF accuracy	In non-reflecting test environment, depending on the DF antenna • With R&S©ADD119 (300 kHz to 30 MHz) • 20 MHz to 80 MHz • 80 MHz to 1.3 GHz	• ≤ 2° RMS • ≤ 2° RMS, 1° RMS typ. • ≤ 1° RMS, 0.5° RMS
Reflection resistance	DF error at 50 % reflections, for receive frequencies > 30 MHz	1.7° RMS
DF sensitivity	Depending on the DF antenna	
Polarization	• With R&S©ADD197 • With R&S© ADD119/196/295/071/075	• Vertical, horizontal and circu-lar • Vertical
Realtime bandwidth for wideband direction finding (Requires the R&S EB500-WDF option)		Up to 20 MHz
Channel spacing for wideband direction finding		2 MHz, 1 MHz, 500 kHz, 200 kHz, 100 kHz, 50 kHz, 25 kHz, 20 kHz, 12.5 kHz, 10 kHz, 8.33 kHz, 5 kHz, 2 kHz, 1 kHz, 500 Hz, 200 Hz
Minimum signal duration	For a single burst signal	1 ms
Minimum burst duration	For multiple burst signals	0.5 ms
Display resolution	Selectable	0.1° or 1°
Operating modes		FFM (Fixed Frequency Mode), FSCAN (Frequency Scan), MSCAN (Memory Scan)
DF bandwidths		1200 kHz, 480 kHz, 240 kHz, 120 kHz, 60 kHz, 30kHz, 15 kHz, 12 kHz, 7.5 kHz, 6 kHz, 5 kHz, 3.75 kHz 3 kHz, 1.875 kHz, 1.5 kHz, 1.2 kHz, 750 Hz, 600 Hz, 375 Hz, 300 Hz, 187 Hz, 150 Hz, 120 Hz, 75 Hz, 60 Hz, 37 Hz, 30 Hz, 18 Hz, 15 Hz, 7 Hz, 3 Hz, 1Hz, 0.75 Hz, 0.375 Hz
DF-capable modulation modes		CW, AM, FM, SSB, FSK, PSK

1.5 Equipment Supplied

Designation	Order number
CD set R&S EB500	4072.8510.00
R&S EB500 Software and Documentation CD ROM	4072.8532.00
Option CD ROM (only where SW option is ordered)	4072.8610.00
R&S EB500 Getting Started (English)	4072.8432.00
1x Ethernet patch cable 2m	4055.6458.00
Power cable	country-specific

1.6 Ordering Information

Designation	Note	Type	Order number
Monitoring Receiver with-out front control panel	Model 02	R&S EB500	4072.5004.02
Monitoring Receiver with front control panel	Model 03	R&S EB500	4072.5004.03
HF Frequency Range Extension (9 kHz to 32 MHz)	HW-Module	R&S EB500-HF	4072.8003.02
SHF Frequency Range Extension (3.6 GHz to 6 GHz)	Option Key	R&S EB500-FE	4072.9300.02
Panorama Scan (RF Spectrum)	Option Key	R&S EB500-PS	4072.9200.02
ITU Measurement Soft-ware	Option Key	R&S EB500-IM	4072.9100.02
DF Upgrade (Direction Finding)	Upgrade	R&S EB500-DF	4072.9400.02
Digital Down Converter	Option Key	R&S EB500-DDC	4072.9500.02
DF Error Correction (Prerequisite is DF upgrade available)	Option Key	R&S EB500-COR	4072.9600.02
Wideband Direction Finder (Prerequisite is DF upgrade available)	Option Key	R&S EB500-WDF	4072.9651.02
Selective Call / Pager Decoder	Option Key	R&S EB500-SL	4072.9800.02

2 Preparation for Use

This section describes the basic steps to be taken when setting up the R&S EB500 for the first time.

2.1 Specific Safety Instructions

CAUTION

General safety instructions

Please make sure you observe the basic safety instructions included in this documentation as well as the instructions for setup and connection to prevent personal injury or damage to the R&S EB500. This is of particular importance when you use the R&S EB500 for the first time.

The following safety instructions apply in particular:

- IEC 364
- VDE 0100
- DIN 57100

These safety regulations deal with the following aspects:

- Prevention of accidents
- Protection against overvoltage
- Insulation of equipment
- Grounding
- Characteristics and laying of lines and cables
- Provisions for operational facilities and rooms and systems of a special nature

CAUTION

Setup

Before turning on the R&S EB500, please make sure that the following conditions are fulfilled:

- Covers are in place and all fasteners are tightened.
- Fan openings are unobstructed.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are correctly connected and not overloaded.
- The R&S EB500 is dry and shows no condensation.

Non-observance may cause damage to the R&S EB500 or other devices in the setup.

The R&S EB500 is supplied completely assembled except for the handles and mounting brackets, which must be attached by the user.

2.2 Setup

2.2.1 Bench Operation

NOTICE

Equipment cooling

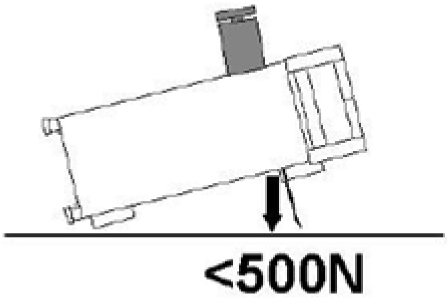
Do not expose the R&S EB500 to humidity. Leave at least 50 mm of empty space along both side panels in order to ensure proper equipment cooling.

There are no special requirements for desktop use. To facilitate access to the front panel elements, you should raise the front of the R&S EB500 by folding out its standing feet.

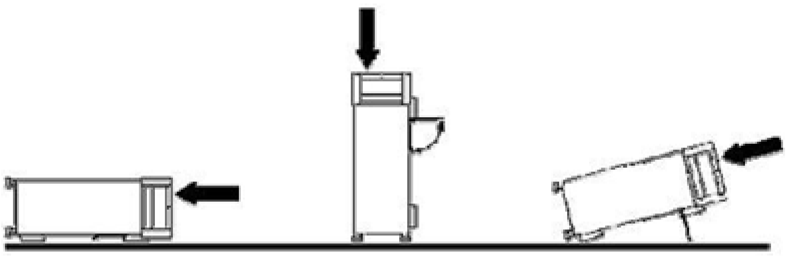
CAUTION

Risk of injury

The feet may fold in if they are not folded out completely or if the R&S EB500 is shifted. The feet may break if they are overloaded. Fold the feet completely in or completely out to ensure stability of the R&S EB500 and personal safety. To avoid injuries, never shift the R&S EB500 when its feet are folded out. The overall load (the device's own weight plus that of any devices stacked on top of it) on the folded-out feet must not exceed 500 N. Place the R&S EB500 on a stable surface. Secure any devices stacked on top of it against slipping (e.g. by locking their feet on the top front frame). When the R&S EB500 is standing on its folded-out feet, do not work under it and do not put anything under it as this would pose a risk of personal injury or material damage.



The R&S EB500 can be used in any of the positions shown here.



2.2.2 Rack Mounting

NOTICE

Ambient temperature

The R&S EB500 should be used in an area where the ambient temperature does not exceed –10 °C to +55 °C (model 02) or 0 °C to 55 °C (model 03), respectively. The R&S EB500 is fan-cooled and must be installed with sufficient space along the sides to ensure a free flow of air. Make sure that there is sufficient space for hot air to escape from the R&S EB500. To ensure sufficient cooling do not attach telescopic rails to the sides of the unit.

2.2.3 In-vehicle Mounting

For use in vehicles, the receiver can be powered directly from the vehicle's battery via the DC input.

2.2.4 EMI Protective Measures

In order to avoid electromagnetic interference (EMI), the R&S EB500 may only be operated when it is closed and all shielding covers are in place. Use only appropriate shielded signal and control cables with proper termination.

2.2.5 Connecting the R&S EB500 to the Power Supply

Connect the R&S EB500 observing the following sections and instructions for use. The R&S EB500 is suitable only for DC operation.

2.2.5.1 Connecting to the Power Adapter

The R&S EB500 is connected to the AC supply 100V to 240V via the supplied AC/DC adapter (R&S P/N: 3586.4426.00) and the socket X1 (10V to 32VDC) on the rear panel. The connection to X1 is via a Neutrik Speakon NL4FX connector (shown in figure 2-1 below).

Installing the connector:

1. Insert the Speakon® NL4FX connector into socket X1 on the rear panel.
2. Turn the connector clockwise until it is locked in place and secured by the safety latch.

Removing the connector:

1. Press and chuck back the safety latch of the Speakon® NL4FX connector.
2. Turn the connector counterclockwise and withdraw it.

Fig. 2-1: Speakon® NL4FX

2.2.5.2 Connecting to the DC Source

The R&S EB500 is connected to an external 10 VDC to 32 VDC source (e.g. battery) via the supplied DC cable (R&S P/N: 4072.7036.00) to the connector X1 (10V to 32VDC) on the rear panel.

DC supply voltage

Make sure that the available supply voltage is between 10 V and 32 V. Observe correct voltage polarity when connecting. Incorrect polarity may blow the fuse on the DC converter inside the R&S EB500 or damage the R&S EB500.

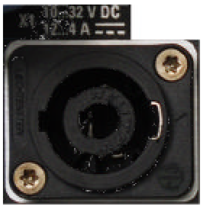
NOTICE

The DC connector is intended for disconnection of the receiver from DC-Source.

Preferable use the R&S delivered Power Supply TRG150A240.

If an other power supply is used, please note: This power supply shall be in accordance with IEC / EN / UL / CSA 60950-1 or IEC / EN / UL / CSA 61010-1

2.2.6 Power On and Off



The DC power connection X1 is located at the top left corner of the R&S EB500 rear panel. With the DC power connected, the R&S EB500 is in STANDBY or READY state, depending on the state of the STANDBY toggle switch at the front panel of the R&S EB500 when it was last switched off. The standby power is below 0.8W.

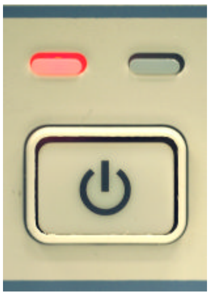
2.2.7 STANDBY and READY

The STANDBY key is located at the bottom left corner of the front panel. With the DC power connected, press the STANDBY key briefly to switch the R&S EB500 from the STANDBY to the READY state and vice versa. In STANDBY state, the amber LED on the right will turn on and only the power switch circuit is being powered. In this state, it is safe to remove the DC power and disconnect the R&S EB500 from the AC/DC power adapter. In READY state, the green LED on the left is on. The R&S EB500 is ready for operation. All modules are being powered and the receiver initiates its startup procedure.

Model 02

In the case of R&S EB500 Model 02 (without front control panel), the green Power LED doubles as a 'Fail' status LED. In conditions of failure, the LED will turn red instead of green, as shown in the figures below.

R&S EB500 Model 02 Ready

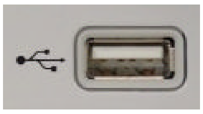


R&S EB500 Model 02 in Failure mode. Refer to chapter 5.1.5, "Troubleshooting", on page 368 for possible actions to take.

2.2.8 Connecting External Accessories

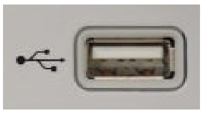
For connecting an external mouse or keyboard a USB hub is required.

2.2.8.1 Connecting a USB Hub



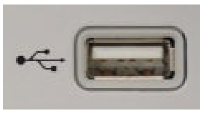
You can connect a USB hub to the USB port on the front panel of the R&S EB500. The USB hub is detected automatically when connected. It is safe to connect and disconnect the hub during the measurement.

2.2.8.2 Connecting a Mouse



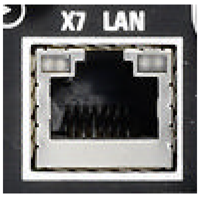
You can connect a mouse to the USB port on the front panel of the R&S EB500. The mouse is detected automatically when connected. It is safe to connect and disconnect the mouse during the measurement.

2.2.8.3 Connecting a Keyboard



You can connect a keyboard to the USB port on the front panel of the R&S EB500. The keyboard is detected automatically when connected. It is safe to connect and disconnect the keyboard during the measurement.

2.2.8.4 Connecting a LAN Cable



You can connect a LAN cable to the LAN port (X7) on the rear panel of the R&S EB500.

To establish a LAN connection, proceed as described below.

1. Refer to chapter 5.7, "Change Device IP Address", on page 398 to learn how to set the receiver’s IP address.
2. Connect a LAN cable to the LAN port. The R&S EB500 has an internal switch which automatically detects the type of LAN cable connected so you can use any standard

type of LAN cable to establish a network connection with the R&S EB500 (dedicated or non-dedicated).

Dedicated vs. non-dedicated network connections

There are two methods to establish a LAN connection with the R&S EB500:

- A non-dedicated network (Ethernet) connection from the R&S EB500 to an existing network. The R&S EB500 is assigned an IP address and can coexist with a computer and with other hosts on the same network.
- A dedicated network connection between the R&S EB500 and a single computer. The computer must be equipped with a network adapter and is directly connected to the R&S EB500. The use of hubs, switches or gateways is not required; however, data transfer is still made using the TCP/IP protocol.

Please refer to "Network Configuration Dialog" on page 134 to learn how to retrieve the IP address.

3 Operation

This chapter contains a detailed description of how to operate the R&S EB500. Following an overview of the device's front and rear panel, respectively, its graphical user interface (GUI) is explained in detail. This chapter contains all the information required to access the various configuration options and settings necessary to operate the R&S EB500.

3.1 Front-Panel Tour

3.1.1 R&S EB500 Model 03 (with front control panel)

This chapter provides an overview of the front-panel elements of the R&S EB500 with front control panel.

The front panel of the R&S EB500 with display consists of the VGA display with the softkey area (bottom side), utility keys (left side), and the hardkey area with the connectors and control interfaces (right side). The individual controls are described in the following sections.

3.1.1.1 Display

The R&S EB500 is equipped with a 5.7" color display (640x480 pixels) providing control elements for the measurements and various output elements for the results.

3.1.1.2 Softkeys

"Softkeys" are located below the display. The actual function of a softkey is indicated on the label just above the softkey. Their purpose is to provide quick, direct access to the main settings in the active (highlighted) panel on the display. On the other hand they can provide selection options for the utility keys at the left: when either one of the utility keys APPL, MODE, SETUP, MENU, MEM or HELP is pressed the softkeys will provide the operator with a number of options to select. There are a total of six softkeys and in most cases there are more options than softkeys: in those cases the rightmost softkey "More" will serve the purpose of browsing to the next set of softkeys. The next set again might have a "More" key.

3.1.1.3 Front-Panel Controls and Indicators

STANDBY Key

The STANDBY key toggles between STANDBY and READY state and shuts down the R&S EB500. See chapter 2.2.7, "STANDBY and READY", on page 21 for an explanation of the LED colors related to the state of the device.

Utility Keys

At the left side of the display we find the utility keys: these are keys that provide the operator with menus and dialogs to configure settings, and shortcuts to change the R&S EB500 into different receiver application or operation modes. There are also "Help", "Escape" and "Panel focus" keys.

ESC terminates an ongoing operation, e.g. by closing a dialog.

APPL sets the R&S EB500 to a particular application mode: RECEIVER, VIDEO, ITU, DF (optional). See chapter 3.3.3.5, "APPL", on page 89.

The MODE key is required in case the operator wants to change the receiver from a Fixed Frequency Mode to one of the scanning modes. It also provides fast access to scanning-related control functions such as "Run+", "Run-" and "Stop":

- "Run-" runs the scan in negative direction.
- "Stop" stops the scan.
- "Run+" runs the scan in positive direction.
- "Restart" will start the scan at the configured "START" frequency and run in positive direction (only for FScan and MScan)

SETUP provides access to the setup and configuration dialogs (see chapter 3.3.3.10, "SETUP", on page 128).

The MENU key gives the operator fast access to a number of operational functions such as "Record", "Zoom" or "Lock.

The MEM key is basically a shortcut to a number of memory-related dialogs.

HELP starts the online help system (see chapter 3.3.3.9, "HELP", on page 123).

The PANEL key provides the operator with the option to set the focus on one of the panels on the display. A panel "in focus" will be open for active control; i.e. the softkeys will "act" upon the panel in focus.

Receiver Control Keys

At the right side of the display you will find a row of keys that directly change receiver parameters. At the lower half you will find the four keys BW, AFC, DET and DEMOD.

BW selects the demodulation bandwidth (between 100 Hz and 20 MHz).

AFC switches automatic frequency control (AFC) ON or OFF.

DET selects the level measurement mode (AVERAGE, PEAK, FAST or RMS).

DEMOD selects the demodulation mode (FM, AM, PULS, PM, IQ, ISB, CW, USB, LSB).

At the upper half you will find another set of receiver control keys. These are ATT (Attenuation), MGC (Gain Control), and SQU (Squelch). Other keys at the right side are MARK (which is a shortcut to set and control markers in the spectrum), the SELECT rollkey (no label) and the rollkey for audio volume control.

SELECT rollkey and controls

After pressing either one of the keys MARK, ATT, MGC or SQU, the SELECT rollkey will act on behalf of the respective Marker, Attenuation, (Manual) Gain Control or Squelch function of the receiver.

Pressing ATT will set the SELECT key to control automatic or manual attenuation. When pressing the SELECT rollkey, manual attenuation is selected. After that, by turning the rollkey the desired attenuation (between 0 and 40 dB for HF/V/UHF) can be set.

Pressing MGC will set the SELECT key to work on behalf of automatic or manual gain control (AGC and MGC, respectively). When manual gain control is set, turning the rollkey sets the desired gain control.

Pressing SQU will set the SELECT key to work on behalf of squelch. Pressing the rollkey will set squelch ON or OFF. If it is ON, then turning the rollkey sets the level threshold.

When MARK is pressed, a number of "Marker" related softkeys will appear and the SELECT rollkey can be used for operating upon the different X and Y markers in the panels. The softkeys provide options to choose sets of X-markers (X1/X2 and X3/X4) or Y-markers (Y1/Y2) as well as softkeys to display measurement values and to clear one set of markers or all markers: MEAS VAL, CLEAR, CLEAR ALL, FREQ VAL. See chapter 3.3.3.4, "MARK", on page 89.

Pressing the "X1/X2" softkey will activate a set of X markers with the X1 (left) marker active, and pressing again will make the X2 (right) marker active. The active marker can be moved by turning the SELECT rollkey. Similar behavior can be achieved with the X3/X4 and Y1/Y2 markers. Pressing the rollkey will hide the activated markers and pressing again will display the markers at their last positions. Note that only one marker pair can be activated at a time and for this active pair only one marker (the green marker) is active for control by the rollkey.

Navigation Keys

At the right side of the receiver control keys you will find a large number of keys which can be categorized as multipurpose: the navigation keys at the lower half and the data-entry keys (alphanumeric keys) at the upper half.

The navigation keys consist of one rollkey: the "Main Rollkey" or ROTARY KNOB and two arrow keys: CURSOR LEFT and CURSOR RIGHT.

The CURSOR LEFT / CURSOR RIGHT keys move the cursor in input fields and scroll within lists, dialogs or tables.

The main function of the ROTARY KNOB is to control the receiver frequency. In addition, it provides access to the following functions:

- Increasing or decreasing numeric values in editing mode
- Scrolling within lists or tables
- Confirming entries (pressing the ROTARY KNOB is equivalent to pressing ENTER)

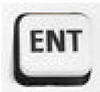
Data Entry Functions

The keys in the data entry keypad are used to enter numbers and letters. Data entry keys are only enabled if an editable field has been selected for entry mode. This can be achieved in the following manner:

- Key-in a number when no dialog is active: The key will be interpreted as a frequency value.
- Key-in a number in a highlighted softkey: The parameter of the softkey will take the value of the number entered.
- Key-in a numeric or alphanumeric value in an active dialog field: The context of the field will determine if the entry is interpreted as numeric or alphanumeric.

The keys 0 to 9 enter the corresponding numbers (numeric input fields) or characters (character input fields).

In numeric input fields, the key enters the decimal point. Multiple decimal points are not allowed. In alphanumeric fields the key enters special characters like (? ~ @ ! _ etc).



ENTER activates the edit mode for the selected input field or confirms and terminates an entry.

Volume Control Rollkey

The volume of the speaker and headphones is adjusted with this knob. Pressing the knob will toggle the speaker mute. Headphones remain active when the speaker is in mute position.

USB Port and Headphone Jack

At the bottom, right we can find:

- A USB port which provides a port for external keyboard, mouse or mass storage (of snapshots, recordings etc) on USB flash drive.
- A headphone jack for stereo audio on headphone or external speaker.

The front panel USB port complies with USB standard 2.0.

NOTICE

USB port

The maximum current per USB port is 500 mA.

3.1.2 R&S EB500 Model 02 (without front control panel)

An overview of the front-panel elements of the R&S EB500 Model 02 is given in the paragraph below.

Remote Access

NOTICE

Remote Access

A GUI for remote access is available for the Windows XP platform and is particularly useful for the R&S EB500 Model 02 because it gives functionality similar to the Model 03. Follow the instructions in chapter 5.6, "Remote Access GUI Installation", on page 393 to install the external GUI software. A Windows XP machine connected to the same network as the R&S EB500 Model 02 is required.

3.1.2.1 Standby key with LED indicators

The only key on a R&S EB500 Model 02 is the standby key. The key is accompanied by two indicators:

- Ready (green) or Fail (red) LED indicator. The Ready LED also serves as Fail LED, as shown in "Model 02" on page 21.
- Standby (amber) LED indicator.

3.1.2.2 Headphones Jack

The headphones Jack allows stereo headphones with a 3.5 mm stereo plug to be connected.

3.2 Rear-Panel Tour

This chapter describes the various inputs and outputs located on the rear panel of the R&S EB500.

3.2.1 X1 Power Supply

Standard Speakon NL4FX socket for DC power input. Socket accepts 10~32 VDC on pin 1+ and ground on pin 1- of connector. Power requirement as indicated. Refer to chapter 2.2.5.1, "Connecting to the Power Adapter", on page 20 for instructions on connecting to the power adapter using the Speakon NL4FX connector.

3.2.2 X13 / X14 Antennas

N-type female

- X13 Antenna input: 9 kHz to 6 GHz, suitable for HF/V/UHF bands.
- X14 Antenna input: 9 kHz to 32 MHz, suitable for HF band.

NOTICE

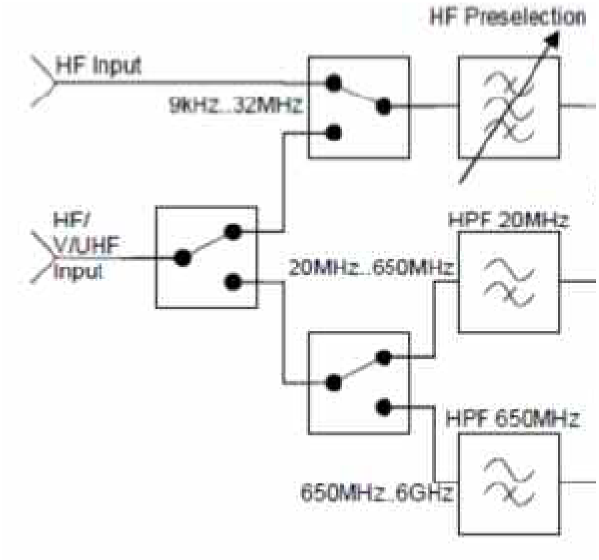
Interfaces X13, and X14

All interfaces must be operated with double shielded RF cables.

NOTICE

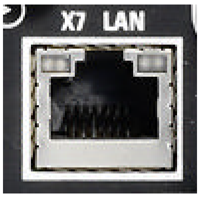
Antenna inputs and frequency ranges

Depending on the option R&S EB500-HF, the antenna inputs can be used for different frequency ranges: X13 is a HF/VHF/UHF input and X14 serves as HF input only.



When the HF option is installed, the HF input can be chosen from either X13 or X14. For the default configuration (only V/UHF) the only available input is X13.

3.2.3 X7 LAN Ethernet



The LAN port (RJ-45) at the rear panel is a 10/100/1000Base-T port. Use this port to integrate the R&S EB500 in a local area network (LAN), primarily for remote-control purposes.

NOTICE

Ethernet Cable

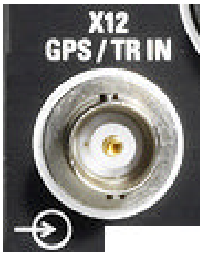
At least a CAT 6 double-shielded Ethernet cable should be used.

3.2.4 Miscellaneous IO

X8 VIDEO A and **X9 VIDEO B** are SMA connector outputs. Use these outputs for an analog video monitor or connect an oscilloscope to both connectors to see the AM and FM demodulated signals at the same time. Both connectors can also be switched to output-controlled analog IF in two channels, with an adjustable center frequency of 0 Hz to 70 MHz.

X10 REF IN is a BNC input for an external reference frequency. Use this connector to synchronize the receiver with a frequency normal.

X11 REF OUT is a BNC output for other devices, e.g. other R&S EB500 units. Use this connector to synchronize the other devices.



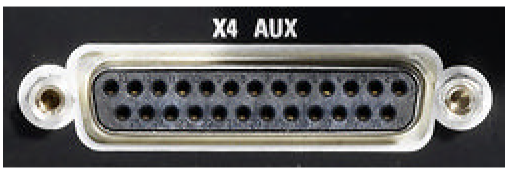
X12 GPS/TR IN is a BNC connector for an external 1 sec trigger pulse, e.g. from a GPS device.

NOTICE

Interfaces X8, X9, X10, X11 and X12

All interfaces must be operated with double shielded coaxial cables.

3.2.5 AUX / AUX Audio



X3 AUX AUDIO is a 25-pin D-Sub female connector with the output of different audio signals. There are also some special trigger inputs on this connector. Use this connector if you want to record the analog audio signal of the R&S EB500

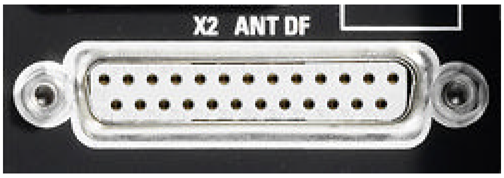
X4 AUX is a 25-pin D-Sub female connector for controlling external antenna switching units. Use this connector if you have an antenna switching unit in your system.

NOTICE

Interfaces X3, and X4

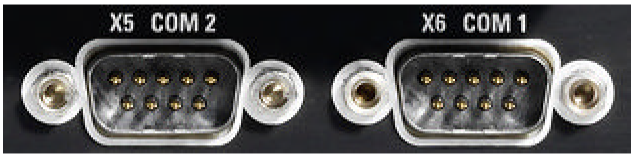
All interfaces must be operated with double shielded data cables.

3.2.6 Antenna Control Interface



X2 ANTENNA DF is a 25-pin D-Sub connector. If DF upgrade R&S EB500-DF is installed then this connector can be used for controlling direction-finder antennas.

3.2.7 Serial Interfaces



EIA 232D compatible

- X5 COM2, 9-pin D-Sub male connector.
- X6 COM1, 9-pin D-Sub male connector.

X5 and X6 can be used for:

- Serial GPS devices according to the NMEA0183 standard. Use this connector for an external GPS device to determine the location and the exact time of the device.
- Serial compass devices according to the NMEA0183 standard. Use this connector for an external compass device to determine the direction of your vehicle.
  This will mostly be used in combination with direction finding (requires DF upgrade R&S EB500-DF).

NOTICE

SCPI

Besides control of devices according to the NMEA0183 standard, the COM2 port X5 also allows external control of the R&S EB500 by using SCPI syntax. See chapter 7.2, "Configuration of the LAN Interface with SERIAL Interface", on page 429

3.3 Graphical User Interface (GUI)

This chapter provides a detailed description of the device's graphical user interface.

3.3.1 GUI Layout

Following is an overview of the layout and individual elements of the device's graphical user interface.

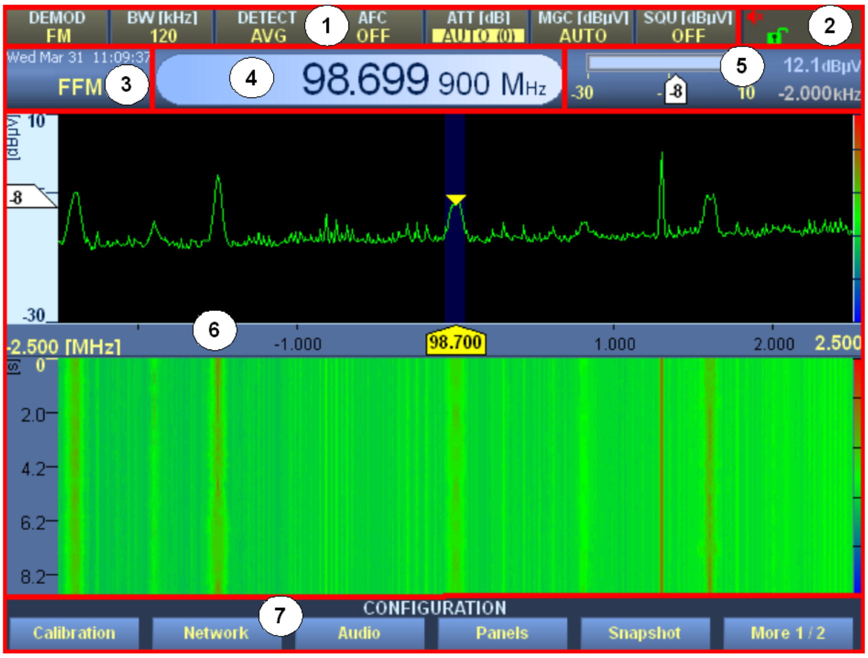
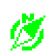
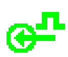
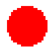
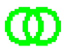
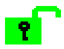


Fig. 3-1: GUI Layout.

In the table below follows a short description of the different panels, according to the panel number indicated in the figure.

Panel No.	Description	
1	**Basic receiver parameters**	
2	**Icons** Shows one or several of the following icons to indicate a specific function or condition of the R&S EB500:	
		Compass connected.
		GPS connected.
		Configuration: using external reference.

Panel No.	Description	
		Receiver overflow.
		Recording in progress.
		Marker selected.
		Speaker is off.
		Speaker is on.
		Audio signal is available in stereo at current frequency.
		The R&S EB500 is not locked.
		The R&S EB500 is locked by another client. Access is not possible.
		The R&S EB500 is locked. Only the current operator can make changes (exclusive write access).
	ERR	A critical error occurred in the receiver. The "Test Points" dialog will provide more information.
3	**Mode** Shows the current receiver mode, e.g. FFM, PScan, FScan or MScan. The current date and time is also shown.	
4	**Frequency** Shows the current receiver frequency. As this is the most important parameter, it is displayed much larger than the remaining parameters.	
5	**Measurement parameters** Shows the basic measurement parameters (level, frequency offset; numerically and bar graph).	

Panel No.	Description
6	**Panel area** The panel area is used for displaying the various panels of the R&S EB500 (spectrum and waterfall are shown). ● The light cyan color of the scale bar indicates that the panel is in focus: softkey operations affect the panel (see below). A marker to show the squelch level relative to the trace level is also displayed. ● The dark blue bar around the demodulation frequency marking denotes the bandwidth being demodulated. ● On the right side, the rainbow colored bar indicates the color that is mapped to the corresponding spectrum level for the waterfall display.
7	**Softkeys** Softkeys change their function based on the panel that is in focus. They show panel-dependent parameters, e.g. "SPAN" and "STEP" for IF panel and IF Waterfall panel. Other softkeys are only related to e.g. RF panel, RF Waterfall panel etc. Softkeys can be related to hardkeys: they can e.g. provide selection options in case one of the Utility keys is pressed or in case DET or MARK is pressed. Softkeys can also provide the option for selecting a unit (kHz, MHz etc) e.g. when keying-in a frequency, they can provide additional functionality when editing input fields in dialogs, e.g. backspace or caps lock. Finally they can serve as shortcut keys for navigating through tables in dialogs, e.g. in the "Memory Setup" dialog or through the "Help" pages.

3.3.2 Description of Panels

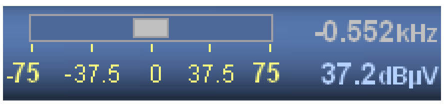
The individual panels are described in more detail in the following sections.

3.3.2.1 Frequency Panel

By default, the frequency panel displays the following parameters:

- date and time
- operating mode ("FFM", "FScan", "FScan Stop" etc.)
- frequency field
- level (numerically and bar graph)
- frequency offset (numerically)

The frequency panel can be configured such that the bar graph frequency offset is shown instead of the bar graph level (see "Panels Configuration Dialog" on page 139) as shown in the figure below.



The default setting is "Level". If you select "Fieldstrength", the level, offset and fieldstrength are shown as numerical values.

The unit displayed in the frequency field can be changed via the panel configuration, using SETUP > "Config" > "Panels"; see "Panels Configuration Dialog" on page 139.

3.3.2.2 Parameter Panel

The parameter panel shows the most important receiver parameters.

Table 3-1: The table below lists all the parameters of the parameter panel with a short description of each

ATT	Attenuation (manual, automatic)
MGC	Gain control (manual, automatic)
SQU	Squelch (manual, automatic)
BW	Bandwidth (0.1 kHz - 20.0 MHz)
AFC	Automatic frequency correction "ON"/"OFF"
DET	Detection ("AVG", "PEAK", "FAST", "RMS")
DEMOD	Demodulation ("CW", "LSB", "USB", "ISB", "AM", "FM", "PULS", "PM", "IQ")

You can change these parameters using the appropriate front-panel controls.

Either one of the parameters "ATT", "MGC" or "SQU" at the top panel will be highlighted by means of a yellow background. This will tell the operator which of the parameters can currently be controlled by the SELECT rollkey.

If none are highlighted then the SELECT key is set to control the markers. This will be indicated by the "Marker" icon at the top right (see chapter 3.3.1, "GUI Layout", on page 35).

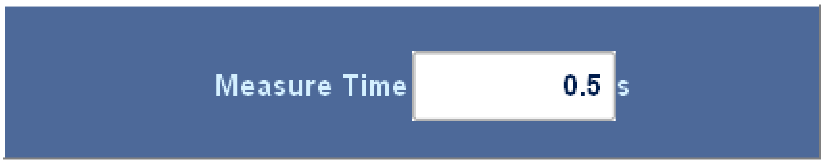
Other parameters will only be highlighted for a very short duration to indicate which parameter is being changed.

3.3.2.3 Parameter Input

Use the parameter dialog to enter a value directly. The dialog is active for the current GUI element, i.e. a softkey. Normally it will be active for the center frequency: The dialog will appear once a user starts entering a number.

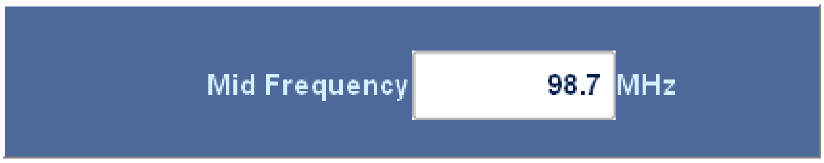
When a GUI element has the focus, it is shown in a lighter color.

Example: "MEAS TIME" softkey has the focus. The related parameter dialog will be:



As long as the dialog is on the foreground the default softkey bar will be replaced by the softkey bar below. These softkeys allow you to change the unit used for the parameter shown, replace a wrongly typed digit or change the sign.

Most of the time the focus is not with any of the softkeys. Instead the focus is on one of the panels, e.g. the IF panorama, which are not meant for input. In that case the parameter input will directly work on the receiver center frequency, as shown below.



The dialog will open by:

- pressing ENTER. The dialog opens for the currently focused GUI element or the receiver frequency. The current value is shown.
- pressing a number key. The dialog opens for the currently focused GUI element or the receiver frequency. The number associated with the number key pressed is shown.

The dialog will close by:

- pressing ENTER. The receiver will change the center frequency to the number just entered.
- pressing ESC. The number just entered will be discarded.
- pressing any of the receiver control keys ATT, MGC, SQU, BW, AFC, DET or DEMOD. The number just entered will be redirected. See below.

Parameter redirection

Once open, a particular dialog is not limited to the parameter shown. Input can be redirected by pressing one of the following controls while the dialog is still open.

- When pressing ATT the attenuation will change to "Manual" with the value taken from the dialog.
- When pressing MGC the gain control will change to "Manual" with the value taken from the dialog.
- When pressing SQU the squelch will be switched on and the value will be taken from the dialog.
- For the BW, DET and DEMOD keys the value from the dialog will represent the index in the selector box, e.g. the second DET is "FAST" and the eighth BW is "2.7 kHz".
- For AFC there are only two options: 0 is "off" and 1 is "on".

3.3.2.4 Markers

The main marker for the receive frequency is displayed in yellow at the center of the spectrum. Range markers (red or purple) are activated with the marker selector, which can be reached via the MARK key (see: "Receiver Control Keys" on page 26).

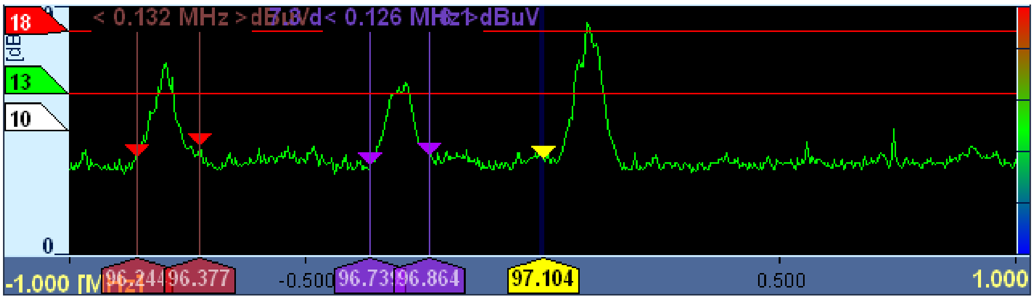


Fig. 3-2: Markers.

Once the MARK key is pressed two things will happen:

- The SELECT knob will become available for manipulating the markers. Take note of the Marker icon in the icon panel (see:figure 3-1).
- The default softkey bar changes into a dedicated softkey bar to provide options for enabling / disabling and controlling the markers.

"X1/X2" activates and/ selects the first and second frequency range marker (red).

"X3/X4" activates and selects the third and fourth frequency range marker (purple).

"Y1/Y2" activates and selects the first and second level range marker (red).

"Clear" deactivates the currently activated marker pair.

"Clear All" deactivates all markers, i.e. X1, X2, X3, X4, Y1 and Y2.

"Marker Val" activates / deactivates the output of the level of the currently selected frequency range marker. This is only possible for X1, X2, X3 and X4.

"Freq Val" activates / deactivates output of the frequency and level of the received signal.

When the "Real Freq" softkey is pressed, the frequency value in the marker will show the actual frequency of the level indicated by the marker. See the note below for an explanation.

Only two range markers are selected at any one time. Selected range markers are displayed in solid colors (red and green or purple and green). Only the green color marker can be moved by the SELECT knob. By pressing the softkey of the activated marker pair, the green marker can be toggled, e.g. between X1 and X2 in case of X1/X2 markers or X3 and X4 in case of X3/X4 markers. This way the movable marker can be swapped.

NOTICE

Real frequency display at the markers

When the stepsize is set to average, there are usually more frequency levels calculated than what can be can be displayed on the screen. This is because the screen resolution is 640 pixels in horizontal direction whereas the number of frequencies calculated by FFT can be much higher (up to 4000 depending on the settings). For some settings up to eight frequencies can fall into one pixel.

The algorithm that is used in the R&S EB500 will display for each pixel the frequency with the highest level of all the frequencies that fall in that particular pixel. The frequency indicated by the marker however is the frequency, according to the pixel in the screen (the mean of all the frequencies that fall in that particular pixel).

In order to be able to find out what is the actual frequency represented by the level indicated, you should press the "Real Freq" softkey. When "Real Freq" is highlighted you will see the frequency indicated by the marker change over time, because in a real signal the frequency with the highest level will never be exactly the same all the time.

Pressing the SELECT knob (see: "Receiver Control Keys" on page 26) activates or deactivates a single range marker. Non-selected range markers are displayed in a translucent color (red or purple). Measurement output fields are displayed along the upper edge in the respective range-marker color.

Averaging of the measurement output can be switched on under SETUP > Config > Panels Configuration > Averaging For Ruler's Digital Output. The frequency span between two activated markers is shown along the upper edge.

The measurement output for range markers can also be shown in the measurement output panel (see: "Panels Configuration Dialog" on page 139).

3.3.2.5 IF Panorama

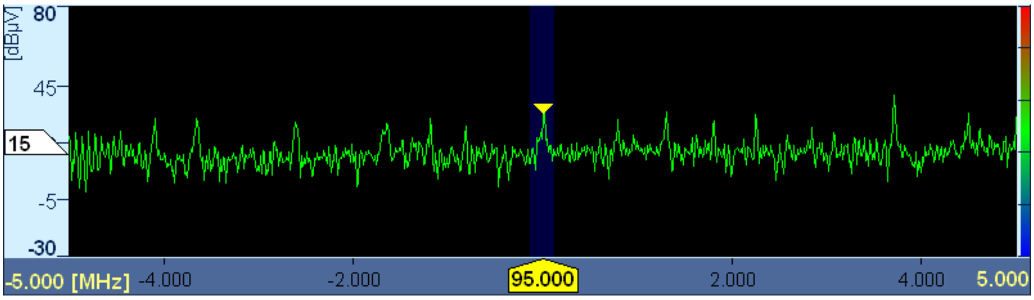


Fig. 3-3: IF Panorama.

In FFM the IF panorama shows signals centered around the current receive frequency. The IF panorama bandwidth is determined by the frequency span setting (softkey "SPAN"). The dark blue background indicates the receiver bandwidth. The level threshold is indicated along the left margin. The color set for color indexing in the IF waterfall panel is shown along the right margin.

The ROTARY KNOB, the CURSOR LEFT / CURSOR RIGHT keys and the numeric keypad all can be used to control the center frequency. The ROTARY KNOB can be used for turning (clockwise for higher frequencies and counter-clockwise for lower frequencies) and clicking (the center frequency will be rounded to the nearest "STEP" value). The CURSOR LEFT / CURSOR RIGHT keys will change the center frequency with half the "SPAN" to lower or higher frequencies: after pressing the CURSOR LEFT key the center frequency will be reduced by half the "SPAN" and after pressing the CURSOR RIGHT key it will be increased by half the "SPAN". The number keys allow direct entry of a new center frequency: If the focus is not on any dialog or softkey then the effect of just keying a number using the number keys will cause the receiver to use that particular number for the center frequency, provided the number is within the range of the receiver.

If you connect a mouse and left click the yellow main marker on the X axis its ruler (the yellow line above the marker) will briefly appear. You can change the position of an active X marker by left dragging it. If you left drag the yellow main marker along the X axis, you can change the center frequency. By right dragging the yellow main marker along the X axis you can change the demodulation frequency.

If you left click the squelch marker (level threshold marker) on the Y axis its ruler will briefly appear. By left dragging the squelch marker along the Y axis, you can change its value. By left dragging a Y marker along the Y axis you can change its position.

You can move the center frequency by left clicking into the spectrum. By right clicking into the spectrum, you can move the demodulation frequency to the clicked position. You can change the position of a marker in the spectrum by left dragging it. You can change the center frequency by left dragging the yellow main marker in the spectrum. By right dragging the yellow main marker in the spectrum, you can change the demodulation frequency.

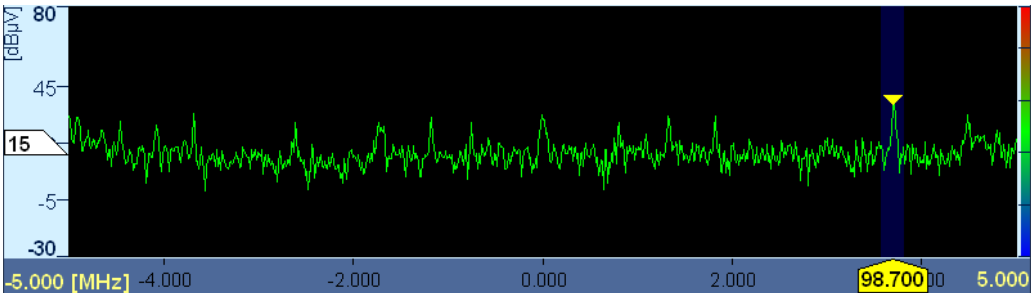
If you connect a keyboard then you can also change the center frequency using the cursor keys. The CURSOR RIGHT and CURSOR UP keys will move the center frequency by half the set "SPAN" to a higher frequency. The CURSOR LEFT and CURSOR DOWN keys will move the center frequency by half the set "SPAN" to a lower frequency.

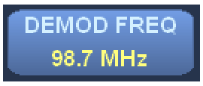
If you press the mouse wheel or ROTARY KNOB, the current center frequency will be rounded to the step width. If you connect an external keyboard then SHIFT+<NUMERIC KEY> will round the center frequency to the corresponding decimal power, e.g. SHIFT +3 will round to kHz.

Use the following softkeys to configure the IF panorama:

Press the "DEMOD FREQ" button to set the demodulation frequency, which is normally the same as the receive frequency. Any deviations will be temporary, which means that the ROTARY KNOB will act upon the demodulation frequency for as long as the focus is on the "DEMOD FREQ" button. The frequency limits of the demodulation frequency are determined by the receive frequency and the IF panorama span.

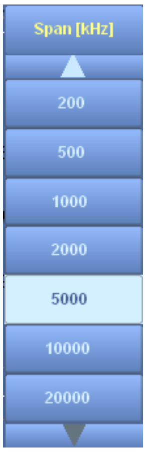
In the IF Panorama it can easily be seen by a change in the position of the blue bandwidth bar whether the demodulation frequency has been changed. The bar will not be positioned at the centre anymore, as can be seen in the figure below.





Once the focus is not on the "DEMOD FREQ" softkey anymore, a change in frequency will again affect the main frequency and the blue bandwidth bar will return back to the centre of the IF Panorama.

See also `[SENSe:]FREQuency:DEModulation` on page 265.



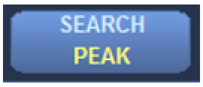
Press the "SPAN" button to set the IF panorama span.

A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also `[SENSe:]FREQuency:SPAN` on page 270.

Press the "STEP" button to set the IF panorama step width. Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.



Press the "SEARCH PEAK" button to center the IF panorama to the next left or right level peak, or to the absolute level peak. You can choose either the center frequency or the demodulation frequency. Once the softkey is pressed, a new row of softkeys will appear, which show the available options.

See also:

`CALCulate:IFPan:MARKer:MAXimum:LEFT` on page 204

`CALCulate:IFPan:MARKer:MAXimum:RIGHt` on page 204

`CALCulate:IFPan:MARKer:MAXimum[:PEAK]` on page 204

`CALCulate:IFPan:MARKer:DEModulation:MAXimum:LEFT` on page 204

`CALCulate:IFPan:MARKer:DEModulation:MAXimum:RIGHt` on page 204

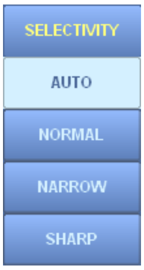
`CALCulate:IFPan:MARKer:DEModulation:MAXimum[:PEAK]` on page 204

Press the "FFT MODE" button to select the FFT mode for the IF panorama data.

Once the softkey is pressed, a vertical selector will appear, which shows the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE"

See also `CALCulate:IFPan:AVERage:TYPE` on page 202.

Press the "SELECTIVITY" button to set the selectivity in the IF panorama. You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span.



A related vertical selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP."

See also `CALCulate:IFPan:SELectivity` on page 205.

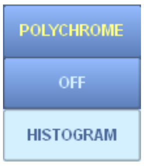
Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "POLYCHROME" button to operate the IF panorama in polychrome mode. You can set it to "OFF" or "HISTOGRAM" (color histogram). A related selector shows the available options.



If you select "HISTOGRAM", the frequency of the levels of the received signal measured over a defined time ("PERSISTENCE") will be shown in addition to the levels. Red dots indicate high occupancy (more frequently occurring levels) whereas blue dots indicate low occupancy (less frequently occurring levels).

Black areas indicate that no levels are being measured.

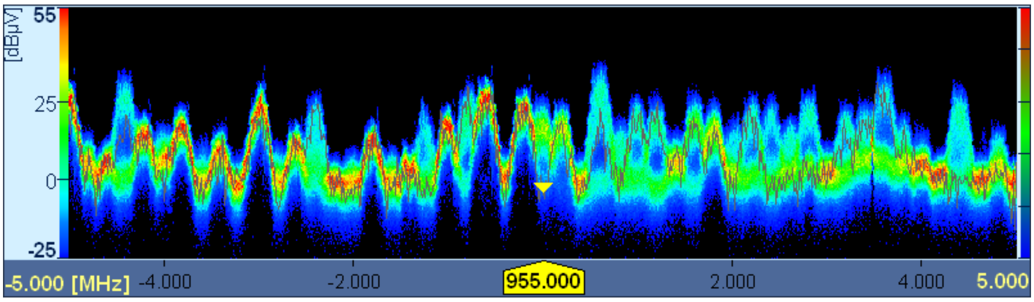


Fig. 3-4: Polychrome IF panorama.

See also `CALCulate:PIFPan:MODE` on page 208 .

Press the "100% TIME" button to set the 100% time (the level occupancy required to indicate 100% in the color bar scale) for the polychrome IF panorama.

See also `CALCulate:PIFPan:ACTTime` on page 207 .

Press the "PERSISTENCE" button to set persistence, i.e. the time during which the occupancy of a signal is to be measured.

See also `CALCulate:PIFPan:OBSTime` on page 209.

Press the "CLEAR POLYCHROME" button to clear the polychrome IF panorama; the measurement will restart.

See also `CALCulate:PIFPan:CLEar` on page 208 .

Press the "LOW LIMIT" button to set the lower time limit for 100% time. Occupancies less than the lower limit will not be indicated with a color in the IF panel. You can set the lower limit to a value between 0 ms and the upper limit.

Press the "UPPER LIMIT" button to set the upper time limit for 100% time. Occupancies higher than the upper limit will not be indicated with a color in the IF panel. You can set the upper limit to a value between the lower limit and 100% time.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]` on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

If you turn the "Differential" mode off, the regular spectrum is displayed again.

Press the "CONFIG IFPAN" button to configure the IF panorama. You can configure the value range of the Y axis, the color set for the waterfall and the "Hold Maximum" function.

See also chapter 3.3.3.11, "IF Panorama Dialog", on page 170.

3.3.2.6 IF Waterfall

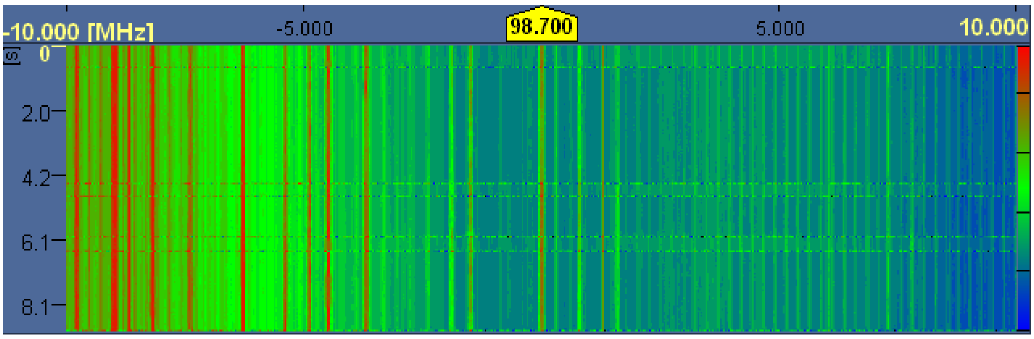


Fig. 3-5: IF Waterfall.

The IF waterfall, which by default is displayed below the IF panorama, shows signal levels from the IF panorama over time. The signal levels are color coded; the colors correspond to the color set shown along the right margin. They correspond with the level in the IF panorama. The time in seconds is indicated along the left margin.

You can change the position of a Y marker by turning the SELECT rollkey or by left dragging it along the Y axis (in case a mouse is connected).

If you want to change the center frequency by using a mouse, left click into the waterfall. Likewise, if you want to change the demodulation frequency, right click into the waterfall. You can also left drag a marker in the waterfall to change its position. You can change the center frequency by left dragging the yellow main marker on the X axis. By right dragging the yellow main marker on the X axis, you can change the demodulation frequency. If the IF waterfall is displayed in a single-panel layout (SETUP > "Layout" > "IF WF ONLY") then there will be no X axis and no marker.

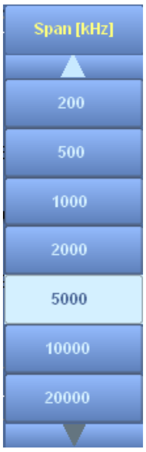
Press the mouse wheel or ROTARY KNOB to round the current center frequency to the step width.

Use the following softkeys to configure the IF waterfall:

Press the "DEMOD FREQ" button to set the demodulation frequency, which is normally the same as the receive frequency. Any deviations will be temporary, which means that the ROTARY KNOB will act upon the demodulation frequency for as long as the focus is on the "DEMOD FREQ" button. The frequency limits of the demodulation frequency are determined by the receive frequency and the IF panorama span.

See also [SENSe:]FREQuency:DEModulation on page 265.

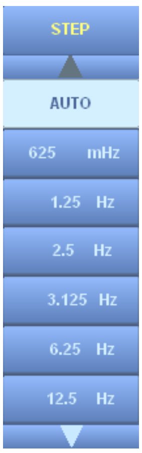
Press the "SPAN" button to set the IF panorama span.



A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also [SENSe:]FREQuency:SPAN on page 270.

Press "STEP" button to set the IF panorama step width.



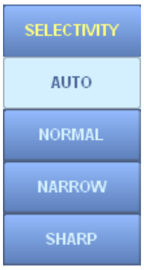
Step widths range from 625 mHz to 2 MHz. When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.

Press the "FFT MODE" button to select the FFT mode for the IF panorama data.

Once the softkey is pressed, a vertical selector will appear, which show the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE"

See also `CALCulate:IFPan:AVERage:TYPE` on page 202.

Press the "SELECTIVITY" button to set the selectivity in the IF panorama.



You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span. A related selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP."

See also `CALCulate:IFPan:SELectivity` on page 205.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "POLYCHROME" button to operate the IF panorama in polychrome mode. You can set it to "OFF" or "HISTOGRAM" (color histogram). A related selector shows the available options.

This is explained in detail in the IF Panorama above.

See also `CALCulate:PIFPan:MODE` on page 208 .

Press the "100% TIME" button to set the 100% time (the level occupancy required to indicate 100% in the color bar scale) for the polychrome IF panorama.

See also `CALCulate:PIFPan:ACTTime` on page 207 .

Press the "PERSISTENCE" button to set persistence, i.e. the time during which the occupancy of a signal is to be measured.

See also `CALCulate:PIFPan:OBSTime` on page 209.

Press the "CLEAR POLYCHROME" button to clear the polychrome IF panorama; the measurement will restart.

See also `CALCulate:PIFPan:CLEar` on page 208.

Press the "LOW LIMIT" button to set the lower time limit for 100% time. Occupancies less than the lower limit will not be indicated with a color in the IF panel. You can set the lower limit to a value between 0 ms and the upper limit.

Press the "UPPER LIMIT" button to set the upper time limit for 100% time. Occupancies higher than the upper limit will not be indicated with a color in the IF panel. You can set the upper limit to a value between the lower limit and 100% time.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the "CONFIG IF WF" button to configure the IF waterfall. You can configure the waterfall speed, and the color set to be used for the waterfall.

See also chapter 3.3.3.12, "IF Waterfall Dialog", on page 174.

3.3.2.7 RF Spectrum

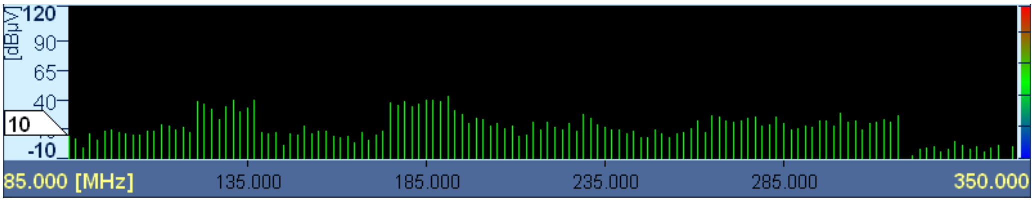


Fig. 3-6: RF Spectrum.

The RF spectrum shows signals in Scan mode. The RF spectrum span width is determined by setting the start and stop frequency. The level threshold is indicated along the left margin. The color set for color indexing in the RF waterfall is displayed along the right margin.

Just like in the IF panorama (FFM mode, see chapter 3.3.2.5, "IF Panorama", on page 42) you can use the main rollkey, the arrow keys and the numeric keypad to control the center frequency. However, you won't see an effect for every scan mode. In fact, only in PScan mode the center frequency will actually change and demodulation will take place once the scan is stopped. For FScan and MScan, demodulation takes place all the while and the center frequency can only be changed once the scan has stopped.

If you connect a keyboard then you can change the center frequency using the cursor keys. The CURSOR RIGHT and CURSOR UP keys will move the center frequency by half the set "SPAN" to a higher frequency. The CURSOR LEFT and CURSOR DOWN keys will move the center frequency by half the set "SPAN" to a lower frequency. This can be done during the scan or at scan stop.

Depending on the scan mode, use the following softkeys to configure the RF panel:

Panorama scan

The panorama scan requires option R&S EB500-PS. Check SETUP > Information > Options.

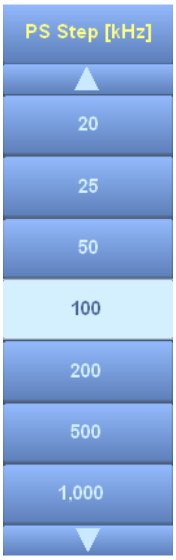
Press the "START" button to set the start frequency for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:STARt` on page 269.

Press the "STOP" button to set the stop frequency for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:STOP` on page 269.

Press the "STEP" button to select the step width for the panorama scan.



A related selector dialog will pop-up providing the available options.

See also `[SENSe:]PSCan:STEP` on page 284.

Press the button "CYCLE COUNT" to set the cycle count, i.e. how often the frequency band between the start and stop frequency is to be scanned. You can set the cycle count to a number between 1 and 1000. You can also set it to "INFinity".

See also `[SENSe:]PSCan:COUNt` on page 283.

Press the button "FFT MODE" to select the FFT mode for the IF panorama data.

A related selector shows the available options. Available options are "MINIMUM", "MAX-IMUM", "AVERAGE" and "CLRWRITE"

See also: `CALCulate:IFPan:AVERage:TYPE` on page 202.

Press the "CENTER" button to set the center frequency for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:CENTer` on page 267.

Press the "SPAN" button to set the span for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:SPAN` on page 268.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

If you turn the "Differential" mode off, the regular spectrum is displayed again.

Press the button "CONFIG" to configure the RF spectrum. You can configure the value range of the Y axis and the "Hold Max" function. You can also choose between a comb and line spectrum and specify the color set to be used for the waterfall.

See also chapter 3.3.3.13, "RF Panorama Dialog", on page 176.

Frequency scan

Press the "START" button to set the start frequency for the frequency scan.

See also `[SENSe:]FREQuency:STARt` on page 271.

Press the "STOP" button to set the stop frequency for the frequency scan.

See also `[SENSe:]FREQuency:STOP` on page 272.

Press the "STEP" button to select the step width for the frequency scan.

See also `[SENSe:]SWEep:STEP` on page 290

Press the button "CYCLE COUNT" to set the cycle count, i.e. how often the frequency band between the start and stop frequency is to be scanned. You can set the cycle count to a number between 1 and 1000. You can also set it to "INFinity".

See also `[SENSe:]SWEep:COUNt` on page 287.

Press the button "FFT MODE" to select the FFT mode for the IF panorama data.

A related selector shows the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE".

See also `CALCulate:IFPan:AVERage:TYPE` on page 202.

Press the "CENTER" button to set the center frequency for the frequency scan.

Press the "SPAN" button to set the span for the frequency scan.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "DWELL TIME" button to set the dwell time in milliseconds for each frequency. You can also set dwell time to "INFinity". The system will then dwell on the current frequency until you press RUN+ or RUN-.

See also `[SENSe:]SWEep:DWELl` on page 288.

Press the button "NO SIG TIME" to set the time for signal-controlled operation, i.e. if the signal disappears during dwell time, the system will wait for the time specified and then continue with the scan. You can also turn signal-controlled operation off.

See also:

`[SENSe:]SWEep:HOLD:TIME` on page 289

`[SENSe:]SWEep:CONTrol[:ON]` on page 286

Press the button "FUNCTION SUPPRESS" to configure the suppress list. Once the "FUNCTION SUPPRESS" button is pressed a new row of softkeys appears with options as shown below.

- "Suppress" adds the current frequency to the list.

- "Supp-" adds the current frequency to the list and the scan will continue in the reverse direction once the dwell time ended
- "Supp+" is similar to "Supp-" except that scan will continue in the forward direction once the dwell time ended.
- "Store-" works like "Supp-" except that the current frequency is also copied to memory.
- "Store+" works like "Supp+" except that the current frequency is also copied to memory.
- "Sort" will sort the suppress list in ascending order.
- "Clear All" empties the suppress list; it clears the list of all frequency ranges.
- "Edit" will open the "Suppress List Setup" dialog, which is used to edit the frequencies to be suppressed during a frequency scan. You can define, edit, sort and delete these frequencies in the "Suppress List Setup" dialog.
  See also chapter 3.3.3.21, "Suppress List Setup Dialog", on page 189.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

If you turn the "Differential" mode off, the regular spectrum is displayed again.

Press the button "CONFIG" to configure the RF spectrum. You can configure the value range of the Y axis and the "Hold Max" function. You can also choose between a comb and line spectrum and specify the color set to be used for the waterfall.

See alsochapter 3.3.3.13, "RF Panorama Dialog", on page 176 .

Memory scan

Press the "MEM SELECT" button to set the number of the current memory channel. Depending on "SELECT MODE", the new memory channel will/will not be loaded.

During scanning the softkey will indicate which memory channel is currently loaded.

See also `[SENSe:]MSCan:CHANnel` on page 279.

Press the button "SELECT MODE" to set the mode for "MEM SELECT". Setting it to "PREVIEW" mode changes only the number of the current memory channel. Mode "AUTO RECALL" causes the receiver to assume the settings associated with the new memory channel.

Press the "MEM SQUELCH" button to use the squelch value from memory (turn it "ON") or the global squelch value (turn it "OFF").

See also `OUTPut:SQUelch:CONTrol` on page 244.

Press the button "CYCLE COUNT" to set the cycle count, i.e. how many cycles the frequency band between the start and stop frequency is to be scanned. You can set the cycle count to a number between 1 and 1000. You can also set it to "INFinity".

See also `[SENSe:]MSCan:COUNt` on page 280.

Press the button "FFT MODE" to select the FFT mode for the IF panorama data.

A related selector shows the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE".

See also `CALCulate:IFPan:AVERage:TYPE` on page 202.

Press the "DWELL TIME" button to set the dwell time in milliseconds for each frequency. You can also set dwell time to "INFinity". The system will then dwell on the current frequency until you press RUN+ or RUN-.

See also `[SENSe:]MSCan:DWELl` on page 282.

Press the button "NO SIG TIME" to set the time for signal-controlled operation, i.e. if the signal disappears during dwell time, the system will wait for the time specified and then continue with the scan. You can also turn signal-controlled operation off.

See also:

`[SENSe:]MSCan:HOLD:TIME` on page 282

`[SENSe:]MSCan:CONTrol[:ON]` on page 280

Press the button "FUNCTION SUPPRESS" to configure the suppress list. The options below appear in a new row of softkeys that replace the default softkey bar once the "SUPPRESS" button is pressed.

- "Suppress" adds the current frequency to the list.
- "Supp-" adds the current frequency to the list and the scan will continue in the reverse direction once the dwell time ended.
- "Supp+" is similar to "Supp-" except that the scan will continue in the forward direction once the dwell time ended.

See also chapter 3.3.3.21, "Suppress List Setup Dialog", on page 189.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the button "CONFIG" to configure the RF spectrum. You can configure the value range of the Y axis and the "Hold Max" function. You can also specify the color set to be used for the waterfall.

See also chapter 3.3.3.13, "RF Panorama Dialog", on page 176.

3.3.2.8 RF Waterfall

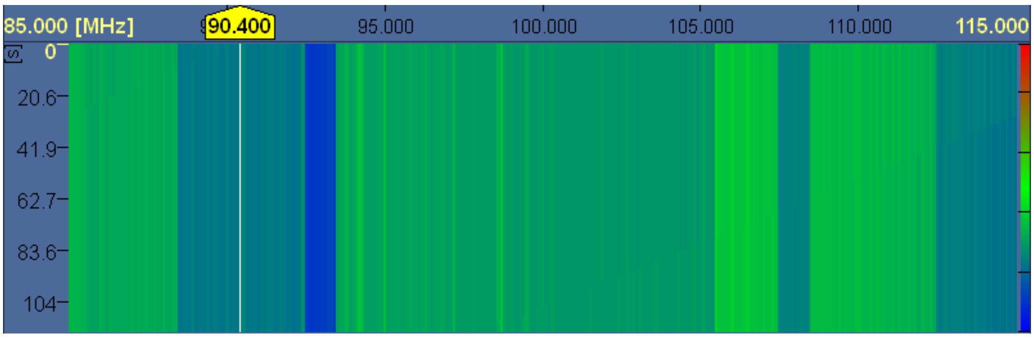


Fig. 3-7: RF Waterfall.

The RF waterfall below the RF spectrum shows signal levels from the RF spectrum over time. The signal levels are color coded; the colors correspond to the color set shown along the right margin. The time in seconds is indicated along the left margin.

You can change the position of a Y marker by left dragging it along the Y axis.

Just like in the RF panorama (FFM mode, see chapter 3.3.2.5, "IF Panorama", on page 42) you can use the main rollkey, the arrow keys and the numeric keypad to control the center frequency. However, you won't see an effect for every scan mode. In fact, only in PScan mode the center frequency will actually change and demodulation will take place once the scan is stopped. For FScan and MScan, demodulation takes place all the while and the center frequency can only be changed once the scan has stopped.

If you connect a keyboard then you can change the center frequency using the cursor keys. The CURSOR RIGHT and CURSOR UP keys will move the center frequency by half the set SPAN to a higher frequency. The CURSOR LEFT and CURSOR DOWN keys will move the center frequency by half the set SPAN to a lower frequency. This can be done during the scan or at scan stop.

Use the following softkeys to configure the RF waterfall, depending on the scan mode:

Panorama scan

The panorama scan requires option R&S EB500-PS. Check SETUP > Information > Options.

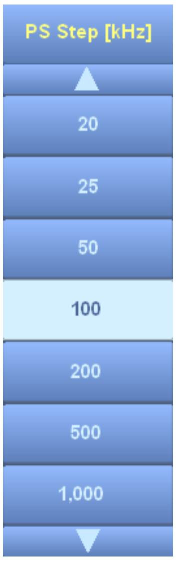
Press the "START" button to set the start frequency for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:STARt` on page 269.

Press the "STOP" button to set the stop frequency for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:STOP` on page 269.

A related vertical selector will pop-up providing the available options.



See also `[SENSe:]PSCan:STEP` on page 284.

Press the button "CYCLE COUNT" to set the cycle count, i.e. how for how many cycles the frequency band between the start and stop frequency is to be scanned. You can set the cycle count to a number between 1 and 1000. You can also set it to "INFinity".

See also `[SENSe:]PSCan:COUNt` on page 283.

Press the "CENTER" button to set the center frequency for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:CENTer` on page 267.

Press the "SPAN" button to set the span for the panorama scan.

See also `[SENSe:]FREQuency:PSCan:SPAN` on page 268.

Press the "STEP" button to select the step width for the panorama scan.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the button "CONFIG" to configure the RF waterfall to set the speed, interpolation mode and color set for the waterfall. In case the RF panorama is displayed as a comb spectrum, the waterfall will show gaps at the same spacing. These can be interpolated by ticking the "Interpolation Mode" checkbox in this dialog.

See also chapter 3.3.3.14, "RF Waterfall Dialog", on page 178.

Frequency scan

Press the "START" button to set the start frequency for the frequency scan.

See also `[SENSe:]FREQuency:STARt` on page 271.

Press the "STOP" button to set the stop frequency for the frequency scan.

See also `[SENSe:]FREQuency:STOP` on page 272.

Press the "STEP" button to select the step width for the frequency scan.

See also `[SENSe:]SWEep:STEP` on page 290.

Press the button "CYCLE COUNT" to set the cycle count, i.e. how many cycles the frequency band between the start and stop frequency is to be scanned. You can set the cycle count to a number between 1 and 1000. You can also set it to "INFinity".

See also `[SENSe:]SWEep:COUNt` on page 287.

Press the "CENTER" button to set the center frequency for the frequency scan.

Press the "SPAN" button to set the span for the frequency scan.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "DWELL TIME" button to set the dwell time in milliseconds for each frequency. You can also set dwell time to "INFinity". The system will then dwell on the current frequency until you press RUN+ or RUN-.

See also `[SENSe:]SWEep:DWELl` on page 288.

Press the button "NO SIG TIME" to set the time for signal-controlled operation, i.e. if the signal disappears during dwell time, the system will wait for the time specified and then continue with the scan. You can also turn signal-controlled operation off.

See also:

`[SENSe:]SWEep:HOLD:TIME` on page 289

`[SENSe:]SWEep:CONTrol[:ON]` on page 286

Press the button "FUNCTION SUPPRESS" to configure the suppress list. The options below appear in a new softkey bar that replaces the default softkey bar once the "FUNCTION SUPPRESS" button is pressed.

- "Suppress" adds the current frequency to the list.
- "Supp-" adds the current frequency to the list and the scan will continue in the reverse direction once the dwell time ended
- "Supp+" is similar to "Supp-" except that the scan will continue in the forward direction once the dwell time ended.
- "Store-" works like "Supp-" except that the current frequency is also copied to memory.
- "Store+" works like "Supp+" except that the current frequency is also copied to memory.
- "Sort" will sort the suppress list in ascending order.
- "Clear All" empties the suppress list; it clears the list of all frequency ranges.
- "Edit" will open the "Suppress List Setup" dialog, which is used to edit the frequencies to be suppressed during a frequency scan. You can define, edit, sort and delete these frequencies in the "Suppress List Setup" dialog.
  See also chapter 3.3.3.21, "Suppress List Setup Dialog", on page 189.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the button "CONFIG" to configure the RF waterfall to set the speed, interpolation mode and color set for the waterfall. In case the RF panorama is displayed as a comb spectrum, the waterfall will show gaps at the same spacing. These can be interpolated by ticking the "Interpolation Mode" checkbox in this dialog. Note that gaps caused by suppressed frequency ranges will not be interpolated.

See also chapter 3.3.3.14, "RF Waterfall Dialog", on page 178.

See also `[SENSe:]SWEep:COUNt` on page 287.

Memory scan

Press the "MEM SELECT" button to set the number of the current memory channel. Depending on "SELECT MODE", the new memory channel will/will not be loaded.

During scanning the softkey will indicate which memory channel is currently loaded.

See also `[SENSe:]MSCan:CHANnel` on page 279.

Press the button "SELECT MODE" to set the mode for "MEM SELECT". Setting it to "PREVIEW" mode changes only the number of the current memory channel. Mode "AUTO RECALL" causes the receiver to assume the settings associated with the new memory channel.

Press the "MEM SQUELCH" button to use the squelch value from memory ("ON") or the global squelch value ("OFF").

See also `OUTPut:SQUelch:CONTrol` on page 244.

Press the button "CYCLE COUNT" to set the cycle count, i.e. how many cycles the frequency band between the start and stop frequency is to be scanned. You can set the cycle count to a number between 1 and 1000. You can also set it to "INFinity".

See also `[SENSe:]MSCan:COUNt` on page 280.

Press the "DWELL TIME" button to set the dwell time in milliseconds for each frequency. You can also set dwell time to "INFinity". The system will then dwell on the current frequency until you press RUN+ or RUN-.

See also `[SENSe:]MSCan:DWELl` on page 282.

Press the button "NO SIG TIME" to set the time for signal-controlled operation, i.e. if the signal disappears during dwell time, the system will wait for the time specified and then continue with the scan. You can also turn signal-controlled operation off.

See also:

[SENSe:]MSCan:HOLD:TIME on page 282

[SENSe:]MSCan:CONTrol[:ON] on page 280

Press the button "FUNCTION SUPPRESS" to configure the suppress list. The options below appear in a softkey bar that replaces the default softkey bar once the "FUNCTION SUPPRESS" button is pressed.

- "Suppress" adds the current frequency to the list.
- "Supp-" adds the current frequency to the list and the scan will continue in the reverse direction once the dwell time ended.
- "Supp+" is similar to "Supp-" except that scan will continue in the forward direction once the dwell time ended.

See also chapter 3.3.3.21, "Suppress List Setup Dialog", on page 189.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also [SENSe:]FREQuency:STEP[:INCRement]? on page 272.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the button "CONFIG" to configure the RF waterfall, i.e. to set the speed and color set for the waterfall.

See also chapter 3.3.3.14, "RF Waterfall Dialog", on page 178.

3.3.2.9 Video Panorama

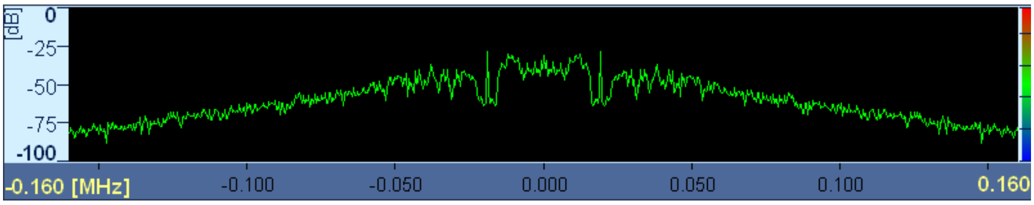


Fig. 3-8: Video Panorama.

In FFM the video panorama shows the spectrum of the demodulated signal. The span width of the video panorama is calculated, based on the receiver bandwidth, normally rounded off to a number larger than the bandwidth sufficient to provide the required FFT length (4096). The color set for color indexing in the video waterfall is shown along the right margin.

The ROTARY KNOB, the CURSOR LEFT / CURSOR RIGHT keys and the numeric keypad all can be used to control the center frequency. The ROTARY KNOB can be used for turning (clockwise for higher frequencies and counter-clockwise for lower frequencies) and clicking (the center frequency will be rounded to the nearest step value). The CURSOR LEFT / CURSOR RIGHT keys will change the center frequency by half the "SPAN" to lower or higher frequencies: after pressing the left arrow the center frequency will be reduced by half the "SPAN", and after pressing the right arrow it will be increased by half the "SPAN". The number keys allow direct entry of a new center frequency: If the focus is not on any dialog or softkey then the effect of just keying a number using the number keys will cause the receiver to use that particular number for the center frequency, provided the number is within the range of the receiver.

You can move the center frequency by left clicking into the spectrum. By right clicking into the spectrum, you can move the demodulation frequency to the clicked position. You can change the position of a marker in the spectrum by left dragging it.

Use the following softkeys to configure the video panorama:

Press the button "VIDEO TRACE" to select which demodulation is used for the video panorama. A related selector shows the available options.

See also `DISPlay:MENU[:NAME]` on page 220.

Press the button "FREQ INCR" to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the button "CONFIG" to configure the video panorama, e.g. to set the value range for the Y axis.

See also chapter 3.3.3.15, "Video Panorama Dialog", on page 179.

3.3.2.10 Video Waterfall

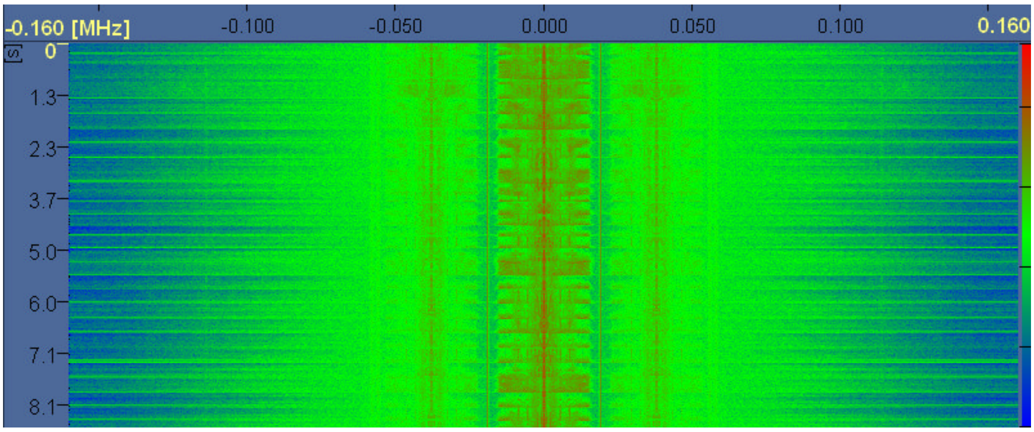


Fig. 3-9: Video Waterfall.

The video waterfall below the video panorama shows signal levels from the video panorama over time. The signal levels are color coded; the colors correspond to the color set shown along the right margin. The time in seconds is indicated along the left margin.

You can change the position of a Y marker by left dragging it along the Y axis.

Just like in the video panorama (see chapter 3.3.2.9, "Video Panorama", on page 61) you can use the the ROTARY KNOB, the CURSOR LEFT / CURSOR RIGHT keys and the numeric keypad to control the center frequency.

Use the following softkeys to configure the video waterfall:

Press the button "VIDEO TRACE" to select which demodulation is used for the video panorama. A related selector shows the available options.

See also `DISPlay:MENU[:NAME]` on page 220.

Press the button "FREQ INCR" to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also `[SENSe:]FREQuency:STEP[:INCRement]?` on page 272.

Press the button "CONFIG" to configure the video waterfall, i.e. to set the speed and color set for the waterfall.

See also chapter 3.3.3.16, "Video Waterfall Dialog", on page 179.

3.3.2.11 ITU Measurement

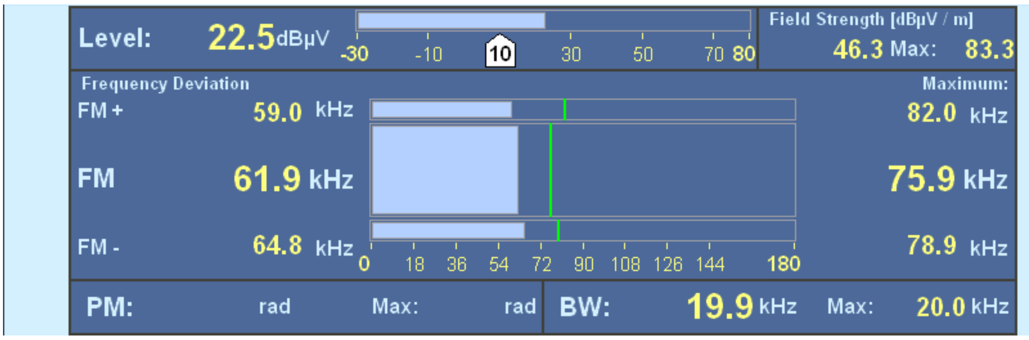


Fig. 3-10: ITU Panel: Frequency deviation measurement.

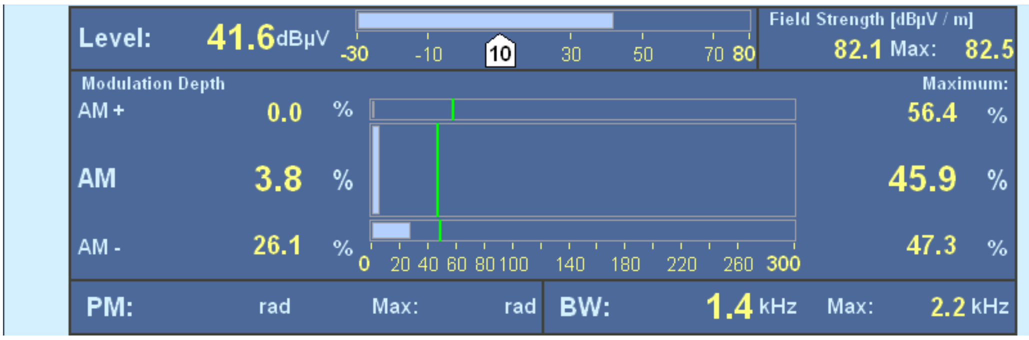


Fig. 3-11: ITU Panel: Modulation depth measurement.

The ITU panel shows the following measurement output in accordance with the ITU guidelines:

- level, field strength
- modulation depth
- frequency deviation
- PM phase deviation, bandwidth

Press the button "DEMOD FREQ" to set the demodulation frequency, which is normally the same as the receive frequency. Any deviations will be temporary. The frequency limits of the demodulation frequency are determined by the receive frequency and the IF panorama span.

See also . `[SENSe:]FREQuency:DEModulation` on page 265.

Press the button "BW MEASMODE" to select the bandwidth measurement mode, i.e. "XDB" or "BETA%".

Press the "XDB" button to set the "XDB" measurement mode value. You can select a value between 0 dB and 100 dB.

Press the "BETA%" button to set the "BETA%" measurement mode value. You can select a value between 0.1% and 99.9%.

Press the "RESET" button to reset all maximum ITU measurement values.

This button will toggle between AM measurement (modulation depth in percent) and FM measurement (frequency deviation in kHz).

Depending on the setting of the softkey "AM/FM MODE", the ITU measurement will display either the Modulation Depth (AM) or the Frequency Deviation (FM). The modulation depth and frequency deviation are displayed digitally (values on the left-hand side) as well as in analog form (as bars). The related maxima are shown digitally (values on the right-hand side) and in analog form (as a vertical line within the bar representation). The PM phase deviation display is not active unless the PM modulation mode is switched on. The ITU panel requires option R&S EB500-IM.

Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

3.3.2.12 Polar Panel

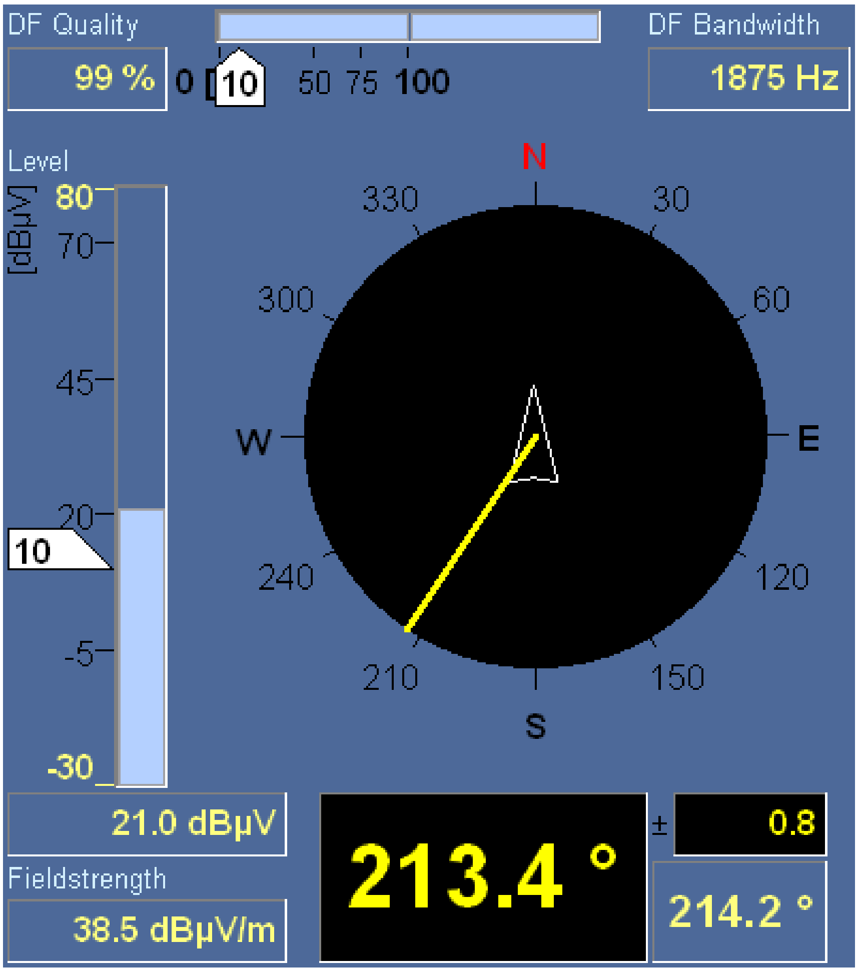


Fig. 3-12: Polar Panel.

The polar panel shows the bearing of a signal within a 360° azimuth dial. Invalid bearings are indicated by a gray bearing indicator. If no new valid bearing values arrive after a period of more than one minute, the polar panel will be stopped. In this case, a "Stopped" message will appear along with the time at which the panel was stopped. If persistence has been turned on, the bearing indicator will be shown as a gray dashed line throughout the persistence period. Once the persistence period has expired, it will be shown as a solid gray line.

The polar panel requires DF upgrade R&S EB500-DF.

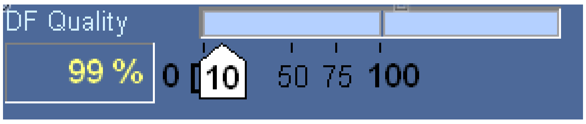
Besides the bearing of the signal the following additional information is displayed:

- The bearing value in digital form (large black indicator).

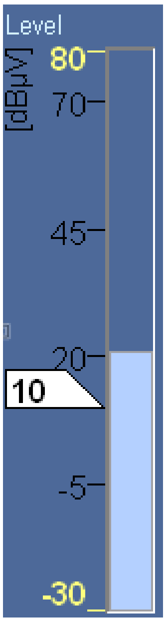
- If the "Azimuth" softkey is set to "Average" (see the softkey description below), the small black indicator will show the standard deviation for the average from the last 10 measurements. If the "Azimuth" softkey is set to "Current", the small black indicator will not show any value, just three dashes (- - -).

- If the "Azimuth" softkey is set to "Average", the blue indicator will show the average from the last 10 measurements. If the "Azimuth" softkey is set to "Current", the blue indicator will show the previous valid bearing value.

- The DF quality in digital and analog form with DF quality squelch.



- The level in digital and analog form with DF level squelch.



- The field strength in digital form.

- The DF bandwidth (current panorama bandwidth, which depends on the step width and selectivity).

Use the following softkeys to configure the polar panel:

Press the "DF QUALITY" button to set the DF quality, which ranges from 0% to 100%.

Once this softkey has the focus you can change the value by using the ROTARY KNOB or numeric keys.

Press the "SPAN" button to set the IF panorama span.

A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also `[SENSe:]FREQuency:SPAN` on page 270.

Press the "STEP" button to set the IF panorama step width. Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.

Press the "LEVEL SQU" button to set the DF squelch for DF averaging in "NORM" ("NORMal") or "GATE" mode.

See also `MEASure:DFINder|DF:THReshold[:UPPer]` on page 232 .

Press the "SQU MODE" button to select or turn off the squelch mode. If the DF squelch is turned off, it is not shown in the DF panorama or the polar panel.

A related selector shows the available modes.

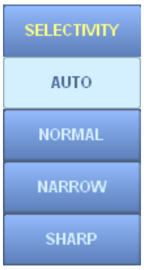
Available modes are "OFF", "GATE" and "NORMAL".

See also `MEASure:DFINder|DF:MODE` on page 230 .

Press the "AF DF MODE" button to set the application in FFM mode to direction finding ("DF") or measurement ("AF"). If you change the application mode from "Receiver" to "DF", the related mode is activated automatically. In AF mode you can turn on the polychrome IF panorama and use the PScan, provided the option R&S EB500-PS is installed.

See also `MEASure:APPLication` on page 228.

Press the "DF MEAS TIME" button to set the DF measurement time, which is independent of the global measurement time. You can use the ROLLKEY or numeric pad to set the measurement time to the desired value.



Press the "Selectivity" button to set the selectivity in the panorama. You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span. A related selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP".

See also `CALCulate:IFPan:SELectivity` on page 205 .

Press the "SHOW ON TOP" button to show either the geographic north or the vehicle axis on top of the wind rose.

If the "Azimuth" softkey is set to "Average", the average and standard deviation from the last 10 measurements will be calculated and shown in the panel.

If the "Azimuth" softkey is set to "Current", the previous valid bearing value will be shown instead of the average.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

Press the "CONFIG POLAR" button to configure the polar panel. You can configure the value range of the level Y axis. You can configure the following parameters: value range of the level Y axis, background of the wind rose, persistence of the DF beam and accuracy of the DF value.

See also chapter 3.3.3.19, "Polar Display Dialog", on page 185 .

3.3.2.13 DF IF Panorama

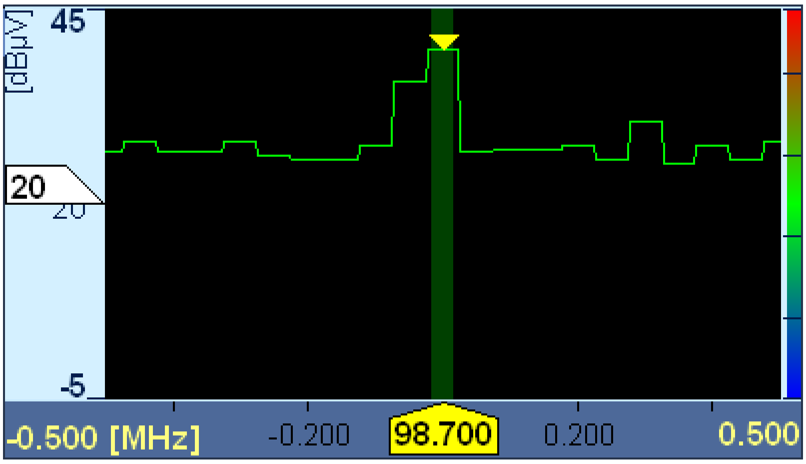


Fig. 3-13: DF IF Panorama.

In FFM the DF IF panorama shows signals centered around the current receive frequency. The DF IF panorama bandwidth is determined by the frequency span setting (softkey "SPAN"). The dark green background indicates the DF bandwidth. The DF level threshold is indicated along the left margin. The color set for color indexing in an IF waterfall panel is shown along the right margin.

The DF IF panorama requires DF upgrade R&S EB500-DF.

The ROTARY KNOB, the CURSOR LEFT / CURSOR RIGHT keys and the numeric keypad all can be used to control the center frequency. The ROTARY KNOB can be used for turning (clockwise for higher frequencies and counter-clockwise for lower frequencies) and clicking (the center frequency will be rounded to the nearest "STEP" value). The CURSOR LEFT / CURSOR RIGHT keys will change the center frequency with half the "SPAN" to lower or higher frequencies: after pressing the CURSOR LEFT key the center frequency will be reduced by half the "SPAN" and after pressing the CURSOR RIGHT key it will be increased by half the "SPAN". The number keys allow direct entry of a new center frequency: If the focus is not on any dialog or softkey then the effect of just keying a number using the number keys will cause the receiver to use that particular number for the center frequency, provided the number is within the range of the receiver.

If you connect a mouse and left click the yellow main marker on the X axis its ruler (the yellow line above the marker) will briefly appear. You can change the position of an active X marker by left dragging it. If you left drag the yellow main marker along the X axis, you can change the center frequency. By right dragging the yellow main marker along the X axis you can change the demodulation frequency.

If you left click the squelch marker (level threshold marker) on the Y axis its ruler will briefly appear. By left dragging the squelch marker along the Y axis, you can change its value. By left dragging a Y marker along the Y axis you can change its position.

You can move the center frequency by left clicking into the spectrum. By right clicking into the spectrum, you can move the demodulation frequency to the clicked position. You can change the position of a marker in the spectrum by left dragging it. You can change the center frequency by left dragging the yellow main marker in the spectrum. By right dragging the yellow main marker in the spectrum, you can change the demodulation frequency.

If you connect a keyboard then you can also change the center frequency using the cursor keys. The CURSOR RIGHT and CURSOR UP keys will move the center frequency by half the set "SPAN" to a higher frequency. The CURSOR LEFT and CURSOR DOWN keys will move the center frequency by half the set "SPAN" to a lower frequency.

If you press the mouse wheel or ROTARY KNOB, the current center frequency will be rounded to the step width. If you connect an external keyboard then SHIFT+<NUMERIC KEY> will round the center frequency to the corresponding decimal power, e.g. SHIFT +3 will round to kHz.

Use the following softkeys to configure the IF panorama:

Press the "DEMOD FREQ" button to set the demodulation frequency, which is normally the same as the receive frequency. Any deviations will be temporary, which means that the ROTARY KNOB will act upon the demodulation frequency for as long as the focus is on the "DEMOD FREQ" button. The frequency limits of the demodulation frequency are determined by the receive frequency and the IF panorama span.

See also `[SENSe:]FREQuency:DEModulation` on page 265.

Press the "AF DF MODE" button to set the application in FFM mode to direction finding ("DF") or measurement ("AF"). If you change the application mode from "Receiver" to "DF", the related mode is activated automatically. In AF mode you can turn on the polychrome IF panorama and use the PScan, provided the option R&S EB500-PS is installed.

See also `MEASure:APPLication` on page 228.

Press the "LEVEL SQU" button to set the DF squelch for DF averaging in "NORM" ("NORMal") or "GATE" mode.

See also `MEASure:DFINder|DF:THReshold[:UPPer]` on page 232 .

Press the "SQU MODE" button to select or turn off the squelch mode. If the DF squelch is turned off, it is not shown in the DF panorama or the polar panel.

A related selector shows the available modes.

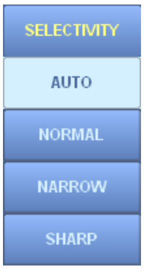
Available modes are "OFF", "GATE" and "NORM" ("NORMal").

See also `MEASure:DFINder|DF:MODE` on page 230.

Press the button "DF MEAS TIME" to set the DF measurement time, which is independent of the global measurement time. You can use the ROLLKEY or numeric pad to set the measurement time to the desired value. In addition, there is a selector which allows you to select one of seven predefined time periods.

See also `MEASure:DFINder|DF:TIME` on page 231.

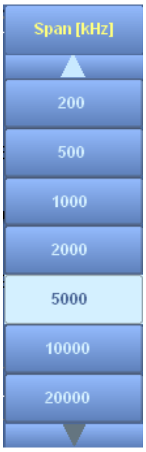
Press the "SELECTIVITY" button to set the selectivity in the IF panorama.



You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span.

A related vertical selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP."

Press the "SPAN" button to set the IF panorama span.



A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also `[SENSe:]FREQuency:SPAN` on page 270.

Press the "STEP" button to set the IF panorama step width.

Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.

Press the "SEARCH PEAK" button to center the IF panorama to the next left or right level peak, or to the absolute level peak. You can choose either the center frequency or the demodulation frequency. Once the softkey is pressed, a new row of softkeys will appear, which show the available options.

See also:

`CALCulate:IFPan:MARKer:MAXimum:LEFT` on page 204

CALCulate:IFPan:MARKer:MAXimum:RIGHt on page 204

CALCulate:IFPan:MARKer:MAXimum[:PEAK] on page 204

CALCulate:IFPan:MARKer:DEModulation:MAXimum:LEFT on page 204

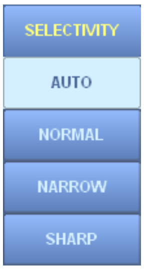
CALCulate:IFPan:MARKer:DEModulation:MAXimum:RIGHt on page 204

CALCulate:IFPan:MARKer:DEModulation:MAXimum[:PEAK] on page 204

Press the "FFT MODE" button to select the FFT mode for the IF panorama data.

Once the softkey is pressed, a vertical selector will appear, which shows the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE"

Press the "SELECTIVITY" button to set the selectivity in the IF panorama.



You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span.

A related vertical selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP."

Press the "SPAN" button to set the IF panorama span.

A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also [SENSe:]FREQuency:SPAN on page 270.

Press the "STEP" button to set the IF panorama step width.

Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.

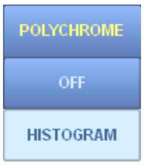
Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "POLYCHROME" button to operate the IF panorama in polychrome mode. You can set it to "OFF" or "HISTOGRAM" (color histogram). A related selector shows the available options.



If you select "HISTOGRAM", the frequency of the levels of the received signal measured over a defined time ("PERSISTENCE") will be shown in addition to the levels. Red dots indicate high occupancy (more frequently occurring levels) whereas blue dots indicate low occupancy (less frequently occurring levels).

Black areas indicate that no levels are being measured.

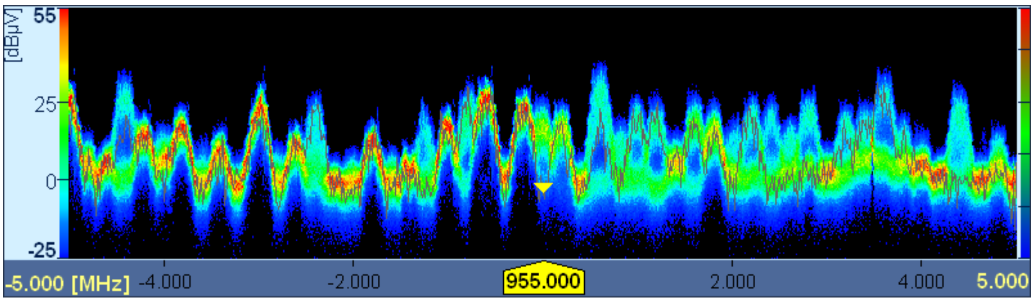


Fig. 3-14: Polychrome IF panorama.

See also `CALCulate:PIFPan:MODE` on page 208.

Press the "100% TIME" button to set the 100% time (the level occupancy required to indicate 100% in the color bar scale) for the polychrome IF panorama.

See also `CALCulate:PIFPan:ACTTime` on page 207.

Press the "PERSISTENCE" button to set persistence of the polychrome panorama, i.e. the time during which the occupancy of a signal is to be measured.

See also `CALCulate:PIFPan:OBSTime` on page 209.

Press the "CLEAR POLYCHROME" button to clear the polychrome IF panorama; the measurement will restart.

See also `CALCulate:PIFPan:CLEar` on page 208.

Press the "LOW LIMIT" button to set the lower time limit for 100% time. Occupancies less than the lower limit will not be indicated with a color in the IF panel. You can set the lower limit to a value between 0 ms and the upper limit.

Press the "UPPER LIMIT" button to set the upper time limit for 100% time. Occupancies higher than the upper limit will not be indicated with a color in the IF panel. You can set the upper limit to a value between the lower limit and 100% time.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the "CONFIG DFPAN" button to configure the DF IF panorama. You can configure the value range of the Y axis, the color set for the waterfall and the "Hold Maximum" function.

See also: chapter 3.3.3.17, "DF Panorama Dialog", on page 180.

3.3.2.14 DF IF Waterfall

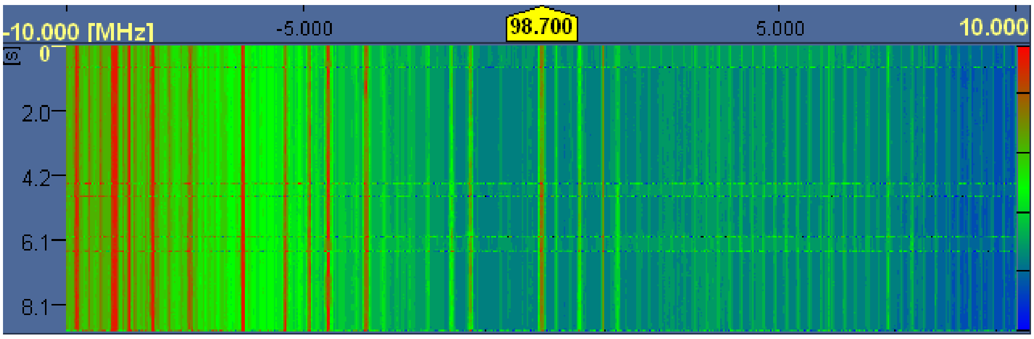


Fig. 3-15: DF IF Waterfall.

The DF IF waterfall, which by default is displayed below the DF IF panorama, shows signal levels from the DF IF panorama over time. The signal levels are color coded; the colors correspond to the color set shown along the right margin. They correspond with the level in the DF IF panorama. The time in seconds is indicated along the left margin.

The DF IF waterfall requires DF upgrade R&S EB500-DF.

Color Coding

With option R&S EB500-WDF the color coding of the DF IF Waterfall panel can be changed from Level to Azimuth. With Azimuth coding the panel shows the waterfall panel for the measured DF angles, the colors representing the azimuth values as indicated in the color bar at the left of the azimuth panel.

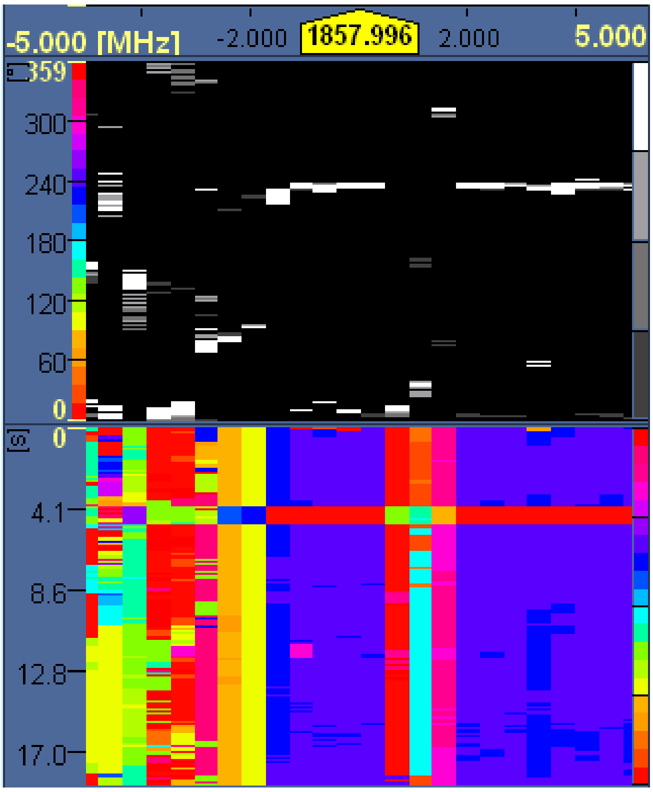


Fig. 3-16: DF Waterfall panel with Azimuth color coding.

Use the Color Coding softkey (see below) to switch between level and azimuth colors.

You can change the position of a Y marker by turning the SELECT rollkey or by left dragging it along the Y axis (in case a mouse is connected).

If you want to change the center frequency by using a mouse, left click into the waterfall. Likewise, if you want to change the demodulation frequency, right click into the waterfall. You can also left drag a marker in the waterfall to change its position. You can change the center frequency by left dragging the yellow main marker on the X axis. By right dragging the yellow main marker on the X axis, you can change the demodulation frequency. If the IF waterfall is displayed in a single-panel layout (SETUP > "Layout" > "IF WF ONLY") then there will be no X axis and no marker.

Press the mouse wheel or ROTARY KNOB to round the current center frequency to the step width.

Use the following softkeys to configure the IF waterfall:

Press the COL CODING button to change the color coding of the waterfall. The color coding option only makes sense when the azimuth reading is available, which requires option R&S EB500-WDF. See "Color Coding" on page 75 for an example of azimuth color coding.

Press the "AF DF MODE" button to set the application in FFM mode to direction finding ("DF") or measurement ("AF"). If you change the application mode from "Receiver" to "DF", the related mode is activated automatically. In AF mode you can turn on the polychrome IF panorama and use the PScan, provided the option R&S EB500-PS is installed.

See also `MEASure:APPLication` on page 228.

Press the "LEVEL SQU" button to set the DF squelch for DF averaging in "NORM" ("NORMal") or "GATE" mode.

See also `MEASure:DFINder|DF:THReshold[:UPPer]` on page 232.

Press the "SQU MODE" button to select or turn off the squelch mode. If the DF squelch is turned off, it is not shown in the DF panorama or the polar panel.

A related selector shows the available modes.

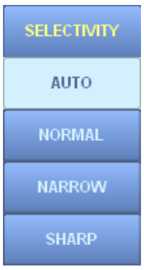
Available modes are "OFF", "GATE" and "NORM" ("NORMal").

See also `MEASure:DFINder|DF:MODE` on page 230.

Press the button "DF MEAS TIME" to set the DF measurement time, which is independent of the global measurement time. You can use the ROLLKEY or numeric pad to set the measurement time to the desired value. In addition, there is a selector which allows you to select one of seven predefined time periods.

See also `MEASure:DFINder|DF:TIME` on page 231.

Press the "SELECTIVITY" button to set the selectivity in the IF panorama. You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span.



A related vertical selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP."

Press the "SPAN" button to set the IF panorama span.

A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also `[SENSe:]FREQuency:SPAN` on page 270.

Press the "STEP" button to set the IF panorama step width. Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.

Press the "FFT MODE" button to select the FFT mode for the IF panorama data.

Once the softkey is pressed, a vertical selector will appear, which shows the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE"

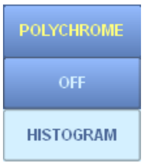
Press the "MEAS MODE" button to select the measurement mode. The measurement mode can be set to "CONT" ("CONTinuous") or "PER" ("PERiodic").

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "MEAS TIME" button to set the measurement time. You can set a concrete time for periodic measurements or you can set it to "AUTO", in which case it will be determined automatically.

See also chapter 4.5.9, "MEASure Subsystem", on page 227.

Press the "POLYCHROME" button to operate the IF panorama in polychrome mode. You can set it to "OFF" or "HISTOGRAM" (color histogram). A related selector shows the available options.



If you select "HISTOGRAM", the frequency of the levels of the received signal measured over a defined time ("PERSISTENCE") will be shown in addition to the levels. Red dots indicate high occupancy (more frequently occurring levels) whereas blue dots indicate low occupancy (less frequently occurring levels).

Black areas indicate that no levels are being measured.

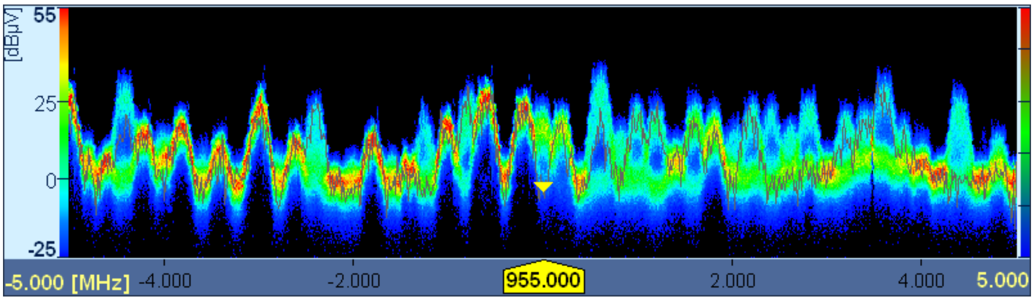


Fig. 3-17: Polychrome IF panorama.

See also `CALCulate:PIFPan:MODE` on page 208.

Press the "100% TIME" button to set the 100% time (the level occupancy required to indicate 100% in the color bar scale) for the polychrome IF panorama.

See also `CALCulate:PIFPan:ACTTime` on page 207.

Press the "PERSISTENCE" button to set persistence of the polychrome panorama, i.e. the time during which the occupancy of a signal is to be measured.

See also `CALCulate:PIFPan:OBSTime` on page 209.

Press the "CLEAR POLYCHROME" button to clear the polychrome IF panorama; the measurement will restart.

See also `CALCulate:PIFPan:CLEar` on page 208.

Press the "LOW LIMIT" button to set the lower time limit for 100% time. Occupancies less than the lower limit will not be indicated with a color in the IF panel. You can set the lower limit to a value between 0 ms and the upper limit.

Press the "UPPER LIMIT" button to set the upper time limit for 100% time. Occupancies higher than the upper limit will not be indicated with a color in the IF panel. You can set the upper limit to a value between the lower limit and 100% time.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

Press the "DIFF MODE" button to turn on the "Differential" mode. When turned on, the current spectrum is used as the reference; only the changes with respect to the reference spectrum are displayed.

This mode is indicated by the words "Differential Mode" displayed at the top of the spectrum. Note that the waterfall panel does not support differential mode.

Press the "CONFIG DFPAN" button to configure the DF IF panorama. You can configure the value range of the Y axis, the color set for the waterfall and the "Hold Maximum" function.

See also: chapter 3.3.3.18, "DF Waterfall Dialog", on page 183.

3.3.2.15 Azimuth Panel

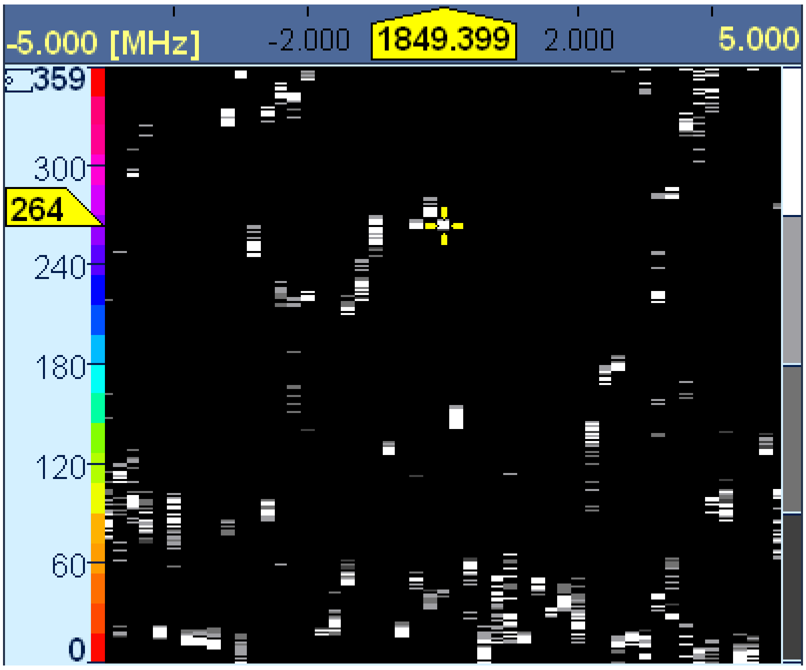


Fig. 3-18: Azimuth panel.

The azimuth panel shows bearing angles dependent on the frequency. An azimuth ruler and cross-hairs cursor allows you to select a signal manually or automatically. See "RULER MODE" softkey. The color set for color indexing in the DF IF waterfall panel (see chapter 3.3.2.14, "DF IF Waterfall", on page 74) is shown along the left margin. The waterfall does not show the bearing values unless the "COL CODING" softkey has been set to AZIMUTH. The signal age is shown along the right margin. White stands for current signals. The signal age is updated every second and indicated by a darker color. After four seconds, the signals are removed from the display.

The azimuth panel requires option R&S EB500-WDF.

The ROTARY KNOB, the CURSOR LEFT / CURSOR RIGHT keys and the numeric keypad all can be used to control the center frequency. The ROTARY KNOB can be used for turning (clockwise for higher frequencies and counter-clockwise for lower frequencies) and clicking (the center frequency will be rounded to the nearest "STEP" value). The CURSOR LEFT / CURSOR RIGHT keys will change the center frequency with half the "SPAN" to lower or higher frequencies: after pressing the CURSOR LEFT key the center frequency will be reduced by half the "SPAN" and after pressing the CURSOR RIGHT key it will be increased by half the "SPAN". The number keys allow direct entry of a new center frequency: If the focus is not on any dialog or softkey then the effect of just keying a number using the number keys will cause the receiver to use that particular number for the center frequency, provided the number is within the range of the receiver.

If you connect a mouse and left click the azimuth marker on the Y axis its ruler will briefly appear. You can change the value of the azimuth marker by left dragging it. You can change the position of a Y marker by left dragging it along the Y axis.

You can move the center frequency by left clicking into the azimuth panel. By right clicking into the azimuth panel, you can move the demodulation frequency to the clicked position. You can change the position of a marker in the azimuth panel by left dragging it. You can change the center frequency by left dragging the yellow main marker in the azimuth panel. By right dragging the yellow main marker in the azimuth panel, you can change the demodulation frequency.

If you connect a keyboard then you can also change the center frequency using the cursor keys. The CURSOR RIGHT and CURSOR UP keys will move the center frequency by half the set "SPAN" to a higher frequency. The CURSOR LEFT and CURSOR DOWN keys will move the center frequency by half the set "SPAN" to a lower frequency.

Use the following softkeys to configure the azimuth panel:

The "Ruler Mode" softkey can be used to set the azimuth ruler either in Auto (automatic) or Manual mode. In Auto mode there will only be a cross-hairs cursor at the azimuth of the demod frequency.

In Manual mode the cross-hairs cursor can be set manually by left dragging the cursor in the y-direction. In Manual mode there is also a marker on the y-axis. Dragging the marker along the y-axis will move the cursor. A ruler will shortly appear when the cursor position has changed.

Press the "AF DF MODE" button to set the application in FFM mode to direction finding ("DF") or measurement ("AF"). If you change the application mode from "Receiver" to "DF", the related mode is activated automatically. In AF mode you can turn on the poly-chrome IF panorama and use the PScan, provided the option R&S EB500-PS is installed.

See also `MEASure:APPLication` on page 228.

Press the "LEVEL SQU" button to set the DF squelch for DF averaging in "NORM" ("NORMal") or "GATE" mode.

See also `MEASure:DFINder|DF:THReshold[:UPPer]` on page 232 .

Press the "SQU MODE" button to select or turn off the squelch mode. If the DF squelch is turned off, it is not shown in the DF panorama or the polar panel.

A related selector shows the available modes.

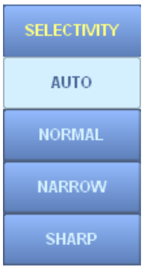
Available modes are "OFF", "GATE" and "NORM" ("NORMal").

See also `MEASure:DFINder|DF:MODE` on page 230.

Press the button "DF MEAS TIME" to set the DF measurement time, which is independent of the global measurement time. You can use the ROLLKEY or numeric pad to set the measurement time to the desired value. In addition, there is a selector which allows you to select one of seven predefined time periods.

See also `MEASure:DFINder|DF:TIME` on page 231.

Press the "SELECTIVITY" button to set the selectivity in the IF panorama.



You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span.

A related vertical selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP."

Press the "SPAN" button to set the IF panorama span.

A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also `[SENSe:]FREQuency:SPAN` on page 270.

Press the "STEP" button to set the IF panorama step width.

Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the IF panorama span. A related vertical selector will pop-up, showing the available options.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

The "Azimuth" softkey is basically an indicator for the azimuth at the marker position.

3.3.2.16 DDC Display

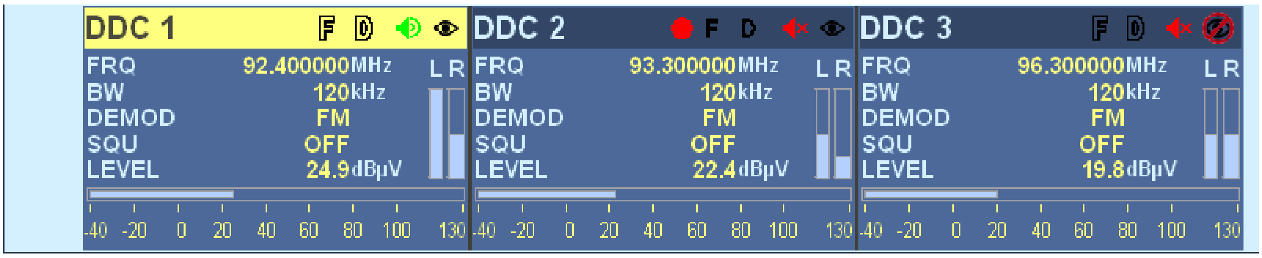


Fig. 3-19: DDC Display

The DDC display shows the configuration for each of the four digital down converters (DDCs) of the R&S EB500. The DDC currently in use is indicated by the yellow bar along the top. It contains specific icons showing the current configuration and state of the DDC:

	The DDC is shown in the spectrum.
	The DDC is not shown in the spectrum.
	The DDC audio is turned on.
	The DDC audio is turned off.
	The demodulation of the DDC is coupled to the demodulation of the primary receive path.
	The demodulation of the DDC is independent of the demodulation in the primary receive path.
	The frequency of the DDC is coupled to the frequency of the primary receive path.
	The frequency of the DDC is independent of the frequency in the primary receive path.
	The DDC data is being recorded.

Note

Digital Down Converter functions are only accessible with the installed software option R&S EB500-DDC.

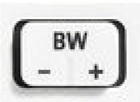
A configuration comprises the following parameters:

- frequency

- demodulation bandwidth
- demodulation mode
- squelch
- volume and balance
- visibility in the IF panorama
- indication of the DDC's coupling to the center frequency
- indication of the DDC's demodulation coupling to the demodulation of the primary receive path.

The DDC currently being configured is highlighted in yellow. Once you have activated the panel, you can select the desired DDC using the CURSOR LEFT / CURSOR RIGHT keys. Use the ROLLKEY to change the receive frequency of the selected DDC.

See also [SENSe:]FREQuency:DDC[<numeric_suffix>] on page 488.



Use the BANDWIDTH keys to set the demodulation bandwidth.

See also [SENSe:]BANDwidth|BWIDth[:RESolution]:DDC[<numeric_suffix>] on page 486 .

If you want to change the squelch or turn it off or on, use the SQU key together with the SELECT knob.

See also OUTPut:SQUelch:DDC[<numeric_suffix>][:STATe] on page 484.

If you want to change the volume or mute / unmute it, use the VOLUME / MUTE knob.

See also:

SYSTem:AUDio:DDC[<numeric_suffix>]:VOLume on page 492

SYSTem:AUDio:DDC[<numeric_suffix>][:STATe] on page 493

Use the configuration dialog of the DDC display to configure the volume, balance and visibility for all the DDC channels. The volume and balance are visualized via two bars marked "L" and "R". They represent the volume of the left and right channel, respectively. If you have the sound turned off, the speaker icon in the upper bar is crossed out. The same applies to the visibility icon. If a DDC is shown in the IF panorama, an icon with an eye is displayed in the upper bar. If the DDC is not shown, the eye is crossed out.

If you press the MEM > "RCL" and MEM > "Save" keys while the DDC panel is selected, the keys will affect the frequency of the current DDC rather than the center frequency (see "Recall to DDC frequencies" on page 121 and "Save DDC frequencies" on page 123).

The measured level of the related DDC is shown digitally (by value) and in analog form (represented by a bar). If no valid measurement values are available, no value is displayed and the bar is not filled.

You can also use the mouse to control the DDC display. Select a DDC by clicking into the desired DDC's field. Once a DDC has been selected, you can change its state. If you click the visibility icon you can turn visibility on or off. The DDC channels are visible in the IF panorama by means of dark-red bars and numbered markers, representing the DDC channels with the bandwidth for each channel (see the figure below).

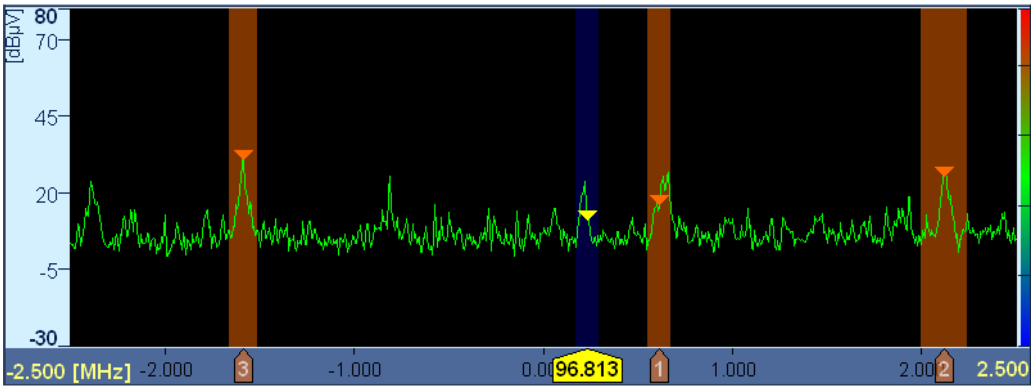


Fig. 3-20: IF Panorama with all three DDC channels visible.

Clicking the speaker icon turns the audio on or off. Clicking the frequency or demodulation coupling icon activates or deactivates the coupling. Clicking the line for the DDC's demodulation bandwidth sets the next possible bandwidth for this particular DDC. The DDC's demodulation mode is set likewise. Clicking the squelch line turns the squelch on or off. When a squelch has been turned on, it is shown as a white marker in the level indicator. You can change it via drag & drop using the left mouse key.

The DDC display can be configured with the following softkeys:

Press the "DEMOD FREQ" button to set the demodulation frequency, which is normally the same as the receive frequency. Any deviations will be temporary, which means that the ROTARY KNOB will act upon the demodulation frequency for as long as the focus is on the "DEMOD FREQ" button. The frequency limits of the demodulation frequency are determined by the receive frequency and the IF panorama span.

See also [SENSe:]FREQuency:DEModulation on page 265.

Press the "SPAN" button to set the panorama span.

A related vertical selector will pop-up, showing the possible values, which range from 1 kHz to 20 MHz.

See also [SENSe:]FREQuency:SPAN on page 270.

Press the "STEP" button to set the step width. Step widths range from 625 mHz to 2 MHz.

When set to "AUTO", the step width is determined automatically depending on the span. A related vertical selector will pop-up, showing the available options.

After pressing the "SEARCH DDC PEAK" button the following row of softkeys will appear.

The three leftmost options allow you to set the currently selected DDC to the next left, right or absolute level peak, respectively.

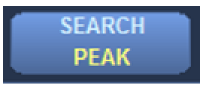
The "LEFT NEXT" button will allocate the peak left of the absolute level peak in the span to the first DDC channel that is not within the span, starting with DDC1.

The "RIGHT NEXT" button will allocate the peak right of the absolute level peak in the span to the first DDC channel that is not within the span, starting with DDC1.

Once all DDC channels are within the span, the "LEFT NEXT" and "RIGHT NEXT" buttons have no more effect.

See also:

- `CALCulate:IFPan:MARKer:DDC[<numeric_suffix>]:MAXimum:LEFT` on page 484
- `CALCulate:IFPan:MARKer:DDC[<numeric_suffix>]:MAXimum:RIGHt` on page 484
- `CALCulate:IFPan:MARKer:DDC[<numeric_suffix>]:MAXimum[:PEAK]` on page 483
- `CALCulate:IFPan:MARKer:DDC:NEXT:MAXimum:LEFT` on page 484
- `CALCulate:IFPan:MARKer:DDC:NEXT:MAXimum:RIGHt` on page 484



Press the "SEARCH PEAK" button to center the IF panorama to the next left or right level peak, or to the absolute level peak. You can choose either the center frequency or the demodulation frequency. Once the softkey is pressed, a new row of softkeys will appear, which show the available options.

See also:

- CALCulate:IFPan:MARKer:MAXimum:LEFT on page 204
- CALCulate:IFPan:MARKer:MAXimum:RIGHt on page 204
- CALCulate:IFPan:MARKer:MAXimum[:PEAK] on page 204
- CALCulate:IFPan:MARKer:DEModulation:MAXimum:LEFT on page 204
- CALCulate:IFPan:MARKer:DEModulation:MAXimum:RIGHt on page 204
- CALCulate:IFPan:MARKer:DEModulation:MAXimum[:PEAK] on page 204

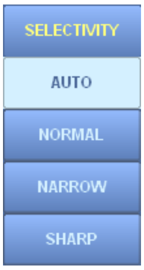
Press the "FREQ UNCOUPLED" / "FREQ COUPLED" softkey to activate or deactivate the coupling of the current DDC's frequency to the center frequency. If "COUPLED", the DDC's frequency will change along with the center frequency. If "UNCOUPLED", the frequency of the current DDC will not be affected by the center frequency.

Press "DEMOD UNCOUPLED" / "DEMOD COUPLED" softkey to activate or deactivate the coupling of the current DDC's demodulation to the primary receive path. If "COUPLED", the demodulation bandwidth, demodulation mode and squelch of the DDC will change along with the settings of the primary receive path. If "UNCOUPLED", the current DDC's demodulation will not be affected by changes in the primary receive path.

The "COPY DDC > RX" softkey copies the center frequency to the receive frequency of the current DDC.

The "COPY RX > DDC" softkey copies the receive frequency of the current DDC to the center frequency.

Press the "SELECTIVITY" button to set the selectivity in the panorama. You can only set the desired selectivity. The actual selectivity that can be achieved depends on the combination of step width and span.



A related vertical selector shows the available options. Available options are "AUTO", "NORMAL", "NARROW" and "SHARP".

See also CALCulate:IFPan:SELectivity on page 205.

Press the "FFT MODE" button to select the FFT mode for the panorama data.

Once the softkey is pressed, a vertical selector will appear, which shows the available options. Available options are "MINIMUM", "MAXIMUM", "AVERAGE" and "CLRWRITE"

See also CALCulate:IFPan:AVERage:TYPE on page 202.

Press the "FREQ INCR" button to set the frequency increment for changing the receive frequency. You can choose between manual and automatic mode. If you select manual mode, the specified value will be used as increment. If you select "AUTO" mode, the step width of the currently focused panel will be used as increment.

See also [SENSe:]FREQuency:STEP[:INCRement] on page 272.

Press the "SHOW ON" / "SHOW OFF" softkey to show or hide the selected DDC in the IF panorama. Set it to "ON" if you want it to be shown. An icon with an eye is displayed in the related DDC field and the DDC channels are shown in the IF panorama provided they are within the span.

Press the "SELECT" button to select the DDC to be configured. A related selector shows the available DDCs.

Press "CONFIG DDC" to open the "DDC Display" dialog. You can specify whether or not the demodulation bandwidth of the individual DDCs should be displayed in the IF panorama. You can also make all DDCs visible simultaneously and change their coupling status. In addition, you can set the volume and balance of the individual DDCs.

3.3.2.17 Selective Call

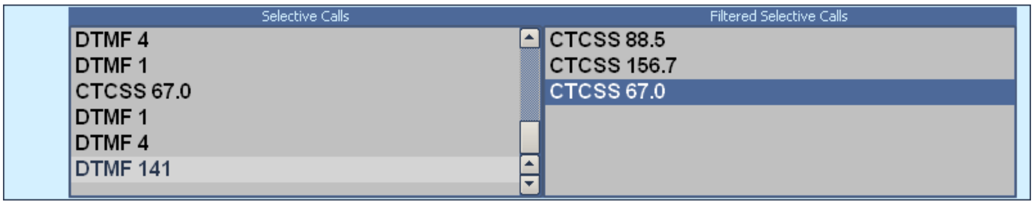


Fig. 3-21: Selective Call panel.

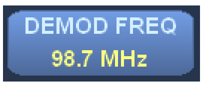
The Selective Call panel shows the decoded selective call and demodulated pager data. While the list on the left shows all data, the list on the right shows only filtered data. The Selective Call panel requires option R&S EB500-SL.

Use the LEFT or RIGHT cursor key to select a particular list. Within a list, you can scroll through the list entries using the UP or DOWN cursor key. If the last entry in a list is selected, automatic scrolling is activated, i.e. every new selective call will be selected automatically and the list will be scrolled down. If the last entry is not selected, automatic scrolling is deactivated and a new selective call will not cause any scrolling.

Use the mouse wheel or ROLLKEY to scroll the selected list up or down.

If you press the mouse wheel or ROLLKEY, the selected list will be switched.

Use the following softkeys to configure the Selective Call panel:



Press the "DEMOD FREQ" button to set the demodulation frequency, which is normally the same as the receive frequency. Any deviations will be temporary, which means that the ROTARY KNOB will act upon the demodulation frequency for as long as the focus is on the "DEMOD FREQ" button. The frequency limits of the demodulation frequency are determined by the receive frequency and the IF panorama span.

See also `[SENSe:]FREQuency:DEModulation` on page 265.

Press the "FILTER" button to select one or more selective call methods as filter criteria. Filtered selective calls are additionally shown in the right-hand list. Once the filter has been switched on, a new set of softkeys with the different filter methods provided.

Available methods are "CCIR 1", "CCIR 7", "CCITT", "EEA", "EIA", "EURO", "NATEL", "VDEW", "ZVEI-1", "ZVEI-2", "DTMF", "CTCSS" and "DCS".

Toggling the "SELECT" button between "LEFT" and "RIGHT" changes the highlight between the "LEFT" list (Selective Calls) and "RIGHT" list (Filtered Selective Calls). Scrolling with the ROLLKEY will only act upon the list with the highlight.

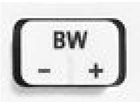
The "CLEAR LEFT" button will clear the left-hand list of all entries.

The "CLEAR RIGHT" button will clear the right-hand list of all entries.

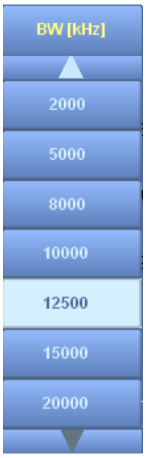
3.3.3 Using Front-Panel Keys and Dialogs

This chapter contains a detailed description of the front-panel keys of the R&S EB500 and how to use the associated dialogs.

3.3.3.1 BANDWIDTH



This key is used to set the demodulation bandwidth. Pressing the left side of the key (BW-) will decrease the bandwidth, whereas pressing the right side of the key (BW+) will increase the bandwidth. At the same time, when the key is pressed, a vertical selector will open and the desired demodulation bandwidth can be chosen directly by moving up and down.

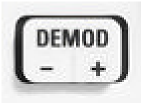


Available bandwidths are 0.1 kHz, 0.15 kHz, 0.3 kHz, 0.6 kHz, 1 kHz, 1.5 kHz, 2.1 kHz, 2.4 kHz, 2.7 kHz, 3.1 kHz, 4 kHz, 4.8 kHz, 6 kHz, 9 kHz, 12 kHz, 15 kHz, 30 kHz, 50 kHz, 120 kHz, 150 kHz, 250 kHz, 300 kHz, 500 kHz, 800 kHz, 1000 kHz, 1250 kHz, 1500 kHz, 2000 kHz, 5000 kHz, 8000 kHz, 10,000 kHz, 12,500 kHz, 15,000 kHz and 20,000 kHz.

The selector will close after it has been idle for more than 3 sec. While the dialog is open, the user can scroll through the available bandwidth settings and while scrolling the high-lighted value will be adopted by the receiver so the effect is immediate. Scrolling can be done by pressing BW+ or BW-. The main rollkey can also be used for scrolling. When an arrow at the top or bottom of the selector is highlighted, it indicates that more values can be selected for the demodulation bandwidth.

See also `[SENSe:]BANDwidth|BWIDth[:RESolution]` on page 253 .

3.3.3.2 DEMODULATION



This key is used to set the demodulation mode. Pressing the left side (DEMOD-) or right side (DEMOD+) of the key will change the demodulation from a list of options in reverse or forward directions. At the same time, when the key is pressed, a vertical selector will open and the desired demodulation mode can be chosen directly by moving up and down.

The vertical selector will show the available demodulation options: CW, USB, LSB, ISB, AM, FM, PULS, PM and IQ.

The selector will close after it has been left idle for more than 3 sec. While the selector is open, the user can scroll through the available demodulation settings. The highlighted value will be adopted by the receiver so the effect is immediate. Demodulation modes which are not available for the current receiver setting are shown with a dark background. Scrolling can be done by the DEMOD- or DEMOD+ key. The main rollkey can also be used for scrolling. When an arrow at the top or bottom of the selector is highlighted, it indicates that more modes can be selected for demodulation. From the figure on the left, it can be seen that there are more demodulation modes available when the user scrolls down to below PULS and that the demodulation modes CW, LSB and USB are not available with the current receiver settings.

See also `[SENSe:]FREQuency:DEModulation?` on page 266.

3.3.3.3 DETECT

This key is used to set the level measurement mode. Once the DET key is pressed the softkey bar will be replaced by a set of softkeys which show the modes that are available. This will you to set a mode directly. The available modes are: "AVG", "PEAK", "FAST" and "RMS".

3.3.3.4 MARK

The MARK key is used to open a new set of softkeys which allows you to activate or deactivate the markers in the panels. You can also configure the way the markers are displayed.

See chapter 3.3.2.4, "Markers", on page 40 for a detailed explanation on how to operate the markers.

3.3.3.5 APPL

This key is used to set the receiver to a particular application mode. The default softkey bar will be replaced by a set of softkeys which show the modes available. Available application modes are "RECEIVER", "VIDEO", "ITU", "DF""DDC", "WDF" and "Decode".

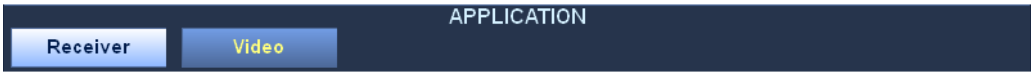
- Application mode ITU requires option R&S EB500-IM.
- Application mode DF requires option R&S EB500-DF.

- Application mode DDC requires option R&S EB500-DDC.
- Application mode WDF requires option R&S EB500-WDF. A prerequisite is DF Upgrade R&S EB500-DF.
- Application mode Decode requires option R&S EB500-SL.

Application Mode WDF

The DF application mode is a subset of the WDF application mode. With R&S EB500-WDF installed all the DF-related features are accessible through the WDF application mode.

Application modes in Basic configuration:



Application modes with ITU option R&S EB500-IM and DF upgrade R&S EB500-DF installed.

Application modes with DF upgrade R&S EB500-DF and options R&S EB500-WDF, R&S EB500-DDC and R&S EB500-SL installed.

3.3.3.6 MODE

This key is used to open a selector which allows a user to set the scan mode of the R&S EB500 and to provide the controls required to run and stop a scan. Available modes are "FFM" and "SCAN" as well as a number of options depending on the type of scan.

When the user chooses SCAN he will be provided with a vertical selector which gives the three scan options PScan, FScan and MScan.

In case of PScan, there are only two options for controlling the scan: "Run" and "Stop", so the softkeys look like the figure below.

In case of FScan, there are more ways to control the scan: "Run-" to scan in the direction of lower frequencies, "Stop", "Run+" to scan in the direction of higher frequencies and "Restart" to restart the scanning from the start frequency in the direction of higher frequencies. The softkeys look like the figure below.

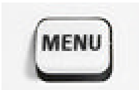
In case of MScan, the options are the same as for FScan, except for the "Restart" option; the softkeys therefore look like the figure below.

Panorama Scan

The Panorama Scan (PScan) mode requires option R&S EB500-PS.

See also . `[SENSe:]FREQuency:MODE` on page 266.

3.3.3.7 MENU



The MENU key is used to select a choice of menu options to provide fast access to a number of utility functions of the R&S EB500. A new set of softkeys provides access to the available configuration options.

Below follows a short description of all the MENU softkeys.

A key-press on the "SNAPSHOT" key will take a snapshot of the full screen, including softkeys, dialogs etc.

Keyboard shortcut

There are certain GUI elements which cannot be captured with the "Snapshot" key. These are the softkeys, dialogs etc. under the MENU key (because the "Snapshot" key is also under the MENU key). For those cases, if you want to take a snapshot, you can plug-in a keyboard and use the combination `Alt` + `Shift` + `P`.

A fixed duration audio recording will open a dialog for audio recording. With the option R&S EB500-DDC installed, the dialog also provides the option to record audio and IQ data for the individual DDC channels.

For a detailed explanation, see "RECORD" on page 92.

Opens the "PRESET" softkey bar, which allows you to choose between different preset configurations or to save a configuration as one of the PRESET options; see: "Preset Softkeys" on page 95 for more details.

The "Zoom +" key zooms in into an RF spectrum. The actual zoom can be configured with the markers: If markers are active then the function will zoom-in between the active markers.

The "Zoom -" key will zoom out, after a zoom-in has taken place. If no zoom-in was performed than pressing the key will not have any effect.

The "Tests" key opens the "TESTS" softkey bar, which allows you to run a long or short self-test of the receiver hardware, review the test results and generate a test report.

See: "Test Points Dialog" on page 96 for more details.

The "File" key opens the "FILE" softkey bar, which has an "Import" function for importing profiles, memory and suppress lists from a USB flash drive. It also has an "Export" function for exporting profiles, memory / suppress lists, test reports, snapshots etc to a USB flash drive.

For a detailed explanation, see "FILE" on page 98

The "Sanitizing" key will start a sanitizing process that will clear all the user data.

The Sanitizing function will be explained in detail in "Sanitizing" on page 113.

RECORD

This key is used to open the "Recording" dialog. This dialog is used to record. The duration of a recording during replay is visualized by a progress bar at the bottom of the dialog.

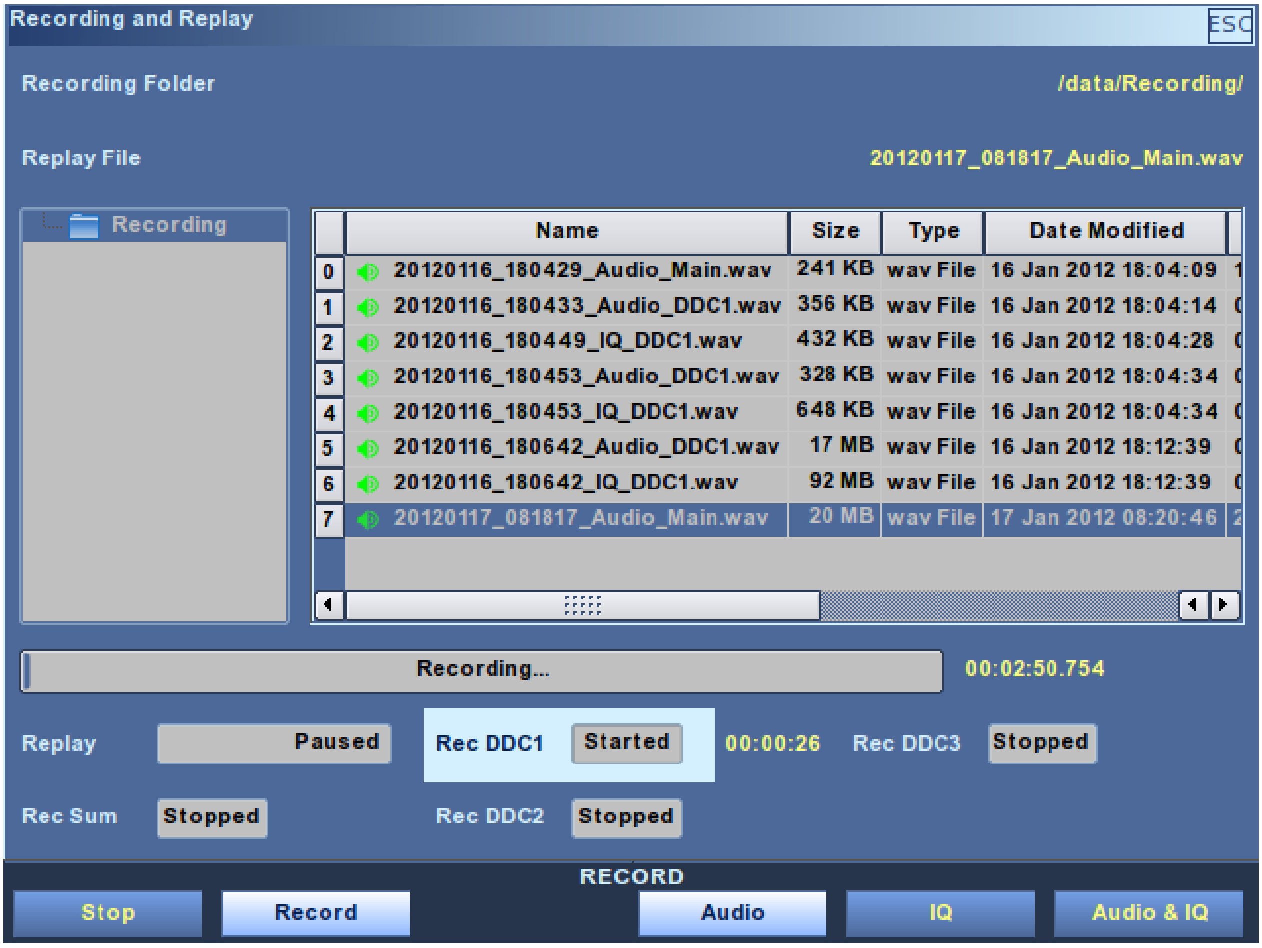
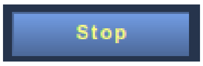


Fig. 3-22: Recording Dialog.

Use this field to control the recording sum. Press "Record" when the field is highlighted and the recording will start. The audio data recorded is stored in the folder indicated above.

The recording duration is displayed next to the indicator.



Use the "STOP" softkey to stop the recording.

The audio data recorded is saved into a "wav" file in the selected destination folder.

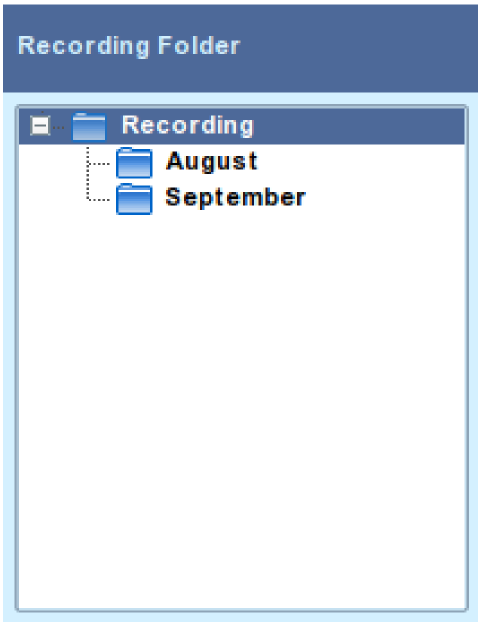
NOTICE

Recording from DDC channels

In order to start recording from one of the DDC channels, highlight the particular channel and start recording in a similar manner as when recording Sum Audio. DDC channels also allow recording of IQ data.

As shown in the figure above, a different set of softkeys will appear when one of the DDC fields is selected. These softkeys allow you to select recording of audio data, IQ data or both. The audio / IQ data recorded is stored in the folder above in separate "wav" files. Recording for DDC2 and DDC3 operates likewise.

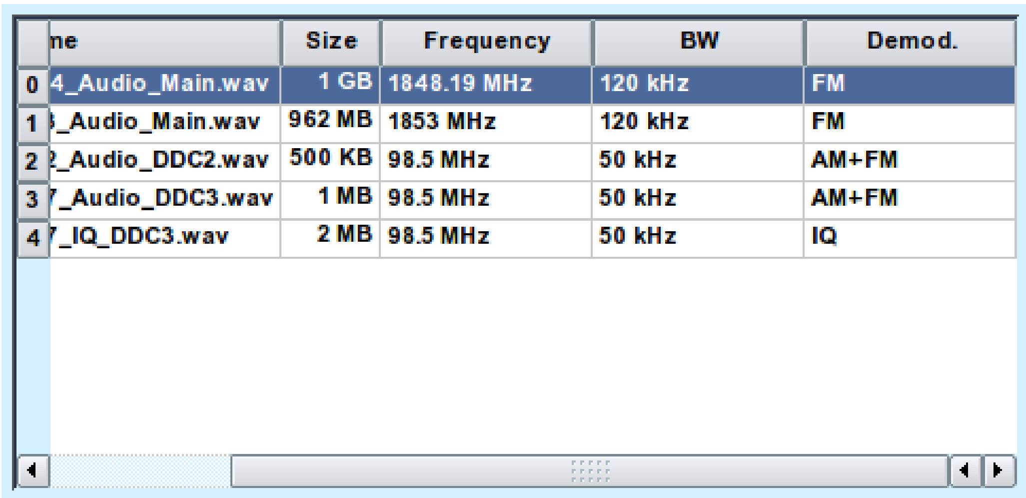
The DDC fields are not available unless option R&S EB500-DDC is installed.



The file browser lets you specify the destination folder for all new recordings:

Activate the browser by pressing the ENTER key. All recordings are stored `Recording`. You can create subfolders in `Recording`, using the file management utilities (see). You can now navigate within the browser. The files are represented in a tree-like structure. If you select a collapsed ("+") node with the mouse wheel or ROLLKEY, the node will expand. If it is an expanded ("-") node, it will collapse.

Use the CURSOR UP or CURSOR DOWN key to select an entry in the browser. Use the CURSOR LEFT or CURSOR RIGHT key to collapse or expand a node, respectively, and to scroll left or right. Press the ESC key or ENTER key to deactivate the browser. To the right of the browser is a list which shows all the "WAV" files stored in the currently selected folder:



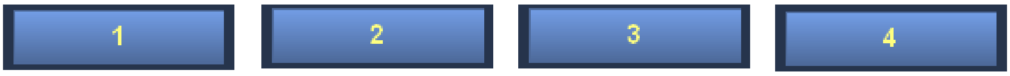
In addition to the file names, the list shows the recording parameters for each file, i.e. the frequency, bandwidth and demodulation mode.

Preset Softkeys

Some menu items provide access to a layer of submenu items; "Preset" is one of them. The respective options for "Preset" are shown below.

A short description of the different softkeys will follow.

Press the "Reset" key and the R&S EB500 main processor will reset. The GUI will freeze until the R&S EB500 main processor is running again.



Up to four configurations can be stored as Preset configurations. The Preset configurations are stored at the client side so each GUI, whether internal or external, can have its own preset configurations.

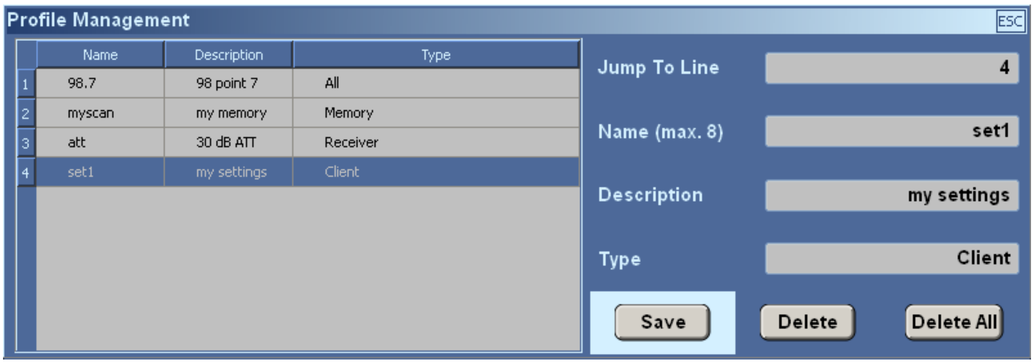
Press the "Default" key and the receiver will reload all its default values.

When pressing the "Last" key the R&S EB500 will reload its last configuration, i.e. the configuration before loading a profile or before a reset.

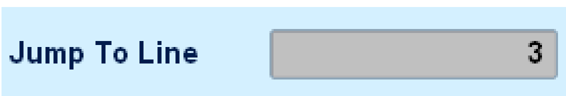
The "Config" key will open up a dialog for configuring (adding or deleting) a profile; see "Profile Management Dialog" on page 95.

Profile Management Dialog

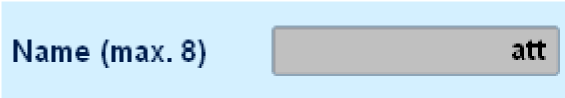
This dialog is used to save certain configurations as a preset profile and to manage or delete one or more profiles.



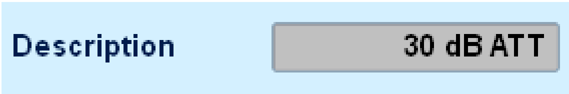
The table gives an overview of the different profiles. With the forward / backward selector keys you can navigate through the table and highlight an item for editing.



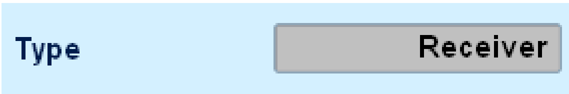
This edit field will allow you to directly key-in the line to edit. This line is highlighted in the table.



The name typed in this field will appear in the softkey label, after the index just as shown below. The maximum length is 8 characters.



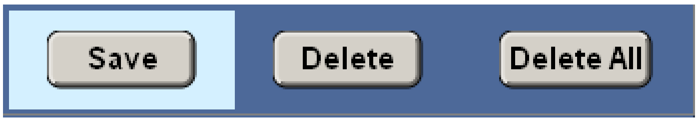
The description will only appear in the dialog; it can be of any length however.



There are three types of profile that can be saved, selectable by means of a vertical selector which will pop-up once this field gets highlighted.

- Client: This profile contains only GUI-related settings such as layouts, snapshot directory and the local host IP address.
- Receiver: This profile holds receiver-related settings, e.g. the receive frequency, bandwidth, demodulation mode and start and stop limits
- Memory: This profile holds the receiver's 10 000 memory locations.

You can also choose to select all profiles: All three profile types will be saved into one profile.



Once you click "Save" the profile will be saved.

Use the "Delete" button to delete one profile entry and the "Delete All" button to delete the whole profile list.

Test Points Dialog

After pressing the "Tests" the following options are provided:

The "Tests Dialog" key opens the "Test Points" dialog together with another set of soft-keys (see below). The "Short Test" and "Long Test" keys will also be explained below.

The "Test Points" dialog shows a table containing the test point voltages of the various R&S EB500 modules. Each row in the table corresponds to a particular test point. For each test point, the table's columns show the related module, the name of the test point, the current voltage and the permissible upper and lower voltage limits. The following symbols are used in the last column of the table:

	Module	Test Point	Current	Lower Limit	Upper Limit	1 Error
21	EB500PB:	+6V	837	750	910	✓
22	EB500PB:	+8V4	822	750	910	✓
23	EB500PB:	+28V	905	810	990	✓
24	EB500PB:	+0V9	899	810	990	✓
25	EB500PB:	+1V6	879	790	970	✓
26	EB500PB:	+1V2	872	790	970	✓
27	EB500PB:	+1V8	898	810	990	✓
28	EB500PB:	+3V_BAT	939	810	990	✓
29	EB500PB:	+3V3	869	780	960	✓
30	EB500PB:	TEMP_LM83	44	-40	125	✓
31	EB500PB:	TEMP_PPC	43	-40	125	✓
32	EB500PB:	TEMP_ADC	57	-40	125	✓
33	EB500PB:	TEMP_DCDC	41	-40	125	✓
34	PRESEL HF:	TPREAMP_P	1670	800	2000	✓
35	PRESEL HF:	TPREAMP_N	798	400	1200	✓
36	PRESEL HF:	TTEMP	1638	800	2200	✓
37	PRESEL HF:	T_+9V	1240	1050	1350	✓
38	PRESEL HF:	T_-9V	1212	1050	1350	✓
39	PRESEL HF:	T_-5V	661	500	800	✓
40	PRESEL HF:	T_CLK	1165	1000	1400	✓
41	PRESEL HF:	T_CORE	1770	1700	1900	✓

	Module	Test Point	Current	Lower Limit	Upper Limit	1 Error
21	EB500PB:	+6V	837	750	910	✓
22	EB500PB:	+8V4	822	750	910	✓
23	EB500PB:	+28V	905	810	990	✓
24	EB500PB:	+0V9	899	810	990	✓
25	EB500PB:	+1V6	880	790	970	✓
26	EB500PB:	+1V2	872	790	970	✓
27	EB500PB:	+1V8	899	810	990	✓
28	EB500PB:	+3V_BAT	939	810	990	✓
29	EB500PB:	+3V3	868	780	960	✓
30	EB500PB:	TEMP_LM83	44	-40	125	✓
31	EB500PB:	TEMP_PPC	43	-40	125	✓
32	EB500PB:	TEMP_ADC	58	-40	125	✓
33	EB500PB:	TEMP_DCDC	41	-40	125	✓
34	PRESEL HF:	TPREAMP_P	1670	800	2000	✓
35	PRESEL HF:	TPREAMP_N	798	400	1200	✓
36	PRESEL HF:	TTEMP	1637	800	2200	✓
37	PRESEL HF:	T_+9V	1240	1050	1350	✓
38	PRESEL HF:	T_-9V	1212	1050	1350	✓
39	PRESEL HF:	T_-5V	661	500	800	✓
40	PRESEL HF:	T_CLK	1166	1000	1400	✓
41	PRESEL HF:	T_CORE	1776	1700	1900	✓


Voltage is within limits.


Voltage limits are exceeded.


Voltage is too high.

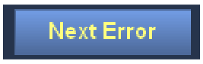

Voltage is too low.

The "Report" key generates a status report which is stored along with the log files. The status report contains the current device configuration, the state of the test points and the error history.

The "Short Test" initiates a "Short Test". See also chapter 4.5.16, "TEST Subsystem", on page 337.

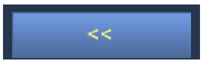
The "Long Test" initiates a "Long Test". See also chapter 4.5.16, "TEST Subsystem", on page 337.

The "Next Group" key shows the test points of the next module in the upper rows of the table.

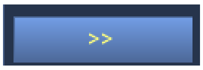


The "Next Error" key scrolls to the next error where the test point limits are exceeded.

The "Error Group" key groups all errors and shows them at the top of the table. This is particularly useful if you want to see all errors at a glance. Press "Error Group" a second time to cancel the grouping of errors.



This key scrolls up.



This key scrolls down.

FILE

After pressing MENU > "FILE" a new softkey bar as shown below will pop-up with the options: "Import" for importing files from a USB flash drive, "Export" for exporting files to a USB flash drive and "Manage" for managing files within the device or USB flash drive.

File Browser

The file import / file export / file management dialogs will all incorporate a file browser. After activating the file browser in the dialog, by using the MAIN ROLLKEY and/or the ENTER key, you can browse into the subfolders of the internal storage or USB flash drive. The accessible folders within the device appear in the `data` file tree, as can be seen from the path just above the file browser.

For different purpose the file browser can come with or without checkbox.

File browser without checkbox

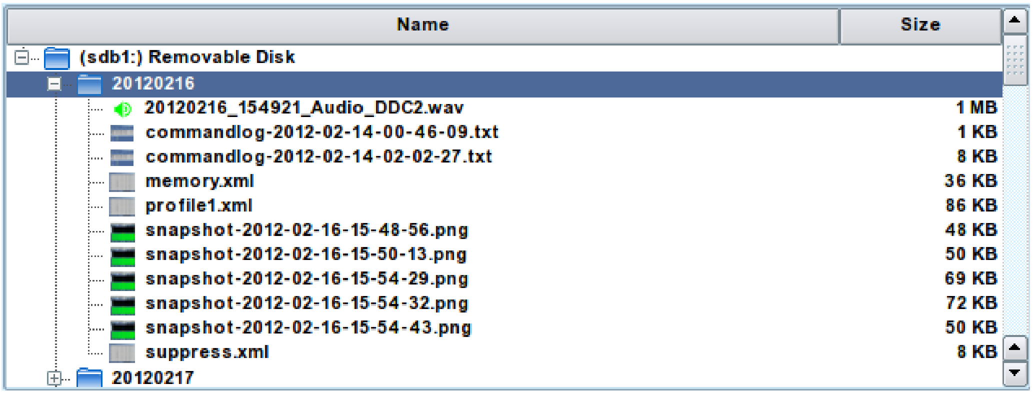


Fig. 3-23: File browser without checkbox.

If the file browser is activated, you can navigate the folder contents. The folders are represented in a tree-like structure. If you select a collapsed ("+") node with the mouse wheel or ROTARY KNOB, the node will expand. If the node is already expanded ("-"), it will collapse.

If you select a node with one of the cursor keys, use the CURSOR LEFT or CURSOR RIGHT key to collapse or expand a node, respectively. You can also use the CURSOR LEFT or CURSOR RIGHT key to scroll left or right, respectively.

A selected file/folder is indicated just above the file browser. Once you have selected the desired source file/folder, you can deactivate the file browser by pressing MAIN ROLLKEY or ENTER key. If you deactivate the file browser by pressing ESC, the selected file/folder will revert back to what it was before the file browser is activated.

File browser with checkbox

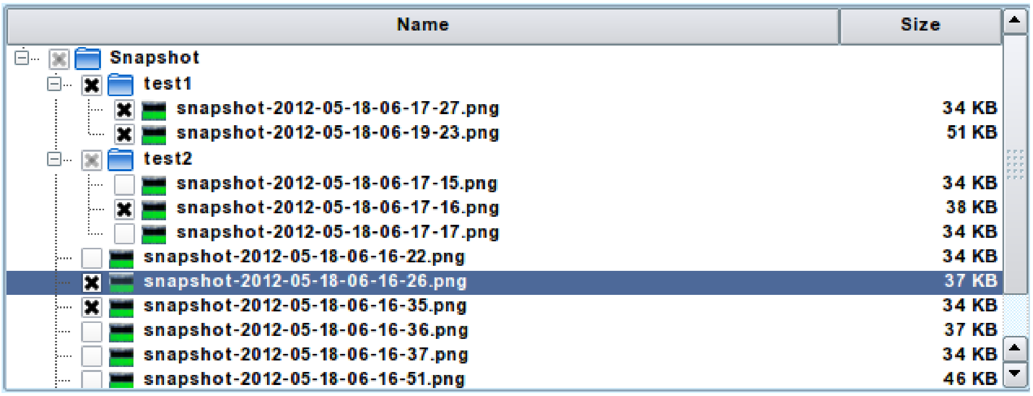


Fig. 3-24: File browser with checkbox.

As can be seen from the figure above, this file browser comes with a check box before each item. With check box, you can select individual files/folders or a group of files/folders and operate on them. A checkbox has 3 states, unchecked, checked and partially checked.


Unchecked: file/folder is not selected.

 Checked: file/folder is selected.

 Partially checked: the contents within this folder are partially selected.

The browser with checkbox comes with two softkeys as shown below. Pressing "(Un)Select" will put a check in the box before the file/folder in focus if it is currently unchecked. This means that the file/folder will be added to the selections for further operation. If the file/folder is already selected, the check will be removed, meaning the file/folder will be removed from the selections. The available space in the current drive, together with the count and size of selected files are indicated below the file browser.

Pressing "Unselect All" will clear all selections.

NOTICE

Selecting folders

If a folder is selected, all the contents in the folder and subfolders are also selected.

If all the files/subfolders in a folder are selected, the folder itself may not be selected. You must select the folder manually.

NOTICE

USB flash drive

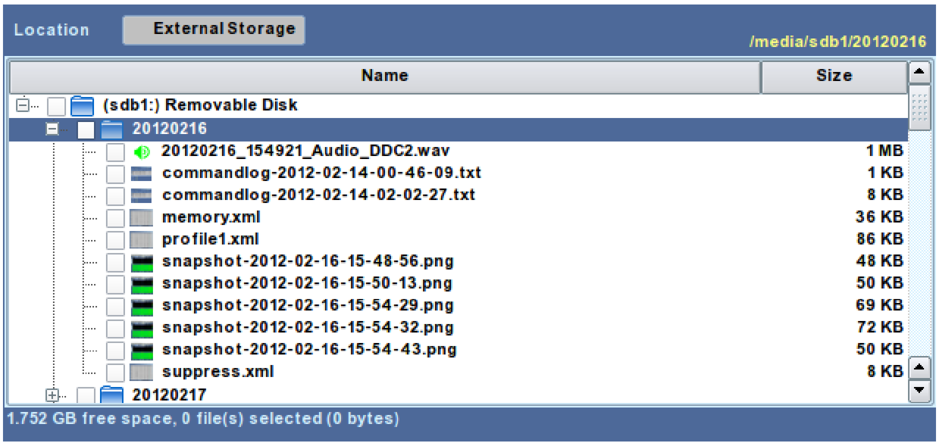


Fig. 3-25: File browser inside the media folder.

It will take a short while before an inserted USB flash drive gets recognized by the operating system. A short message will appear a few seconds after inserting or removing a USB flash drive.

Only after this message has appeared, you can see the USB flash drive indicated in the file browser.

The actual flash drive appears in the `media` file tree, as shown in the figure, either as `(sdb:) Removable Disk` or `(sdb1:) Removable Disk` (or even sdb2 in case there are two partitions on the USB flash drive), depending on the type of flash drive.

File Import

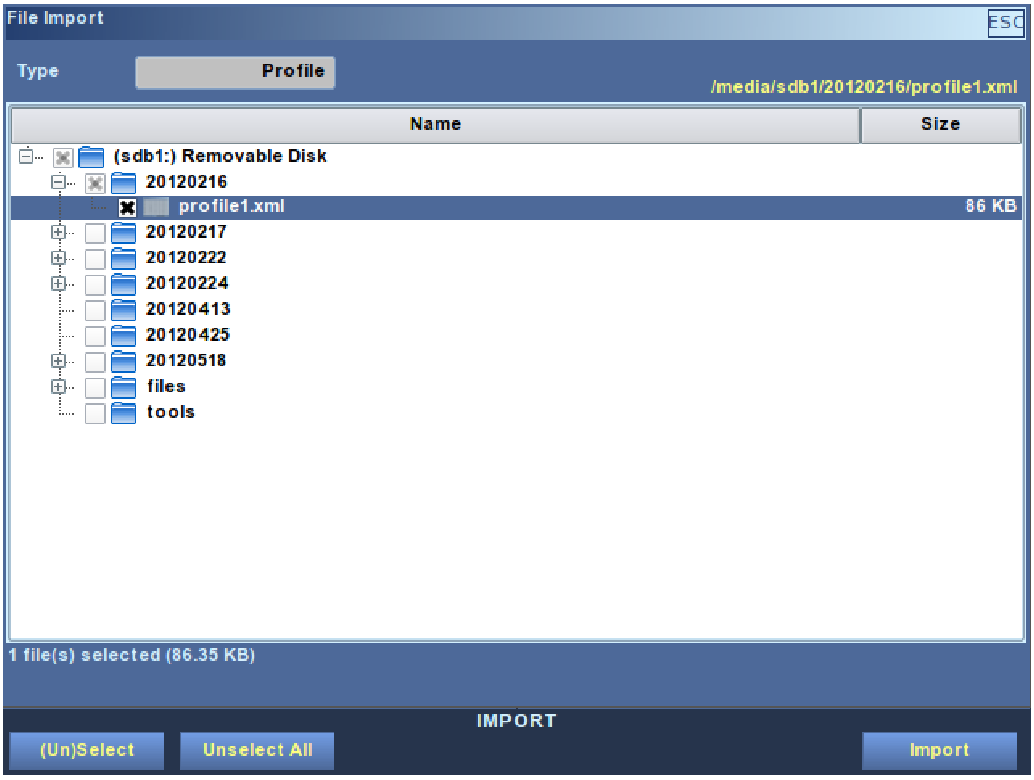


Fig. 3-26: File import dialog.

The dialog is used to import files including profiles, memory configurations and suppress lists from USB flash drive. A USB flash drive should provide the media for transferring files from one R&S EB500 to another R&S EB500. In "File Export" on page 104, it is explained how to export files to USB flash drive. In "FILE" on page 98, it is explained how to use the file browser and navigate in the file tree.

Use this field to filter out those files which are not related.

Valid files names for import:

- Valid profiles: `profile1.xml` to `profile4.xml` and `startup.xml`.
- Valid memory file: `memory.xml`.
- Valid suppress list file: `suppress.xml`.

To import a file, select it and press "Import". The following softkey bar will appear asking for confirmation.

Only after "OK" is clicked, the selected files will be copied over. Pressing "Cancel" will cancel the pending import operation.

WARNING

Closing Dialog

Closing this dialog at any time will cancel all pending operations and clear all selections.

NOTICE

Remote GUI

Also when using the remote GUI it is possible to import files. By default the browser will navigate to the installation folder, as shown in the figure below, however you can navigate to any directory within the same current drive for import when using the file browser.

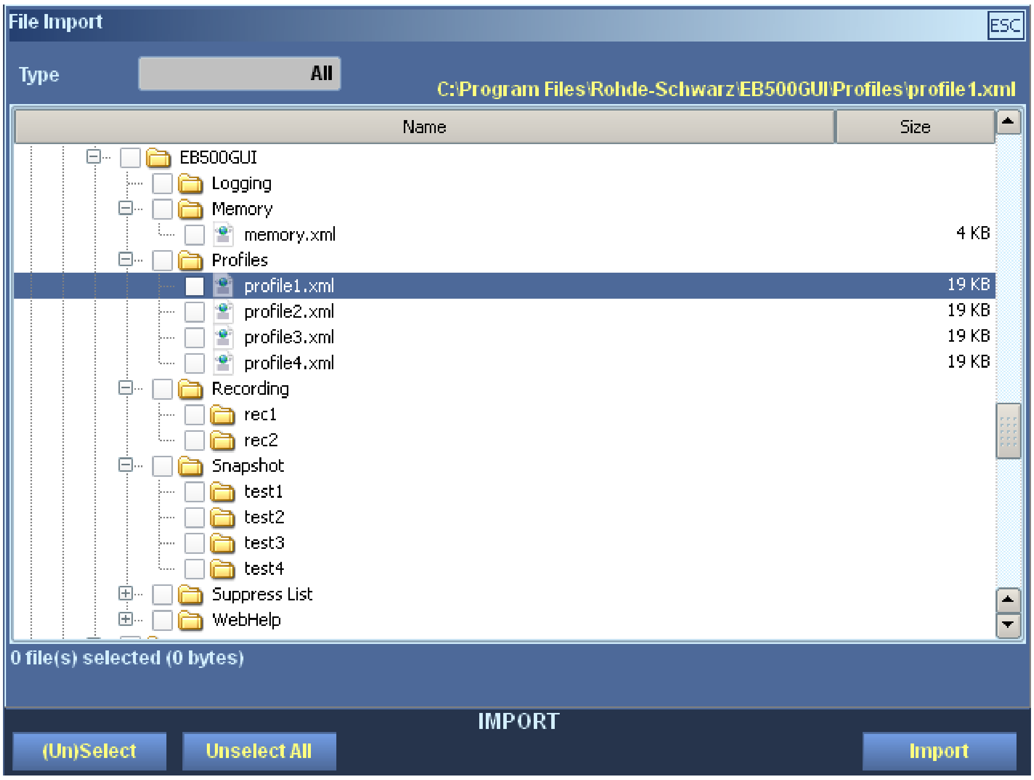


Fig. 3-27: File import dialog - remote GUI

File Export

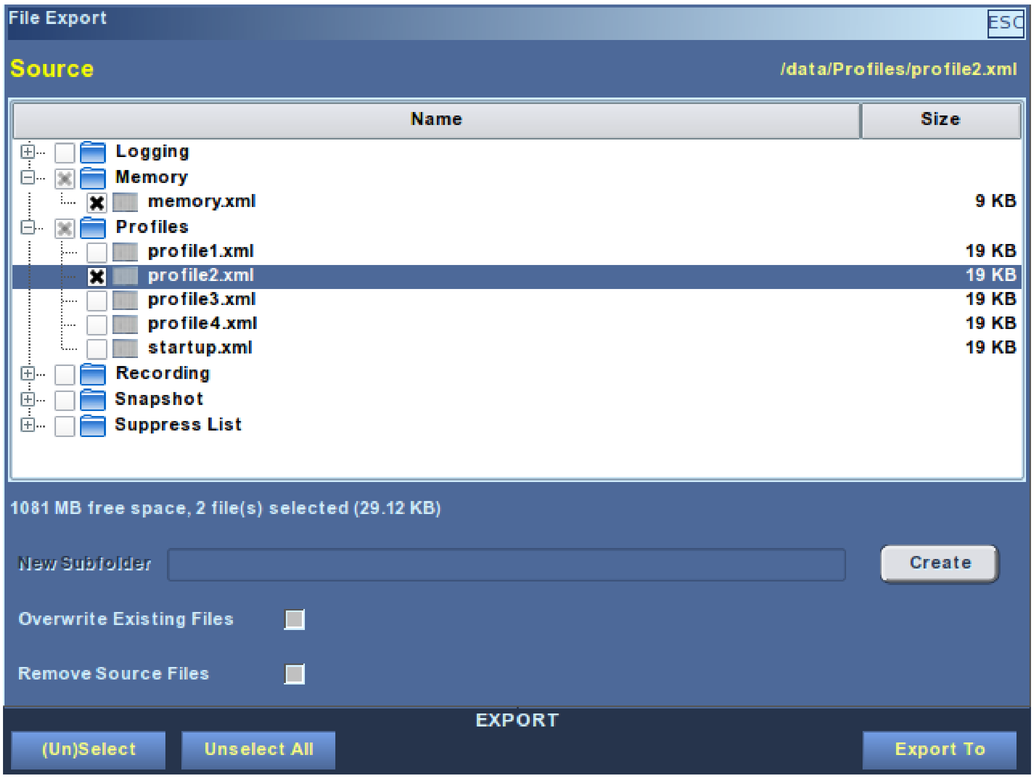


Fig. 3-28: File export dialog.

This dialog allows you to export profiles, memory configurations, suppress lists, snapshots, log files, recordings and test reports to USB flash drive. A USB flash drive should provide the media for transferring profiles from one R&S EB500 to another R&S EB500. When this dialog is opened, the file browser will display accessible folders within the R&S EB500. In "File Browser" on page 98 it is explained how to navigate in a file browser and select a file.

To export, first select your files and press "Export To". The file browser will switch to "Destination" as shown below. The file browser will navigate to the USB flash drive.

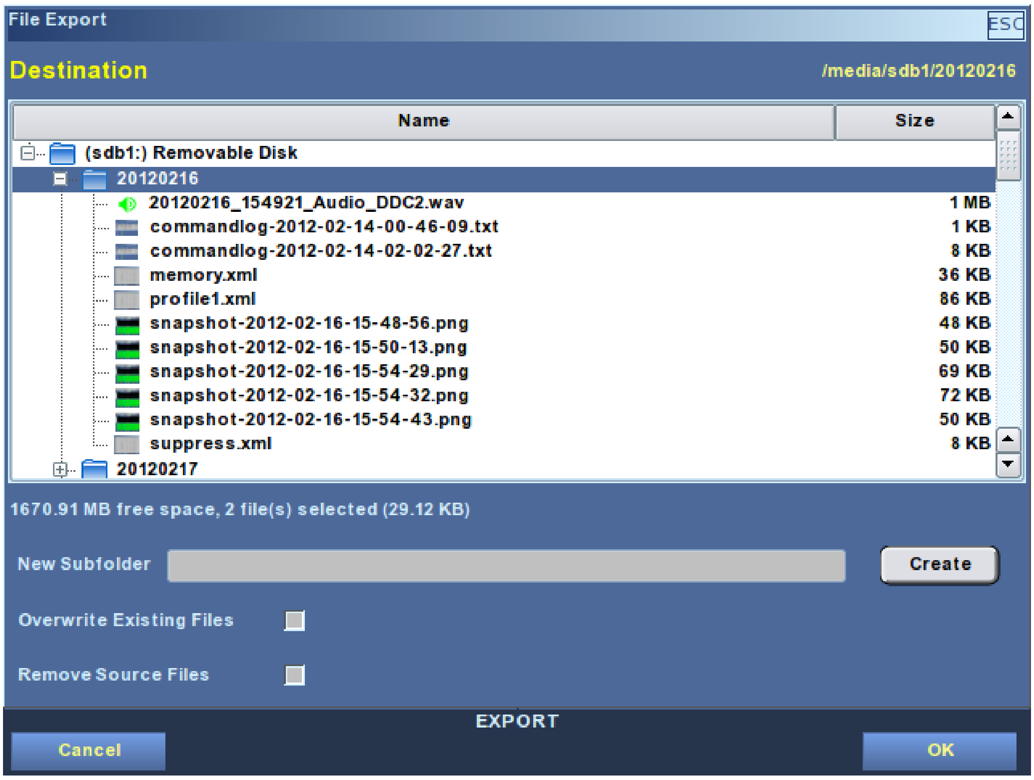
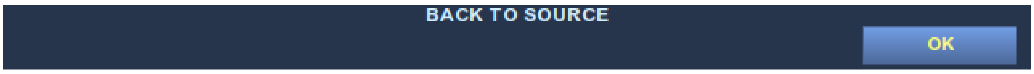


Fig. 3-29: File export - select destination

The softkey bar also changed as shown below.

Navigate to the target folder before pressing "OK" to confirm the export. Pressing "Cancel" will cancel the export operation and dialog will change back to source selection page.

After pressing "OK", the exporting will start and the softkey bar will change as shown below. Pressing "Cancel" during exporting will cause the export operation to abort. The export status is indicated below the file browser.



⚠ WARNING

Cancel Export Operation

If export operation is aborted, exported files will not be imported back. No undo operation is provided.

You can also create subfolders in the destination. Use the field "New Subfolder" to specify the name of a new subfolder to be created in the current folder (highlighted in the file browser) when the "Create" button is pressed. This newly created folder will thereupon become the destination folder for the exported files.

By placing a check mark in the box after "Overwrite Existing Files", any existing files in the destination folder will be overwritten by the newly exported files with the same name. Otherwise the existing files will be retained and a message to this effect will be displayed.

By checking the box after "Delete Source Files", the source files will be deleted from the source location after copying over.

WARNING

Export Memory and Suppress List

You are not allowed to delete the memory and suppress list using this dialog. Use the Memory Setup dialog ("Memory Setup Dialog" on page 114) and Suppress List Setup dialog (chapter 3.3.3.21, "Suppress List Setup Dialog", on page 189) for this purpose.

If you do not uncheck the "Delete Source Files" checkbox, the export will not proceed.

NOTICE

Remote GUI

Using the remote GUI it is also possible to export files. The browser will navigate to the installation folder, as shown in the figure below. However you can only see those files/ folders that can be exported.

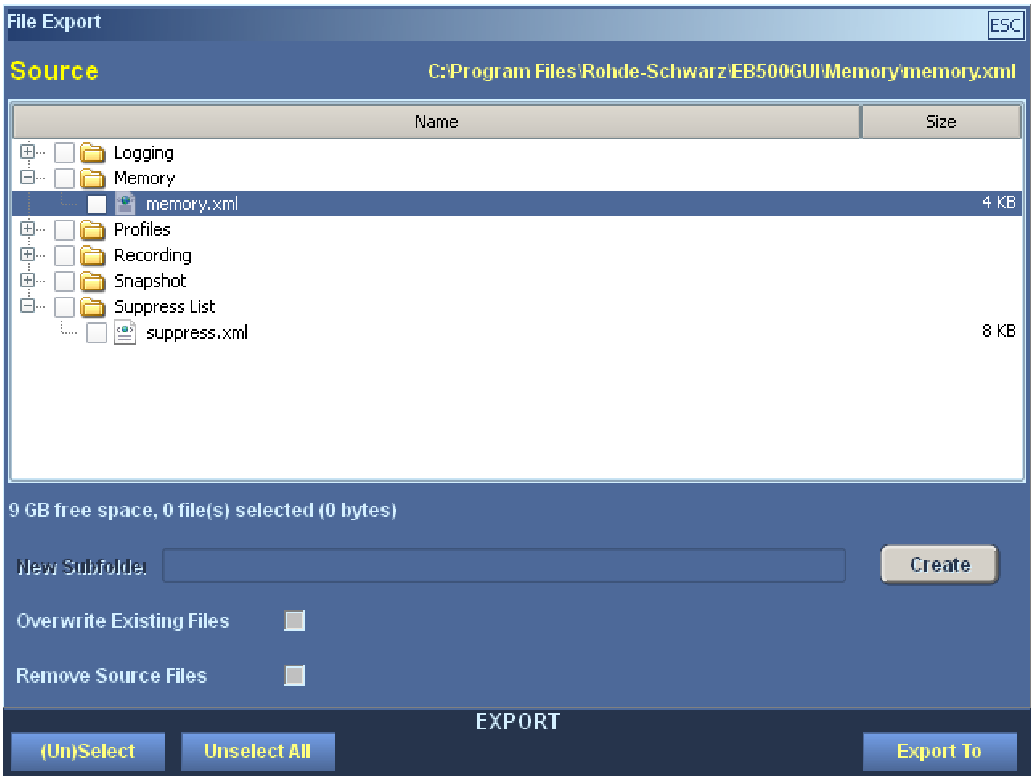


Fig. 3-30: Export dialog - select source

After pressing "Export To", you can select the destination folder for exported files. The file browser will by default navigate to the installation folder. However you can navigate to any folder within the same drive.

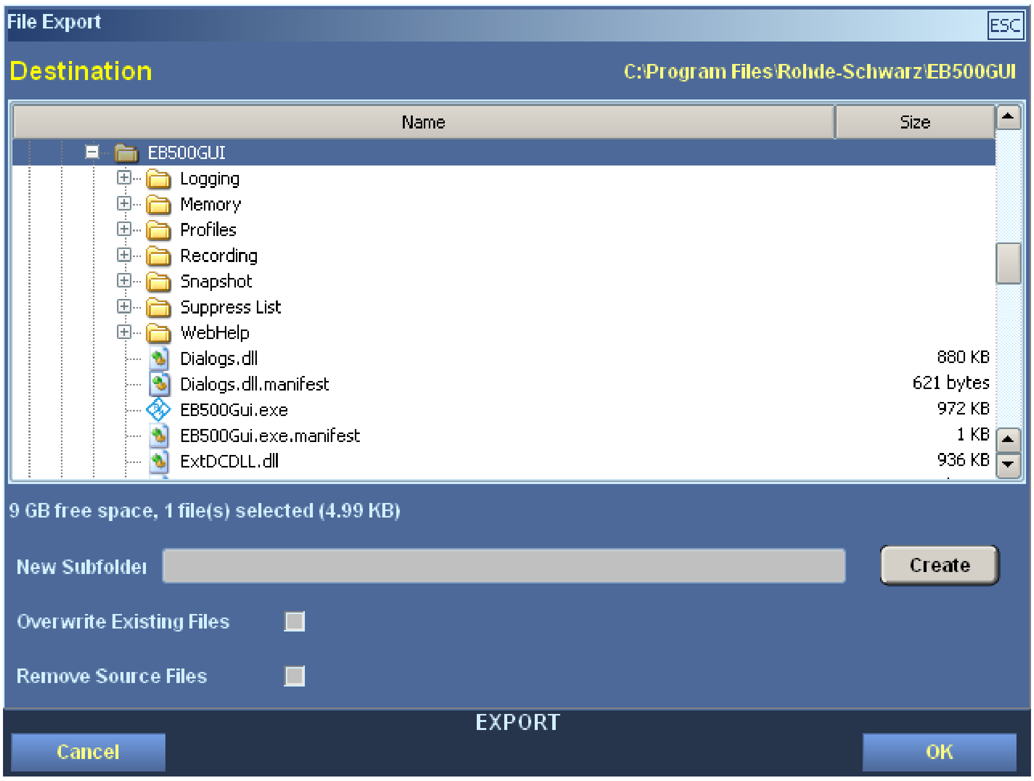


Fig. 3-31: Export dialog - select destination

File Management

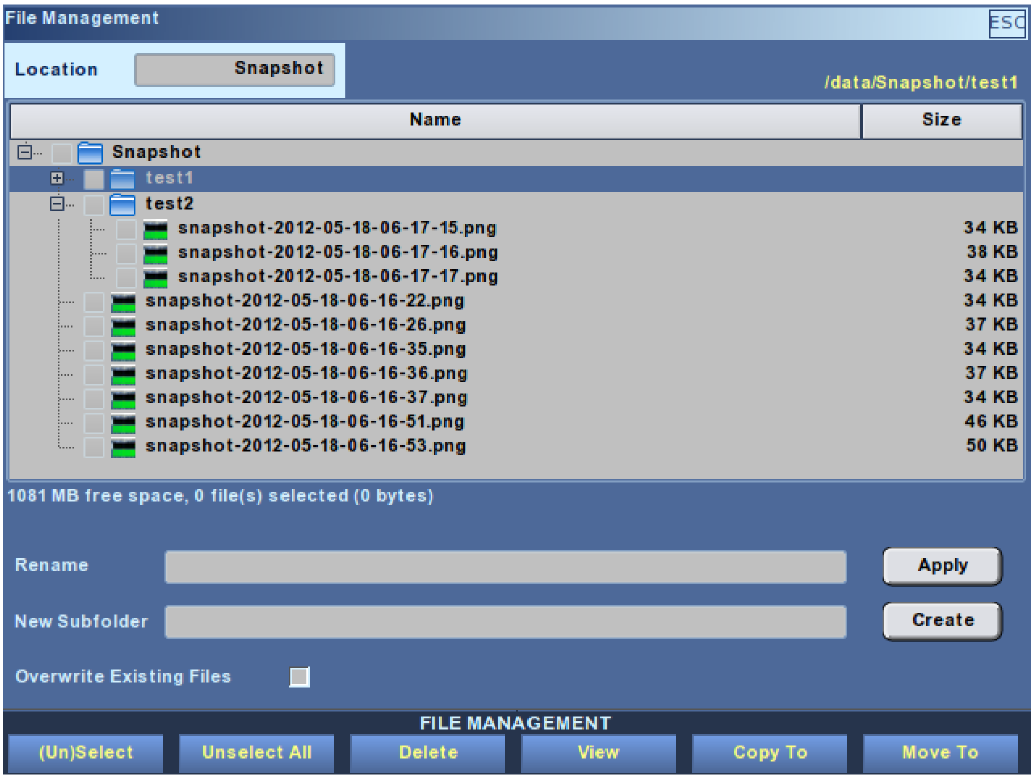
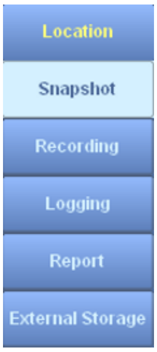


Fig. 3-32: File management dialog.

This dialog is used for managing files within the R&S EB500 or USB flash drive. In "FILE" on page 98, it is explained how to use the file browser and navigate in the file tree.



This field is a filter specifying which directory you are managing. "Snapshot", "Recording", "Logging" and "Report" are predefined folders within the R&S EB500 that allow management by the user up to a certain extent. "Logging" and "Report" share the same folder. "External Storage" refers to USB flash drive.

NOTICE

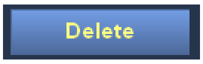
Remote GUI

If "Location" is changed to "External Storage", by default the file browser will navigate to the installation folder. However you can navigate into any directory within the same drive.

To rename a file/folder, first navigate to it with the help of MAIN ROLLKEY key. The current name will appear in the edit box after label "Rename". Then switch the focus to the renaming edit box and change the name with the help of keypad. Pressing the button "Apply" will apply the change. Renaming will fail if a file or folder with the same name already exists.

Use the field "New Subfolder" to specify the name of a new subfolder to be created in the current folder (highlighted in the file browser) when the "Create" button is pressed. This operation will fail if a subfolder with the same name already exists in the same folder.

The softkey bar shown as below is associated with the File Management Dialog, to provide basic operations.



To delete files/folders, first select any files you want to delete using "(Un)Select" and press "Delete". The following softkey bar will appear asking for confirmation.

Only after "OK" is pressed, the selected files will be deleted. Pressing "Cancel" will cancel the pending delete operation.

NOTICE

Predefined folders

It is not allowed to rename or delete predefined folders (Snapshot, Recording, Logging).

You can organize files and folders by copying or moving them around. To copy a file/folder to another parent folder, select it and press "Copy To". The confirmation softkey bar will appear. Before pressing "OK", you can choose the folder that you want to copy to. Pressing "Cancel" will cancel the operation. "Move To" works in the same way except that the source file/folders will be deleted.

By placing a check mark in the box after "Overwrite Existing Files", any existing files in the destination folder will be overwritten by the new files with the same filename. Otherwise the existing files will be retained and a message to this effect will be displayed.

The softkey "View" is used to view a snapshot. This softkey is enabled only when "Location" is switched to "Snapshot" or "External Storage". After the "View" key is pressed, a new dialog will pop up displaying the currently focused snapshot. If the current focus is a folder, the first snapshot in this folder will be displayed. "View Snapshot Dialog" on page 111 will explain which operations are provided to assist in viewing a snapshot.

View Snapshot Dialog

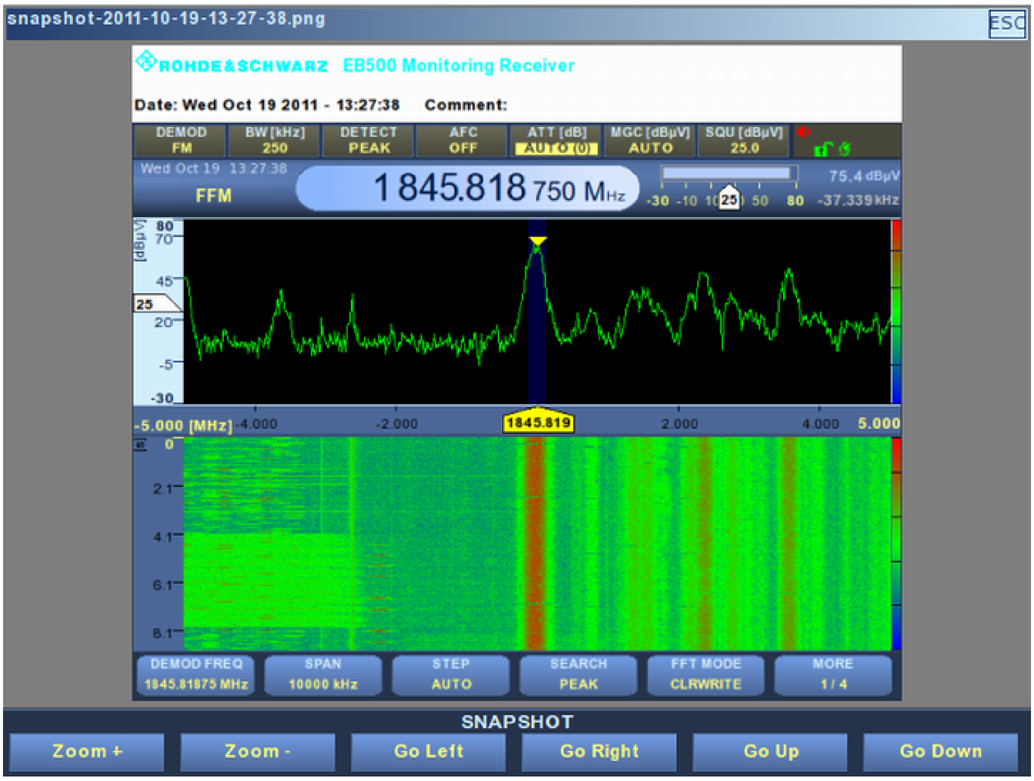


Fig. 3-33: View snapshot dialog

This dialog is used to view a snapshot. The title of this dialog displays the file name of the snapshot being viewed. Closing this dialog will go back to the "File Management Dialog" which is explained in "File Management" on page 109.

The following softkey bar is associated with this dialog to provide zooming and navigation functions.

You can also use ROTARY KNOB to zoom in and zoom out the snapshot. You can use CURSOR LEFT to view the previous snapshot in current directory and CURSOR RIGHT to view the next. Once zoomed in, you can use "Go Left". "Go Right", "Go Up" and "Go Down" to navigate the snapshot.

View Receiver Configuration with Snapshot

When the checkbox "View Receiver Configuration" in the Snapshot Configuration Dialog ("Snapshot Setup Dialog" on page 142) has been checked, the receiver configuration at the time the snapshot was taken can be seen in the viewer.

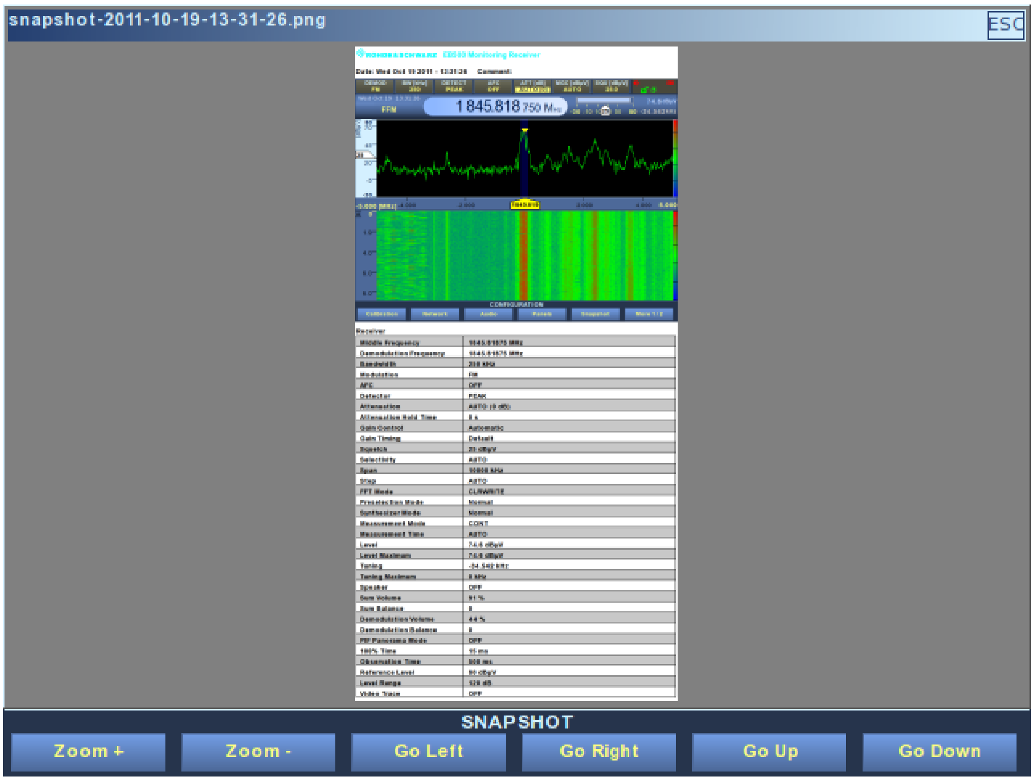


Fig. 3-34: View snapshot with receiver configuration.

Use the zooming and navigation keys to focus on a particular area of the snapshot.

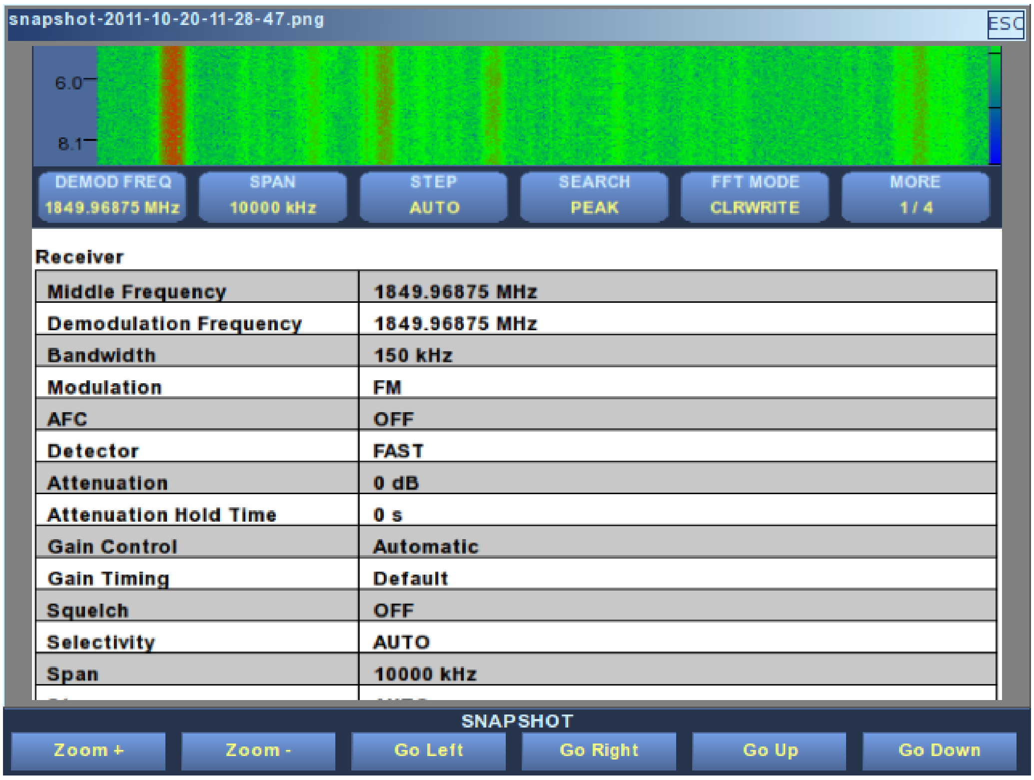
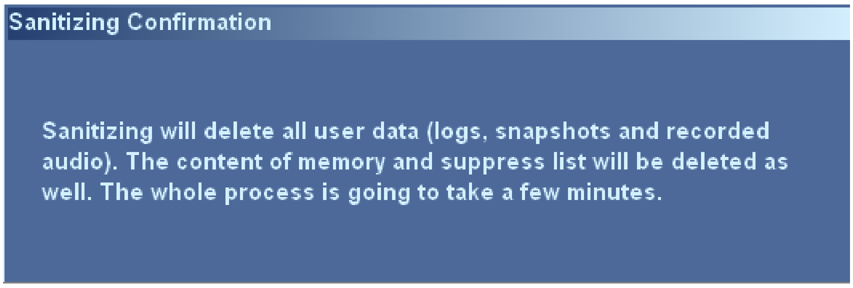


Fig. 3-35: Snapshot viewing -- zoomed-in on the receiver configuration.

Sanitizing

After clicking the "Sanitizing" softkey a dialog will pop-up which explains what is involved with sanitizing: All the user data (log files, suppress lists, snapshots etc) will be erased. The receiver will reset at the end of the process.



For external GUI this process will take only a few minutes. For internal GUI on a R&S EB500 model 03 the sanitizing process will take 30 to 90 minutes, depending on the version of the IPS1 board in your R&S EB500. See "Hardware Information Dialog" on page 166 to retrieve the version of the IPS1 board.

The reason that it takes a much longer time to complete on the internal GUI is that the procedure will "randomize" the partition according to DoD 5220.22-M standard in addition to erasing the data partition.

Because the operation is quite drastic, the dialog comes together with Yes/No softkeys to confirm or cancel.

3.3.3.8 MEM

The MEM key opens a new row of softkeys (see below) that provide shortcuts to memory management dialogs.

The "Edit" key will open a dialog for viewing and editing any of the 10 000 memory channels of the R&S EB500. Each channel can accommodate a frequency and the related receiver configuration; see `MEMory:CONTents` on page 236.

The "Recall" key will open the Recall Frequency dialog, which can provide you with any of the configured frequency channels.

The "Save" key will open the Save Frequency dialog, which allows you to quickly save the current frequency.

The "Suppress" key will open a dialog for viewing and editing any of the 100 suppress channels.

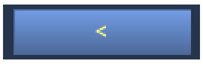
Memory Setup Dialog

The Memory Setup dialog has a table which can contain 10 000 memory entries. The entry index is shown in the leftmost column of the table. The softkey bar (shown below) which appears together with the dialog allows you to navigate through the table.

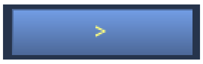
The table cannot be edited directly. Its purpose is to provide an overview of the different entries in terms of properties, sorting and whether an entry is activated or deactivated.

The "First" key will take you to the first page of the table with the first entry (index 0) highlighted.

The "<<" key will scroll the table up one page (lower index). The page size depends on the screen resolution.



The "<" key will move the highlight up one entry: decrease the table index with 1.

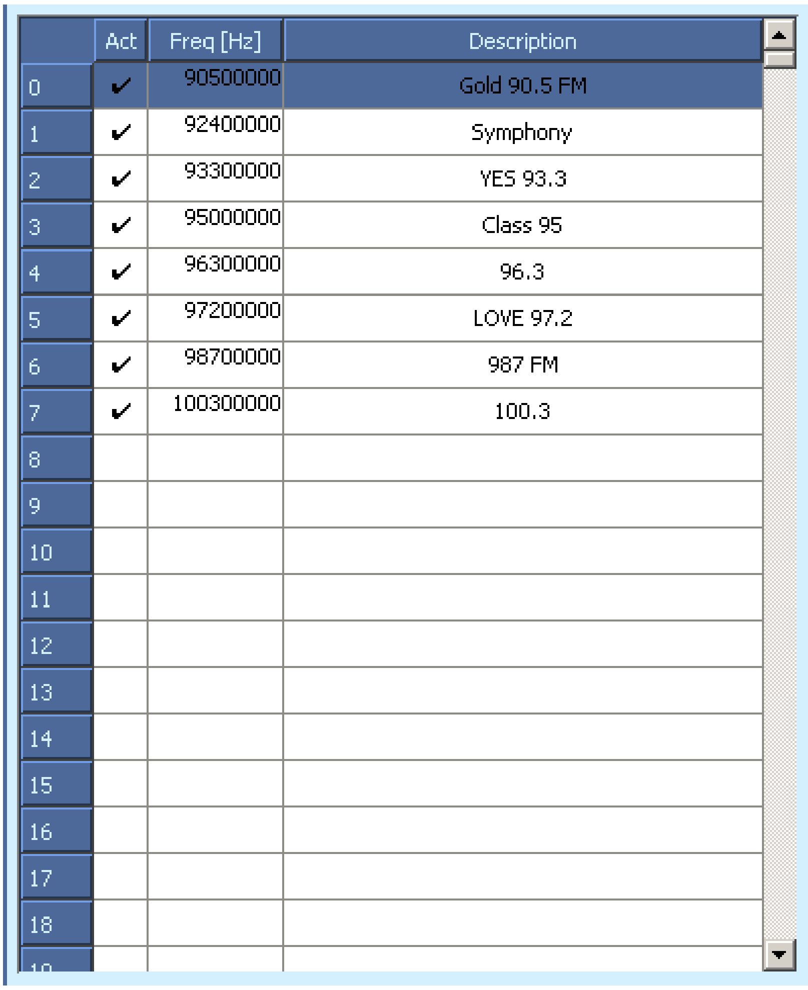


The ">" key will move the highlight down one entry: increase the table index with 1.

The ">>" key will scroll the table down one page (higher index). The page size depends on the screen resolution.

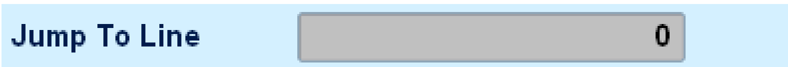
The "Last" key will take you to the last page of the table with the first entry (index 9999) highlighted.

Alternatively, the rollkey can be used to select and highlight the table, as shown below. With the rollkey, you can then navigate through the table.

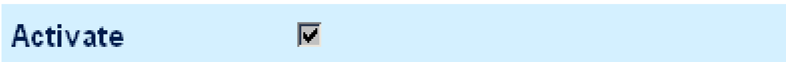


	Act	Freq [Hz]	Description
0	✔	90500000	Gold 90.5 FM
1	✔	92400000	Symphony
2	✔	93300000	YES 93.3
3	✔	95000000	Class 95
4	✔	96300000	96.3
5	✔	97200000	LOVE 97.2
6	✔	98700000	987 FM
7	✔	100300000	100.3
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

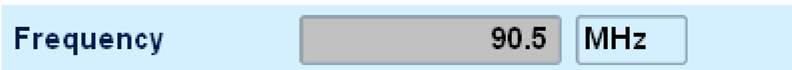
The rollkey is also the main manipulator for all the other fields and buttons in the table. A short description for each of them follows.



Activate this field and key in a number between 0 and 9999. The table highlight will directly jump to the entry with that index. [SENSe:]MSCan:CHANnel on page 279

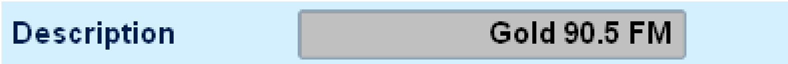


Activate or deactivate the highlighted frequency by checking or unchecking. If the selected memory channel is activated then it will be included in the Memory Scan.

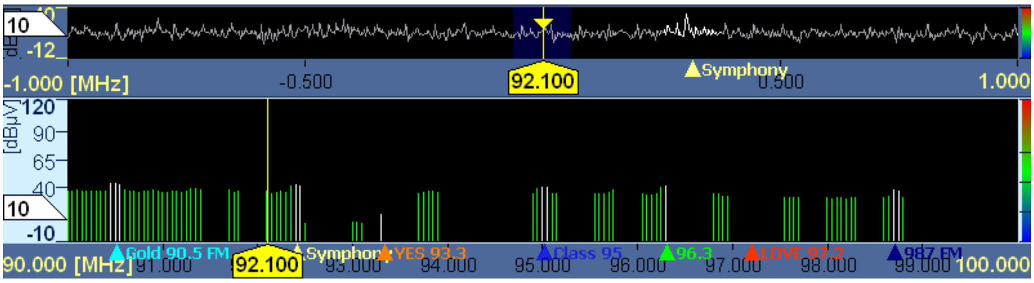


This field allows you to set the frequency for the currently selected memory channel. A related softkey bar allows you to set the unit to be used for entering the frequency. Available units are GHz, MHz, kHz and Hz.

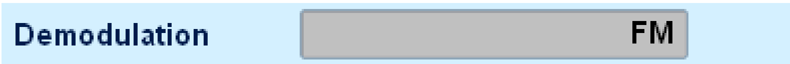
To support editing, this softkey bar also provides a "Backspace" button.



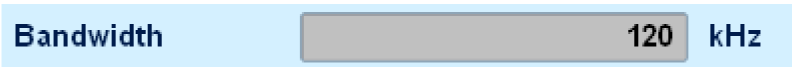
This field allows you to enter a description for a particular memory channel. The description of the first ten entries is also available in the IF panorama and RF panorama, respectively (see the snapshot below). You can enter a total of 16 characters.



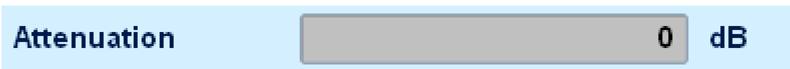
To support editing, a softkey bar is provided with a "Caps Lock" and a "Backspace" button.



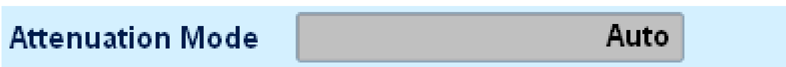
This field allows you to set the demodulation mode for the selected memory channel. A related selector shows the available modes. Available modes are FM, AM, PULS, PM, IQ, ISB, CW, USB and LSB.



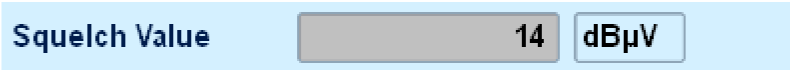
This field allows you to set the demodulation bandwidth for the currently selected memory channel. A related selector shows the available bandwidths. Available bandwidths are 0.1 kHz, 0.15 kHz, 0.3 kHz, 0.6 kHz, 1 kHz, 1.5 kHz, 2.1 kHz, 2.4 kHz, 2.7 kHz, 3.1 kHz, 4 kHz, 4.8 kHz, 6 kHz, 9 kHz, 12 kHz, 15 kHz, 30 kHz, 50 kHz, 120 kHz, 150 kHz, 250 kHz, 300 kHz, 500 kHz, 800 kHz, 1000 kHz, 1250 kHz, 1500 kHz, 2000 kHz, 5000 kHz, 8000 kHz, 10,000 kHz, 12,500 kHz, 15,000 kHz and 20,000 kHz .



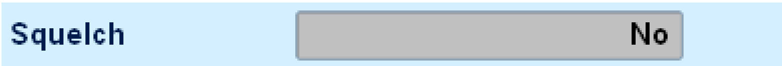
This field allows you to set the manual attenuation for the currently selected memory channel (in dB). Valid input ranges from 0 to 40.



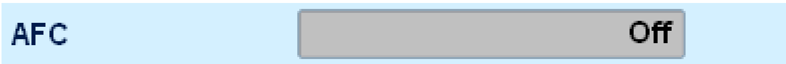
This field allows you to choose between AUTO (automatic attenuation set by the receiver) and MANUAL (the manual setting specified in field "Attenuation"). A related selector shows the available modes. Available modes are AUTO and MANUAL.



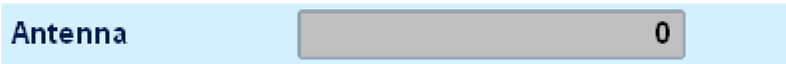
This field allows you to set the squelch value for the currently selected memory channel. Valid input ranges from -30 dBµV to 130 dBµV. A new softkey bar appears which shows the available units as well as +/- and Backspace button. Available units are dBµV and dBm.



This field allows you to activate or deactivate the squelch threshold for the currently selected memory channel. If it is activated (YES), the value from field "Squelch" is used. If it is deactivated (NO), squelch is not used. A related selector shows the available options. Available options are NO and YES.



This field allows you to activate or deactivate automatic frequency correction for the currently selected memory channel. A related selector shows the available options. Available options are OFF and ON.



This field has no effect for the current version of the R&S EB500 firmware.

Press this button to copy the currently selected memory channel into the suppress list for the frequency scan.

Press this button to clear the currently selected memory channel. The receiver settings for this channel will be reset to their default values.

Press this button to activate all assigned memory channels and thus include them in the MScan.

Press this button to deactivate all assigned memory channels and thus exclude them from the MScan.

Press this button to clear all memory channels. The receiver settings for all memory channels are reset to their default values. Before this command is executed, a selector is displayed which allows you to cancel the action. The memory channels will only be cleared if you select "Yes".

Sorts rows by frequency in ascending order.

Sorts rows by frequency in descending order.

Recall Frequency Dialog

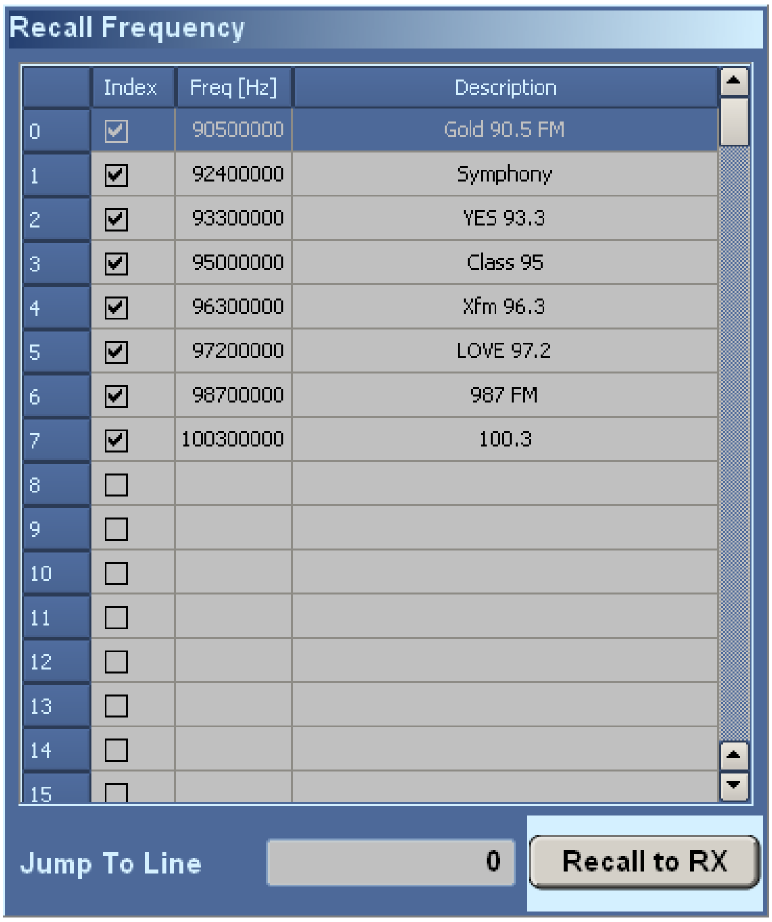


Fig. 3-36: Recall frequency dialog.

Opens the Recall Frequency dialog. With this dialog you can load one of the 10 000 memory channels of the R&S EB500. After clicking "Recall to RX", the receiver will be set to the frequency of the highlighted channel. All the parameters defined for that particular channel (bandwidth, demodulation etc) will be loaded as well.

The "Activated" column in the table only indicates whether a channel has been configured for MScan; even if deactivated you can still use that channel as a recall frequency.

The table comes along with a softkey bar which provides shortcuts to navigate through the table in a similar manner as in the MEM dialog, see: "Memory Setup Dialog" on page 114. We can also directly key-in a line number in the "Jump To Line" field.

Recall to DDC frequencies

When option R&S EB500-DDC is installed, the memory recall will by default apply to the DDC channel that is active.

The following dialog will pop-up instead of figure 3-36.

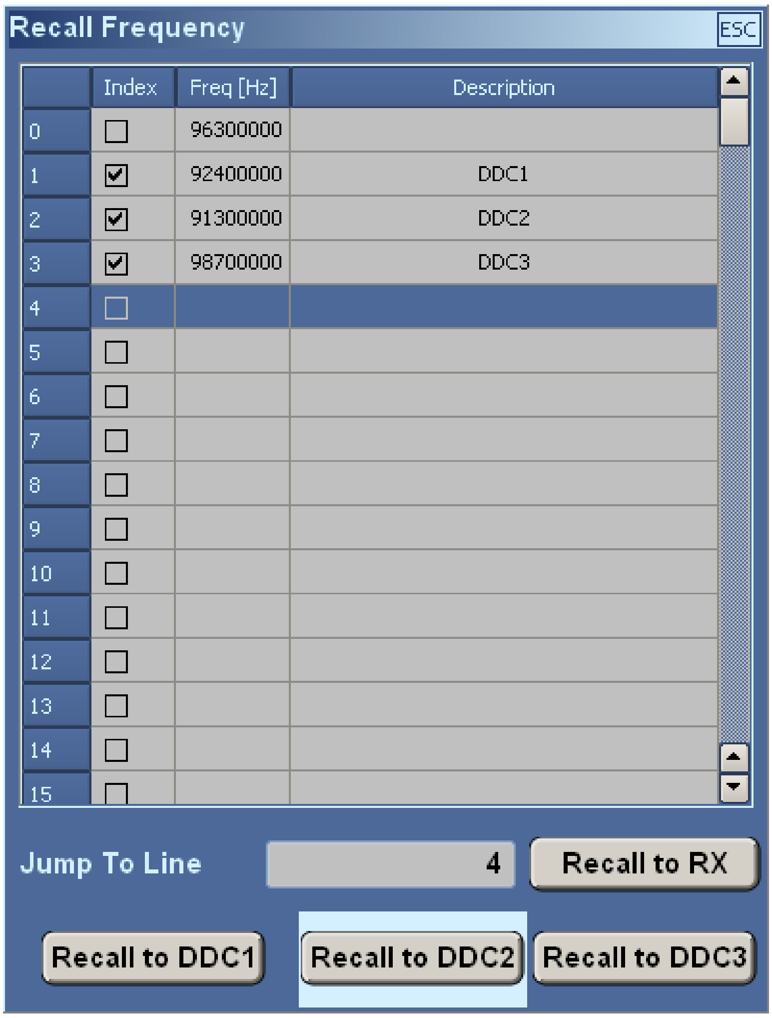


Fig. 3-37: Recall frequency dialog with DDC2 active.

By using the ROLLKEY or CURSOR LEFT / CURSOR RIGHT keys you can change the channel for which the recall frequency applies.

Save Frequency Dialog

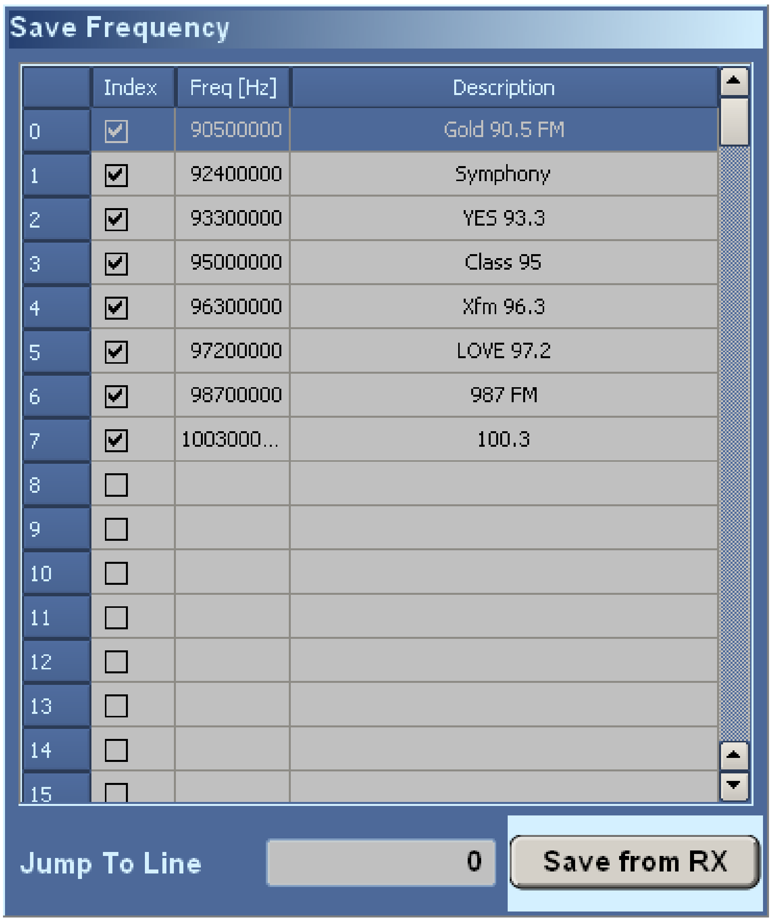


Fig. 3-38: Save frequency.

This key opens the Save Frequency dialog, which allows you to save the current receiver configuration to one of the 10 000 memory channels of the R&S EB500. A memory channel stores the current frequency, the demodulation mode, the demodulation bandwidth and other settings. After saving a channel, the settings of that channel can still be edited via the Memory Setup dialog (see "Memory Setup Dialog" on page 114). Before the dialog opens, the next available memory channel is selected to prevent overwriting an existing entry.

The table comes along with a softkey bar which provides shortcuts to navigate through the table in a similar manner as in the MEM dialog, see: "Memory Setup Dialog" on page 114. If you want to store the frequency in a particular channel instead of the first available slot, you can directly key-in a line number in the "Jump To Line" field.

If you want to use a stored channel to activate for MScan, you need to open the Memory Setup dialog (see "Memory Setup Dialog" on page 114) and check the "Activate" checkbox.

Save DDC frequencies

When option R&S EB500-DDC is installed, the memory save will by default apply to the DDC channel that is active.

The following dialog will pop-up instead of figure 3-38.

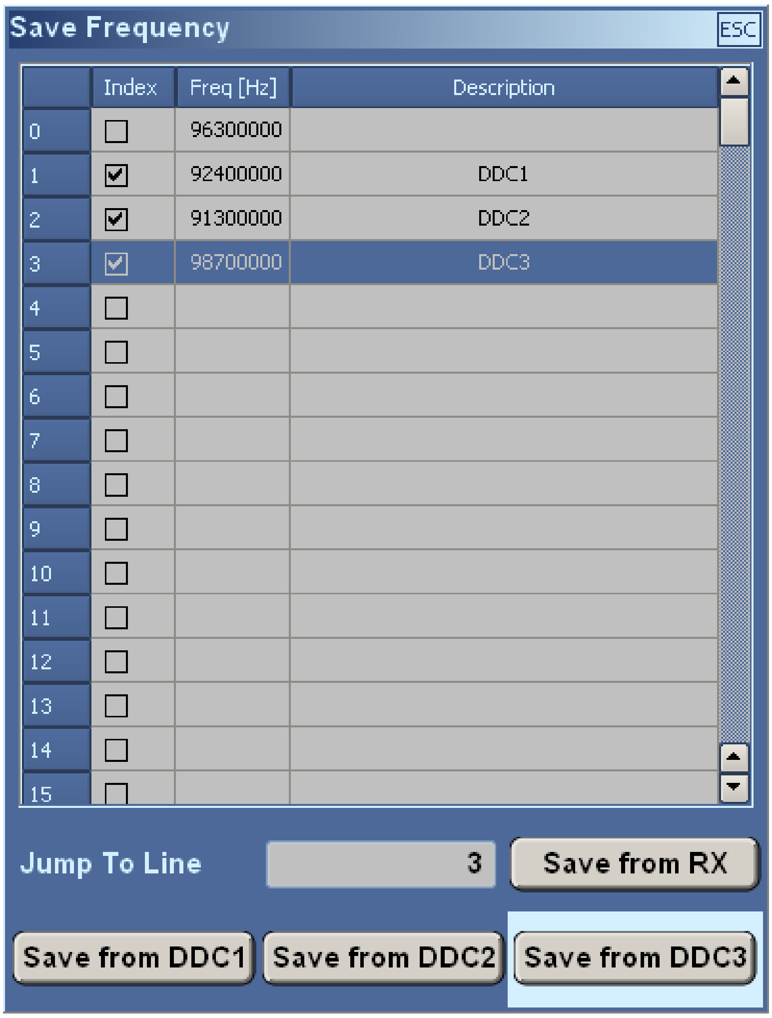


Fig. 3-39: Save frequency dialog with DDC3 active.

By using the ROLLKEY or CURSOR LEFT / CURSOR RIGHT keys you can change the channel for which the save frequency applies.

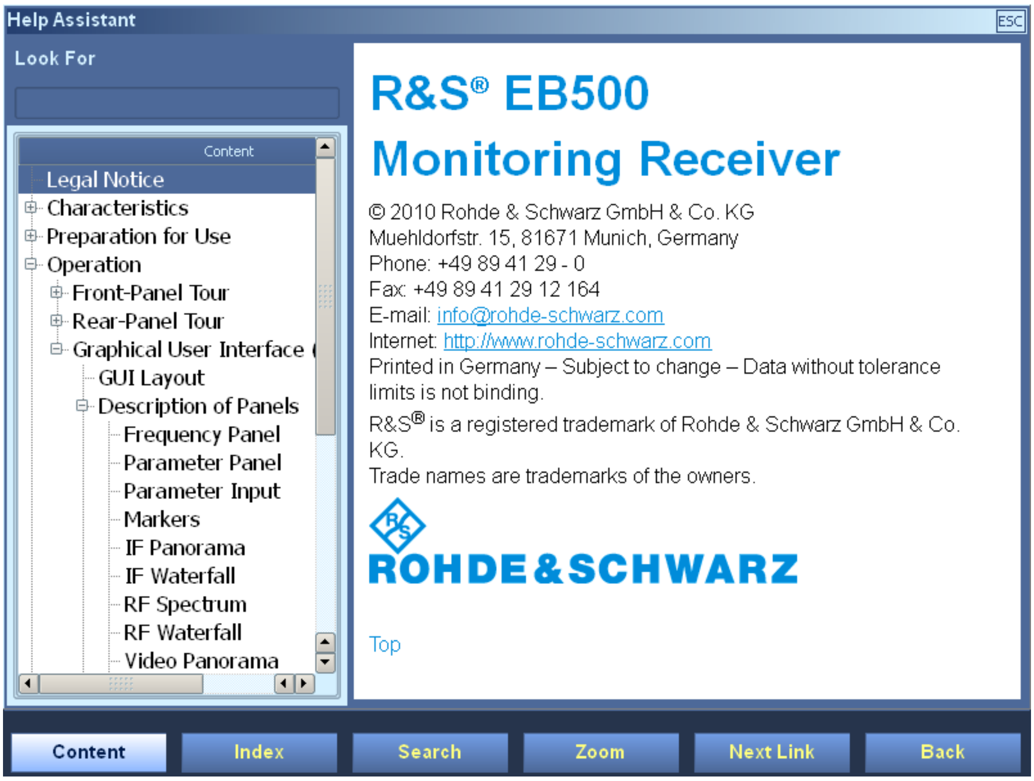
3.3.3.9 HELP

All the information from the operating manual can be shown on the display of the R&S EB500 after pressing the HELP key (or F1 for users of an external GUI).

The Help Assistant comprises three components:

- The browser (at the right)
- The help navigator (at the left)

- The search field (at the top left)



Navigation in the help system differs from navigation in all the other dialogs. Pressing the ENTER key or the ROTARY KNOB takes you directly from the activated navigator to the browser. You do not need to deactivate the navigator and activate the browser. Just like in any other dialog, the focus can be on either one of the components.

Use the PANEL key to move the focus from one component to another component.

ESC will close the dialog.

Browser

The browser (which works like a normal web browser) shows the actual help topics. If the browser is selected but not yet active, it has a normal blue border. To activate the browser, press the ENTER key, the ROLLKEY or click the mouse wheel. An active browser is indicated by a thin blue frame. Use the ROLLKEY to scroll up and down. Use the CURSOR LEFT / CURSOR RIGHT keys to scroll left and right. Step through the page from hyperlink to hyperlink by pressing "Next Link". Pressing ENTER or the ROTARY KNOB opens the selected link.

Pressing ESC deactivates the browser, regardless of whether or not the browser is active.

Navigator

The Navigator allows the user to navigate through the help content. There are three ways in which this navigation can take place: by content, by index and by search, based on a search term. See below for more details.

Look For

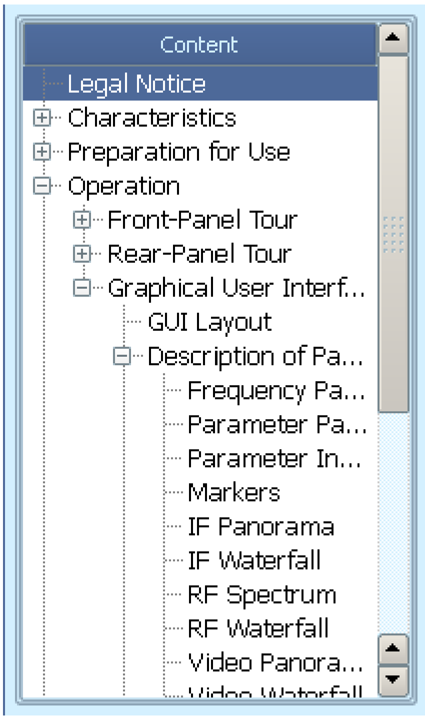
The "Look For" field is provided for keying in a search term, when navigating in the "Search" mode.

Softkeys

Regardless of which component is selected, you can use the softkeys at the bottom to browse the documentation.

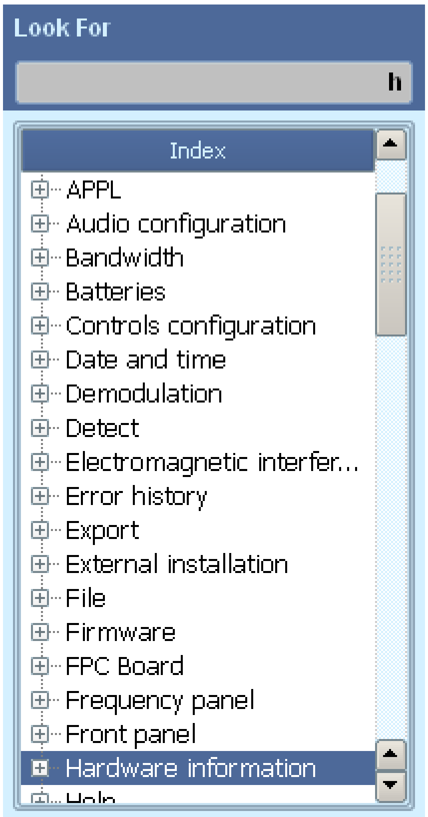
The three softkeys at the left ("Content", "Index" and "Search") decide on the type of navigator.

If "Content" is pressed, the navigator changes to "Content" mode. In this mode, you can browse the table of contents.



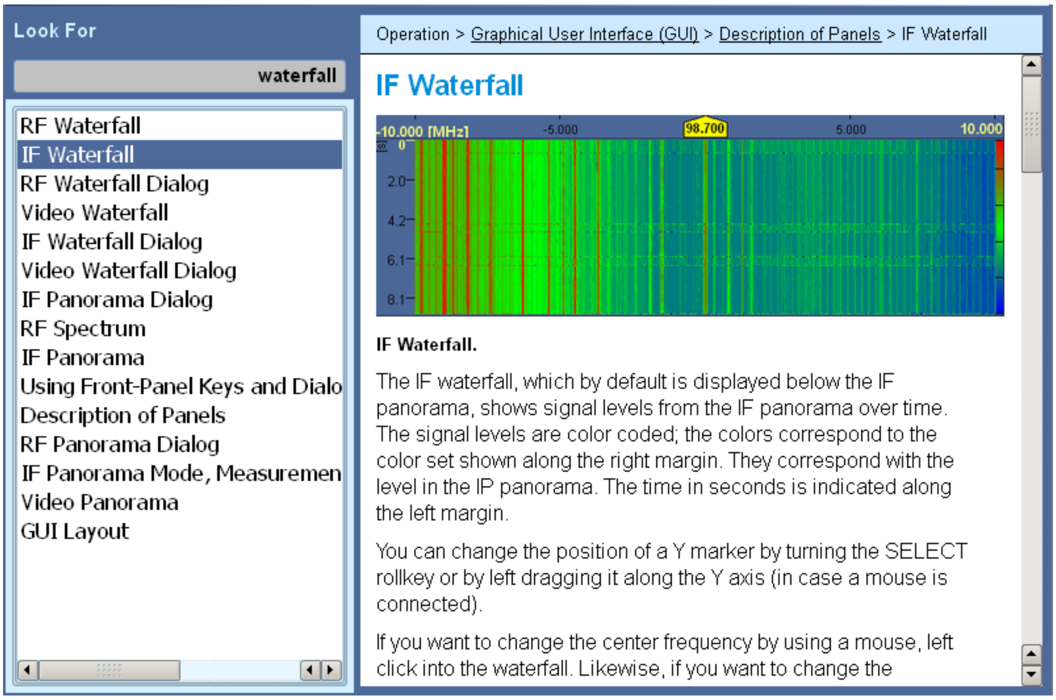
If "Index" is pressed, the navigator changes to "Index" mode. This allows you to browse the documentation by index (index entries are sorted alphabetically).

In "Index" mode the "Look For" field can be activated: By keying-in the first few characters of a index term you can speed up the search, as shown above.



If "Search" is pressed, the navigator changes to "Search" mode. In this mode the help content can be accessed based on keyword search.

In "Search" mode, the "Look For" field must be activated and the keyword should be entered there. Then by pressing the ENTER key or the ROTARY KNOB the navigator will list all the pages that have a reference to this keyword.



For all the three modes, after pressing the ENTER key or the ROTARY KNOB the browser will show the page that was selected.

The "Zoom" key provides 5 different zoom levels: By repeatedly pressing the "Zoom" key the browser will display the content from minimum zoom through intermediate zoom levels to maximum zoom and then roll-back to minimum zoom.

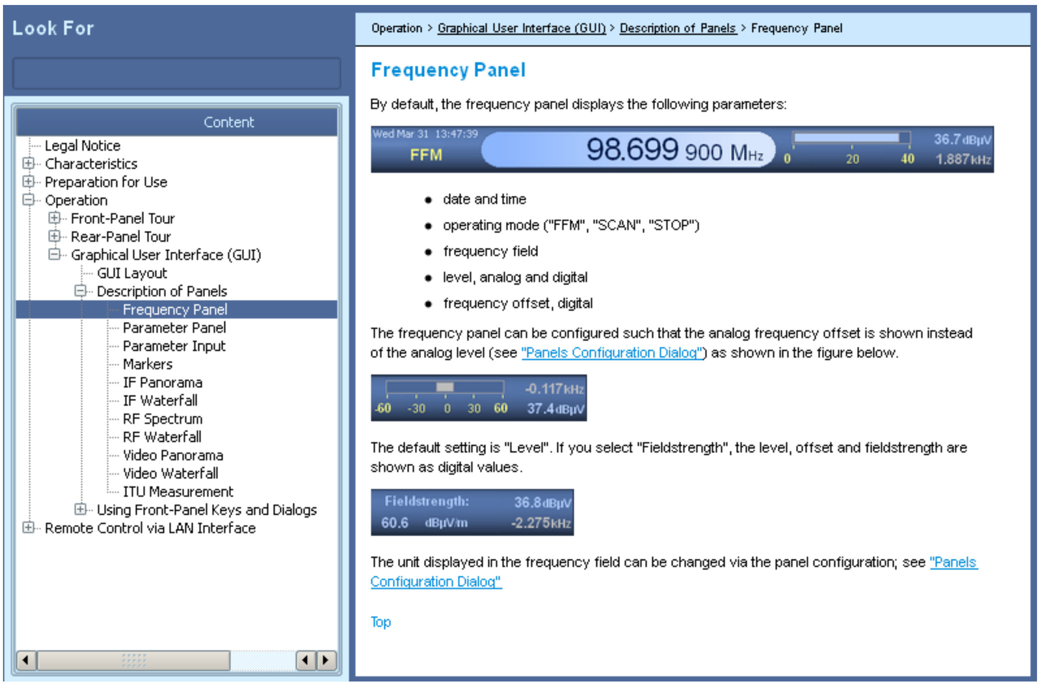


Fig. 3-40: Help Assistant at minimum zoom.

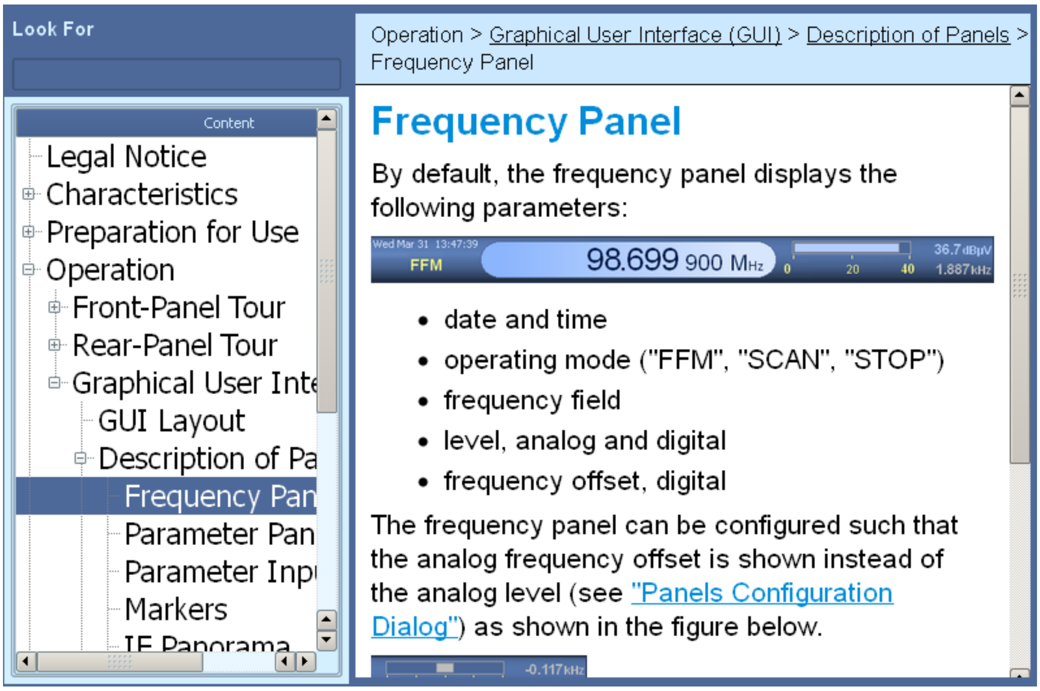


Fig. 3-41: Help Assistant at maximum zoom.

The two softkeys at the right ("Next Link" and "Back") are provided to facilitate browsing.

Whichever panel has the focus, the focus will immediately switch to the browser once any of these two keys is pressed.

By pressing the "Next Link" key, you can step through the browser from one hyperlink to another hyperlink. By pressing ENTER or the ROTARY KNOB you can browse into the hyperlink just like in a normal web browser.

After browsing through the content by using the "Next Link", you can always go back to the previous page by pressing the "Back" key.

3.3.3.10 SETUP

This key is used to configure the R&S EB500. A large number of softkeys are available to provide access to the different configuration options.

Below follows a short description of all the SETUP softkeys.

The "Receiver" key opens the "Receiver Configuration" dialog. This dialog is used to configure the receiver; see "Receiver Configuration Dialog" on page 129.

The "Antenna" key opens the "Antenna Control" dialog. This dialog allows you to specify the antenna input and AUX-Port output. It also provides the option to enable / disable the automatic antenna switching; see "Antenna Control Dialog" on page 131.

The "Config" key opens the "CONFIG" softkeys, which allow you to choose from several configuration dialogs. These dialogs are used to configure the receiver, to calibrate the equipment, to make network and audio settings, and to configure printer options; see "Configuration Softkeys" on page 133.

The "Peripherals" key opens the "PERIPHERALS" softkeys, which let you open specific dialogs used to configure your peripheral equipment. Currently the related settings only provide options to setup the antennas; see "Peripherals Softkeys" on page 149.

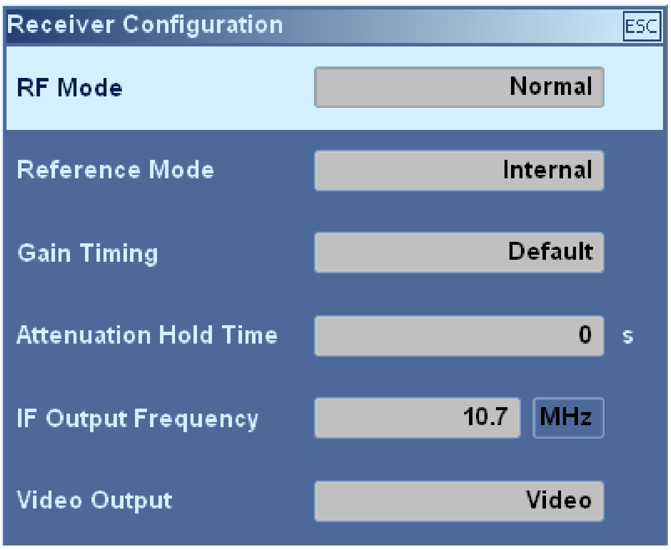
The "Information" key opens the "INFORMATION" softkeys, which let you choose from several dialogs providing information on the equipment's state, including the equipment version, the installed hardware and software options, the connected peripheral equipment, and the current error and information messages; see "Information Softkeys" on page 164.

The "Logging" key opens the "Error History" dialog, which shows error and information messages; see "Error History Dialog" on page 169.

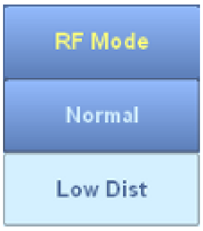
The "Layout" key opens a vertical selector which for the current application (APPL) and operation mode (MODE) provides the different layout options in terms of possible panel combinations.

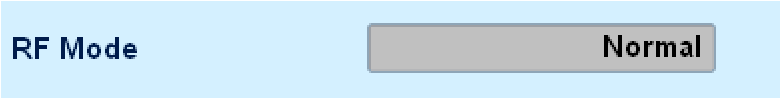
In the paragraphs that follow the options are further explained by means of their corresponding dialogs.

Receiver Configuration Dialog



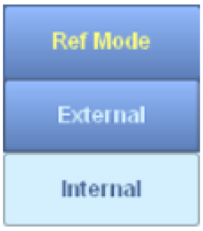
This dialog is used to configure the receiver. You can configure the preselection, the reference frequency, the gain timing, the synthesizer mode, the HF tuner limit, the IF output frequency and the analog video output.

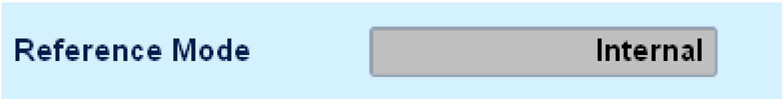




Use this field to set an RF mode. A related selector shows the modes available. Available modes are "Normal" and "Low Dist(ortion)".

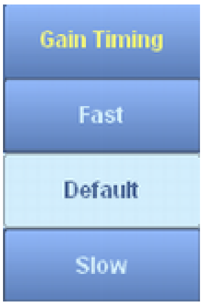
See also `INPut:ATTenuation:MODE` on page 227.

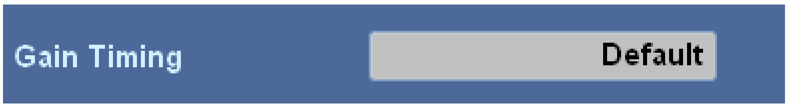




Use this field to set an internal or external reference frequency. A related selector shows the modes available. Available modes are "External" and "Internal".

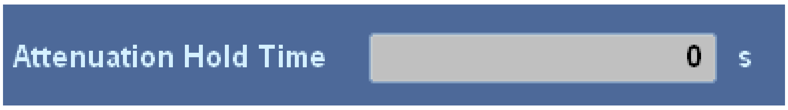
See also `[SENSe:]ROSCillator:SOURce` on page 285.





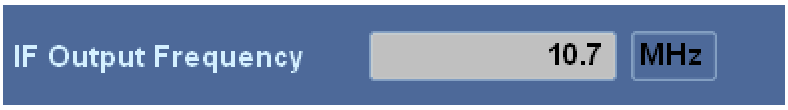
Use this field to set the gain timing. A related selector shows the modes available. Available modes are "Fast", "Default" and "Slow".

See also `[SENSe:]GCONtrol:AUTO:TIME` on page 277.



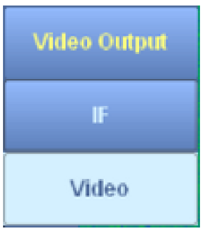
When the attenuator is operated automatically, this parameter specifies a hold time which prevents a premature reduction in attenuation if the input level decreases.

See also `INPut:ATTenuation:AUTO:HOLD:TIME` on page 226.



Use this field to set the IF output frequency to a value between 0 and 70 MHz. The default value is 10.7 MHz. A related selector shows the units you can use to enter the frequency. Available units are "GHz", "MHz", "kHz" and "Hz".

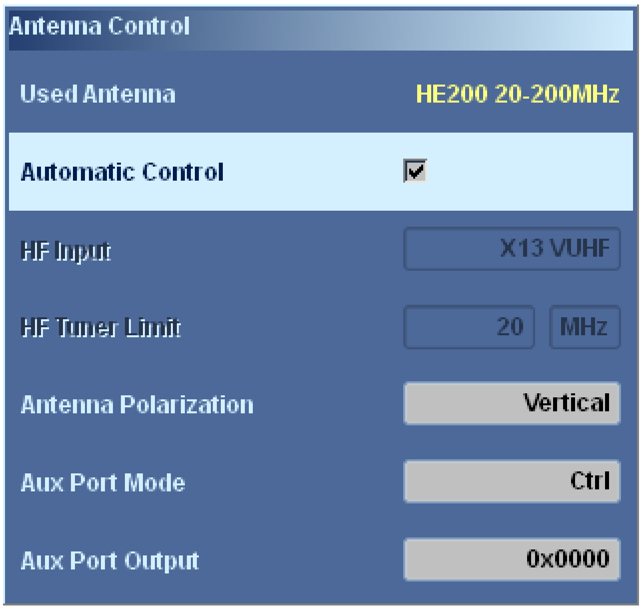
See also `OUTPut:VIDeo:FREQuency` on page 246.



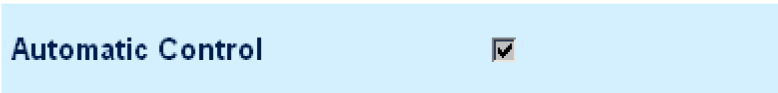
Use this field to specify the video output. A related selector shows the options available. Available options are "IF" and "Video".

See also `OUTPut:VIDeo:MODE` on page 247.

Antenna Control Dialog



This dialog is used to specify the antenna input to be used and the output at the Aux Port. You can also choose between automatic and manual antenna control. The antenna currently used is indicated at the top of the dialog.



Use this field to specify automatic or manual control of the antenna input switch. If a check mark is set, control is done automatically, otherwise manually. If the latter is the case, the control-related fields are enabled for editing and you can specify the antenna input to be used and the output at the Aux Port. In the case of automatic control, the settings made in the "Antenna Setup" dialog will take effect for control of the antenna input.

See also ROUTe:AUTO on page 248.

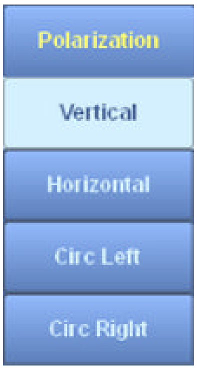
The field HF Input indicates which input is used for the HF antenna for signal reception. There are two antenna inputs, however only one input is suitable for VUHF: X13: You will not be able to change to a different port, therefore the dialog does not show the VUHF input. On the other hand, a HF antenna can be connected to either X13 or X14; therefore the HF input field will provide a selector with the options "X14 HF" or "X13 VUHF".

You can only change the antenna input if automatic input control is deactivated (in the setup shown in the figures above automatic control is activated).

See also `ROUTe:VUHF[:INPut]` on page 252 and `ROUTe:HF[:INPut]` on page 250.

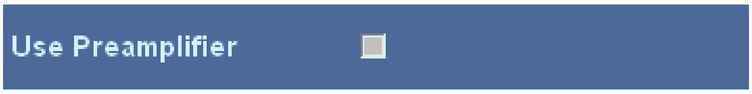
Use the field "HF Tuner Limit" to set the HF tuner limit. You can only set the HF tuner limit if automatic input control is deactivated. The HF tuner limit is the limit frequency which distinguishes if the HF option is used for reception or the VUHF tuner is used for reception. A related selector shows the available units. Available units are "GHz", "MHz", "kHz" and "Hz". This field is not editable unless option HF is installed.

See also `[SENSe:]FREQuency[:CW|FIXed]` on page 264.



Use this field to select the antenna polarization. Available options are "Vertical", "Horizontal", "Circ Left" and "Circ Right".

See also `ROUTe:POLarization` on page 251.



Use this field to activate or deactivate the antenna's preamplifier. If a check mark is set, the preamplifier will be switched on, otherwise it will be switched off. See also: `ROUTe:GAIN[:STATe]` on page 250.

Use this field to set the Aux Port mode. A related selector lets you choose between the three available modes: "Freq", "Ctrl" and "Auto".

Please note the following when selecting a mode:

- In "Ctrl" mode, the output at the Aux Port is determined by the entry made in field "Aux Port Output".
- If "Freq" mode is selected, the current receiver frequency is output at the Aux Port in BCD format. The frequency is indicated in MHz. For "Freq" mode, field "Aux Port Output" is not needed and is therefore disabled.
- If "Auto" is selected, the setting from the antenna setup is used and field "Aux Port Output" is disabled.

See also `OUTPut:AUXMode` on page 240.

Use this field to set the Aux Port Output manually. It cannot be changed unless "Aux Port Mode" is set to "Ctrl". This value is shown in hexadecimal format.

See also:

`OUTPut:BITAux[<numeric_suffix>][:STATe]` on page 241

OUTPut:BYTAux[<numeric_suffix>][:STATe] on page 243

OUTPut:WRDaux[:STATe] on page 248

Configuration Softkeys

Some of the options provide access to a second level of setup; "Config" is one of them. The respective options for "Config" are shown below.

In the paragraphs that follow, the dialogs that belong to the different softkeys will be explained in detail.

Opens the "Receiver Calibration" dialog. This dialog is used to calibrate the R&S EB500.

See "Receiver Calibration Dialog" on page 134.

Opens the "Network Configuration" dialog. This dialog shows the current network settings and allows network configuration.

See "Network Configuration Dialog" on page 134.

Opens the "Audio Configuration" dialog. This dialog is used to configure the audio options of the R&S EB500.

See "Audio Configuration Dialog" on page 136.

Opens the "Panels Configuration" dialog. This dialog is used to change general panel settings or to enable additional panels.

See "Panels Configuration Dialog" on page 139.

Opens the "Snapshot Setup" dialog. This dialog is used to configure the output options for the screen snapshots.

See "Snapshot Setup Dialog" on page 142.

Opens the "Remote Lock" dialog. This dialog is used to set a remote lock and view the configuration of the connected clients.

See "Remote Lock Dialog" on page 145.

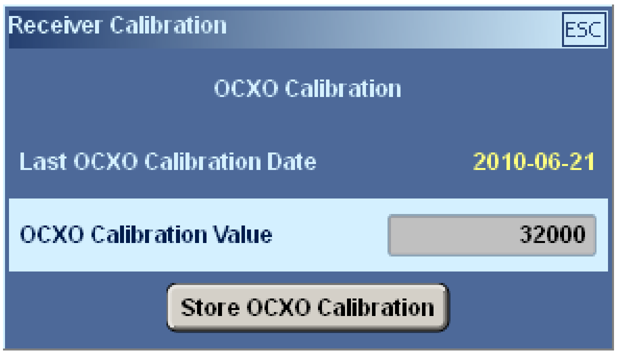
Opens the "Controls Configuration" dialog. This dialog is used to set the progression for the knobs and the direction of the ROLLKEY as well as the sound produced when a key is pressed.

See "Controls Configuration Dialog" on page 146.

Opens the "Date and Time" dialog. This dialog is used to set the date and time of the device as well as the time zone to be used.

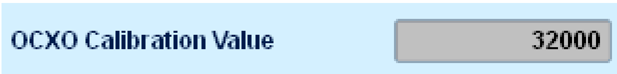
See "Date and Time Dialog" on page 148.

Receiver Calibration Dialog



This dialog is used to calibrate the OCXO reference frequency or the coefficients for IF equalizer.

The last calibration date is stated on top of the dialog.



Use this field to enter the D/A converter value for setting the exact OCXO reference frequency.

See also `CALibration:ROSCillator[:DATA]` on page 211.

Press this button to store the OCXO calibration value and the OCXO calibration date. The calibration date shown in the dialog will be updated accordingly.

See also `CALibration: ROSCillator:STORe` on page 212.

Network Configuration Dialog

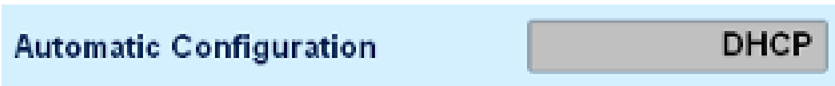
This dialog is used to view the current network configuration and manage the network configuration options.

Network configuration dialog (internal)

Network configuration dialog (external)

The network configuration dialog looks different on the front-panel (internal) GUI as compared to the external GUI. The first line in the external GUI shows the local host address used for communication. It can be configured via application startup parameter "-h" and cannot be changed once the application has been started.

The lower portion of this dialog shows the current IP address, port number, subnet mask and gateway. The upper portion allows you to configure the network options.



Use this field for network configuration or automatic address assignment. A related selector shows the options available. Available options are "Fixed" and "DHCP".

If "DHCP" is selected, the network address is assigned automatically, i.e. there is no need to edit the fields in the lower portion of the dialog. As a consequence, these fields are disabled when "DHCP" is selected.

If "Fixed" is selected, there is no automatic address assignment and the IP address has to be entered manually in the lower portion of the dialog, along with other network settings. In this case, the related fields are enabled for editing.

Use this field to configure the LAN address, which will be stored non-volatile in the R&S EB500. It can only be changed if "Automatic Configuration" is set to "Fixed".

Use this field to configure the LAN port, which is stored in non-volatile memory in the R&S EB500. It can only be changed if "Automatic Configuration" is set to "Fixed".

See also `SYSTem:COMMunicate:LAN|SOCKet:ACTual:PORT` on page 318.

Use this field to configure the LAN subnet mask, which is stored non-volatile in the R&S EB500. It can only be changed if "Automatic Configuration" is set to "Fixed".

See also `SYSTem:COMMunicate:LAN|SOCKet[:SAVE]:SMASk` on page 319.

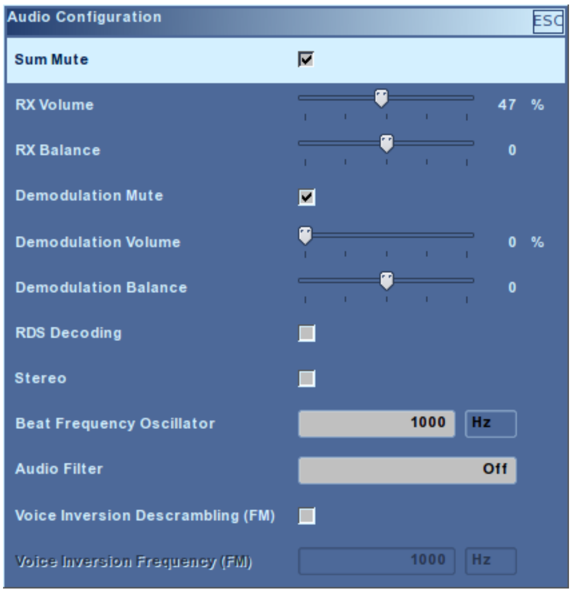
Use this field to configure the LAN gateway, which is stored non-volatile in the R&S EB500. It can only be changed if "Automatic Configuration" is set to "Fixed".

See also `SYSTem:COMMunicate:LAN|SOCKet[:SAVE]:DGATeway` on page 319.

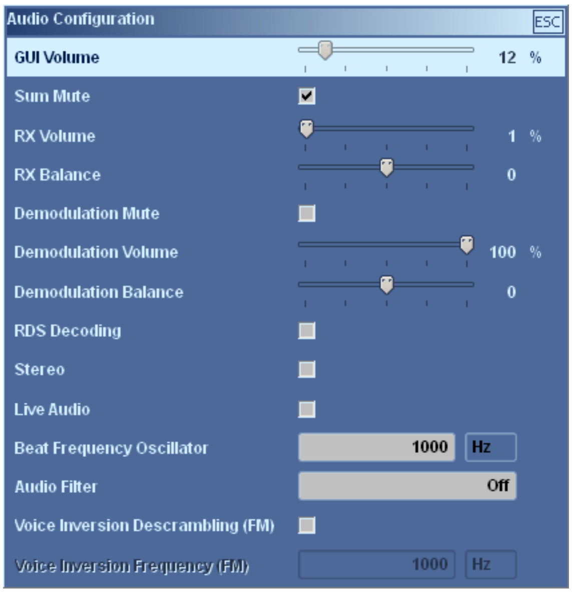
Press "Apply" to save the current settings. Note that the new settings will not take effect until the R&S EB500 is restarted. Press "Restore" if you want to cancel any pending changes, i.e. changes that have been made but have not yet been applied via the "Apply" button.

Audio Configuration Dialog

This dialog is used to configure the audio options of the R&S EB500.



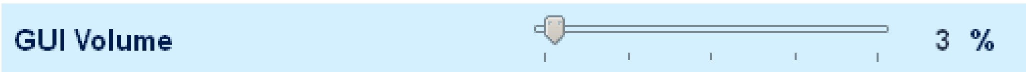
Audio configuration dialog (internal)



Audio configuration dialog (external)

Live Audio for external GUI

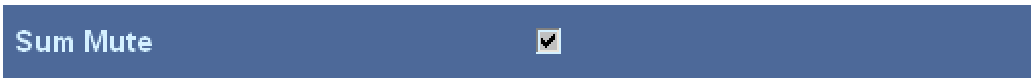
The audio configuration dialog for the external GUI has additional settings for live audio and GUI volume.



The first line in the external GUI shows the GUI volume. The slider can control the operating system's master volume; "Live Audio" has to be switched on to hear it. This control affects the volume on a PC running an external GUI and the audio is produced by the PC's soundcard. It should not be confused with the volume set via the VOLUME / MUTE knob, which is used to control the receiver volume on the R&S EB500.

You can start a live audio session by making use of the PC soundcard: set a check mark in the "Live Audio" box , as shown above. The volume can be controlled by "GUI Volume".

The live audio session will run until the user unchecks the "Live Audio" field.



If a check mark is set, sound is output to the headphones while the receiver's built-in speaker remains mute. Otherwise, sound is output to the built-in speaker.

If option R&S EB500-DDC is installed, the "Mute" applies to the sum of all (main demodulation and DDC) channels. Individual channels can be muted by checking the boxes for the individual channels in the DDC Configuration Dialog (see chapter 3.3.3.20, "DDC Display Dialog", on page 187).

If option R&S EB500-DDC is not installed, both the boxes "Sum Mute" and "Demodulation Mute" (see below) must be unchecked in order to be able to hear sound over the internal speaker.

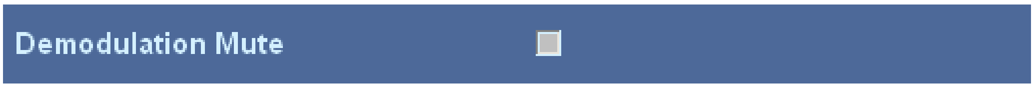
See also `SYSTem:SPEaker:STATe` on page 335.

Use the slider to control the receiver volume. This control sets the volume of the signal received from 0 to 100%; the slider has exactly the same effect as the VOLUME knob. The sound is output to the internal speaker or the headphones.

See also `SYSTem:AUDio:VOLume` on page 316.

Use the slider to set the receiver balance for headphones output AF X3, ranging from -50 to +50.

See also `SYSTem:AUDio:BALance` on page 311.



Set a check mark to turn off the demodulation volume.

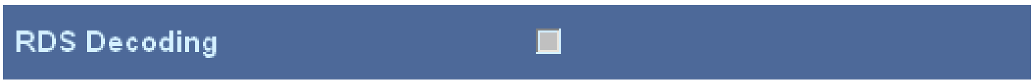
See also `SYSTem:AUDio:DEModulator:STATe` on page 314

Use the slider to set the demodulation volume. You can set it to a value between 0% and 100%.

See also `SYSTem:AUDio:DEModulator:VOLume` on page 314 .

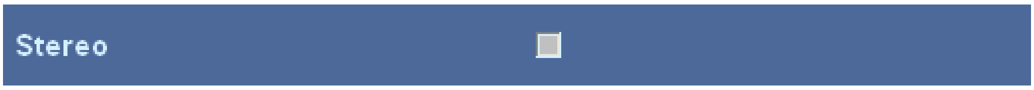
Use the slider to set the demodulation balance. You can set it to a value between -50 and +50.

See also `SYSTem:AUDio:DEModulator:BALance` on page 313 .



If you set a check mark here, the RDS decoder will be switched on, otherwise it will be switched off. RDS detection works only when the RDS decoder is switched on; the decoding can be monitored in the RDS panel: see "Panels Configuration Dialog" on page 139; this panel will be opened once the RDS box is checked. RDS requires bandwidths of 120 kHz or more. This feature also requires the R&S EB500-IM option.

See also `[SENSe:]FM:RDS[:STATe]` on page 262.



If you set a check mark here, the stereo decoder will be switched on, otherwise it will be switched off. Stereo detection works only when the stereo decoder is switched on. Stereo requires bandwidths of 120 kHz or more.

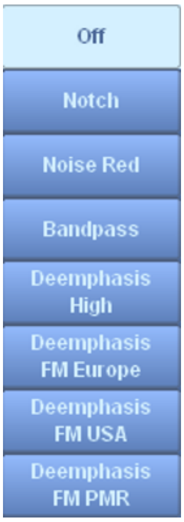
See also `[SENSe:]FM:STEReo[:STATe]` on page 263.

Use this field to set the BFO (Beat Frequency Oscillator) frequency. Please note that this value is irrelevant unless the demodulation mode is "CW". A related selector shows the available units for the frequency. Available units are "GHz", "MHz", "kHz" and "Hz".

See also `[SENSe:]DEModulation:BFO` on page 259.

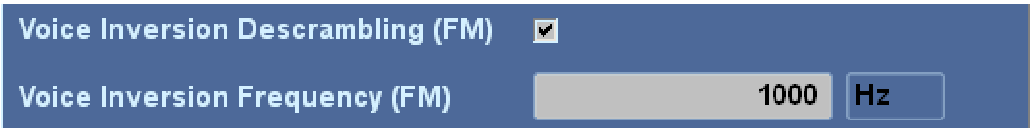
Use this field to configure the audio filter mode. A related selector shows the available modes. Available modes are "Off", "Notch", "Noise Red", "Bandpass", "Deemphasis High", "Deemphasis FM Europe", "Deemphasis FM USA", "Deemphasis PMR".

For a detailed function description see also `OUTPut:FILTer: MODE` on page 243.



Use this field to configure the audio filter mode. A related selector shows the available modes. Available modes are "Off", "Notch", "Noise Red", "Bandpass", "Deemphasis High", "Deemphasis FM Europe", "Deemphasis FM USA" and "Deemphasis PMR".

For a detailed function description see also `OUTPut:FILTer: MODE` on page 243.



If you set a check mark at "Voice Inversion Descrambling", the inverse AF demodulation will be switched on. Once it is switched on, the field "Voice Inversion Frequency" will be activated to set the oscillator frequency for the inverse AF. A related selector shows the available units for the frequency.

See also: `SYSTem:AUDio:DEModulator:INVerse[:STATe]` on page 312 and `SYSTem:AUDio:DEModulator:INVerse:FREQuency` on page 311.

Panels Configuration Dialog

This dialog is used to specify general panel settings.

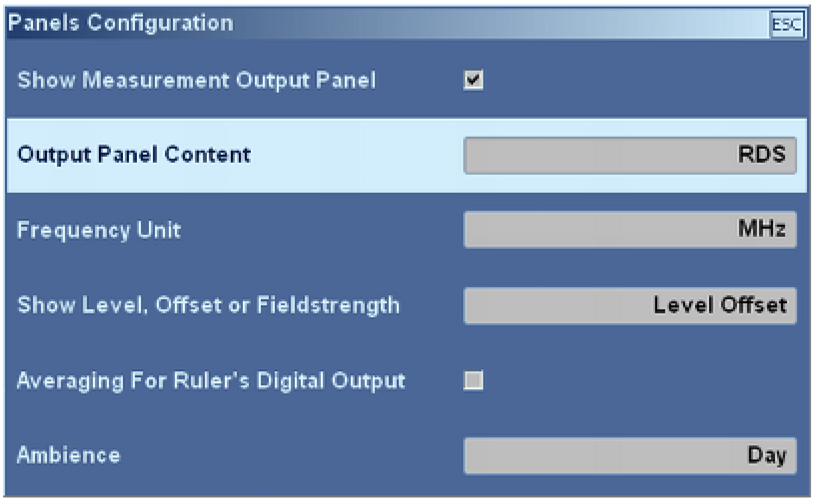
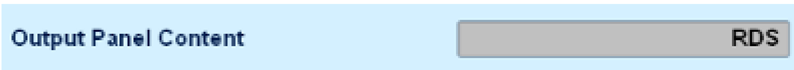


Fig. 3-42: Panels Configuration dialog (ambience mode is "Day").

Place a check mark here to activate an additional panel, called "Measurement Output Panel".



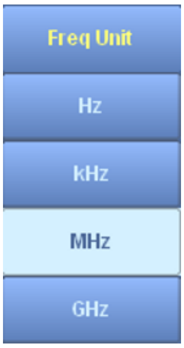
If the check mark is placed in the checkbox above then this field becomes active for input and the accompanying selector provides different configuration options for the output panel to show information containing either one of the following:

Output panel content

- Information on the markers -- level at each of the activated markers and delta between each of the marker pairs.

- RDS information -- provided RDS is switched on (see "Audio Configuration Dialog" on page 136), the receiver is tuned to a station that provides RDS and RDS can indeed be decoded.

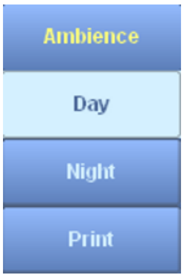
- Geographic information -- set either manually or provided by GPS (see "Location Setup Dialog" on page 162).



Use this field to change the unit to be used for entering frequencies in the panels. A related selector shows the available units. Available units are "GHz", "MHz", "kHz" and "Hz".

Use this field to indicate whether to show the level, offset or fieldstrength in the frequency panel (see chapter 3.3.2.1, "Frequency Panel", on page 37). A related selector shows the available options.

Use this field to specify whether the markers' output should be averaged. If a check mark is set, the output is averaged, otherwise it is not.



Use this field to change the user interface ambience. The user interface has three different color modes: "Day" (as shown above), "Night" and "Print" (shown below).

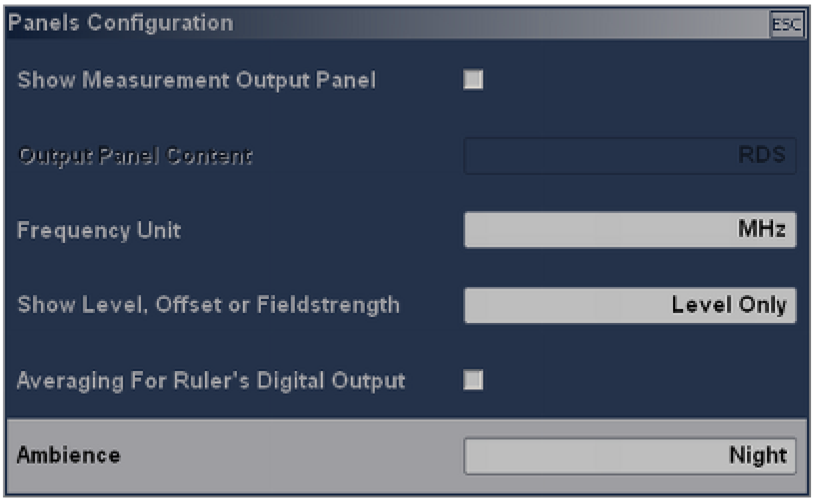


Fig. 3-43: Panels Configuration dialog (ambience mode is "Night").

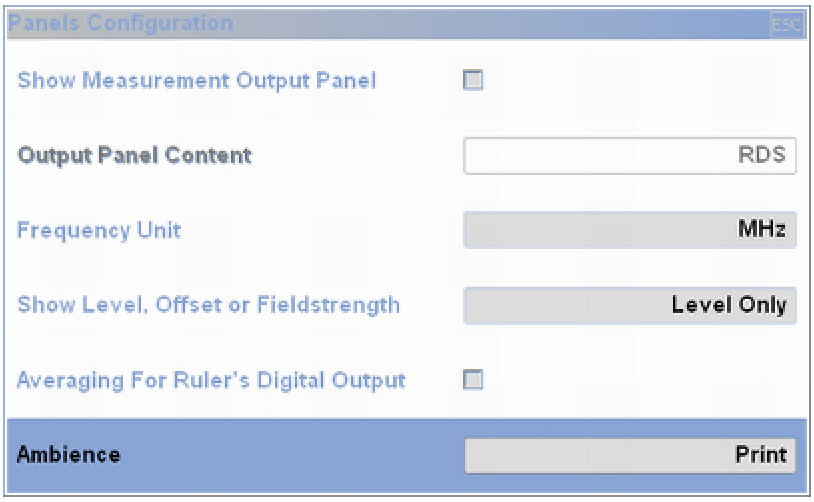


Fig. 3-44: Panels Configuration dialog (ambience mode is "Print").

Snapshot Setup Dialog

This dialog is used to configure the snapshot image format for the "Snapshot" function (MENU > "Snapshot"). A snapshot will be output to a file on the data partition on the internal flash memory (or on harddisk for external GUI). The dialog also allows to enter comments that will be printed with each snapshot.

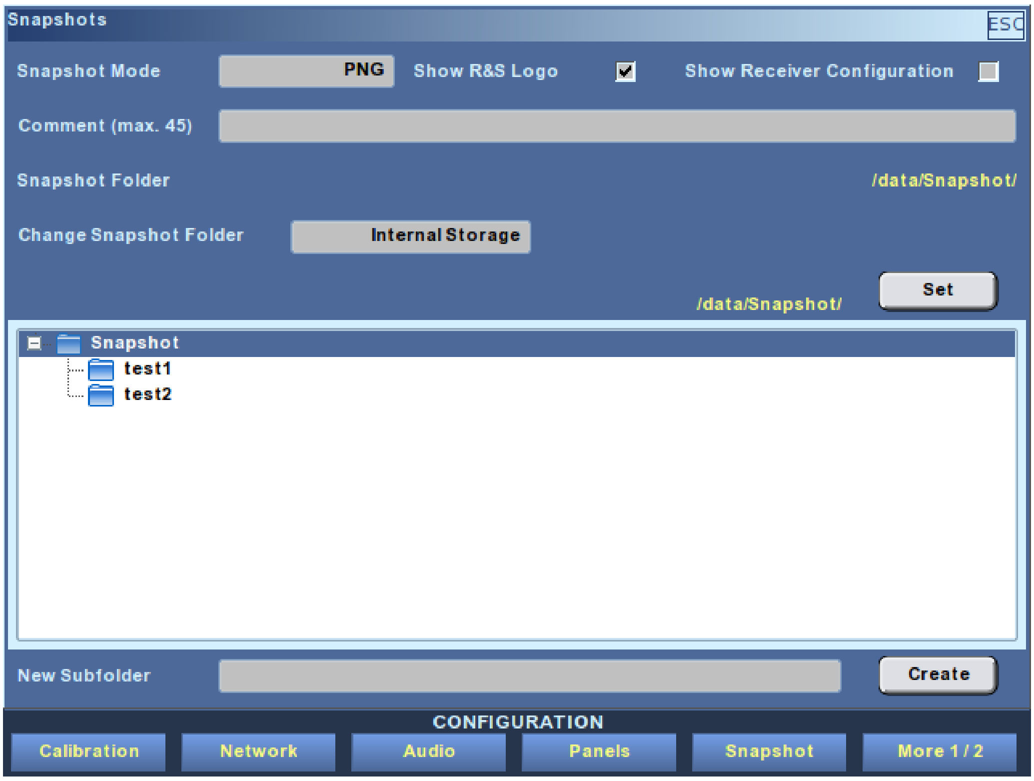


Fig. 3-45: Snapshot Setup dialog.

For the internal GUI, the storage will be stored in the data partition on internal flash memory. They can be copied to USB flash drive by making use of the "Export Snapshots" function"; see "File Export" on page 104.

In the external GUI the default storage will be in the `Snapshot` folder in the installation folder of the EB500 GUI.

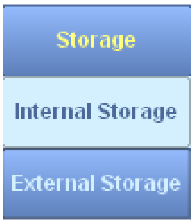
Use this field to specify the output file format. This may be a PDF document or an image file. A related selector shows the available options. Available options are "PDF", "BMP" and "PNG".

If you do not want the Rohde & Schwarz logo on top of your snapshots then uncheck the checkbox above.

If you want to print receiver configurations with the snapshot then place a check in the checkbox above.

Use this field to enter a comment for your snapshot. Comments are limited to 45 characters in length, including spaces and symbols.

This field displays the current destination path of snapshots.



This field allows you to save snapshots to either internal or external storage.
`Internal Storage` refers to the predefined folder `Snapshot` in the device.
`External Storage` refers to USB flash drive. When you are changing the storage type, the file browser shown as below will navigate to the corresponding path. In "File Browser" on page 98 it is explained how to use a browser.

Once you browse to the folder you want to configure, deactivate the file browser with either ROLLKEY or ENTER key. Only after pressing the "Set" button the new snapshot path will be set to the current snapshot path.

Use the field "New Subfolder" to specify the name of a new subfolder to be created in the current folder (highlighted in the file browser) when the "Create" button is pressed. This operation will fail if there exists a subfolder with the same name.

Remote GUI

You can also set the snapshot path in remote GUI.

In remote GUI, if `Internal Storage` is selected the file browser will navigate to the predefined `Snapshot` folder located in the installation directory. You can only browse subfolders within `Snapshot` folder.

If `External Storage` is selected, the file browser will by default navigate to the installation directory, however you can navigate to any directory within the same drive.

Remote Lock Dialog

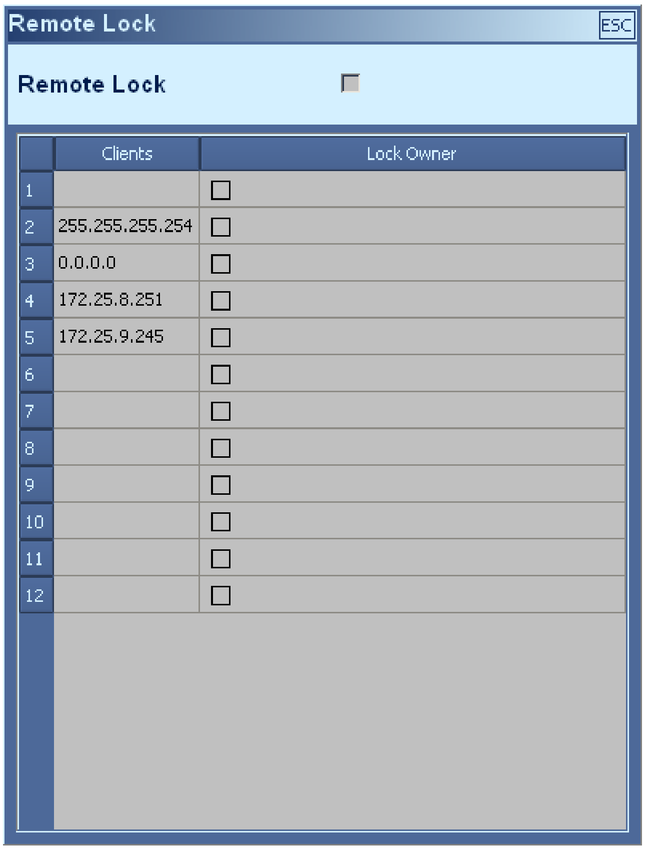


Fig. 3-46: Remote Lock Dialog.

This dialog is used to view the clients currently connected to the R&S EB500. You can see whether or not the R&S EB500 is locked, and which client has exclusive write permission.

If no check mark is set, the R&S EB500 is not locked. Setting a check mark gives you exclusive write permission for the R&S EB500. If you see a check mark, the R&S EB500 has already been locked. The table below this field shows the client which has obtained a lock on the R&S EB500 ("lock owner").

See also

- `SYSTem:LOCK:REQuest?` on page 330
- `SYSTem:LOCK:RELease` on page 330

	Clients	Lock Owner
1		☐
2	255.255.255.254	☐
3	0.0.0.0	☐
4	172.25.8.251	☑
5	172.25.9.245	☐
6		☐
7		☐

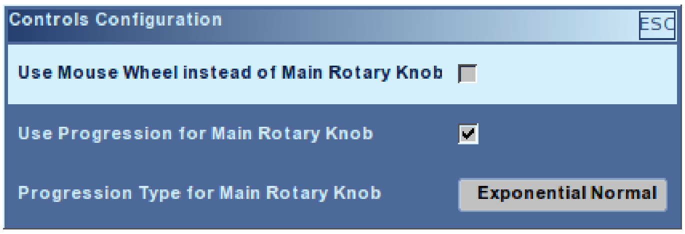
This table shows all clients currently connected to the R&S EB500. The clients' IP addresses are shown in the first column. The second column shows which client, if any, owns a lock on the R&S EB500. Take note that the internal client (GUI) has IP address `192.168.255.254` and can also be locked out, as shown in the table.

The "lock" icon in the icon panel indicates whether the R&S EB500 is locked or unlocked, see the table in chapter 3.3.1, "GUI Layout", on page 35. After reset of the R&S EB500, all locks will be cleared.

Locking out of trace data

A "locked" R&S EB500 will block all write operations by all clients except the one that owns the lock. Only this client has write permission and will be able to receive trace data, by registering for particular traces (see chapter 6, "Mass Data Output", on page 403). However, a client that was connected already before the receiver got locked will continue to receive trace data, provided he was registered for this trace before he got locked out.

Controls Configuration Dialog

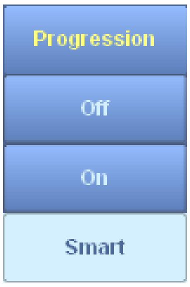


This dialog is used to configure the R&S EB500's controls, i.e. its keys and knobs. For instance you can set the device to produce a sound when a key is pressed. You can also set the direction for the main rotary knob (ROTARY KNOB) as well as its progression.

Set a check mark here if you want to use the mouse wheel rather than the main rotary knob (ROTARY KNOB) to navigate within the various dialogs. The main ROTARY KNOB will not be disabled however; see the note below. The focus direction changes accordingly, as does the direction when setting a value in a particular dialog field.

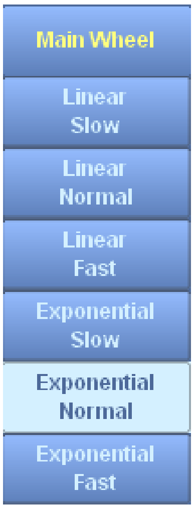
Direction for the Main Rotary Knob

You can also check this box if you prefer a different direction for the main rotary knob (by default turning clockwise navigates upward in a dialog; counterclockwise navigates downward).



Use this field if you want to use progression for the mouse wheel and ROTARY KNOB. When progression is switched off, turning the ROTARY KNOB results in a linear change of the value being set. On the other hand, when progression is switched on any change will be subject to the selected type of progression, which can be selected from the options shown below.

The third option is "smart" progression. When using this option the R&S EB500 will set a progression that is most suitable for the application mode and measurement mode in which the R&S EB500 is currently operating.



Use this field to specify the type of progression to be used for the ROTARY KNOB (or mouse wheel). You can set progression to one of six types, three of which are linear and three exponential in behavior, as shown by the related "Main Wheel" selector.

Progression for the Main Rotary Knob

The concept of progression works as follows: if the speed at which the knob turns is faster than a certain threshold, the frequency change will not be stepwise, as specified by "FREQ INCR", but faster. This is achieved by combining a number of steps.

A linear progression will combine one or more steps based on the speed of turning. The amount of steps that is combined depends on whether "Linear Slow", "Linear Normal" or "Linear Fast" is chosen.

An exponential progression works the same as linear progression when the wheel is turned with a slow speed. When the wheel is turned with higher speed however, the number of steps that is combined will be a function of the turning speed to the power of 2 or even power of 3.

Date and Time Dialog

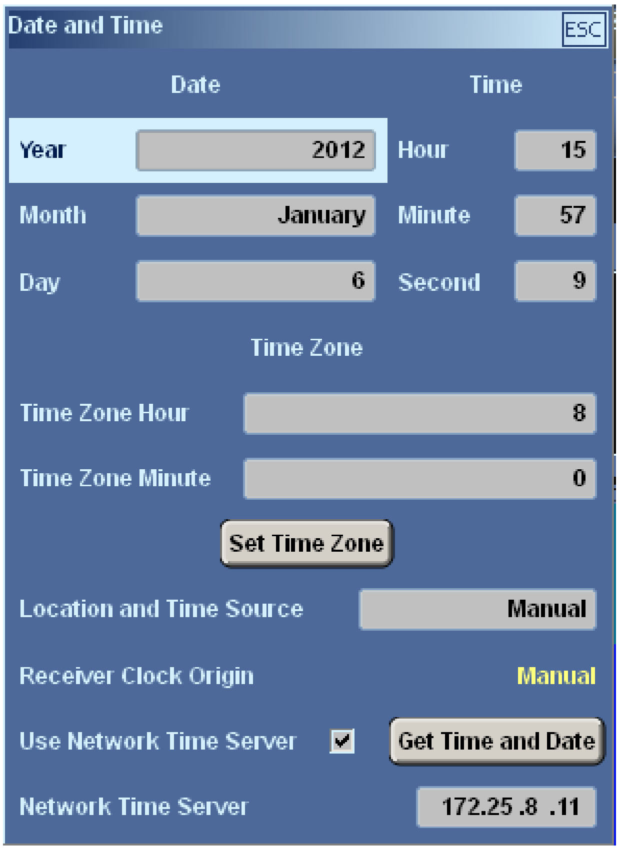
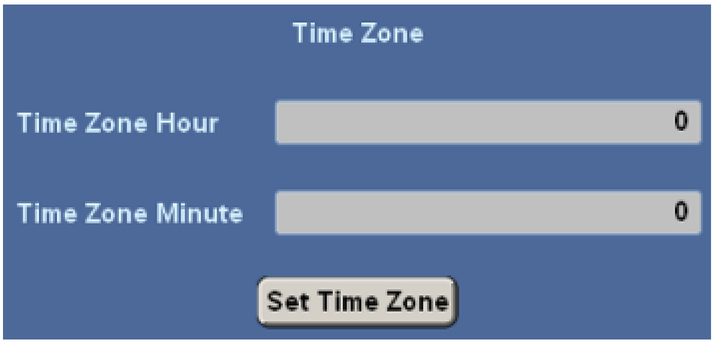


Fig. 3-47: Date and Time Configuration dialog.

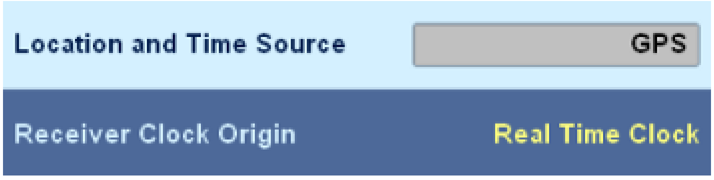
This dialog is used to set the receiver date, time and time zone. The fields on top of the dialog are used to set the current year, month, day, hour, minute and second.

See also `SYSTem:DATE` on page 323 and `SYSTem:TIME` on page 335.



The time zone setting of the R&S EB500 can be changed by the "TimeZone Hour" and "TimeZone Minute" fields. You need to click the "Set Time Zone" button to apply the new setting.

See also `SYSTem:TZONe` on page 336.



Use the "Location and Time Source" field to set the source of the current time and position. A related selector shows the available options. Available options are "GPS" and "Manual". If a GPS receiver is connected you can select "GPS" and the time and position will be taken from the GPS receiver automatically. You can also enter the current time manually by selecting "Manual".

Time Source

When the R&S EB500 boots-up the time source will be taken from the real-time clock. If you configure the time either manually or by changing the time source to GPS, this will be indicated in the dialog, e.g. in the figure below it can be seen that the time has been changed manually.

The last part of the dialog provides fields to retrieve the time from a Network Time Server. Key-in the IP address of a Time Server, check the checkbox and press Get Time and Date in order to get the time provided by the Time Server.

Peripherals Softkeys

The "Peripherals" softkeys provides access to the dialogs: "Antenna Setup" and "Antenna Definition."

In the paragraphs that follow, the dialogs that belong to the different selectors will be explained in detail.

The "Antenna Setup" key opens the "Antenna Setup" dialog, which is used to configure the connected antennas. Here you can configure the antennas' operating frequency range.

The "Antenna Def" key opens the "Antenna Definition" dialog, which is used to configure the receiving antennas to be shown in the "Antenna Setup" dialog.

NOTICE

Antenna Definition / Antenna Setup

Note that antennas need to be defined in the "Antenna Definition" dialog before they can be configured in the "Antenna Setup" dialog.

The "Compass" key opens the "Compass Setup" dialog, which is used to configure the connected compasses. You can also retrieve specific compass data.

The "Compass Calib" key opens the "Compass Calibration" dialog, which is used to calibrate the selected compass.

The "Declination" key opens the "Declination" dialog, which is used to set the declination, either manually or by reading from a connected GPS.

The "Location" key opens the "Location" dialog. This dialog is used to configure the source for positional data and set the format for showing the position of the R&S EB500.

Antenna Definition Dialog

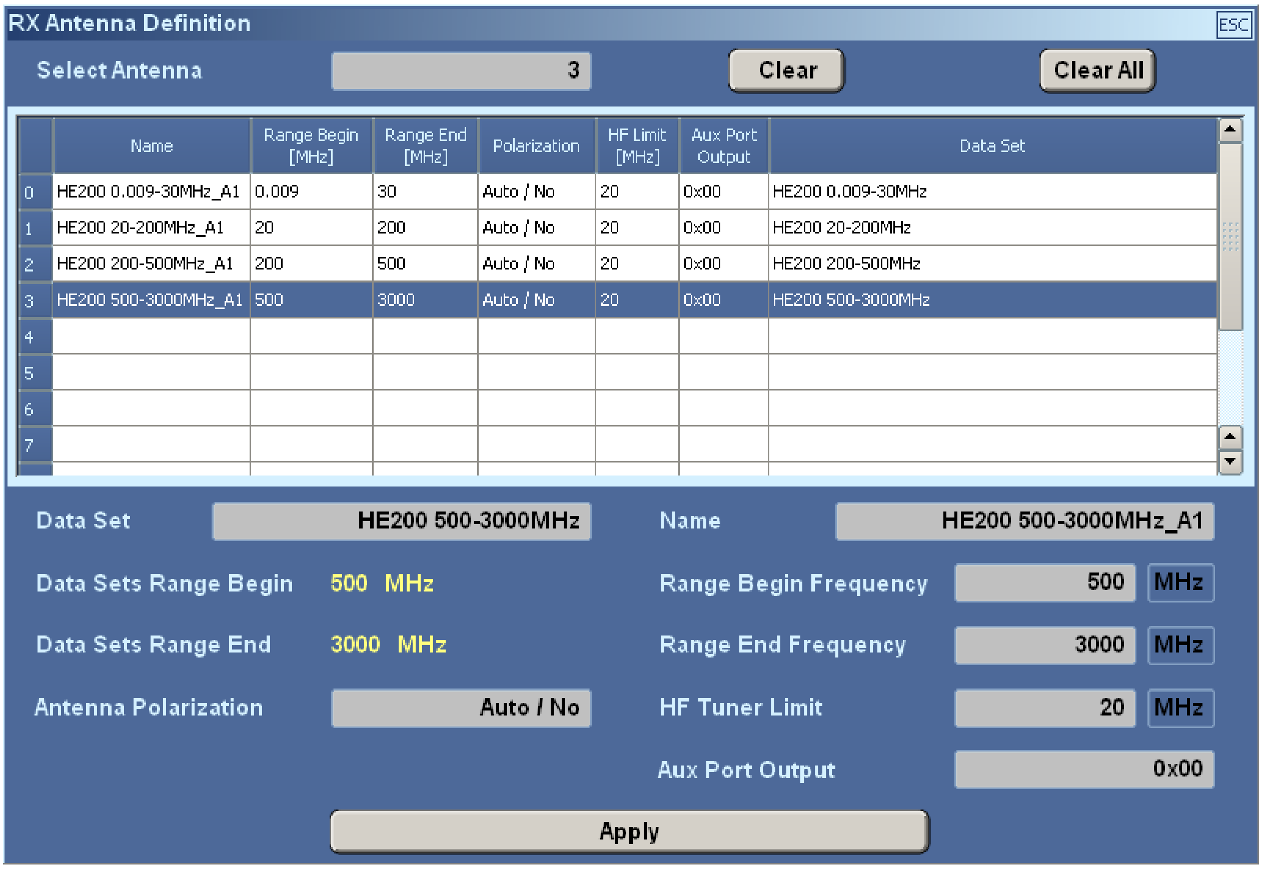


Fig. 3-48: Antenna Definition dialog.

This dialog is used to define the connected receiving antennas. You can define up to twelve antennas. For each antenna, you can specify a frequency range, a name and several other parameters. As opposed to most other dialogs, any changes you make here will not be applied until you press the "Apply" button.

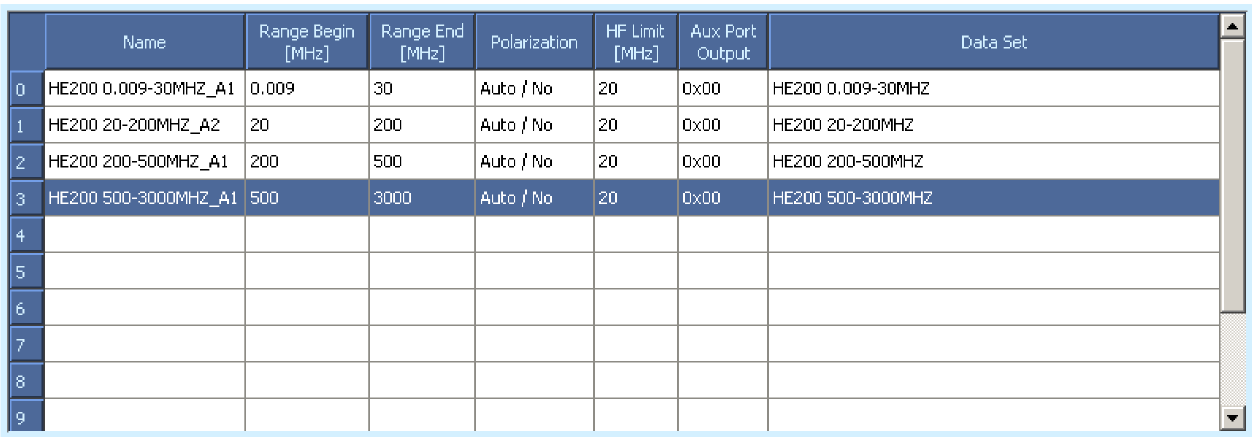
Use this field to select the antenna you wish to configure. A maximum of twelve antennas can be connected.

Press this button to delete the currently selected antenna definition.

See also SYSTem:ANTenna:RX[:SETup]:CLEar[<numeric_suffix]
on page 302.

Press this button if you want to clear all antenna definitions. All parameters will be reset to their default values. Before this command is executed a selector appears prompting you to confirm your choice. No action is taken unless you select "Yes" in the CONFIRM selector below.

The table below shows all antennas along with their parameters.



	Name	Range Begin [MHz]	Range End [MHz]	Polarization	HF Limit [MHz]	Aux Port Output	Data Set
0	HE200 0.009-30MHZ_A1	0.009	30	Auto / No	20	0x00	HE200 0.009-30MHZ
1	HE200 20-200MHZ_A2	20	200	Auto / No	20	0x00	HE200 20-200MHZ
2	HE200 200-500MHZ_A1	200	500	Auto / No	20	0x00	HE200 200-500MHZ
3	HE200 500-3000MHZ_A1	500	3000	Auto / No	20	0x00	HE200 500-3000MHZ
4							
5							
6							
7							
8							
9							

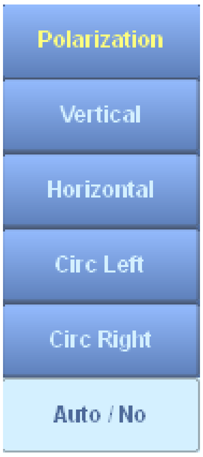
The first column shows the antenna name. Each entry shows the related antenna's design frequency range, its polarization, the HF tuner limit and the Aux Port output. The rightmost column indicates the antenna data set used. The antenna data set contains the name of the antenna type, the value range of the antenna type and the K factor table of that particular type.

Use this field to select the antenna data set for the antenna to be defined.

The data set contains the name of the antenna type, the frequency range and K factors. When you select the name of the antenna type, the type's frequency range is displayed below this field. Depending on the data set, a default name and frequency range are suggested. Please note that the data set's K factors are not shown.

The data set may contain antennas of up to 256 antenna types. If there is no data set for a particular antenna, you can use the set from the first entry in the list. In this case it is assumed that no K factors exist. You can then choose any name and frequency range you wish.

See also SYSTem:ANTenna:RX[:SETup]:FACtor[<numeric_suffix>] on page 303.



Use this field to select the antenna's polarization. The name suggested for the antenna will be adjusted based on the polarization you select. A related selector shows the available options. Available options are "Vertical", "Horizontal", "Circ Left", "Circ Right" and "Auto / No".

See also: chapter 4.5.15, "SYSTem Subsystem", on page 301.

Use this field to change the default antenna name. You can enter a maximum of 23 characters.

See also SYSTem:ANTenna:RX[:SETup]:NAME[<numeric_suffix>] on page 306.

Antenna names

Antenna names must be unique, both in the definition list and the setup.

Use this field to set the lower operating frequency limit for the selected antenna. Depending on the antenna data set, a default "Range Begin Frequency" will be suggested. A selector (see below) shows the available units for entering the frequency. Available units are "GHz", "MHz", "kHz" and "Hz".

Use this field to set the upper operating frequency limit for the selected antenna. Depending on the antenna data set, a default "Range End Frequency" is suggested. A selector (see below) shows the available units for entering the frequency. Available units are "GHz", "MHz", "kHz" and "Hz".

Use this field to set the upper HF tuner limit. Softkeys will be provided (see below) to show the available units for entering the frequency. Available units are "GHz", "MHz", "kHz" and "Hz".

Use this field to set the Aux Port output. If the Aux Port mode has been set to "AUTO" in the "Antenna Control" dialog, the value set here will be output to the Aux Port. The value is specified in hexadecimal notation.

See also SYSTem:ANTenna:RX[:SETup]:OUTPut:BYTAux [<numeric_suffix>][:STATe] ? on page 306.

Press "Apply" to save any changes made. When the data is saved, the system will check for duplicate names.

Antenna Setup Dialog

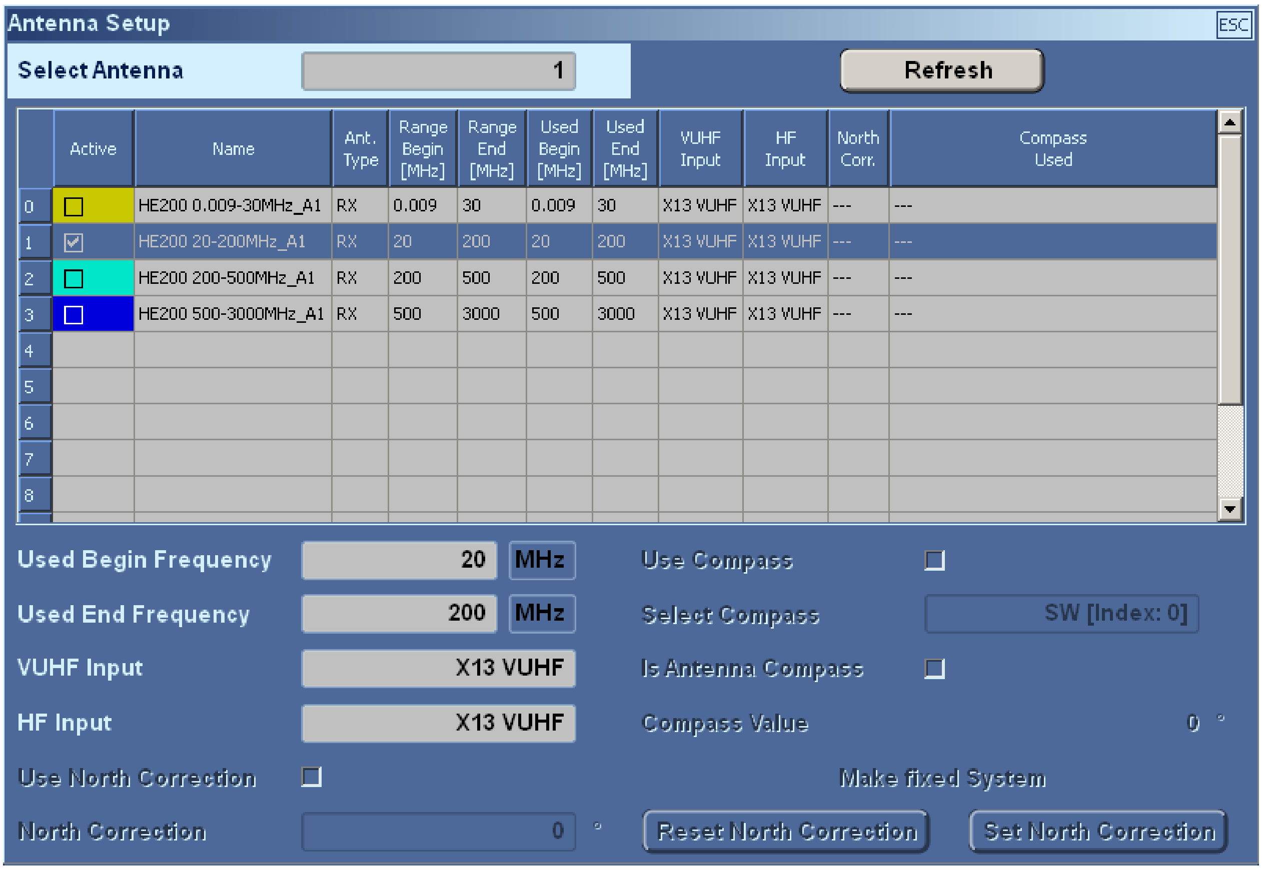
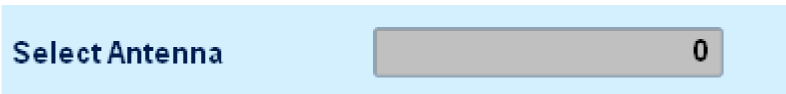


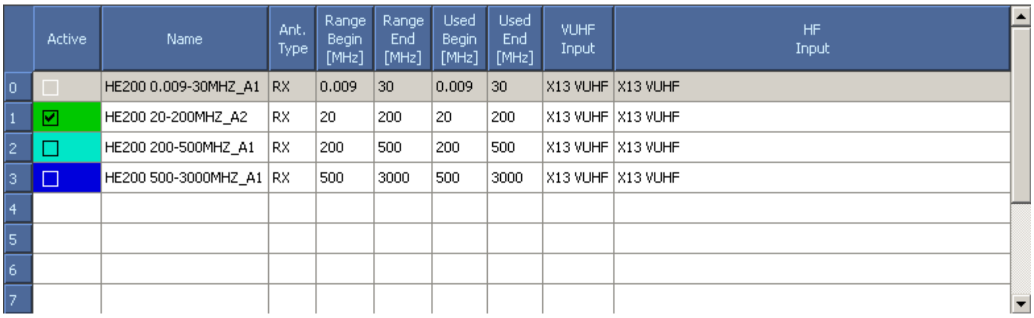
Fig. 3-49: Antenna Setup dialog.

This dialog is used to configure the antennas connected to the R&S EB500. You can configure the frequency range to be used by the antenna as well as the compass and preamplifier.



Use this field to select the antenna you wish to configure. A maximum of twelve antennas can be connected.

Press this button to check for any connected antennas and refresh the antenna table. This may take several seconds.



	Active	Name	Ant. Type	Range Begin [MHz]	Range End [MHz]	Used Begin [MHz]	Used End [MHz]	VUHF Input	HF Input
0		HE200 0.009-30MHZ_A1	RX	0.009	30	0.009	30	X13 VUHF	X13 VUHF
1		HE200 20-200MHZ_A2	RX	20	200	20	200	X13 VUHF	X13 VUHF
2		HE200 200-500MHZ_A1	RX	200	500	200	500	X13 VUHF	X13 VUHF
3		HE200 500-3000MHZ_A1	RX	500	3000	500	3000	X13 VUHF	X13 VUHF
4									
5									
6									
7									

The table in this dialog shows the currently connected antennas and their properties. A check mark in the first column indicates the antenna which is currently active. The second column shows the antenna name. You can also see an antenna's design range and the actual operating range used as well as its type, i.e. whether it is a direction-finding ("DF") or receiving ("RX") antenna. The table also shows the current north correction and the configured inputs. The rightmost column shows whether or not a compass is connected.

Use this field to set the lower operating frequency limit for the selected antenna. A related selector shows the available units. Available units are "GHz", "MHz", "kHz" and "Hz".

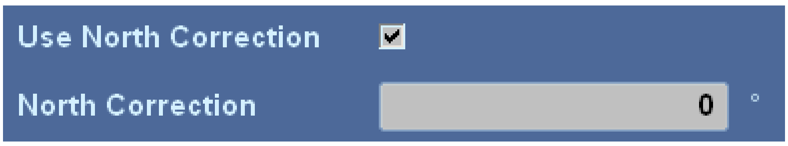
See also `SYSTem:ANTenna[:SETup]:FREQuency:STARt` on page 308.

Use this field to set the upper operating frequency limit for the selected antenna. A related selector shows the available units. Available units are "GHz", "MHz", "kHz" and "Hz".

See also `SYSTem:ANTenna[:SETup]:FREQuency:STOP` on page 308.

Use this field to select the HF antenna input for signal reception.

See also `SYSTem:ANTenna[:SETup]:ROUTe:HF[:INPut]` on page 309.



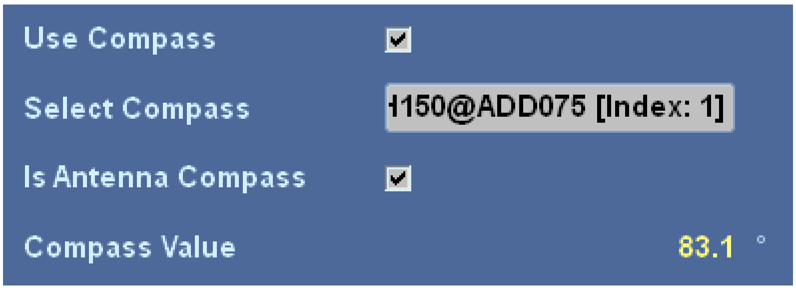
The fields "Use North Correction" and "North Correction" are only enabled when the DF upgrade R&S EB500-DF is installed.

Place a checkmark behind the label "Use North Correction" to specify that north correction should be used for the selected antenna. See also `SYSTem:ANTenna[:SETup]:NORTh` on page 309.

North Correction

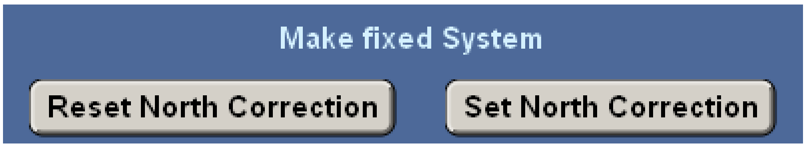
The north Correction is used to compensate for misalignment between the forward direction of the vehicle and the orientation of the antenna dipoles. This is explained in chapter 11.6, "North Adjustment", on page 471.

Set the desired north correction for the selected antenna in the field next to "North Correction". You can enter any value between 0° and 359.9°. See also `SYSTem:ANTenna[:SETup]:NORTh` on page 309.



These fields are enabled for editing if a compass can be connected to the selected antenna. Otherwise these fields will be disabled. If you set a check mark next to the "Use Compass" label, you can configure the compass to be used with the selected antenna. The compass reading will be considered in direction finding, and the related fields will be enabled as well. See also `SYSTem:ANTenna[:SETup]:COMPass` on page 308.

Use the field "Select Compass" to select the compass to be used. It shows the name and index of the compass. You can see below this field whether or not the selected compass is an antenna compass. The current compass value is shown as well. See also `SYSTem:ANTenna[:SETup]:COMPass` on page 308.



Use the button "Reset North Correction" in conjunction with button "Set North Correction" if you want to change from a mobile to a stationary system, i.e. balance the current compass value and the antenna's north correction. Follow this procedure to change from mobile to stationary: 1. Press button "Reset North Correction", which sets the north correction and the compass offset to 0°. Wait until the compass has adjusted, which you can see in field "Compass Value". 2. Press button "Set North Correction". The compass value is now copied to north correction and the compass is switched off.

Compass Setup Dialog

This dialog is used to configure the connected compasses and view their parameters. You can also set the offset for a particular compass or restart the compass.

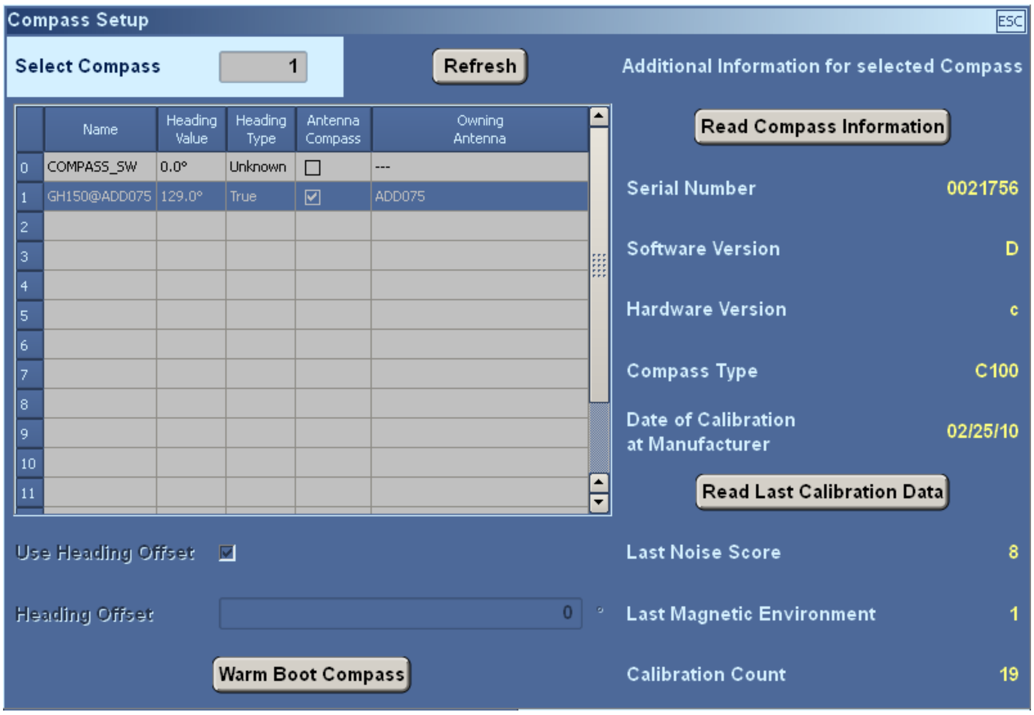
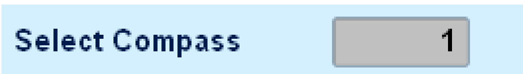


Fig. 3-50: Compass Setup dialog.



Use this field to select the compass you want to configure. Up to 14 compasses can be connected.

Press this button if you want the R&S EB500 to check for connected devices and refresh the compass table. This may take several seconds.

Set a check mark next to "Use Heading Offset" label if you want the offset for the selected compass to be used for the "North Correction" (see `SYSTem:COMPass:HEADing:OFFSet` on page 323). This will also enable the field "Heading Offset" for editing. Use this field to set the desired offset for the selected compass. You can enter a value between 0° and 359.9°.

R&S GH150 Electronic Compass

DF antennas, like R&S ADD197, can be installed together with the electronic compass R&S GH150. With this configuration, the antenna and compass are combined into one fixed system. If you use this kind of combination, the "Heading Offset" cannot be set. The heading offset will follow the "North Correction" of the antenna. See "Antenna Setup Dialog" on page 154.

If you leave the check box unchecked, no offset will be used and field "Heading Offset" will remain disabled.

See also `SYSTem:COMPass:HEADing:OFFSet` on page 323.

Press this button to restart the compass.

Press this button if you want to retrieve general information on the selected compass. The available data will be displayed below this button, including the serial number, the software and hardware version, the compass type and the date of calibration at the manufacturer's.

Press this button if you want to see the calibration data for the selected compass. The data is displayed below the button and includes information on the quality of the most recent calibration (noise score and magnetic environment) as well as the calibration count.

	Name	Heading Value	Heading Type	Antenna Compass	Heading Offset	Owning Antenna
0	SW	0.0°	Unknown	☐	---	---
1	GH150@ADD075	344.3°	Magnetic	☑	0.0°	ADD075
2	GPS	315.8°	---	☐	---	---
3						
4						
5						
6						
7						
8						
9						
10						
11						

The table displays all compasses along with their parameters. The first column shows the name of the compass. The table shows the heading value and type as well as the owning antenna, where applicable. The offset is also shown. A navigation selector is available throughout the "Compass Setup" dialog.

Compass Calibration Dialog

This dialog is used to field calibrate the selected compass. It will guide you through the calibration process. Each calibration step contains a description and instructions on how to perform the following step.

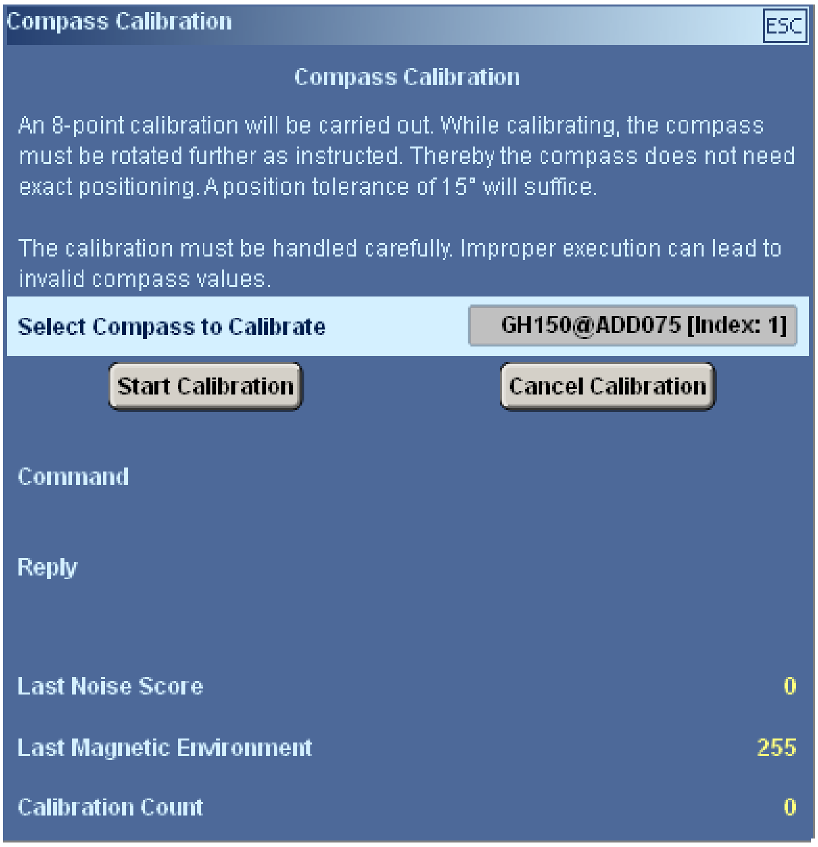


Fig. 3-51: Compass Calibration dialog.

You can select the compass you wish to calibrate and start calibrating by pressing the "Start Calibration" button.

The "Command" field tells you which step to perform next in order to proceed with the calibration process. The button text changes from "Start Calibration" to "Continue Calibration". Press this button each time you wish to continue with the calibration process.

Once you have positioned the compass, press "Continue Calibration". The reply to the command is displayed in field "Reply". Field "Command" is updated to reflect the calibration progress, indicating the next step to be performed.

Once you have completed all the necessary calibration steps, no new command is displayed in field "Command". The text of button "Continue Calibration" changes back to "Start Calibration". Field "Reply" shows the result of the calibration process. The fields in the lower section of the dialog are updated as well, providing data on the most recent calibration performed.

Press the "Cancel Calibration" button if you need to cancel the calibration process. The text of button "Continue Calibration" changes to "Start Calibration". Field "Reply" then displays a message to the effect that the calibration process has been aborted. If you close the dialog while calibrating a compass, the calibration process will be aborted as well.

Declination Setup Dialog

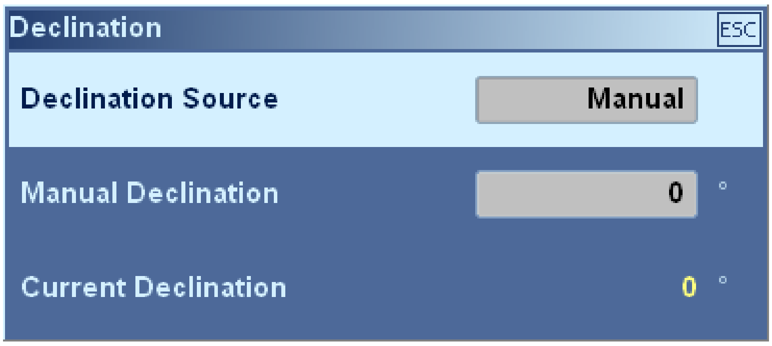


Fig. 3-52: Declination Setup dialog.

This dialog is used to set the declination, which allows you to account for the difference between magnetic and geographic north. The declination depends on the current position. The current declination is shown at the bottom of the dialog. You can set it manually or use the value supplied by a GPS receiver. You can also choose not to use any declination at all. Declination is considered in the compass heading, in which case the compass will supply a "true heading". Without declination the compass will supply a "magnetic heading".

Use this field to specify the declination source. You can use the value supplied by a connected GPS receiver or you can enter a value manually. A related selector shows the available options. Available options are "No", "Manual" and "GPS".

See also `SYSTem:DECLination:AUTO` on page 324 .

If you choose "Manual" as the Declination source, the "Manual Declination" field will be enabled. Here you should enter a declination value. You can enter any value between 0 and 359.9° (in 1/10th of a degree).

See also `SYSTem:MANual:DECLination` on page 330 .

Location Setup Dialog

This dialog is used to configure the source for positional information and to set the format for showing the position of the R&S EB500

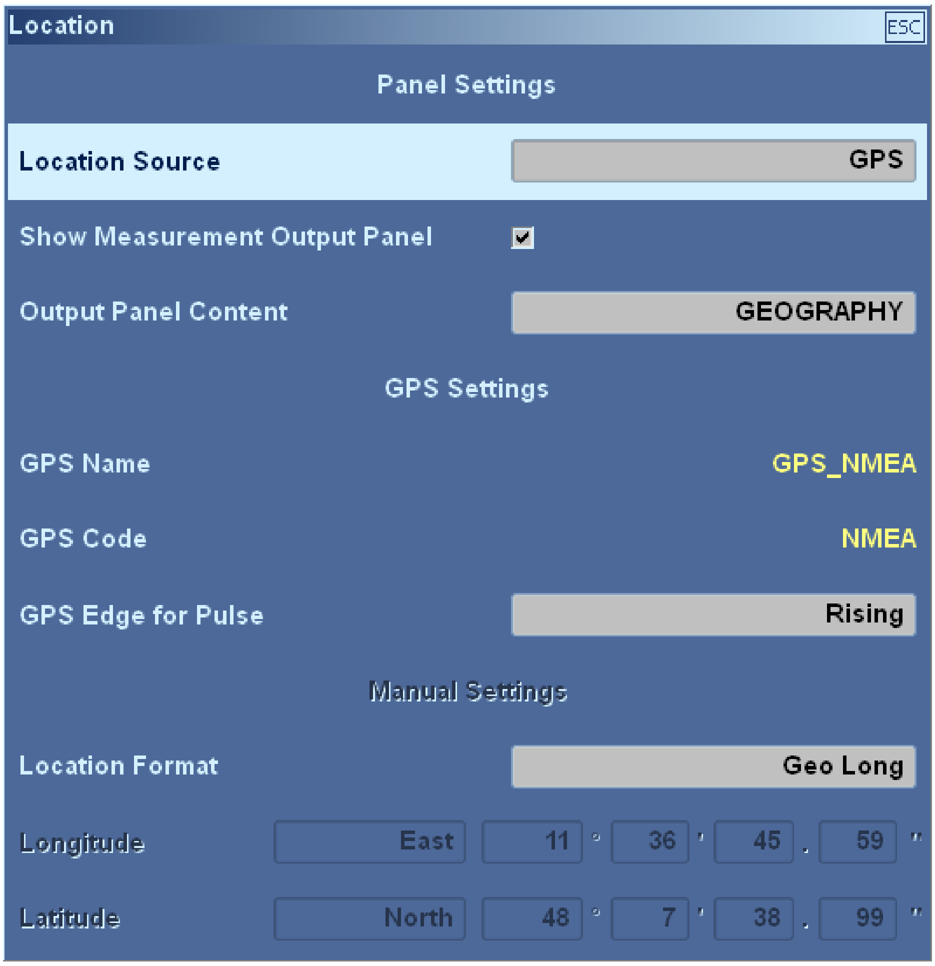
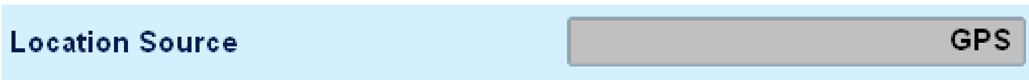
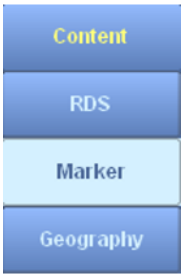


Fig. 3-53: Location Setup Dialog.



Use this field to set the source of the position. A related selector shows the available options. Available options are "GPS" and "Manual". If a GPS receiver is connected, you can select "GPS" and the position will be taken from the GPS receiver automatically. You can also enter the current position manually by selecting "Manual", which will enable the related input fields.

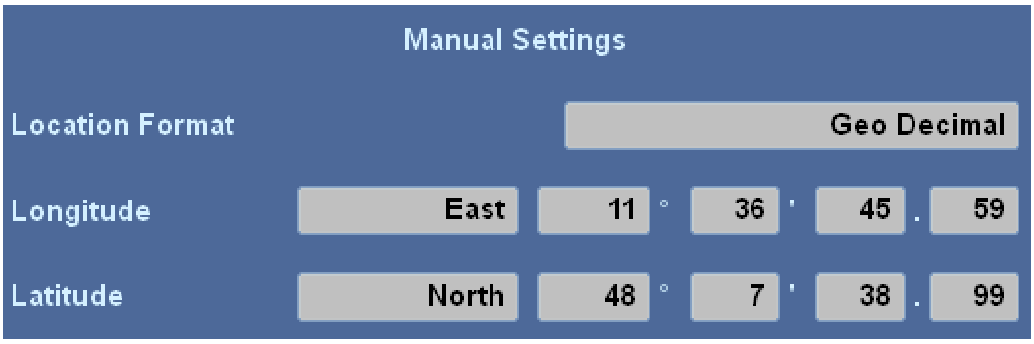
See also `SYSTem:GPS:DATA:AUTO` on page 327 .



Place a check mark in the checkbox "Show Measurement Output Panel" to activate the location output panel. This panel shows information on the current position. The position can be entered manually or the position of a connected GPS device can be used. The "Output Panel Content" must be set to "Geography".

Use this field to specify that the time should be synchronized with the rising or falling edge of the one-second pulse. A related selector shows the available options. Available options are "Rising" and "Falling".

See also `SYSTem:GPS:TRIGger[:SEQuence]:SLOPe` on page 328.



Use the field "Location Format" to set the format of the location shown in the location panel. It is only possible to edit this field, if the location panel is shown. A related selector shows the available options. Available options are "Geo Decimal", "Geo Long", "Geo Short", "UTM" and "Nato UTM".

Use the "Longitude" field to enter the longitude. A selector allows you to specify the direction.

See also:

`SYSTem:MANual:LOCation:LONGitude:DIRection` on page 332

`SYSTem:MANual:LOCation:LONGitude:DEGRees` on page 333

`SYSTem:MANual:LOCation:LONGitude:MINutes` on page 333

SYSTem:MANual:LOCation:LONGitude:SEConds on page 334

Use the "Latitude" field to enter the latitude. A selector allows you to specify the direction.

See also:

SYSTem:MANual:LOCation:LATitude:DIRection on page 331

SYSTem:MANual:LOCation:LATitude:DEGRees on page 331

SYSTem:MANual:LOCation:LATitude:MINutes on page 331

SYSTem:MANual:LOCation:LATitude:SEConds on page 332

Information Softkeys

These softkeys offer access to several dialogs providing information on the system state of the R&S EB500.

The "Version" key opens the "Current Version" dialog. This dialog shows the current version of the various components of the R&S EB500.

The "Options" key opens the "Installed Options" dialog, which shows information on the currently installed options.

See also: chapter 1.6, "Ordering Information", on page 16.

The "Hardware" key opens the "Hardware Information" dialog, which shows information on the currently installed hardware.

The "Peripherals" key opens the "Peripherals Overview" dialog. This dialog shows the external hardware connected to the R&S EB500.

The "Antenna" key opens the "Antenna Overview" dialog. This dialog shows all antennas connected to the R&S EB500 and provides an overview of the frequency ranges covered.

Current Version Dialog

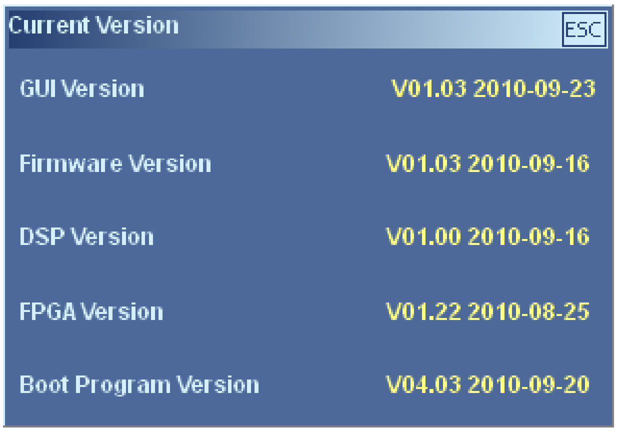


Fig. 3-54: Current Version dialog.

This dialog is used to view version information related to the R&S EB500's individual modules.

Installed Options Dialog

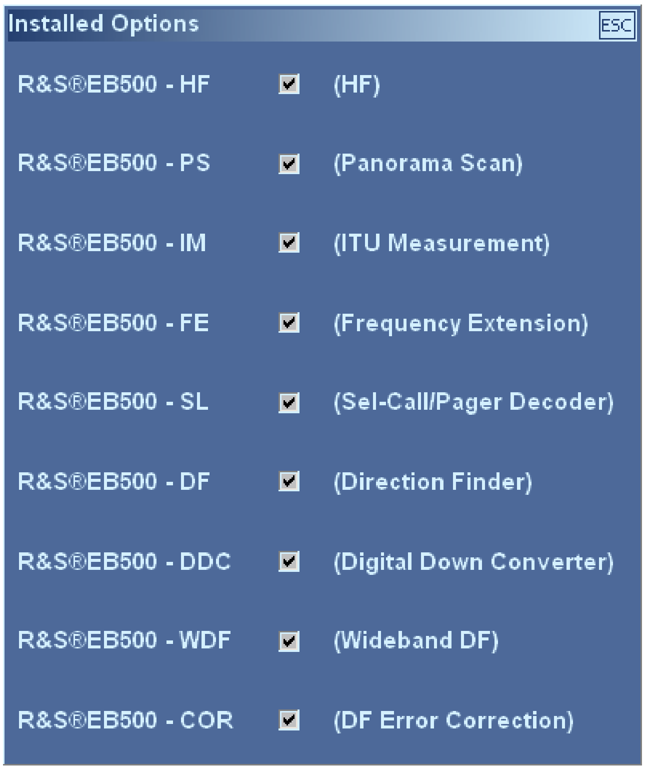


Fig. 3-55: Installed Options dialog.

This dialog is used to view the currently installed options and upgrades. An unchecked checkbox indicates that the corresponding option is not installed.

Hardware Information Dialog

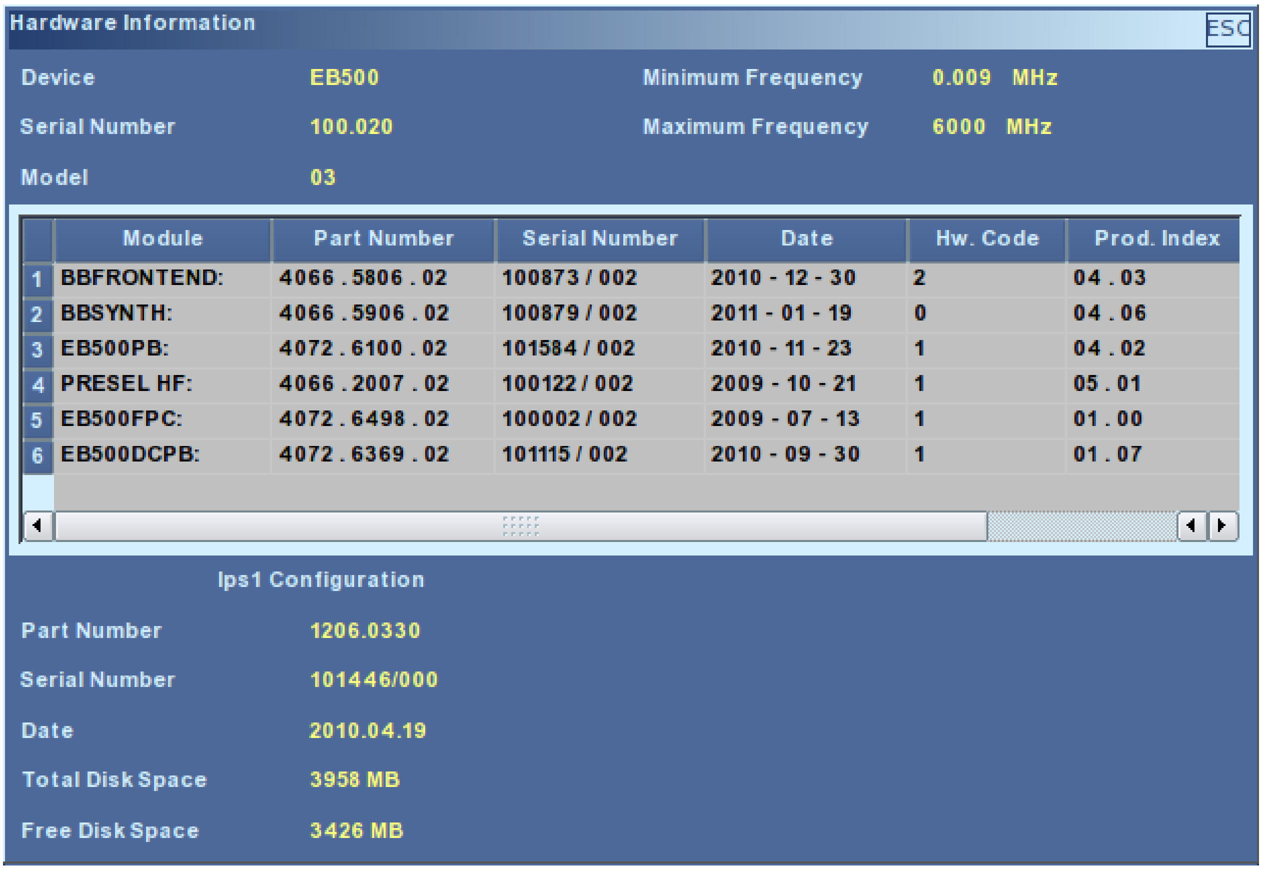


Fig. 3-56: Hardware Information dialog.

This dialog is used to view the currently installed hardware, including the device's serial and model numbers. It also shows the device's minimum and maximum frequency.

NOTICE

IPS1 part number

Earlier versions of the R&S EB500 were configured with an IPS1 board with serial number 1206.0330.

On later versions the R&S EB500 the serial number of the IPS1 board is 1206.0452.

Basically the only difference between both versions is the size of the internal flash memory, which is 4 GB for the earlier versions and 28 GB for the later versions. Take note that the sanitizing process takes much longer when the size of the flash memory is larger (see "Sanitizing" on page 113).

In the lower part of the dialog in the IPS1 Configuration, the total disk space and the free disk space of the internal flash memory is indicated.

WARNING

Exceeding the storage limit

In case the amount of free disk space of the internal flash storage falls below 10% of the total storage space, a warning will be displayed. In this warning the user is asked to free-up some space on the flash either by deleting files or by moving files from internal storage to external USB flash drive, using the dialogs described in "File Management" on page 109 and "File Export" on page 104 respectively.

In case you want to completely clean all the data in the internal flash, use the "sanitizing" method ("Sanitizing" on page 113).

If the warning is repeatedly ignored until the free space has dropped to zero, the R&S EB500 will autonomously remove the oldest files from the internal flash in order to create space neccesary for normal operation.

Peripherals Overview Dialog

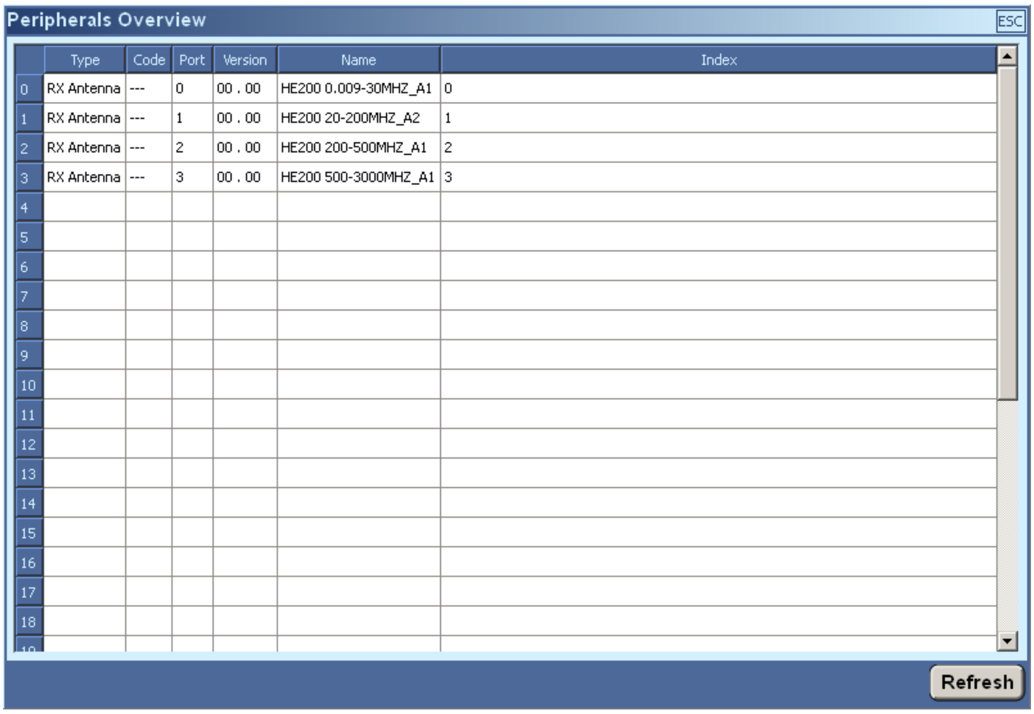


Fig. 3-57: Peripherals Overview dialog.

This dialog is used to view any external hardware connected to the R&S EB500, e.g. compasses or antennas.

Press the "Refresh" button to refresh the peripherals overview table and see the devices connected to the R&S EB500. It can take several seconds to refresh the table.

Antenna Overview Dialog

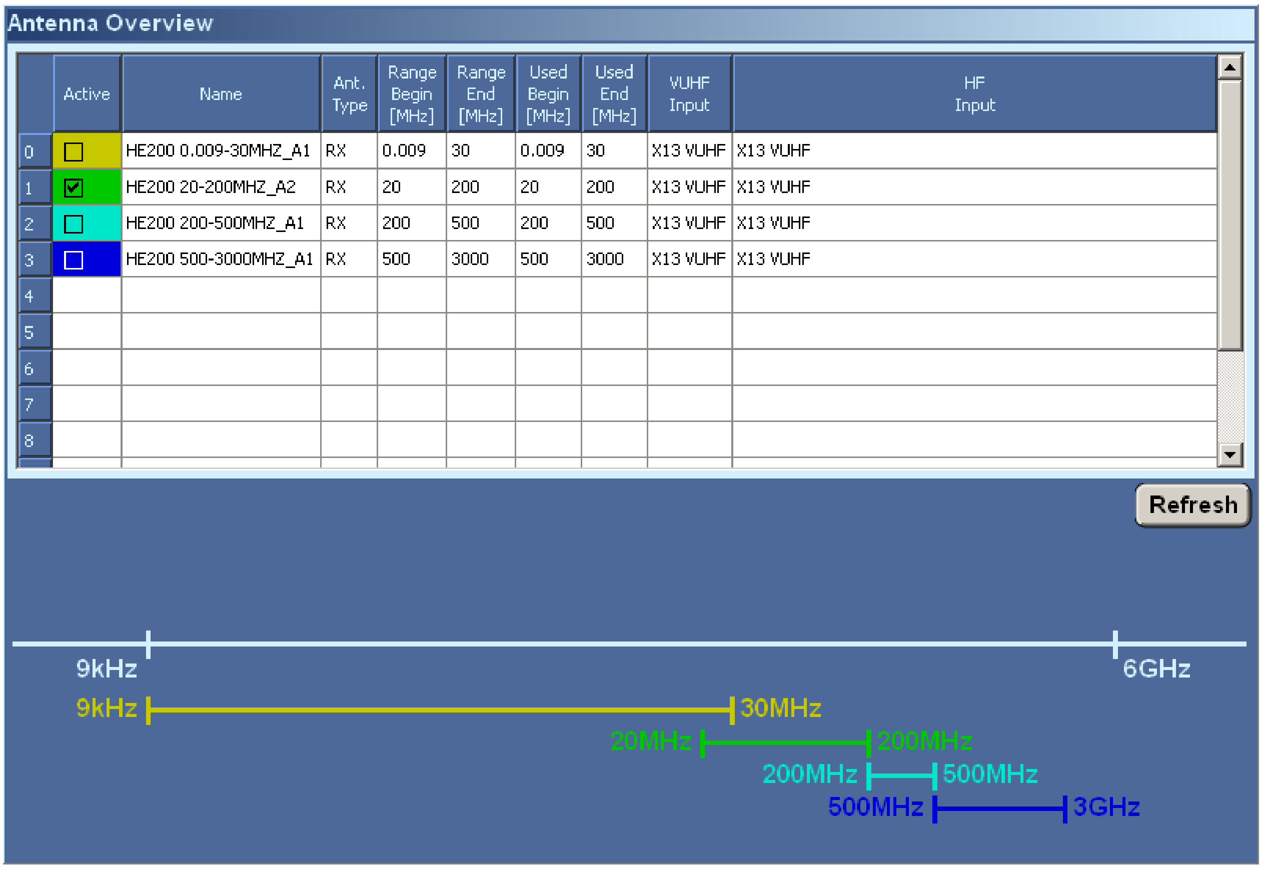


Fig. 3-58: Antenna Overview dialog.

This dialog is used to view the antennas currently connected to the R&S EB500.

Each antenna is shown with the information available, including its nominal frequency range and the actual operating frequency range. The table also shows the antenna type, i.e. whether it is a direction-finding ("DF") or a receiving ("RX") antenna. The two rightmost columns show the configured inputs.

Each antenna is identified with a color code displayed to the left of the antenna name. The color code allows you to identify the frequency range which the antenna covers. This is shown below the table. A check mark to the left of the antenna name indicates which antenna is currently active.

Press the "Refresh" button to check for connected antennas and refresh the antenna table. It can take several seconds to refresh the table.

Error History Dialog

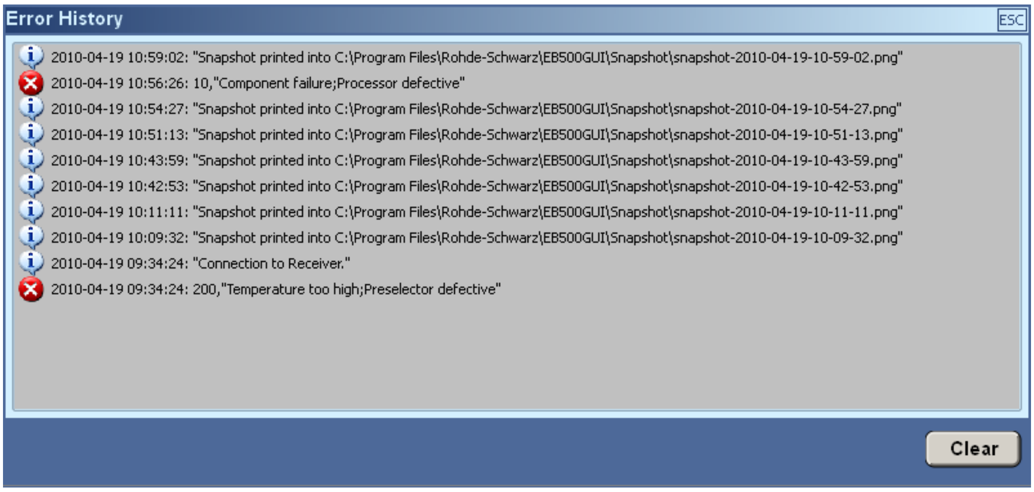


Fig. 3-59: Error History dialog.

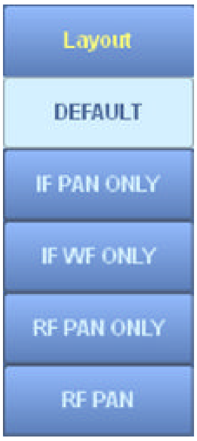
This dialog is used to view the error messages that have been generated. The most recent error will appear at the top of the list, the oldest error at the bottom. If the list is selected, you can activate it by pressing ENTER or the ROTARY KNOB, or by clicking the mouse wheel. Once activated, you can scroll through the list using the ROTARY KNOB or the mouse wheel. You can also use the cursor keys for scrolling. Press ENTER or the ROTARY KNOB or click the mouse wheel to deactivate the list again.

Press the "Clear" button to clear the list of all error messages.

Layout Softkey

As R&S EB500 is able to operate in different application modes and operation modes (see "Utility Keys" on page 26), there are a large number of panels possible to provide useful information at any point in time. However, if there are more than three panels opened at the same time, the information in the panels would become too small and unreadable. For this reason, a selection option is provided so that the user can choose which combination of panels he wants to open for one particular application / operation mode.

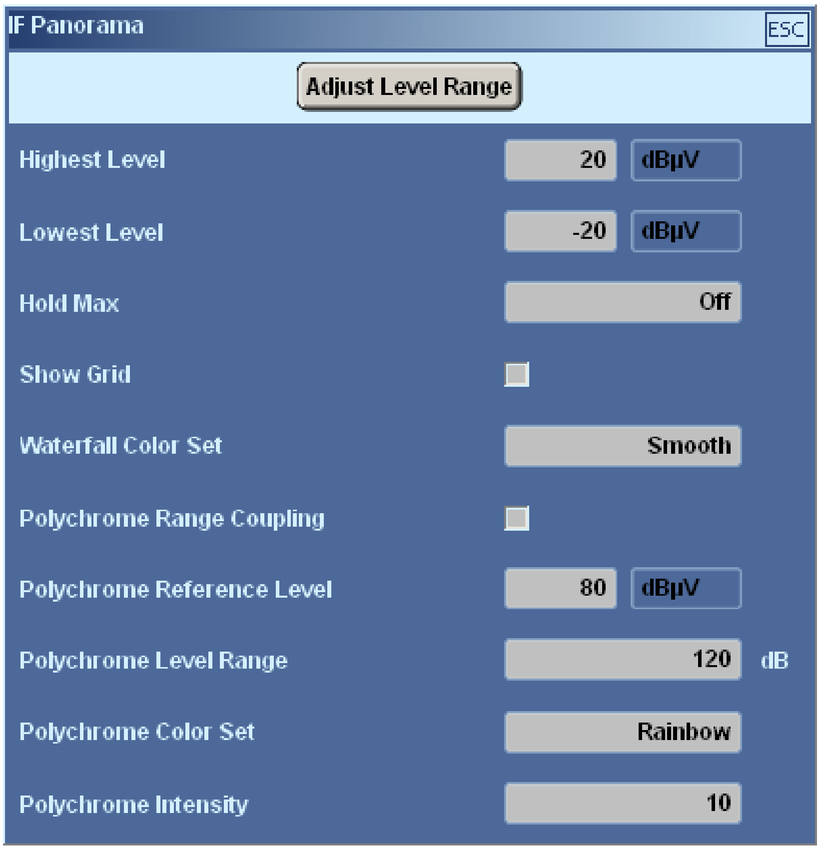
The "Layout" softkey will provide the different layout options for the currently active application / operation mode.



When pressed, the "Layout" softkey will open a vertical selector with the different layout options.

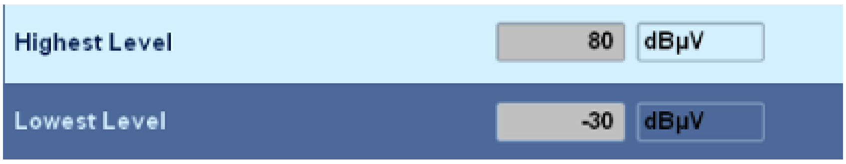
Different modes will provide different selector options.

3.3.3.11 IF Panorama Dialog

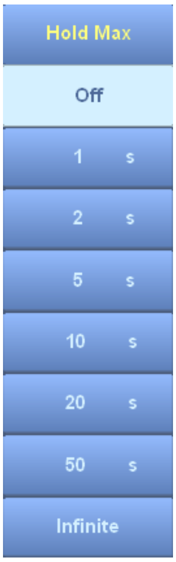


This dialog is used to configure the IF panorama, e.g. to set the Y value range and the polychrome IF panorama parameters.

To set the level parameters automatically, click on "Adjust Level Range".



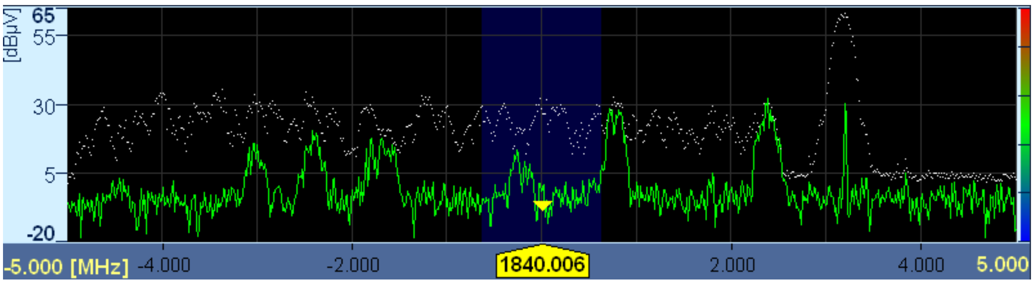
The scale of the IF panel can be set by activating the "Highest Level" and / or "Lowest Level" fields and changing the values, using the ROTARY KNOB or numeric keys. A selector bar will accompany the selection with the options dBµV or dBm as well as +/- and Backspace options.



If the "Hold Max" checkbox is checked then the maximum level will be indicated in the panel for a certain duration, depending on the "Hold Max" setting, which can be 1 sec, 2 sec, 5 sec, 10 sec, 20 sec, 50 sec or infinite.

When the "Show Grid" checkbox is checked the IF panorama will display a grid with 25 dBµV spacing vertically. Horizontally the spacing is "SPAN"/10.

The screenshot below shows an IF panorama with "Hold Max" as well as "Show Grid" enabled.



The waterfall color set can be chosen from the four options "Smooth", "Waterfall", "Cold" and "Gray"; see below.

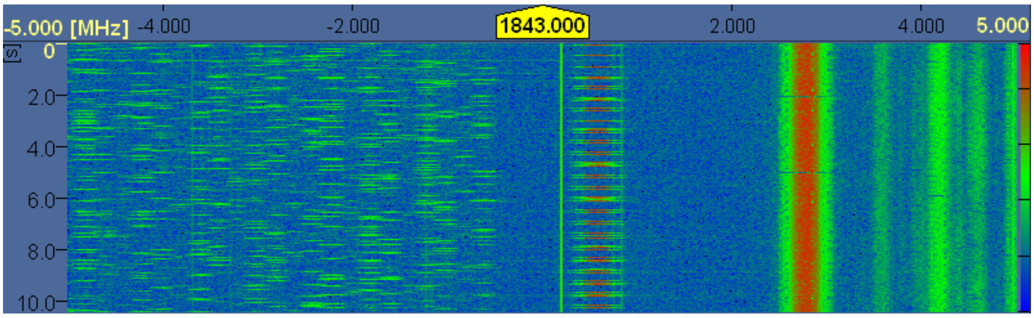


Fig. 3-60: Waterfall Color Set : "Smooth".

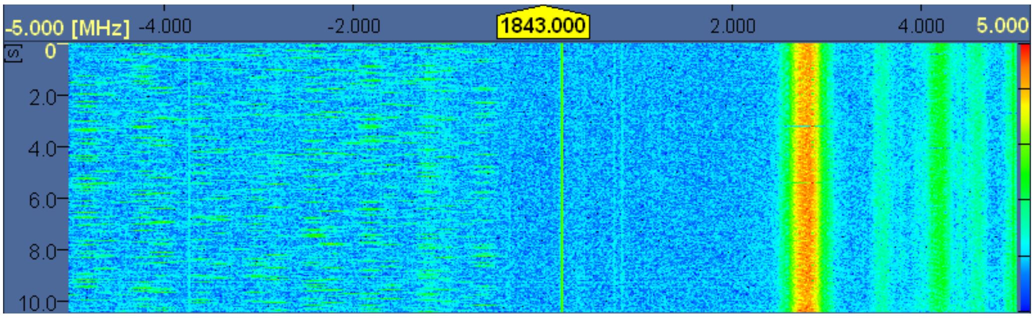


Fig. 3-61: Waterfall Color Set : "Rainbow".

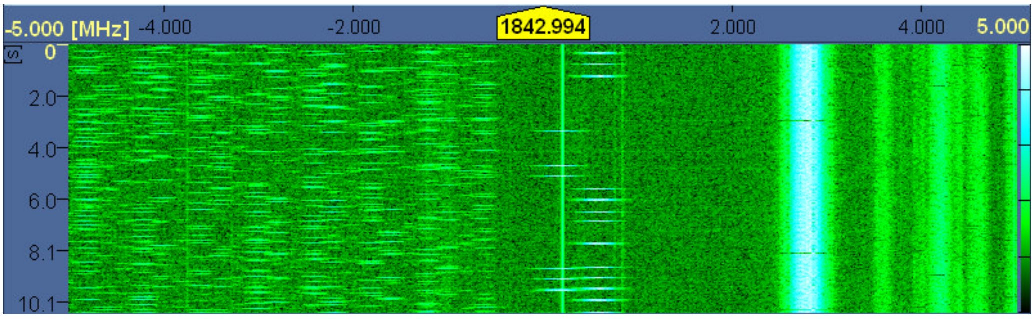


Fig. 3-62: Waterfall Color Set : "Cold".

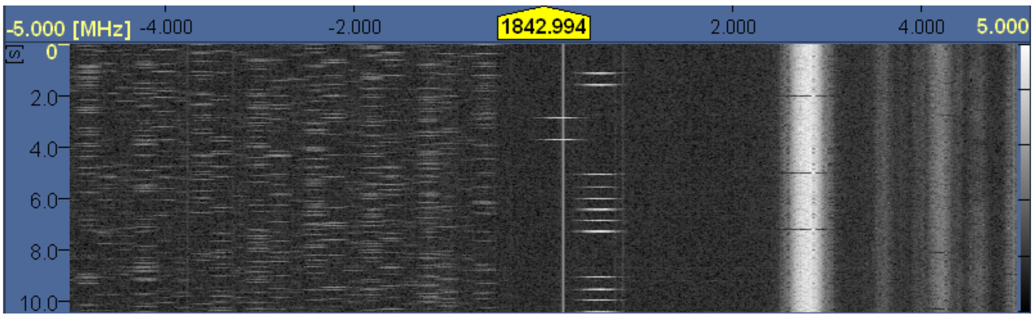


Fig. 3-63: Waterfall Color Set : "Gray".

If you set a check mark here, a change in the Y axis range will automatically adjust the Y range of the polychrome IF panorama. Otherwise, the polychrome IF panorama will not be affected by a change in the Y axis range.

Use this field to specify the upper reference level for drawing the polychrome IF panorama. You can enter any value between -40 and 130 dBµV. A related selector shows the available units. Available units are "dBµV" and "dBm".

Use this field to specify the polychrome IF panorama level range. You can enter any value between 20 and 240 dB.

Use this field to specify the color set for the polychrome IF panorama. A related selector shows the available options. Available options are "Smooth", "Rainbow", "Cold" and "Gray"; see below.

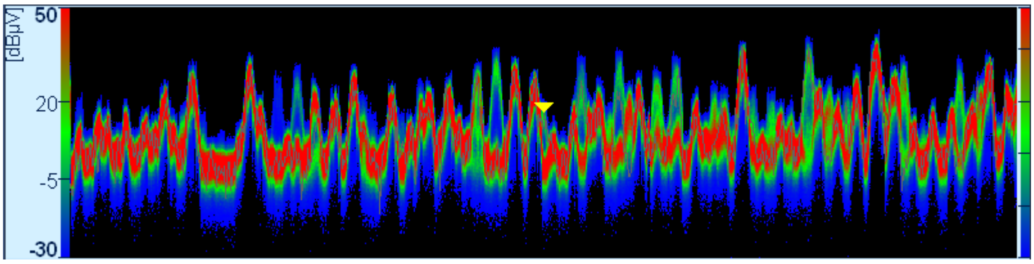


Fig. 3-64: Polychrome Color Set : "Smooth".

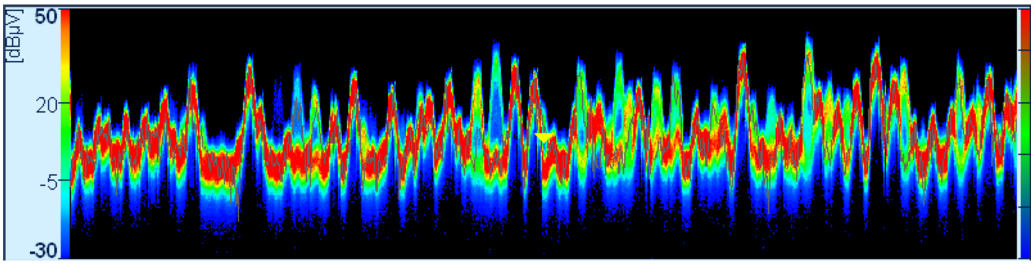


Fig. 3-65: Polychrome Color Set : "Rainbow".

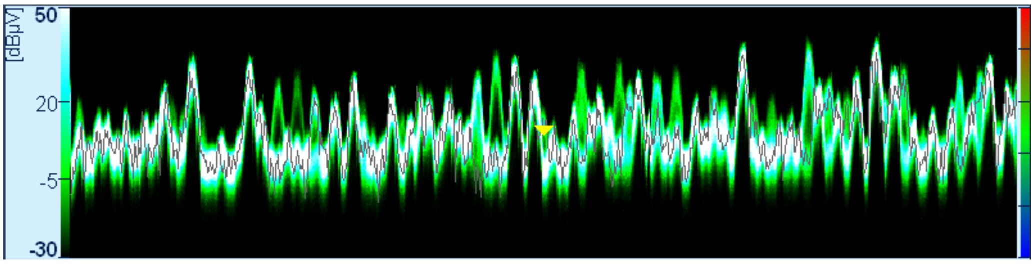


Fig. 3-66: Polychrome Color Set : "Cold".

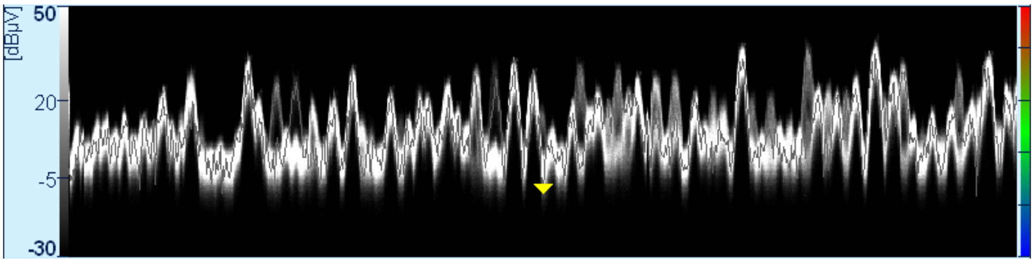
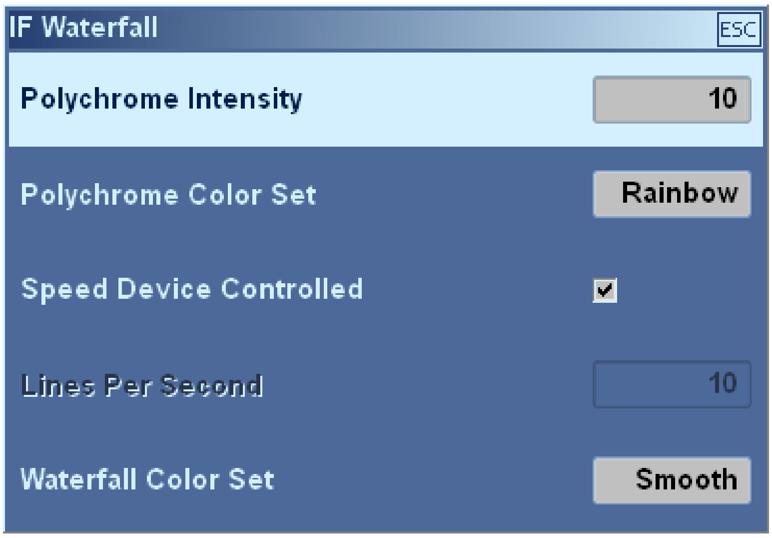


Fig. 3-67: Polychrome Color Set : "Gray".

Use this field to specify the IF panorama polychrome intensity. You can specify any value between 1 and 20.

3.3.3.12 IF Waterfall Dialog



This dialog is used to configure the IF panorama waterfall.

Use the "Polychrome Intensity" field to specify the IF panorama polychrome intensity. You can specify any value between 1 and 20.

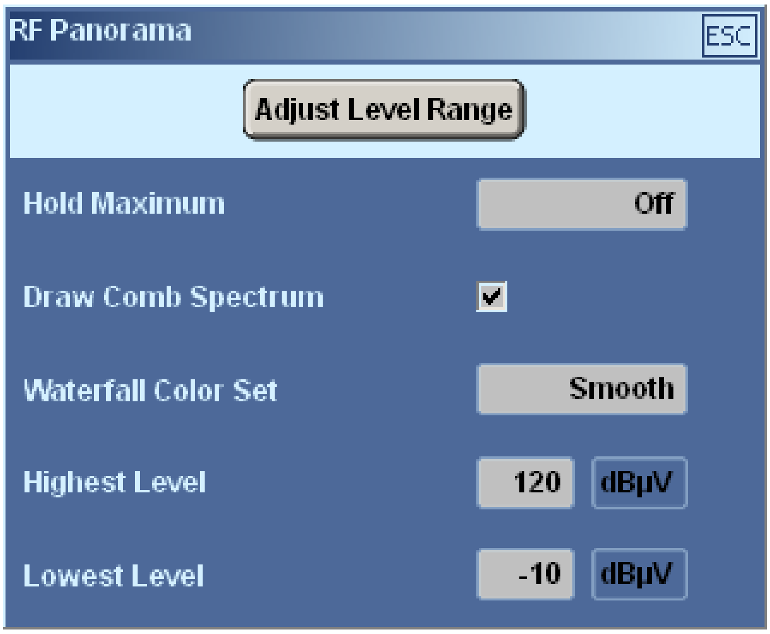
Use "Polychrome Color Set" field to specify the color set for the polychrome IF panorama. The Polychrome Color Set can be chosen from the four options "Smooth", "Waterfall", "Cold" and "Gray"; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170 for example screenshots in each of the four modes.

Use the "Speed Device Controlled" checkbox to specify whether the waterfall speed should be determined by the received measurement values or by a predefined constant. If a check mark is set, the data will be represented as it is received, otherwise you must specify the number of lines to be drawn per second.

If checkbox "Speed Device Controlled" is unchecked, the waterfall speed will be determined by the value you enter in this field. You can enter any number between 1 and 100 (lines).

The "Waterfall Color Set" can be chosen from the four options "Smooth", "Waterfall", "Cold" and "Gray"; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170 for example screenshots in each of the four modes.

3.3.3.13 RF Panorama Dialog



This dialog is used to configure the RF panorama parameters.

To set the level parameters automatically, click on "Adjust Level Range".

The "Hold Maximum" function works just like in the IF Panorama; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170. The two screenshots below show a spectrum with "Hold Maximum" set to infinite.

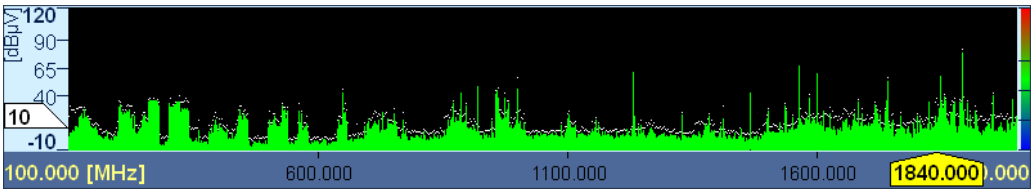


Fig. 3-68: RF Panorama "Comb Spectrum" with "Hold Maximum" set to infinite.

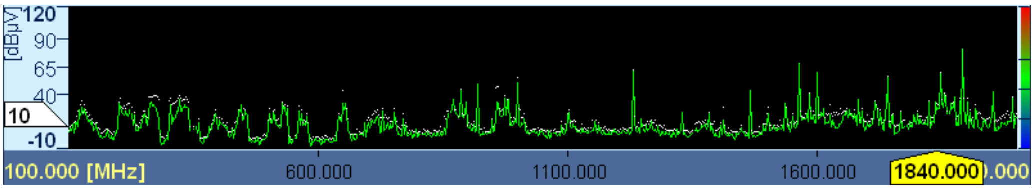
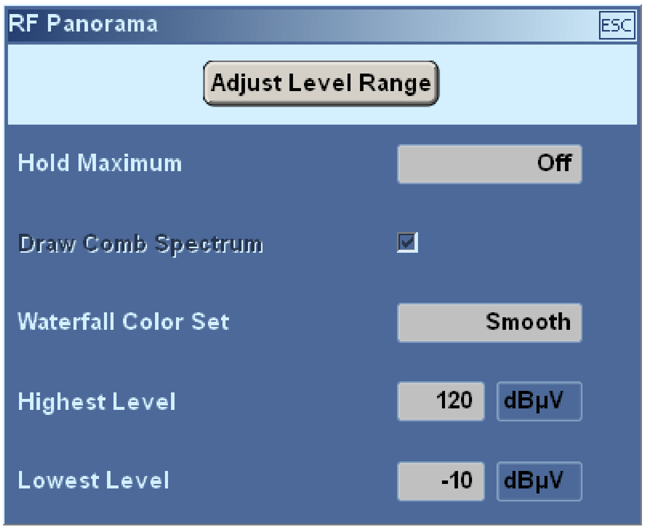


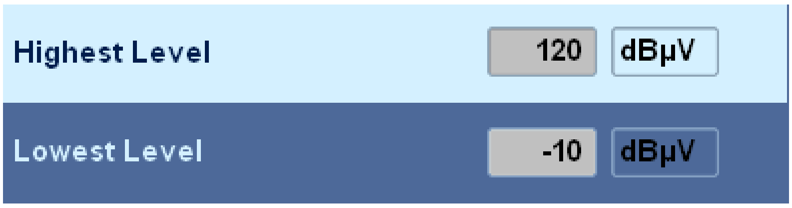
Fig. 3-69: RF Panorama "Line Spectrum" with "Hold Maximum" set to infinite.

If you check the "Draw Comb Spectrum" checkbox, the spectrum will look like the first screenshot. If you uncheck it, the panorama will look like the second screenshot.

In MScan, there is no fixed spacing between the channels. Therefore the option "Draw Comb Spectrum" is permanently switched on and cannot be configured by the user, as shown below.

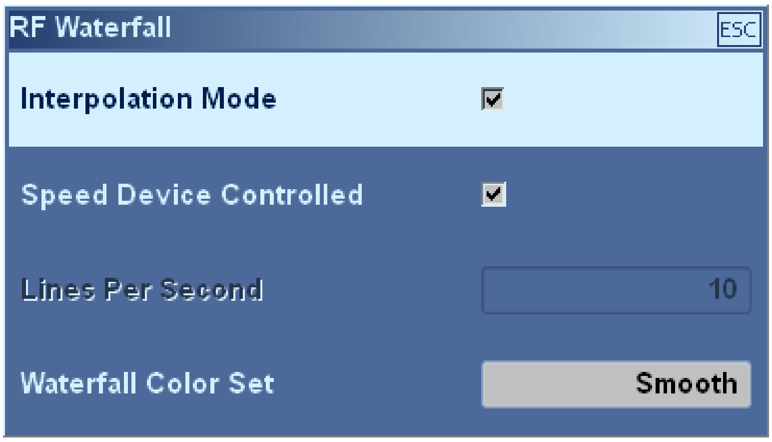


The waterfall color set can be chosen from the three options "Smooth", "Waterfall" and "Cold"; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170 for example screen-shots in each of the three modes.



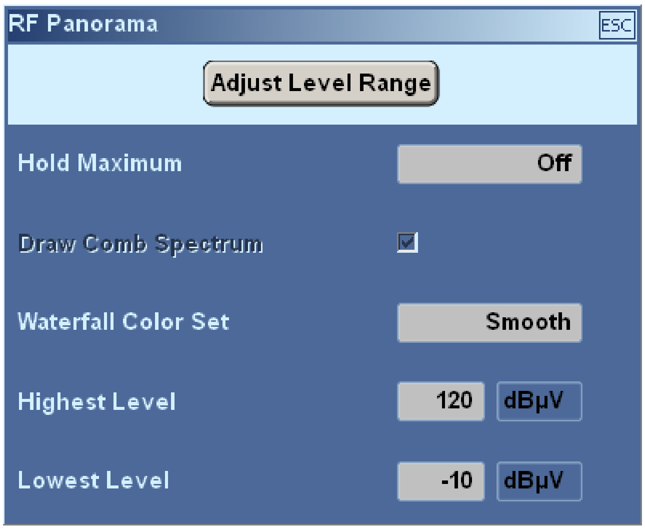
The scale of the RF panel can be set by activating the "Highest Level" and / or "Lowest Level" fields and and the values can be changed, by using the ROTARY KNOB or the numeric keys. A selector bar will accompany the selection with the options dBµV or dBm as well as +/- and Backspace options.

3.3.3.14 RF Waterfall Dialog



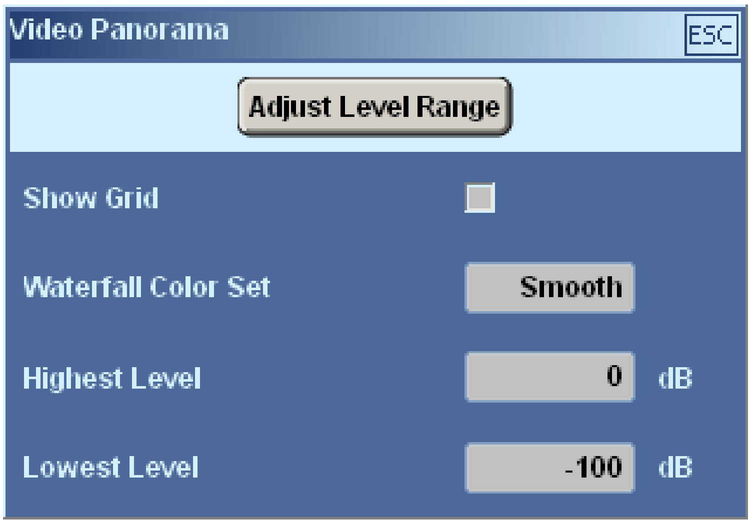
This dialog is used to configure the RF panorama waterfall. If the "Interpolation Mode" checkbox is checked then the waterfall will only be drawn where the measurement is performed, resulting in vertical lines. If you set a check mark to activate the interpolation mode, there will be an interpolation of measurement values and the waterfall will be drawn over the complete area.

In MScan, there is no fixed spacing between the channels. Therefore the interpolation mode is permanently switched off and cannot be configured by the user, as shown below.



The "Speed Device Controlled" and "Waterfall Color Set" fields are similar to the IF Waterfall Dialog; see chapter 3.3.3.12, "IF Waterfall Dialog", on page 174.

3.3.3.15 Video Panorama Dialog

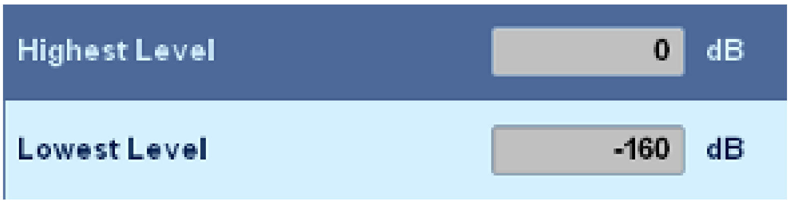


This dialog is used to configure the video panorama.

To set the level parameters automatically, click on "Adjust Level Range".

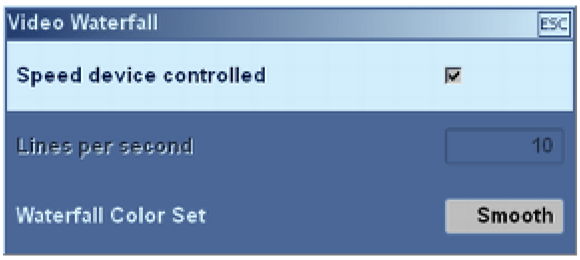
The configuration dialog is similar to the IF panorama; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170.

The level range, however, is different: highest level = 0 dB and lowest level = -160 dB.



3.3.3.16 Video Waterfall Dialog

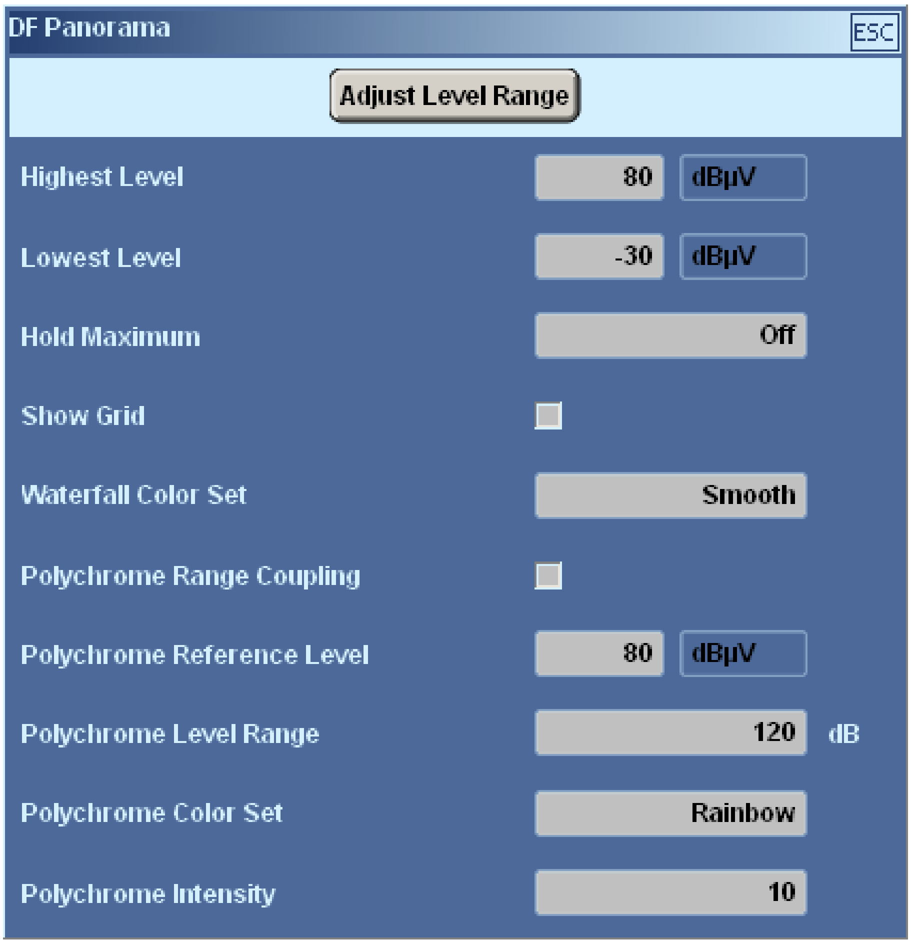
This dialog is used to configure the video panorama waterfall.



The configuration dialog is similar to the IF panorama waterfall; see chapter 3.3.3.12, "IF Waterfall Dialog", on page 174.

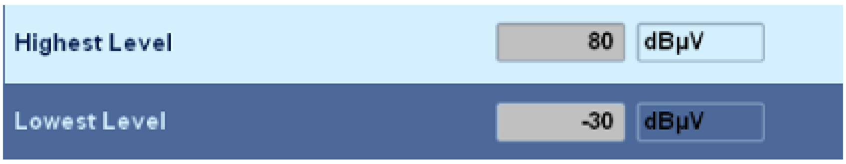
3.3.3.17 DF Panorama Dialog

The dialog is not available unless DF upgrade R&S EB500-DF is installed

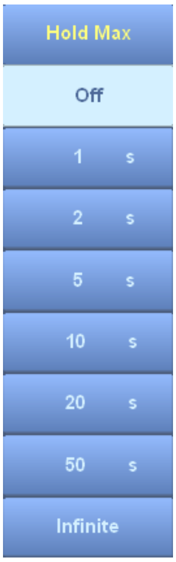


This dialog is used to configure the DF panorama, e.g. to set the Y value range and the waterfall color set.

To set the level parameters automatically, click on "Adjust Level Range".



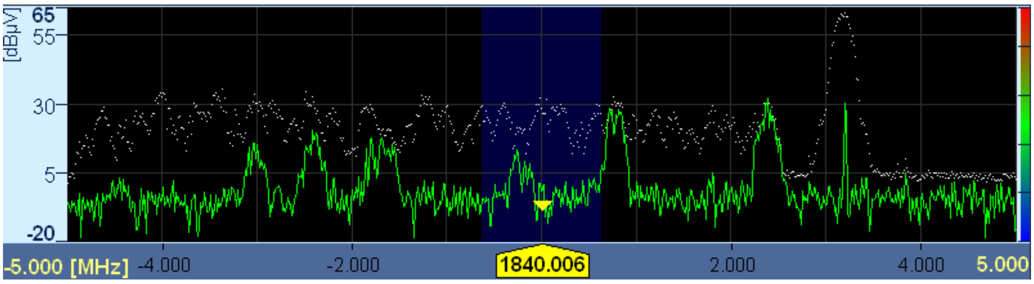
The scale of the DF panel can be set by activating the "Highest Level" and / or "Lowest Level" fields and the values can be changed, by using the ROTARY KNOB or the numeric keys. A selector bar will accompany the selection with the options dBµV or dBm as well as +/- and Backspace options.



If the "Hold Max" checkbox is checked, the maximum level will be indicated in the panel for a certain duration, depending on the "Hold Max" setting, which can be 1 sec, 2 sec, 5 sec, 10 sec, 20 sec, 50 sec or infinite.

When the "Show Grid" checkbox is checked, the DF panorama will display a grid with 25 dBµV spacing vertically. Horizontally, the spacing is "SPAN"/10.

The screenshot below shows an IF panorama with "Hold Max" as well as "Show Grid" enabled.



The waterfall color set can be chosen from the four options "Smooth", "Waterfall", "Cold" and "Gray"; see below.

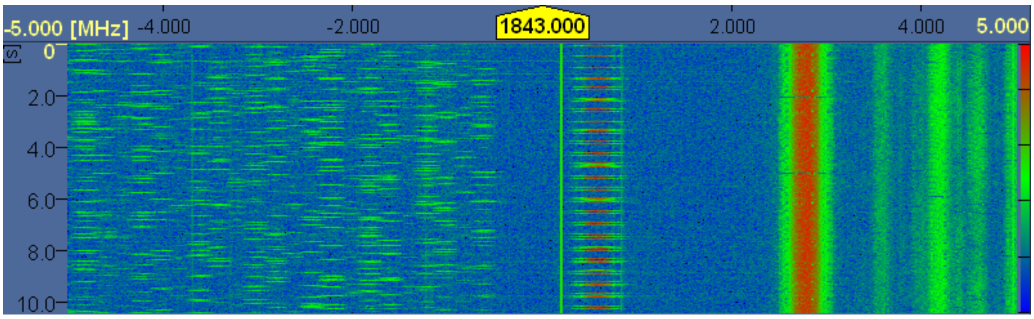


Fig. 3-70: Waterfall Color Set : "Smooth".

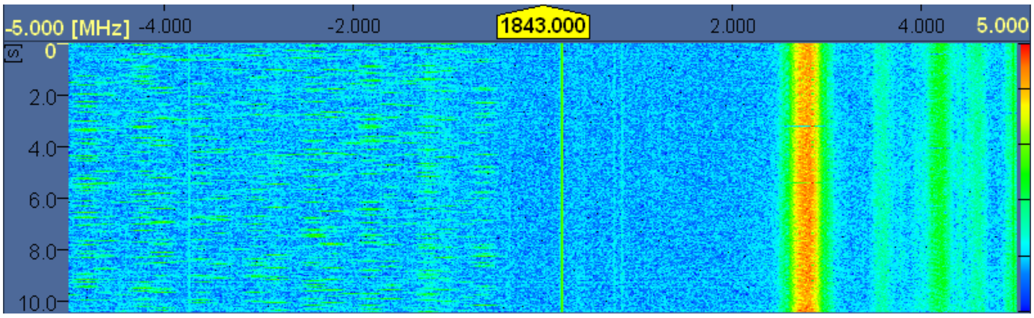


Fig. 3-71: Waterfall Color Set : "Rainbow".

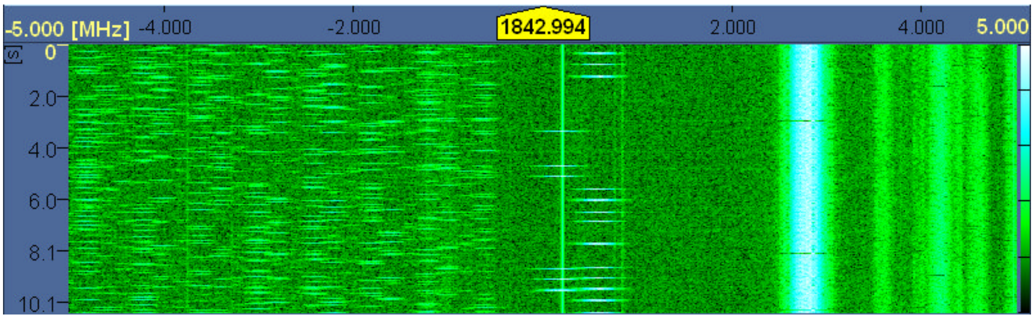


Fig. 3-72: Waterfall Color Set : "Cold".

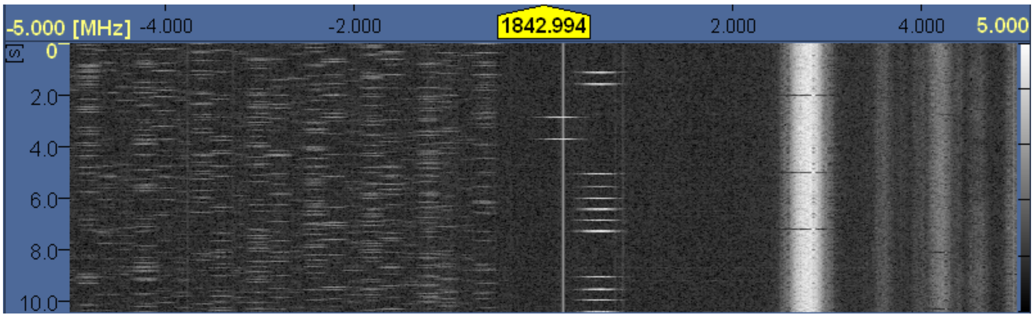


Fig. 3-73: Waterfall Color Set : "Gray".

The scale of the DF panel can be set by activating the "Highest Level" and / or "Lowest Level" fields and and the values can be changed, by using the ROTARY KNOB or the numeric keys. A selector bar will accompany the selection with the options dBμV or dBm as well as +/- and Backspace options.

If you set a check mark here, a change in the Y axis range will automatically adjust the Y range of the polychrome IF panorama. Otherwise, the polychrome IF panorama will not be affected by a change in the Y axis range.

Polychrome IF Panorama in DF Panel

Although it is possible to switch-on the polychrome histogram mode and to configure the parameters for polychrome IF panorama, no polychrome data will be shown in the DF panel until you set the AF/DF mode to AF.

DF data and polychrome data are mutually exclusive.

Use this field to specify the upper reference level for drawing the polychrome IF panorama. You can enter any value between -40 and 130 dBµV. A related selector shows the available units. Available units are "dBµV" and "dBm".

Use this field to specify the polychrome IF panorama level range. You can enter any value between 20 and 240 dB.

Use this field to specify the color set for the polychrome IF panorama. A related selector shows the available options. Available options are "Smooth", "Rainbow", "Cold" and "Gray".

Use this field to specify the IF panorama polychrome intensity. You can specify any value between 1 and 20.

3.3.3.18 DF Waterfall Dialog

The dialog is not available unless DF upgrade R&S EB500-DF is installed

This dialog is used to configure the DF panorama waterfall.

Use the "Speed Device Controlled" checkbox to specify whether the waterfall speed should be determined by the received measurement values or by a predefined constant. If a check mark is set, the data will be represented as it is received, otherwise you must specify the number of lines to be drawn per second.

If checkbox "Speed Device Controlled" is unchecked, the waterfall speed will be determined by the value you enter in this field. You can enter any number between 1 and 100 (lines).

The "Waterfall Color Set" can be chosen from the four options "Smooth", "Waterfall", "Cold" and "Gray"; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170 for example screenshots in each of the four modes.

Use this field to specify the upper reference level for drawing the polychrome IF panorama. You can enter any value between -40 and 130 dBµV. A related selector shows the available units. Available units are "dBµV" and "dBm".

Use this field to specify the polychrome IF panorama level range. You can enter any value between 20 and 240 dB.

Use this field to specify the color set for the polychrome IF panorama. A related selector shows the available options. Available options are "Smooth", "Rainbow", "Cold" and "Gray".

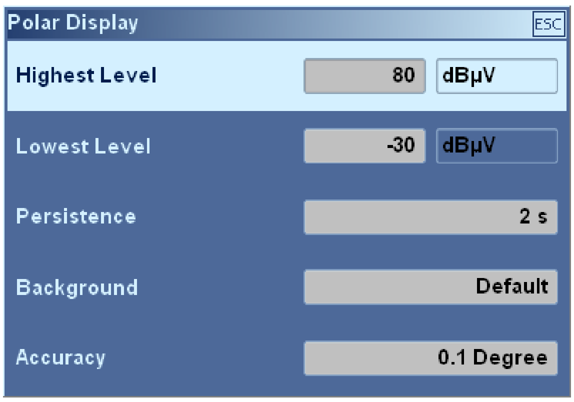
Use this field to specify the IF panorama polychrome intensity. You can specify any value between 1 and 20.

Use the "Polychrome Intensity" field to specify the IF panorama polychrome intensity. You can specify any value between 1 and 20.

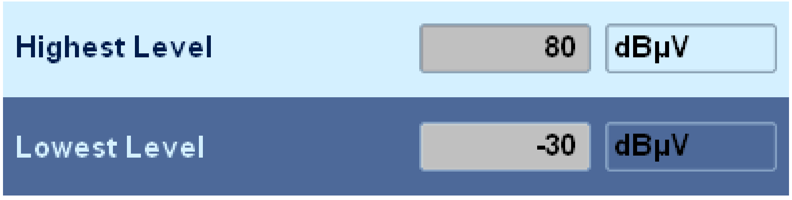
Use "Polychrome Color Set" field to specify the color set for the polychrome IF panorama. The Polychrome Color Set can be chosen from the four options "Smooth", "Waterfall", "Cold" and "Gray"; see chapter 3.3.3.11, "IF Panorama Dialog", on page 170 for example screenshots in each of the four modes.

3.3.3.19 Polar Display Dialog

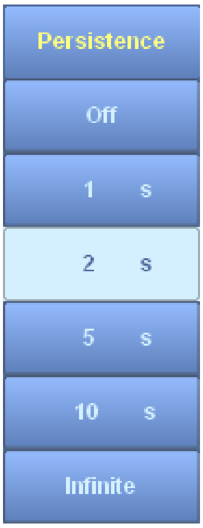
The dialog is not available unless DF upgrade R&S EB500-DF is installed



This dialog is used to configure the polar display.

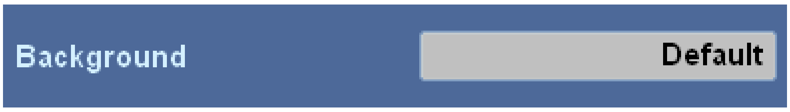


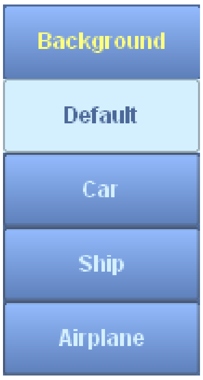
The scale of the Level bar in the Polar Panel can be set by activating the "Highest Level" and / or "Lowest Level" fields and changing the values, using the ROTARY KNOB or numeric keys. A selector bar will accompany the selection with the options dBμV or dBm as well as +/- and Backspace options.



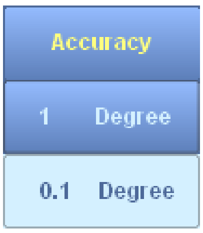
Use this field to set the persistence of the DF beam. This is the amount of time the system waits before it indicates (by graying out the bearing indicator) that a measurement of sufficient quality cannot be achieved.

You can set it to a value between 1 s and 10 s or continuous mode ("Infinite"). You can also turn persistence off. A related selector shows the options available.





Use this field to select the background image for the compass rose. The "Default" image is an arrow. For a more appropriate indication of the used vehicle type, the following options are available: "Default", "Car", "Ship" and "Airplane".



Use this field to select the accuracy of the indicated DF value. A related selector shows the available options, basically one degree or one-tenth of a degree.

3.3.3.20 DDC Display Dialog

This dialog is used to configure the display of the DDCs, i.e. to specify whether or not the demodulation bandwidth should be shown for each DDC.

The dialog is not available unless option R&S EB500-DDC is installed.

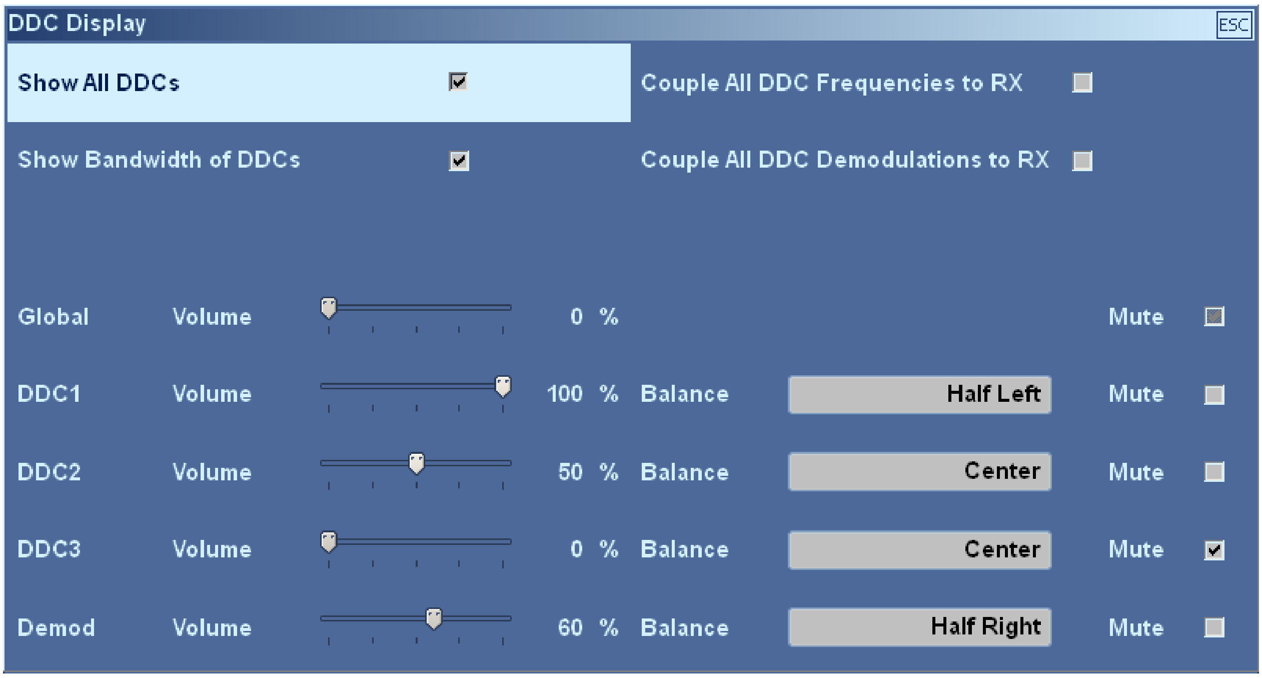
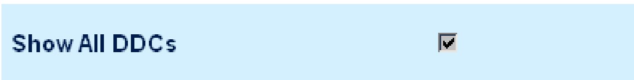


Fig. 3-74: DDC display dialog.

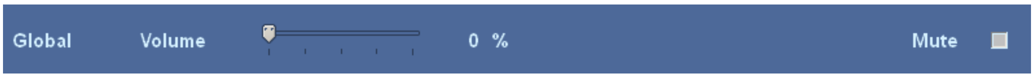


Set a check mark here if you want all DDCs positioned in the current panorama to be shown in the spectrum.

Set a check mark here if you want the demodulation bandwidth of the DDCs to be shown in the spectrum.

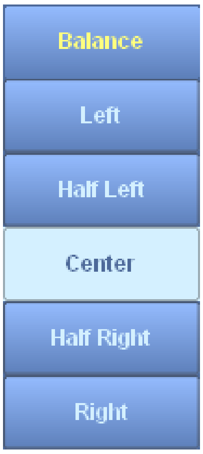
Set a check mark here to couple the frequencies of all DDCs to the center frequency.

Set a check mark here to couple the demodulation (mode and bandwidth) of all DDCs to the demodulation of the primary RX path.



Use this slider to set the volume for all DDCs and the demodulation branch simultaneously. If you change the volume, all other volumes will be changed as well. Set a check mark in the "Mute" checkbox to turn off the audio output of all DDCs and the demodulation branch.

Use these sliders to set the volume of DDC1, DDC2 and DDC3.



Use "Balance" fields to set the balance for each DDC. There are five settings for the balance:

"Left", "Half Left", "Center", "Half Right" and "Right".

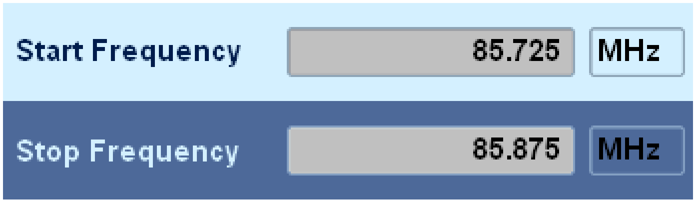
A related selector shows the settings available.

The "Mute" checkboxes can be used to mute or unmute the audio output for each of the DDC channels.

Likewise, for the main demodulation channel there is a "Volume" slider, a "Balance" selector and a "Mute" checkbox to change the volume and balance of the main channel's audio or to mute / unmute it.

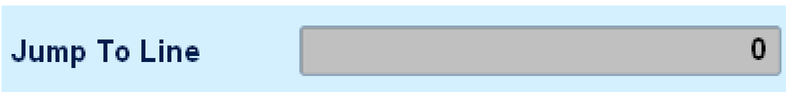
3.3.3.21 Suppress List Setup Dialog

This dialog is used to edit the frequencies to be suppressed during a frequency scan. You can define, edit and delete these frequency ranges.



The FScan will skip scanning any frequency that is in between "Start Frequency" and "Stop Frequency".

Using the softkeys, which appears together with the dialog, you can navigate through the suppress list. Alternatively, you can directly use "Jump To Line".



By clicking the "Clear" button, the highlighted entry in the dialog will be cleared.

The "Suppress" button will populate the highlighted entry with the current center frequency and the current bandwidth of the receiver. So the "Start Frequency" will be center frequency - bandwidth/2, and the "Stop Frequency" will be center frequency + bandwidth/2.

A suppress list entry cannot be overwritten. The entry must be cleared before a new entry can be written into it.

You can also populate the list by using the SUPPRESS functions during FScan; see chapter 3.3.2.7, "RF Spectrum", on page 49

One might be interested to store a frequency range into the memory list as well as into the suppress list. This can be achieved by clicking the "Copy Into Memory List" button.

You can also directly copy and suppress a frequency to the memory list by using the SUPPRESS functions during FScan; see chapter 3.3.2.7, "RF Spectrum", on page 49.

Entries in the memory list must have a predefined bandwidth (one of the 29 bandwidth settings). Otherwise the receiver cannot be configured to that frequency. However, you can use any possible frequency range by editing the start and stop frequency to any value in the suppress list.. If you try to copy a suppress range with a frequency which is not exactly the same as one of the predefined bandwidth settings, the "Copy Into Memory List" function will fail .

This button will clear all the entries in the suppress list. Confirmation softkeys will appear once you click the "Clear All" button.

4 Remote Control via LAN Interface

4.1 General

The R&S EB500 can be remotely controlled via LAN by means of SCPI command syntax. The control commands and the "Status Reporting System" are described in this chapter. The RJ45 LAN ports are located on the rear panel of the R&S EB500. Within TCP/IP, the R&S EB500 supports the SCPI command syntax version 1993.0 ("Standard Commands for Programmable Devices").

The SCPI standard is based on IEEE 488.2 and is aimed at standardizing device-specific commands, error handling and status registers (see chapter 4.3, "Notation", on page 199). This section assumes a basic knowledge of programming and operation of the controller. A description of the interface commands can be obtained from the relevant manuals.

The requirements which the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in the relevant chapters. Thse chapters include a comprehensive description of commands and status registers.

Detailed programming examples of the main functions can be found in chapter 8, "LAN Programming Examples", on page 436.

The default values of the interface parameters of the R&S EB500 are configured by host name and IP address, respectively (89.10.11.23 and port 5555).

To integrate the device into a network:

- Connect the R&S EB500 with the controller via Ethernet cable using standard RJ45 connectors.
- TCP/IP is required to be installed on the controller. The network card can be configured to half or full duplex. R&S EB500 will determine the respective configuration during power-on and responds accordingly.
- If the R&S EB500 is operated in a network, it must be set to a network-compatible IP address. Please consult your network administrator (see also chapter 7, "LAN Configuration", on page 429).
- The `ping` command is a simple way to check whether the controller is able to establish a connection with the R&S EB500. Just enter the command `ping <IP address>` (e.g. `ping 89.10.11.23`) in a command window.
- Commands can be sent to and messages can be received from the R&S EB500 by means of a Telnet application. This Telnet application needs to be configured with the interface parameters of the R&S EB500.
- To test the connection, enter command `*idn?`. This will query the device's identification and the response string should be displayed.

If a particular IP address already exists for a different device, the corresponding entry must be erased from the "ARP" table before setting up a new connection. This can be done in a command window by entering command ARP -d <ip_address>.

Configuring the LAN interface is described in detail in chapter 7, "LAN Configuration", on page 429. Setting the IP address and port number take effect immediately. The R&S EB500 is capable of assuming an IP address assigned dynamically via DHCP.

4.2 Structure and Syntax of the Device Messages

This chapter provides a description of the structure and syntax of the device messages.

4.2.1 SCPI Introduction

SCPI ("Standard Commands for Programmable Devices") 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 has been developed which defines the same functions inside a device, or for different devices. Command systems have been generated which are assigned to these functions. As a consequence, the same functions can be addressed with identical commands. The command systems are of hierarchical structure. The tree structure is illustrated 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 has been defined with greater restrictions than in standard IEEE 488.2 (see chapter 4.2.4, "Responses to Queries", on page 196).

4.2.2 Structure of a Command

Commands consist of a header and, in most cases, followed by one or more parameters. Header and parameters are separated by a "white space" (ASCII codes 0 to 9, 11 to 32 decimal, e.g. blank). Headers may consist of several keywords. Queries are formed by appending a question mark to the header.

Some of the commands used in the following examples may not be implemented in your device.

4.2.2.1 Common Commands

Common commands consist of a header preceded by an asterisk (*), and one or several parameters (or none at all).

Table 4-1: Examples of common commands.

`*RST`		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.

4.2.2.2 Device-Specific Commands

Device-specific commands are of hierarchical structure. 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`.

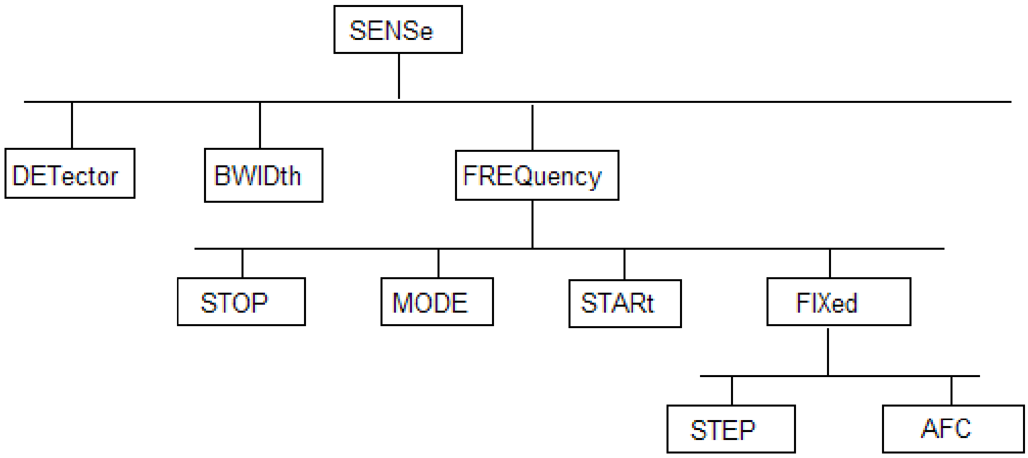


Fig. 4-1: Structure of command system SENSe.

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 is located at the third level of the `SENSe` system. It sets the start frequency of a scan to 118 MHz.

Some keywords occur at several levels within one command system. Their effect depends on the structure of the command, i.e. at which position in the header of a command they are inserted.

Example:

`OUTPut:SQUelch:STATe ON`

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

`SENSe:FM:STEReo:STATe ON`

This command contains the keyword `STATe` at the fourth command level. It defines the state of the FM stereo decoding.

4.2.2.3 Optional Keywords

Some command systems permit certain keywords to be optionally inserted into the header, or to be 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 step width for frequency UP-DOWN to 25 kHz. The following command has the same effect:

`FREQuency:STEP 25 kHz`

An optional keyword must be omitted if its effect is specified in detail by a numeric suffix.

4.2.2.4 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`

Example, short form:

`STAT:QUES:ENAB 1`

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 differentiate between upper and lower-case letters.

4.2.2.5 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 chapter 4.2.5, "Parameters", on page 196.

Example:

`SENSe:FREQuency? MAXimum`

Response: 3000000000.

This query requests the maximum value for the input frequency.

4.2.2.6 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.

4.2.3 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:SQUelch: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. 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 `SENSe` 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`

4.2.4 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. The requested parameter is transmitted without header.

Example:

`SENSe:FREQuency:MODe?`

Response: SWE

Maximum values, minimum values and all further quantities which are requested via a special text parameter are returned as numeric values.

Example:

`FREQuency? MAX`

Response: 3000000000

Numeric values are output without a unit. Physical quantities refer to the basic units.

Example:

`FREQuency?`

Response: 100000000 for 100 MHz

Truth values (boolean) are returned as 0 (for "OFF") and 1 (for "ON").

Example:

`OUTPut:SQUelch:STATe?`

Response: 1

Text (character data) is returned in a short form (see chapter 4.2.4, "Responses to Queries", on page 196).

Example:

`SENSe:FREQuency:MODe?`

Response: SWE

4.2.5 Parameters

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numeric 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.

4.2.5.1 Numeric Values

Numeric 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 of -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:

- Frequency: GHz, MHz or MAHz, kHz and Hz (default unit is "Hz")
- Time: s, ms, µs, ns (default unit is "s")
- Level: dBµV (default unit is "dBµV")
- Percentage: PCT (default unit is "PCT")

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

Example:

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

4.2.5.2 Special Numeric Values

"MINimum", "MAXimum", "UP", "DOWN" and "INFinity" are interpreted as special numeric values. In the case of a query, the numeric value is provided.

Example of a setting command:

`SENSe:GCONtrol MAXimum`

Example of a query:

`SENSe:GCONtrol?`

Response: 100

Table 4-2: Special numeric values.

MIN/MAX	MINimum and MAXimum denote the minimum and maximum value.
UP/DOWN	UP and DOWN increase and decrease the numeric value by one step. The step width can be specified for some parameters which can be set via UP, DOWN and an allocated step command. Some parameters can only be changed in fixed steps (e.g. SENSe:BWIDth UP).
INF	INFinity represents positive infinity. 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 PSCAN to identify the range limit.
NINF	Negative INFinity (NINF) represents negative infinity. 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 a device response. This value is not defined. Possible causes may be a division of zero by zero, a subtraction of infinite from infinite or the representation of missing values (e.g. with `TRACe[:DATA]?`).

4.2.5.3 Boolean Parameters

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

Example of a setting command:

```
OUTPut:SQUelch:STATe ON
```

Example of a query:

```
OUTput:SQUelch:STATe?
```

Response: 1

4.2.5.4 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 of a setting command:

```
SENSe:FREQuency:MODE FIXed
```

Example of a query:

```
SENSe:FREQuency:MODE?
```

Response: FIX

4.2.5.5 Strings

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

Examples:

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

4.2.5.6 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:

```
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 four 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`.

4.2.5.7 Expressions

Expressions must always be enclosed 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)
```

4.2.6 Overview of the Syntax Elements

- The **colon** (:) separates the keywords of a command. In a command line the colon after the separating semicolon marks the uppermost command level.
- A **semicolon** (;) separates two commands of a command line. It does not alter the path.
- A **comma** (,) separates several parameters of a command.
- A **vertical stroke** (|) in parameter indications marks alternative possibilities in the sense of "or".
- A **question mark** (?) forms a query.
- An **asterisk** (*) marks a common command.
- **Quotation marks** ("") introduce a string and terminate it.
- **ASCII character #** introduces block data.
- A **white space** (ASCII codes 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.
- **Brackets** () enclose an expression (channel lists).

4.3 Notation

In the following chapters, all commands implemented in the device are described in detail. The notation corresponds to a large extent to that of the SCPI standards.

4.3.1 Upper and Lower-Case Notation

Upper/lower-case letters serve to mark the long or short form of the keywords of a command in the description. The device itself does not distinguish between upper and lower-case letters.

4.3.2 Vertical stroke |

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`.

4.3.3 Square Brackets [ ]

Keywords in square brackets can be omitted in the header (see chapter 4.2.2.3, "Optional Keywords", on page 194). The device has to accept the full command length due to reasons of compatibility with the SCPI standard. Parameters in square brackets can also be optionally inserted into the command or can be omitted.

4.3.4 Braces { }

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

4.4 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.

Table 4-3: Common commands.

Command	Parameters/ remarks	Description
*CLS	no query	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?	query only	EVENT STATUS READ returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.
*IDN?	query only	IDENTIFICATION QUERY returns the device's identification. Output example: "ROHDE&SCHWARZ,EB500,100.017/002, V01.00-4072.8710.00" 100.017/002 = equipment serial number V01.10 = firmware version number 4072.8710.00 = firmware id number
*IST?	query only	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 when all previous commands have been executed. This bit can be used to initiate a service request (see chapter 4.7, "Status Reporting System", on page 350).
*OPC?	-	The query form of OPERATION COMPLETE writes a "1"' into the output buffer when all preceding commands have been executed (see chapter 4.7, "Status Reporting System", on page 350).
*OPT?	query only	OPTION IDENTIFICATION queries the options included in the device and returns a list of the options installed. The options are separated by a comma: PS = panorama scan (software option) IM = ITU Measurement Function (software option) FE = Module; 3.6 GHz to 6 GHz (software option) SL = Selcall; Sel Call Analysis (software option) DF = Direction Finding (software option) COR = DF Error Correction (software option) DDC = Digital Down Converter (software option) WDF = Wideband Direction Finding (software option) HF = Module; 9 kHz to 32 MHz (hardware option) Example for reply from the unit: PS,IM,0,DF,HF,0,0,0,0,FE
*PRE	0 to 255	PARALLEL POLL ENABLE sets the parallel poll enable register to the value indicated. Query *PRE? returns the contents of the parallel poll enable register in decimal form.
*RST	no query	RESET sets the device to a defined default status. The default setting is indicated in the description of the commands.

Command	Parameters/ remarks	Description
*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?	query only	READ STATUS BYTE reads the contents of the status byte in decimal form.
*TRG	no query	TRIGGER triggers the same actions as the INITiate:CONM[:IMMediate] command.
*TST?	query only	SELFTEST 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 Information on 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 (see also chapter 4.7, "Status Reporting System", on page 350 and "*OPC").

4.5 Device-Specific Commands

4.5.1 ABORt Subsystem

ABORt

This command stops an active scan. It expects no parameters and provides no return value.

Example: `ABORt`

4.5.2 CALCulate Subsystem

CALCulate:IFPan:AVERage:TYPE <aver_proc>

This command sets the averaging procedure for the IF panorama data.

For the averaging procedure, the averaging time and measurement time can be set by commands `MEASure:TIME`. The IF panorama is also used for bandwidth measurement. In periodic measurement mode, the detectors are discharged in line with the cycle of the measurement time.

Parameters:

<aver_proc> MINimum | MAXimum | SCALar | OFF

MINimum
Switches the MIN hold function on.

MAXimum
Switches the MAX hold function on.

SCALar
Switches the AVG averaging function on.

OFF
Switches the CLRWRITE function on.

*RST: OFF

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

CALCulate:IFPan:AVERage:TYPE?

This query returns the averaging procedure for the IF panorama data.

Return values:

<aver_proc> MIN | MAX | SCAL | OFF

MIN
The MIN hold function is on.

MAX
The MAX hold function is on.

SCAL
The AVG averaging function is on.

OFF
The CLRWRITE function is on.

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

CALCulate:IFPan:BANDwidth?

This query returns the current value of the IF panorama 6 dB bandwidth. The value depends on the IF panorama step width and selectivity.

Return values:

<bandwidth> IF panorama bandwidth in Hz.

Example: `CALCulate:IFPan:BANDwidth?` -> 150

CALCulate:IFPan:CLEar

This command restarts the MAX or MIN hold function for the IF panorama data.

Example: `CALCulate:IFPan:CLEar`

CALCulate:IFPan:MARKer:DEModulation:MAXimum[:PEAK]

This command sets the demodulation frequency to the absolute level maximum within the IF panorama spectrum.

Example: `CALCulate:IFPan:MARKer:DEModulation:MAXimum`

CALCulate:IFPan:MARKer:DEModulation:MAXimum:LEFT

This command sets the demodulation frequency to the next relative level maximum left of the marker when the squelch is off. When it is on, the demodulation frequency is set to the next level maximum to the left which is above the squelch line.

Example: `CALCulate:IFPan:MARKer:DEModulation:MAXimum:LEFT`

CALCulate:IFPan:MARKer:DEModulation:MAXimum:RIGHt

This command sets the demodulation frequency to the next relative level maximum right of the marker when the squelch is off. When it is on, the demodulation frequency is set to the next level maximum to the right which is above the squelch line.

Example: `CALCulate:IFPan:MARKer:DEModulation:MAXimum:RIGHt`

CALCulate:IFPan:MARKer:MAXimum[:PEAK]

This command centers the IF panorama spectrum to the absolute level maximum.

Example: `CALCulate:IFPan:MARKer:MAXimum`

CALCulate:IFPan:MARKer:MAXimum:LEFT

This command centers 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.

Example: `CALCulate:IFPan:MARKer:MAXimum:LEFT`

CALCulate:IFPan:MARKer:MAXimum:RIGHt

This command centers 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.

Example: `CALCulate:IFPan:MARKer:MAXimum:RIGHt`

CALCulate:IFPan:SELectivity <selectivity>

This command sets the selectivity in the IF panorama by selecting the FFT filter characteristics within the IF Panorama.

Parameters:

<selectivity> AUTO | NORMal | NARRow | SHARp

AUTO
Sets automatic selection. With AUTO, the selectivity is set automatically depending on the receiver mode DF or AF.

NORMal
Sets normal selection.

NARRow
Sets narrow selection.

SHARp
Sets sharp selection.

Example: `CALCulate:IFPan:SELectivity SHAR`

CALCulate:IFPan:SELectivity?

This query returns the selectivity in the IF panorama.

Return values:

<selectivity> AUTO | NORM | NARR | SHAR

AUTO
Automatic selection.

NORM
Normal selection.

NARR
Narrow selection.

SHAR
Sharp selection.

Example: `CALCulate:IFPan: SELectivity?` -> SHAR

CALCulate:IFPan:STEP <step_width>

This command sets the IF panorama step width. See also chapter 10, "IF Panorama", on page 451.

Parameters:

<step_width>

<numeric_value>
Sets the IF panorama step width.

MINimum
Sets the smallest IF panorama step width.

MAXimum
Sets the largest IF panorama step width.

UP
Sets the next smaller IF panorama step width.

DOWN
Sets the next larger IF panorama step width.

Range: 625 mHz to 2 MHz
*RST: 62.5 Hz

Example: `CALCulate:IFPan:STEP 25 kHz`

CALCulate:IFPan:STEP? <query_param>

This query returns the IF panorama step width.

Query parameters:

<query_param> MIN | MAX

MIN
Returns the smallest IF panorama step width in Hz.

MAX
Returns the largest IF panorama step width in Hz.

Return values:

<step_width> The step width in Hz.

Example: `CALCulate:IFPan:STEP?` -> 100

CALCulate:IFPan:STEP:AUTO <auto_step>

This command specifies whether the IF panorama step width (channel spacing) should be selected automatically depending on the IF panorama span, or explicitly.

Parameters:

<auto_step> ON | OFF

ON
The step width will be selected automatically.

OFF
The step width will be selected explicitly.

*RST: ON

Example: `CALCulate:IFPan:STEP:AUTO ON`

CALCulate:IFPan:STEP:AUTO?

This query returns whether the IF panorama step width (channel spacing) is selected automatically depending on the IF panorama span, or explicitly.

Return values:

<auto_step> 0 | 1

0
The step width is selected explicitly.

1
The step width is selected automatically.

Example: `CALCulate:IFPan:STEP:AUTO?` -> 1

CALCulate:PIFPan:ACTTime <act_time>

This command sets the activity duration time of the polychrome IF panorama.

Parameters:

<act_time>

<numeric_value>
Activity duration time in seconds.

MINimum
Minimum activity duration time.

MAXimum
Maximum activity duration time.

Range: 100 µs to 10 s
*RST: 15 ms

Example: `CALCulate:PIFPan:ACTTime 3`

CALCulate:PIFPan:ACTTime? <query_param>

This query returns the minimum/maximum activity duration time.

Query parameters:

<query_param> none | MIN | MAX

none
Returns the current activity duration time.

MIN
Returns the minimum activity duration time.

MAX
Returns the maximum activity duration time.

Return values:

<act_time> Activity duration time in seconds.

Example: `CALCulate:PIFPan:ACTTime?` -> 3

CALCulate:PIFPan:CLEar

This command clears the polychrome IF panorama.

Example: `CALCulate:PIFPan:CLEar`

CALCulate:PIFPan:LRANge <level_range>

This command defines the PIFPAN display level range.

Parameters:

<level_range>

MIN
Defines the minimum level range.

MAX
Defines the maximum level range.

UP
Increases the level range by 1 dB.

DOWN
Decreases the level range by 1 dB.

<numreric_value>
20.0 to 240.0 dB.

*RST: 120.0

Example: `CALC:PIFP:LRAN 70.5`

CALCulate:PIFPan:LRANge? <query_param>

This query returns the PIFPAN display level range.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current level range.

MINimum
Returns the minimum level range.

MAXimum
Returns the maximum level range.

Return values:

<level_range> PIFPAN display level range.

Example: `CALC:PIFP:LRAN?` -> 70.5

CALCulate:PIFPan:MODE <mode>

This command sets the operating mode of the polychrome IF panorama. See also chapter 12, "Polychrome IF Panorama", on page 479.

Parameters:

<mode> OFF | HISTogram

OFF
Switches the polychrome IF panorama off.

HISTogram
Sets the polychrome IF panorama to histogram mode.

*RST: OFF

Example: `CALCulate:PIFPan:MODE HISTogram`

CALCulate:PIFPan:MODE?

This query returns the operating mode of the polychrome IF panorama.

Return values:

<mode> OFF | HIST | PULS

OFF
The polychrome IF panorama is switched off.

HIST
The polychrome IF panorama is in histogram mode.

PULS
The polychrome IF panorama is in pulse measurement mode.

Example: `CALCulate:PIFPan:MODE?` -> HIST

CALCulate:PIFPan:OBSTime <obs_time>

This command sets the observation time/persistence of the polychrome IF panorama.

Parameters:

<obs_time> **<numeric_value>**
Observation time in seconds.

MINimum
Minimum observation time.

MAXimum
Maximum observation time.

Range: 100 µs to 10 s
*RST: 500 ms

Example: `CALCulate:PIFPan:OBSTime 300`

CALCulate:PIFPan:OBSTime? <query_param>

This query returns the observation time/persistenc of the polychrome IF panorama.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current observation time.

MINimum
Returns the minimum observation time.

MAXimum
Returns the maximum observation time.

Return values:

<observation_time> Observation time in seconds.

Example: `CALCulate:PIFPan:OBSTime?` -> 300

CALCulate:PIFPan:RLEVel <ref_level>

This command sets the reference level value, which corresponds to the topmost line of the PIFPAN.

Parameters:

<ref_level>

MIN
Sets the minimum reference level.

MAX
Sets the maximum reference level.

UP
Increases the reference level by 1 dB.

DOWN
Decreases the reference level by 1 dB.

<numeric_value>
-40.0 to +130.0 [dBuV].

*RST: 80.0

Example: `CALC:PIFP:RLEV 90.5`

CALCulate:PIFPan:RLEVel? <query_param>

This query returns the reference level, which corresponds to the topmost line of the PIF-PAN.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the reference level.

MINimum
Returns the minimum reference level.

MAXimum
Returns the maximum reference level.

Return values:

<ref_level> Reference level.

Example: `CALC:PIFP:RLEV?` -> 90.5

4.5.3 CALibration Subsystem

CALibration:ROSCillator[:DATA] <cal_value>

This command changes the calibration value (D/A converter value) for setting the exact OCXO reference frequency.

Parameters:

<cal_value>

<numeric_value>
Sets the D/A converter value as specified.

MINimum
Sets the minimum D/A converter value.

MAXimum
Sets the maximum D/A converter value.

UP
Increases the D/A converter value by 1.

DOWN
Decreases the D/A converter value by 1.

Range: 0 to 65535 (default = 32768)
*RST: n/a

Example: `CALibration:ROSCillator UP`

CALibration: ROSCillator[:DATA]? <query_param>

This query returns the calibration value (D/A converter value) for setting the exact OCXO reference frequency.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current calibration value.

MINimum
Returns the minimum calibration value.

MAXimum
Returns the maximum calibration value.

Return values:

<cal_value> Calibration value or D/A converter value for setting the exact OCXO reference frequency.

Example: `CALibration: ROSCillator:DATA?` -> 32768

CALibration: ROSCillator:DATE <year>,<month>,<day>

This command sets the calibration date.

Parameters:

<year> Year of calibration.
Range: 1900..

<month> Month of calibration.
Range: 1 to 12

<day> Day of calibration.
Range: 1 to 31

Example: `CALibration:ROSCillator:DATE 2009,05,24`

CALibration: ROSCillator:DATE?

This query returns the calibration date.

Return values:

<year> Year of calibration.
Range: 1900..

<month> Month of calibration.
Range: 1 to 12

<day> Day of calibration.
Range: 1 to 31

Example: `CALibration:ROSCillator:DATE?` -> 2009,05,24

CALibration: ROSCillator:STORe

This command stores the calibration value for setting the exact OCXO reference frequency, and the calibration date.

Note:

When storing the calibration value and the calibration date the `STORe` command must be sent in one single string. If the `STORe` command is sent without date an error message is generated: 1,"Device dependent error;Calibration store only with date".

Example: `CALibration:ROSCillator:DATE 2009,05,24;STORe`

4.5.4 DIAGnostic Subsystem

The DIAGnostic subsystem provides a tree node for all the instrument service and diagnostic routines used in routine maintenance and repair.

DIAGnostic[:SERVice]:INFO:MODule? <module_name>

This query returns information on a particular module.

Query parameters:

<module_name> Abbreviation of the module to be queried. See the table below for abbreviated module names.

Return values:

<module_info> Information on the requested module. See the table below for details.

Example:

```
DIAGnostic:INFO:MODule? P1
->
P1,4072.6100.02,1,01.00,101.449/003,2009,10,12,"PROCESSOR"
```

Example:

```
DIAGnostic:INFO:MODule? ALL
->
V1,4066.5806.02,1,02.01,100.763/002,2010,01,13,
"BBFRONTEND",
S1,4066.5906.02,1,01.00,100.000/000,2009,10,17,
"BBSYNTH",
P1,4072.6100.02,1,01.00,101.449/002,2009,10,12,
"PROCESSOR",
H1,4066.2007.03,1,05.01,100.118/002,2009,10,21,"PRESEL
HF",
M1,4072.6498.02,1,01.00,100.003/002,2010,05,10,
"EB500FPC",
DC,
4072.6369.02,1,01.00,100.003/002,2010,08,03,
"EB500DCPB"
```

Abbreviated module name	Module
V1	tuner
S1	synthesizer
P1	processor board
H1	HF module (hardware option)
DC	EB500DCPB
M1	EB500FPC
ALL	all modules

Module information	Description
<module_name>,	abbreviation of the module name
<part_number>,	module part number (e.g. 4072.6100.02)
<hw_code>,	hardware code (e.g. 1)

Module information	Description
<product_index>,	change index (e.g. 01.00)
<serial_number>,	serial number (e.g. 100.449/003)
<product_date>,	production date (e.g. 2009,10,12)
<module_name>	module name (e.g. "PROCESSOR")

DIAGnostic[:SERVice]:INFO:PERipheral

This command initiates a search for newly connected peripheral equipment.

Example: `DIAGnostic:INFO:PERipheral`

DIAGnostic[:SERVice]:INFO:PERipheral?

This query returns the connected peripheral devices.

Return values:
<device_list> <HwType>,<Code>,<Handle>,<Port>,<Version>,<Name>,…

Comma-separated list for every device detected. The list is returned in the format shown above.

Example: `DIAGnostic:INFO:PERipheral?` -> 8,0,0,0,00.00,"HE200 20-200MHz_A1"

<HwType>: type of peripheral device.

8 = antenna

3 = compass

4 = GPS

<Code>: device code depending on the type of peripheral device connected.

Antenna:

11 = ADD071

19 = ADD119

40 = ADD197

42 = ADD075

44 = ADD295

45 = ADD196

Compass:

0 = USER

1 = GH150

2 = NMEA

3 = SW

4 = GPS

GPS:

0 = USER

1 = GINA

2 = NMEA

<Handle>: Id number of the peripheral device.

The handle is determined by the R&S EB500 and is used to reference a particular peripheral device.

<Port>: number of the port to which a peripheral device is connected.

The port number can only be determined for antennas. They range from 0 to 3. Four port numbers are allocated to the specific antenna control input:

0 to 3: X2 ANT DF

<Version>: Version number of antenna module (applies to antennas only).

Format: xx.yy

<Name>: name of the peripheral device as a string.

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

This query returns the software-generation date. If a module is not available, a zero string ("") is returned and the error message "HW MISSING" is generated.

Suffix:

<numeric_suffix> The processor is selected via the <numeric_suffix>. See the table below for a description of the individual suffixes.

Return values:

<year> Year of software generation.

Range: 1900..

<month> Month of software generation.

Range: 1 to 12

<day> Day of software generation.

Range: 1 to 31

Example: `DIAGnostic:INFO:SDATe1?` -> 2008,01,28

Table 4-4: Suffixes.

1 or no <numeric_suffix>	SW_VERSION_MAIN	version date of the PPC
2	SW_VERSION_IF	version date of the DSP
3	SW_VERSION_FPGA	version date of the FPGA codes

4	SW_VERSION_BOOTPROG	version date of the boot program
5	SW_VERSION_GUI	version date of the GUI firmware
6	SW_VERSION_FPC	version date of the frontpanel controller firmware
7	SW_VERSION_GPS	version date of the GPS firmware

DIAGnostic[:SERVice]:INFO:SVERsion<numeric_suffix>?

This query returns the software version. If a module is not available, a zero string ("") is returned and the error message "HW MISSING" is generated.

Suffix:

<numeric_suffix> The processor is selected via the <numeric_suffix>. See the table below for a description of the individual suffixes.

Return values:

<software_version> Vxx.yy-aaaa.bbbb.cc

Software version and identification number in the format shown above (see `*IDN`).

Example: `DIAGnostic:INFO:SVERsion1?` -> V01.03- 4072.8710.00

Table 4-5: Suffixes.

1 or no <numeric_suffix>	SW_VERSION_MAIN	version date of the PPC
2	SW_VERSION_IF	version date of the DSP
3	SW_VERSION_FPGA	version date of the FPGA codes
4	SW_VERSION_BOOTPROG	version date of the boot program
5	SW_VERSION_GUI	version of the GUI firmware
6	SW_VERSION_FPC	version of the frontpanel controller firm-ware
7	SW_VERSION_GPS	version of the GPS firmware

DIAGnostic[:SERVice]:MODule:STATe? <module_name>

This query returns additional module information.

Query parameters:

<module_name> Name of the module to be queried. See the table below for abbre-viated module names.

Return values:

<module_state>

<module_name>,0
The module is "UNDEFINED". The EEPROM data is corrupted.

<module_name>,1
The module state is "OK".

<module_name>,2
The module state is "FAIL". Error message of a test point of the module.

<module_name>,3
The module state is "NOT_INSTALLED".

Example:

`DIAGnostic:MODule:STATe? S1` -> S1,1
`DIAGnostic:MODule:STATe? ALL` ->
V1,1,S1,1,Z1,1,P1,1,H1,1,M1,1,DC,1,GP,3

Abbreviated module name	Module
V1	tuner
S1	synthesizer
Z1	DSP module
P1	processor board
H1	HF module (hardware option)
DC	EB500DCPB
M1	FPC module
GP	GPS module
ALL	all modules
FAIL	all failed modules (missing modules and modules with empty EEPROM data)

DIAGnostic[:SERVice]:MONitor? <module_name>

This query returns test-point information on one or all recognized modules.

Query parameters:

<module_name> Name of the module to be queried.

V1
Tuner

S1
Synthesizer

P1
Processor board

H1
HF module (hardware option)

DC
EB500DCPB

M1
FPC module

ALL
All modules

Return values:

<testp_info> See below for a detailed description of the information returned.

Example: `DIAGnostic:MONitor? V1` -> #3180xxxxxx

If the output format is set to ASCII, all information relating to the test points of a known module is 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 and upper limit.

Meaning of symbols for the test-point state:

" " = OK, test-point voltage is within limits

"^" = test-point voltage exceeds the upper limit

"v" = test-point voltage is less than the upper limit

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

If the output format is set to binary format, a binary data block will be output which is similar to the structure described under "Parameters", 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

DIAGnostic[:SERVice]:TEMPerature[<numeric_suffix>]?

This query returns the temperature at a particular measurement point of the device.

Suffix:

<numeric_suffix> Selects the measurement point. See the table below for details on the <numeric_suffix>.

Return values:

<temperature> Temperature at the selected measurement point (in °C).

Example: `DIAGnostic:TEMPerature8?` -> 61

Table 4-6: Suffixes.

1 or no <numeric_suffix>	TEMP_PROCBOARD	temperature on the processor board
2	TEMP_PPC	temperature of the PPC
3	TEMP_ADCIF	temperature of the ADC
4	TEMP_DCDC	temperature of the DCDC
5	TEMP_FPGA	temperature of the FPGA
6	TEMP_SYN	temperature in the synthesizer
7	TEMP_PRESEL	temperature in the tuner
8	TEMP_HFPRESEL	temperature of the HF preselection

DIAGnostic[:SERVice]:TPOint[<numeric_suffix>]? <module>

This query returns the test-point voltage of a module. The test point (1 to n_{max}) on the particular module is selected via <numeric suffix>.

Query parameters:

<module> Name of the module to be queried. See the table below for details.

Return values:

<testp_voltage> Current test-point voltage in mV.

Example: `DIAGnostic:TPOint5? V1` -> 1976

Table 4-7: Modules and test points.

V1	tuner	n_{max} = 16
S1	synthesizer	n_{max} = 11
P1	processor	n_{max} = 33
H1	HF module	n_{max} = 8

4.5.5 DISPlay Subsystem

DISPlay:MENU[:NAME] <menu_name>

This command selects a specific data type for the video panorama from the pre-set list.

Parameters:

<menu_name> OFF | DEFault | LEFT | AM | RIGHt | FM | IQ | AMSQuare | FMSQuare | IQSQuare

OFF
No panorama data.

DEFault
No panorama data.

LEFT
Left/AM channel of the video panorama data.

AM
Left/AM channel of the video panorama data.

RIGHt
Right/FM channel of the video panorama data.

FM
Right/FM channel of the video panorama data.

IQ
IQ panorama data (digital IF data).

AMSQuare
Squared AM channel of the video panorama data.

FMSQuare
Squared FM channel of the video panorama data.

IQSQuare
Squared IQ panorama data (digital IF data).

*RST: OFF

Example: `DISPlay:MENU LEFT`

DISPlay:MENU[:NAME]?

This query returns a specific data type that was selected for the panorama display.

Return values:

<menu_name> OFF | LEFT | RIGH | IQ | AMSQ | FMSQ | IQSQ

OFF
No panorama data.

LEFT
Left/AM channel of the video panorama data.

RIGH
Right/FM channel of the video panorama data.

IQ
IQ panorama data (digital IF data).

AMSQ
Squared AM channel of the video panorama data.

FMSQ
Squared FM channel of the video panorama data.

IQSQ
Squared IQ panorama data (digital IF data).

Example: `DISPlay:MENU?` -> LEFT

4.5.6 FORMat Subsystem

FORMat:BORDer <output_order>

This command sets the output order for binary data, i.e. whether data is first to be transferred with low or high byte.

Note:

This command affects only the trace data. For UDP data there is a separate setting option.

Parameters:

<output_order> NORMal | SWAPped

NORMal
MSB -> ... -> LSB

SWAPped
LSB ->... -> MSB

*RST: NORMal

Example: `FORMat:BORDer SWAPped`

FORMat:BORDer?

This query returns the output order for binary data.

Return values:

<output_order> NORM | SWAP

NORM
MSB -> ... -> LSB

SWAP
LSB ->... -> MSB

Example: `FORMat:BORDer?` -> SWAP

FORMat[:DATA] <output_format>

This command sets the output format for the following queries:

`SENSe:DATA?`

`TRACe:DATA?`

Parameters:

<output_format> ASCii | PACKed | LLPacked

ASCii
Output in ASCII format.

PACKed
Output in internal binary data format (32 bit frequencies).

LLPacked
Output in internal binary data format (64 bit frequencies).

*RST: ASCii

Example: `FORMat PACKed`

FORMat[:DATA]?

This query returns the output format for the following queries:

`SENSe:DATA?`

`TRACe:DATA?`

Return values:

<output_format> ASC | PACK

ASC
Output in ASCII format.

PACK
Output in internal binary data format (32 bit frequencies).

LLPACK
Output in internal binary data format (64 bit frequencies).

Example: `FORMat?` -> PACK

FORMat:DIAGnostic:MONitor <output_format>

This command sets the output format for query `DIAGnostic:MONitor?`.

Parameters:

<output_format> ASCii | PACKed

ASCii
Output in ASCII format.

PACKed
Output in internal binary data format.

*RST: ASCii

Example: `FORMat:DIAGnostic:MONitor PACKed`

FORMat:DIAGnostic:MONitor?

This query returns the output format.

Return values:

<output_format> ASC | PACK

ASC
Output in ASCII format.

PACK
Output in internal binary data format.

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

FORMat:MEMory <output_format>

This command sets the output format for query `MEMory:CONTents?`.

Parameters:

<output_format> ASCii | PACKed

ASCii
Output in ASCII format.

PACKed
Output in internal binary data format.

*RST: ASCii

Example: `FORMat:MEMory PACKed`

FORMat:MEMory?

This query returns the output format for query `MEMory:CONTents?`.

Return values:

<output_format> ASC | PACK

ASC
Output in ASCII format.

PACK
Output in internal binary data format.

Example: `FORMat:MEMory?` -> PACK

FORMat:SREGister <data_format>

This command sets the data format for the queries of all "CONDition", "EVENt", "ENABle", "PTRansition", "NTRansition" registers and all IEEE-488.2 status registers.

Parameters:

<data_format> ASCii | BINary | HEXadecimal

ASCii
Output as decimal number in ASCII code (e.g. 128).

BINary
Output as binary number in ASCII code (e.g. #B1000000000000000).

HEXadecimal
Output as hexadecimal number in ASCII code (e.g. #H8000).

*RST: ASCii

Example: `FORMat:SREGister HEXadecimal`

FORMat:SREGister?

This query returns the data format for the queries of all "CONDition", "EVENt", "ENABle", "PTRansition", "NTRansition" registers and all IEEE-488.2 status registers.

Return values:

<data_format> ASC | BIN | HEX

ASC
Output as decimal number in ASCII code (e.g. 128).

BIN
Output as binary number in ASCII code (e.g. #B1000000000000000).

HEX
Output as hexadecimal number in ASCII code (e.g. #H8000).

*RST: ASCii

4.5.7 INITiate Subsystem

INITiate[:IMMediate]

This start command is used to initiate a measurement. It is also used as a start command for different "SCAN" types. If `[SENSe:]FREQuency:MODE` is set to `CW|FIXed`, the corresponding scan will start, taking a measurement for each step. `INITiate` command and the measurement result might be stored in "MTRACE" or "ITRACE".

If `[SENSe:]FREQuency:MODE` is set to `SWEep|MSCan|PSCan`, the corresponding scan is started and for each step a measurement is carried out. For example, if the path is set to the measurement-value buffer "MTRACE" by command `TRACE:FEED:CONTrol MTRACE,ALWays`, the measurement values are stored in "MTRACE".

Example: `INITiate`

INITiate:CONM[:IMMediate]

This command is used to continue a measurement. It is also used as a continue command for different "SCAN" types. "MTRACE" and "ITRACE" data sets are not deleted and are filled with measurement results according to the setting.

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|PSCan`, a measurement is carried out for each step and stored in "MTRACE" or "ITRACE". As an alternative, 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.

Example: `INITiate:CONM`

4.5.8 INPut Subsystem

INPut:ATTenuation <numeric_value>

This command sets the attenuation.

Parameters:

<numeric_value> Attenuation value.

Range: 0 to 40 dB
*RST: 0

Example: `INPut:ATTenuation 15`

INPut:ATTenuation?

This query returns the current attenuation value.

Return values:

<numeric_value> Current attenuation value.

Range: 0 to 40 dB

Example: `INPut:ATTenuation?` -> 15

INPut:ATTenuation:AUTO <att_setting>

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

Parameters:

<att_setting> ON | OFF

ON
Attenuation is coupled to input-signal strength.

OFF
Attenuation is set manually.

*RST: ON

Example: `INPut:ATTenuation:AUTO ON`

INPut:ATTenuation:AUTO?

This query returns the automatic attenuation setting.

Return values:

<att_setting> 0 | 1

0
Attenuation is set manually.

1
Attenuation is set automatically.

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

INPut:ATTenuation:AUTO:HOLD:TIME <hold_time>

This command sets the hold time, which prevents the attenuation value from dropping too early when the input level decreases.

Parameters:

<hold_time> **<numeric_value>**
The hold time in seconds.

MINimum
The minimum hold time.

MAXimum
The maximum hold time.

Range: 0.0 to 10.0 seconds
Increment: 0.1 s
*RST: 0.0 s

Example: `INPut:ATTenuation:AUTO:HOLD:TIME 3`

INPut:ATTenuation:AUTO:HOLD:TIME? <query_param>

This query returns the selected hold time.

Query parameters:

<query_param> none | MIN | MAX

none
Returns the current hold time.

MIN
Returns the minimum hold time.

MAX
Returns the maximum hold time.

Return values:

<hold_time> Hold time in seconds.

Example: `INPut:ATTenuation:AUTO:HOLD:TIME?` -> 3

INPut:ATTenuation:MODE <op_mode>

This command sets the operating modes for different receive conditions.

`NORMal`: This setting is recommended for normal receive conditions.

`LOWDistort`: This setting is especially recommended for areas with a large number of strong signals.

Parameters:

<op_mode> LOWDistort | NORMal

LOWDistort
Reception with low distortion.

NORMal
Normal reception.

*RST: NORMal

Example: `INPut:ATTenuation:MODE LOWDistort`

INPut:ATTenuation:MODE?

This query returns the selection of operating modes for different receive conditions.

Return values:

<op_mode> LOWD | NORM

LOWD
Reception with low distortion.

NORM
Normal reception.

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

4.5.9 MEASure Subsystem

Measurement of bandwidth is only accessible with the installed software option EB500-IM (ITU Measurement).

MEASure:APPLication <AppMode>

This command sets the application mode.

`APPLication RECeiver`

All the demodulation modes are functional and all the measurement values supplied by the receiver sensor functions are valid.

`APPLication DFINder`

Demodulation is limited. With FM, the audio is audible. With AM, the audio is only audible with MGC. The measurement values supplied by the receiver sensor functions are set to "invalid".

Parameters:

<AppMode> RECeiver | RX | AF | DFINder | DF

RECeiver | RX | AF
Receiver application.

DFINder | DF
DF application.

*RST: RECeiver

Example: `MEASure:APPL RX`

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:BANDwidth:LIMits <lower_limit>, <upper_limit>

This command specifies the lower and upper limit within which the bandwidth is measured. For wideband signals like TV transmitters the stepping of the IF panorama span is too coarse. A signal in the neighboring channel could interfere with the bandwidth measurement of a TV transmitter. The limits can only be set within the current IF panorama span.

Error message: If the limits are not within the current IF panorama span, an execution error (-221,"Settings conflict;IFPAN span to BW calculation limits") will be generated.

Parameters:

<lower_limit> Lower limit of the measurement bandwidth.

<upper_limit> Upper limit of the measurement bandwidth.

*RST: -50000,50000

Example: `MEAS:BAND:LIM -30000,40000`

MEASure:BANDwidth:LIMits?

This query returns current limits for the measurement bandwidth.

Return values:

<limits> Lower and upper limit of the measurement bandwidth, separated by a comma.

Example: `MEAS:BAND:LIM?` -> 30000,40000

MEASure:BANDwidth:LIMits:AUTO <limit_coupling>

This command specifies whether the limits within which the bandwidth is measured are coupled to the current IF panorama span. If the coupling is `OFF` the measurement bandwidth can be set smaller than the current IF panorama span. The command `MEASure:BANDwidth:LIMits <lower_limit>, <upper_limit>` specifies the limits of the measurement bandwidth.

Parameters:

<limit_coupling> ON | OFF

ON
The measurement bandwidth is coupled to the IF panorama span.

OFF
The measurement bandwidth is not coupled to the IF panorama span.

*RST: ON

Example: `MEAS:BAND:LIM:AUTO OFF`

MEASure:BANDwidth:LIMits:AUTO?

This query returns the state of the measurement bandwidth coupling.

Return values:

<limit_coupling> 0 | 1

0
The measurement bandwidth is not coupled to the IF panorama span.

1
The measurement bandwidth is coupled to the IF panorama span.

Example: `MEAS:BAND:LIM:AUTO?` -> 0

MEASure:APPLication?

This query returns the application mode.

Return values:

<AppMode> REC | RX | AF | DFIN | DF

Current application mode.

REC | RX | AF
Receiver application.

DFIN | DF
DF application.

Example: `MEASure:APPL?` -> REC

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:DFINder|DF:MODE <DfMeasMethod>

This command sets the DF measurement mode. Three modes can be set at the DF unit:

`NORMal`

This mode is preferably used to monitor radio networks. The direction-finding process is started and stopped by the squelch of the DF unit. The DF display reflects the different angles of arrival of the monitored signals without any delay.

`OFF | CONTinuous`

In this mode, direction finding is done continuously. This may allow bearings to be taken where signals are specially modulated or very weak. Also the squelch no longer starts the direction-finding process.

`GATE`

This mode is used when the emissions of transmitters may be temporarily interrupted by modulation (e.g. temporary transmissions) causing the transmitter's up time to be too short for `NORMal` mode.

Parameters:

<DfMeasMethod> OFF | CONTinuous | GATE | NORMal

OFF | CONTinuous
Continuous direction finding.

GATE
Signal-triggered direction finding.

NORMal
Direction finding with squelch.

*RST: OFF

Example: MEASure:DF:MODE CONT

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:DFINder|DF:MODE?

This query returns the current DF measurement mode.

Return values:

<DfMeasMethod> NORM | OFF | GATE

NORM
Direction finding with squelch.

OFF
Continuous direction finding.

GATE
Signal-triggered direction finding.

Example: `MEASure:DF:MODE?` -> OFF

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:DFINder|DF:TIME <MeasTime>

This command sets the measurement time (= averaging time) for DF averaging.

Parameters:

<MeasTime> **<numeric_value>**
Measurement time in seconds.

MINimum
Minimum measurement time.

MAXimum
Maximum measurement time.

Range: 0.100 s to 10.000 s
Increment: 0.001 s
*RST: 0.100 s
Default unit: s

Example: `MEASure:DF:TIME 500ms`

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:DFINder|DF:TIME? <QueryParam>

This query returns the current measurement time (= averaging time) for DF averaging.

Query parameters:

<QueryParam> none | MINimum | MAXimum

none
Returns the current measurement time.

MINimum
Returns the minimum measurement time.

MAXimum
Returns the maximum measurement time.

Return values:

<MeasTime> Measurement time in seconds.

Example: `MEASure:DF:TIME?` -> 0.500

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:DFINder|DF:THReshold[:UPPer] <threshold>

This command sets the level threshold for DF averaging in `NORMal` or `GATE` mode.

Parameters:

<Threshold>

<numeric_value>
Threshold value in dBµV.

MINimum
Minimum threshold value.

MAXimum
Maximum threshold value.

Increment: 1 dB
*RST: 10 dBµV
Default unit: dBuV

Example: `MEASure:DF:THR 35`

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

MEASure:BANDwidth:BETA

This command configures the bandwidth measurement mode BETA%.

Parameters:

<numeric_value> Value for the bandwidth measurement mode BETA%.

Range: 0.1 % to 99.9 %
Increment: 0.1 %
*RST: 1.0 %

Example: `MEASure:BANDwidth:BETA 10`

MEASure:BANDwidth:BETA?

This query returns the configuration of the bandwidth measurement mode BETA%.

Return values:

<numeric_value> Percentage value of the bandwidth measurement mode BETA%.

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

MEASure:BANDwidth:MODE <BandMeasMode>

This command sets the bandwidth measurement mode.

Parameters:

<BandMeasMode> XDB | BETA

XDB
Sets the bandwidth measurement mode to XDB.

BETA
Sets the bandwidth measurement mode to BETA%.

*RST: XDB

Example: `MEASure:BANDwidth:MODE XDB`

MEASure:BANDwidth:MODE?

This query returns the selected bandwidth measurement mode.

Return values:

<BandMeasMode> XDB | BETA

XDB
The bandwidth measurement mode is set to XDB.

BETA
The bandwidth measurement mode is set to BETA%.

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

MEASure:BANDwidth:XDB

This command configures the bandwidth measurement mode XDB.

Parameters:

<numeric_value> Value for the bandwidth measurement mode XDB.

Range: 0.0 dB to 100.0 dB
Increment: 0.1 dB
*RST: 26.0 dB
Default unit: dB

Example: `MEASure:BANDwidth:XDB 31`

MEASure:BANDwidth:XDB?

This query returns the configuration of the bandwidth measurement mode XDB.

Return values:

<numeric_value> dB value of the bandwidth measurement mode XDB.

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

MEASure:MODE <MeasMode>

This command sets the measurement mode to `CONTinuous` or `PERiodic`.

In `PERiodic` measurement mode, all detectors are discharged after the measurement time has elapsed and before the next measurement starts. Only individual measurement values per measurement 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 measurement time elapses.

In `CONTinuous` measurement mode, the measuring detector is read out every 200 msec, irrespective of the measurement time. These current measurement values are displayed. The measurement time has an effect on the level detectors. With `AVG`, the measurement time determines the averaging time. With `PEAK`, the measurement time determines the fall time. With `FAST`, the measurement 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 measurement value is stored in "MTRACE" each time a measurement is triggered by the command `INIT[:CONM]`.

Parameters:

<MeasMode> CONTinuous | PERiodic

CONTinuous
Continuous measurement.

PERiodic
Periodic measurement.

*RST: CONTinuous

Example: `MEASure:MODE PERiodic`

MEASure:MODE?

This query returns the measurement mode.

Return values:

<MeasMode> CONT | PER

CONT
Continuous measurement.

PER
Periodic measurement.

Example: `MEASure:MODE?` -> PER

MEASure:TIME <TimeSpan>

This command sets the time span for all measurement functions.

Note:

It is the user's responsibility to set a useful time span. The measurement time must be adjusted to the measured signal.

Parameters:

<TimeSpan> **<numeric_value>**
Time span in seconds.

MINimum
Minimum time span.

MAXimum
Maximum time span.

DEFault
Default time span.

Range: 0.000500 s to 900.000000
Increment: 0.0001 s
*RST: DEFault
Default unit: s

Example: `MEASure:TIME 200 ms`

MEASure:TIME? <QueryParam>

This query returns the measurement time span.

Query parameters:

<QueryParam> none | MINimum | MAXimum

none
Returns the current time span.

MINimum
Returns the minimum time span.

MAXimum
Returns the maximum time span.

Return values:

<TimeSpan> Time span in seconds. The default time span is indicated by "DEF".

Example: `MEASure:TIME?` -> 0.20000

4.5.10 MEMory Subsystem

This subsystem contains all the functions necessary to manipulate the R&S EB500 memory channels. The memory channels are addressed with text "MEM0" to "MEM9999" (memory channel 0 to memory channel 9999). Some commands allow the receiver (data set of receiver settings) to be addressed by character data `RX`, the currently set memory channel by `CURRENT` and the next free memory channel by `NEXT`.

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

MEMory:CLEar <name> [,<number>]

This command clears the contents of a memory channel. A certain number of memory channels to be cleared may also be specified.

Parameters:

<name> MEM0 to MEM9999 | CURRENT

MEM0 to MEM9999
Clears the specified memory channel.

CURRENT
Clears the current memory channel.

<number> <count> | MAXimum

<count>
Number of memory channels to be cleared from memory channel <name>; as a default value, <count> = 1 is accepted.

MAXimum
Clears all memory channels from <name> to the last memory channel.

Example: `MEMory:CLEar MEM123`

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

This command loads a memory channel. As an alternative to parameter `<mem_paras>`, a `<definite length block>` can be transferred with binary data. The format is determined by the setting command `FORMat:MEMory` on page 223

Parameters:

<name> MEM0 to MEM9999 | RX | CURRENT | NEXT

Memory channel name.

<mem_paras | packed_struct>

mem_paras
Memory parameters, see description below.

packed_struct
Definite length block with binary data, see description below.

*RST: The contents of the memory channel are maintained after *RST.

Example:

```
MEMory:CONTents MEM1, 98.5 MHz, 34, FM ,120 kHz,
(@1),1,OFF,ON,OFF,ON
```

Note:

When loading the receiver data set (`RX`), the parameter `<ACT>` is ignored. It must however 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` on page 221 .

Table 4-8: Description of <mem_paras>

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 INPut:ATTenua-tion<numeric_value>)
<ATTA>	attenuator auto (see INPut:ATTenuation:AUTO <Boolean>)
<SQUC>	squelch function (see OUTP:SQU:STAT)
<AFC>	setting/resetting the memory to scan (ON/OFF or 1/0)

`<packed_struct>` binary data set as `<definite length block>` has the following structure:

Table 4-9: Description of <packed_struct>

frequency in Hz	8 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 Byte = enumeration:
	0 = 100 Hz, 1 = 150 Hz, 2 = 300 Hz, 3 = 600 Hz, 4 = 1 kHz, 5 = 1.5 kHz, 6 = 2.1 kHz, 7 = 2.4. kHz, 8 = 2.7 kHz, 9 = 3.1 kHz, 10 = 4 kHz, 11 = 4.8 kHz, 12 = 6 kHz, 13 = 9 kHz, 14 = 12 kHz, 15 = 15 kHz, 16 = 30 kHz, 17 = 50 kHz, 18 = 120 kHz, 19 = 150 kHz, 20 = 250 kHz, 21 = 300 kHz, 22 = 500 kHz, 23 = 800 kHz, 24 = 1 MHz, 25 = 1.25 MHz, 26 = 1.5 MHz, 27 = 2.0 MHz, 28 = 5.0 MHz, 29 = 8.0 MHz, 30 = 10.0 MHz, 31 = 12.5 MHz, 32 = 15.0 MHz, 33 = 20.0 MHz
antenna number	1 byte = unsigned character 0 to 99
attenuator	1 byte = unsigned character (0 to 40)
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 = 20

MEMory:CONTents? <query_param>

This query returns the contents of a memory channel.

Query parameters:

<query_param> <name> | RX

MEM0 to MEM9999 | RX | CURRENT
The binary data set is transferred as a `<definite length block>` and has to be interpreted according to the format shown in table 4-8.

Return values:

<mem_contents> Memory contents. Depending on the setting by command `FORMat:MEMory` either an ASCII data set or a binary data set is output. See below for details.

Example: `MEMory:CONTents? MEM1` -> 98500000,34,FM, 120000,#14(@1),0,1,1,0,1

The ASCII data set has the following structure:

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

Table 4-10: ASCII data set structure.

<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?)
<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)

Note:

When querying the receiver data set (`RX`), the parameter `<ACT>` is not defined and has to be ignored. When trying to read out an empty memory channel the error message "MEMORY EMPTY" is generated.

MEMory:CONTents:LABel <name>,<label>

This command sets the description string of a memory channel.

Parameters:

<name> MEM0 to MEM9999 | CURRENT

Memory channel.

<label>	"1234567890123456" Description of a memory channel as string with maximum 16 characters.
Example:	`MEM:CONT:LAB MEM1, "Air Traffic Ch28"`

MEMory:CONTents:LABel? <query_param>

This query returns the description of a memory channel as string.

Query parameters:

<query_param>	MEM0 to MEM9999 | CURRENT Memory channel.

Return values:

<label>	Description of a memory channel.
Example:	`MEM:CONT:LAB? MEM1` -> "Air Traffic Ch28"

MEMory:CONTents:MPAR <name>,<ACT>

This command sets the memory channel parameter (`MPAR` = **M**emory**PAR**ameter) `<ACT>`.

Parameters:

<name>	MEM0 to MEM9999 | CURRENT Memory channel.
<ACT>	ON | OFF Sets/resets the memory channel to be scanned in the memory scan (`ON`/`OFF` or `1`/`0`).
Example:	`MEMory:CONTents:MPAR MEM1, OFF`

MEMory:CONTents:MPAR? <query_param>

This query returns the memory channel parameter `<ACT>`.

Query parameters:

<query_param>	MEM0 to MEM9999 | CURRENT Memory channel.

Return values:

<ACT>	0 | 1 Set/reset for scan (1/0).
Example:	`MEMory:CONTents:MPAR? MEM1` -> 0

MEMory:COPY <src_name>, <dest_name>

This command copies the memory contents from <src_name> to <dest_name>.

Parameters:

<src_name> MEM0 to MEM9999 | RX | CURRENT
Source channel.

<dest_name> MEM0 to MEM9999 | RX | CURRENT | NEXT
Destination channel.

Example: `MEMory:COPY MEM123, MEM10`

MEMory:EXCHange <name1>, <name2>

This command exchanges the contents of two memory channels.

Parameters:

<name1> MEM0 to MEM9999 | RX | CURRENT

<name2> MEM0 to MEM9999 | RX | CURRENT

Example: `MEMory:EXCHange MEM123, RX`

4.5.11 OUTPut Subsystem

OUTPut:AUXMode <aux_mode>

This command sets the AUXMode.

The switch AUXMode determines whether the frequency in BCD or the CTRL word is output to X4 on the rear panel. If AUXMode is set to `AUTO`, the CTRL byte of the used antenna defined in the RX antenna definition is output.

Parameters:

<aux_mode> FREQuency | CTRL | AUTO

FREQuency
Frequency output at "AUX"; four-digit BCD ((1, 10, 100, 1000 MHz).

CTRL
Output of CTRL word binary (CTRL1 to CTRL16).

AUTO
Output of CTRL byte binary (CTRL1 to CTRL8).

*RST: CTRL

Example: `OUTPut:AUXMode FREQuency`

OUTPut:AUXMode?

This query returns the AUXMode setting.

Return values:

<aux_mode> FREQ | CTRL | AUTO

FREQ
Frequency output at "AUX"; four-digit BCD ((1, 10, 100, 1000 MHz).

CTRL
Output of CTRL word binary (CTRL1 to CTRL16).

AUTO
Output of CTRL byte binary (CTRL1 to CTRL8).

Example: `OUTPut:AUXMode?` -> FREQ

OUTPut:BITAux[<numeric_suffix>][:STATe] <boolean>

This command sets one of the 16 bits at X4 AUX on the rear panel.

Suffix:

<numeric_suffix> The suffixes are described in the table below.

Parameters:

<boolean> ON | OFF

ON
The bit is set to "high" level.

OFF
The bit is set to "low" level.

*RST: OFF

Example: `OUTPut:BITAux2 ON`

Table 4-11: Description of suffixes.

Suffix	Description
1	Bit 1 corresponds to CTRL1 at X4.25
2	Bit 2 corresponds to CTRL2 at X4.24
3	Bit 3 corresponds to CTRL3 at X4.23
4	Bit 4 corresponds to CTRL4 at X4.22
5	Bit 5 corresponds to CTRL5 at X4.21
6	Bit 6 corresponds to CTRL6 at X4.20
7	Bit 7 corresponds to CTRL7 at X4.19
8	Bit 8 corresponds to CTRL8 at X4.18
9	Bit 9 corresponds to CTRL9 at X4.8
10	Bit 10 corresponds to CTRL10 at X4.7
11	Bit 11 corresponds to CTRL11 at X4.6
12	Bit 12 corresponds to CTRL12 at X4.5
13	Bit 13 corresponds to CTRL13 at X4.4

Suffix	Description
14	Bit 14 corresponds to CTRL14 at X4.3
15	Bit 15 corresponds to CTRL15 at X4.2
16	Bit 16 corresponds to CTRL16 at X4.1

OUTPut:BITAux[<numeric_suffix>][:STATe]?

This query returns the state of one of the 16 bits at X4 AUX on the rear panel.

Suffix:

<numeric_suffix> Bit to be queried. The suffixes are described in the table below.

Return values:

<bit_state> 0 | 1

0
"Low" level bit is set.

1
"High" level bit is set.

Example: `OUTPut:BITAux2?` -> 1

Table 4-12: Description of suffixes.

Suffix	Description
1	Bit 1 corresponds to CTRL1 at X4.25
2	Bit 2 corresponds to CTRL2 at X4.24
3	Bit 3 corresponds to CTRL3 at X4.23
4	Bit 4 corresponds to CTRL4 at X4.22
5	Bit 5 corresponds to CTRL5 at X4.21
6	Bit 6 corresponds to CTRL6 at X4.20
7	Bit 7 corresponds to CTRL7 at X4.19
8	Bit 8 corresponds to CTRL8 at X4.18
9	Bit 9 corresponds to CTRL9 at X4.8
10	Bit 10 corresponds to CTRL10 at X4.7
11	Bit 11 corresponds to CTRL11 at X4.6
12	Bit 12 corresponds to CTRL12 at X4.5
13	Bit 13 corresponds to CTRL13 at X4.4
14	Bit 14 corresponds to CTRL14 at X4.3
15	Bit 15 corresponds to CTRL15 at X4.2
16	Bit 16 corresponds to CTRL16 at X4.1

OUTPut:BYTAux[<numeric_suffix>][:STATe] <numeric_value>

Sets the 2 bytes at X4 AUX on the rear panel.

Suffix:

<numeric_suffix> Byte 1 corresponds to CTRL1 at X12B.14'AUX'.
Byte 2 corresponds to CTRL2 at X12B.15'AUX'

Parameters:

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

*RST: 0

Example: `OUTPut:BYTAux 7`

OUTPut:BYTAux[<numeric_suffix>][:STATe]?

This query returns the 2 bytes at X4 AUX at the rear panel.

Return values:

Depending on the settings by the `FORMat:SREGister` command , the contents of the register are transferred decimally, binary or hexadecimally in ASCII code.

Example: `OUTPut:BYTAux?` -> 7

OUTPut:FILTer: MODE <filter_mode>

This command sets the audio filter mode.

Parameters:

<filter_mode> OFF | NOTCh | NR | BP | DEHigh | DEEurope | DEUSa | DEPMr

OFF
No filter function.

NOTCh
Automatic elimination of interference signals.

NR
Noise reduction filter.

BP
Bandpass filter 300 Hz to 3.3 kHz.

DEHigh
High deemphasis with time constant 25 µs.

DEEurope
European FM radio deemphasis with time constant 50 µs.

DEUSa
USA FM radio deemphasis with time constant 75 µs.

DEPMr
FM Radio-telephone deemphasis with time constant 750 µs.

*RST: OFF

Example: `OUTPut:FILTer:MODE NOTCH`

OUTPut:FILTer:MODE?

This query returns the activated audio filter mode.

Return values:

<filter_mode> OFF | NOTC | NR | BP | DEH | DEE | DEUS | DEPM

OFF
No filter function.

NOTCh
Automatic elimination of interference signals.

NR
Noise reduction filter.

BP
Bandpass filter 300 Hz to 3.3 kHz.

DEH
High deemphasis with time constant 25 µs.

DEE
European FM radio deemphasis with time constant 50 µs.

DEUS
USA FM radio deemphasis with time constant 75 µs.

DEPM
FM Radio-telephone deemphasis with time constant 750 µs.

Example: `OUTPut:FILTer:MODE?` ->NOTC

OUTPut:SQUelch:CONTrol <source>

This command sets the source for the operating state after switching the unit on, when reading the memory channels with the `MEMory:COPY` command, when using the RCL key or when running a memory scan.

Parameters:

<source> MEMory | NONE

MEMory
The squelch state and squelch value are read from the memory channels.

NONE
The squelch state and squelch value are not read from the memory channels.

*RST: MEMory

Example: `OUTPut:SQUelch:CONTrol NONE`

OUTPut:SQUelch:CONTrol?

This query returns the source of the squelch setting when reading memory channels.

Return values:

<source> MEM | NONE

MEM
The squelch state and squelch value are read from the memory channels.

NONE
The squelch state and squelch value are not read from the memory channels.

Example: `OUTPut:SQUelch:CONTrol?` -> MEM

OUTPut:SQUelch[:STATe] <boolean>

This command switches the squelch on or off.

Parameters:

<boolean> ON | OFF

ON
The squelch is switched on.

OFF
The squelch is switched off.

*RST: OFF

Example: OUTPut:SQUelch ON

OUTPut:SQUelch[:STATe]?

This query returns the squelch setting.

Return values:

<boolean> 0 | 1

0
The squelch is off.

1
The squelch is on.

Example: `OUTPut:SQUelch?` -> 1

OUTPut:SQUelch:THReshold [:UPPer] <threshold>

This command sets the squelch threshold.

Parameters:

<threshold>

<numeric_value>
Sets the squelch threshold in dBµv.

UP
Increases the squelch threshold by 1 dB.

DOWN
Decreases the squelch threshold by 1 dB.

MINimum
Sets the minimum squelch threshold.

MAXimum
Sets the maximum squelch threshold.

*RST: 10 dBµV

Example: `OUTPut:SQUelch:THReshold 35 dBµV`

OUTPut:SQUelch:THReshold[:UPPer]? <query_param>

This query returns the squelch threshold.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current squelch threshold.

MINimum
Returns the minimum squelch threshold.

MAXimum
Returns the maximum squelch threshold.

Return values:

<threshold> Squelch threshold value in dBµV.

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

OUTPut:VIDeo:FREQuency <frequency>

This command sets the center frequency of the analog IF output. This command is only effective if the video mode is set to IF.

Parameters:

<frequency>

<numeric_value>
Frequency value.

MINimum
Minimum frequency.

MAXimum
Maximum frequency.

*RST: 10700000

Example: `OUTPut:VIDeo:FREQuency 15 MHz`

OUTPut:VIDeo:FREQuency? <query_param>

This query returns the video mode settings.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the currently set center frequency.

MINimum
Returns the minimum center frequency.

MAXimum
Returns the maximum center frequency.

Return values:

<frequency> Center frequency in Hz.

Example: `OUTPut:VIDeo:FREQuency?` -> 15000000

OUTPut:VIDeo:MODE <video_mode>

This command sets the video mode. The video-mode switch determines whether the analog IF or the analog demodulated video signal is output at the rear panel through one of the connectors X8 VIDEO A or X9 VIDEO B. In the case of an analog IF, the center frequency can be set with command `OUTPut:VIDeo:FREQuency`.

Parameters:

<video_mode> IF | DEModulator

IF
Output of the analog IF.

DEModulator
Output of the analog demodulated video signal.

*RST: DEM

Example: `OUTPut:VIDeo:MODE IF`

OUTPut:VIDeo:MODE?

This query returns the current video mode.

Return values:

<video_mode> IF | DEM

IF
Output of the analog IF.

DEM
Output of the analog demodulated video signal .

Example: `OUTPut:VIDeo:MODE?` -> IF

OUTPut:WRDaux[:STATe] <numeric_value>

This command sets the word at X4 AUX on the rear panel.

Parameters:

<numeric_value> Value of the AUX word (0 to 65535, #H0000 to #HFFFF or #B0 to #B1111111111111111).

*RST: 0

Example: `OUTPut:WRDaux 7`

OUTPut:WRDaux[:STATe]?

This query returns the word at X4 AUX on the rear panel.

Return values:

Depending on the settings by the `FORMat:SREGister` command , the contents of the register are transferred decimally, binary or hexadecimally in ASCII code.

Example: `OUTPut:WRDaux?` -> 7

4.5.12 ROUTe Subsystem

ROUTe:AUTO <auto_ctrl>

This command selects automatic or manual antenna control.

Parameters:

<auto_ctrl> ON | OFF

ON
Automatic antenna control.

OFF
Manual antenna control.

*RST: ON

Example: `ROUTe:AUTO OFF`

ROUTe:AUTO?

This query returns the antenna control mode.

Return values:

<auto_ctrl> 0 | 1

0
Manual antenna control.

1
Automatic antenna control.

Example: `ROUTe:AUTO?`-> 1

ROUTe:CLOSe <channel_list>

This command selects an antenna. The previous antenna has to be switched off with command `ROUTe:OPEN:ALL` (also see `ROUTe:SELect` on page 252).

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

Parameters:

<channel_list> May contain max. one number (0 to 99).

*RST: @1

Example: `ROUTe:CLOSe (@23)`

Note:
This command has no more function but is still available for reasons of compatibility with earlier receivers.

ROUTe:CLOSe? <channel_list>

This query returns whether the corresponding antenna has been selected.

Query parameters:

<channel_list> Contains a value for each antenna number to be queried.

Return values:

<state> 0 | 1

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

Note:

This command has no more function but is still available for reasons of compatibility with earlier receivers.

ROUTe:CLOSe:STATe? <query_param>

This query returns the selected antenna.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the currently selected antenna.

MINimum
Returns the lowest antenna number.

MAXimum
Returns the highest antenna number.

Return values:

<antenna_num> Antenna number as a <definite length block>.

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

Note:

This command has no more function but is still available for reasons of compatibility with earlier receivers.

ROUTe:GAIN[:STATe] <preamp_state>

This command switches the preamplifier on or off. The CTRL16 at X4.1 (AUX) can be used to switch an external preamplifier. Note: To switch an external preamplifier with X4.1, Aux Port Mode must be set to "AUTO". See `OUTPut:AUXMode` on page 240.

Parameters:

<preamp_state> ON | OFF

ON
Switches the preamplifier on.

OFF
Switches the preamplifier off.

*RST: ON

Example: `ROUTe:GAIN ON`

ROUTe: GAIN[:STATe]?

This query returns the state of the preamplifier.

Return values:

<preamp_state> 0 | 1

0
The preamplifier is off.

1
The preamplifier is on.

Example: `ROUT:GAIN?`-> 1

ROUTe:HF[:INPut] <channel_list>

This command selects the antenna input socket for the HF tuner.

Parameters:

<channel_list> (@0) | (@1)

(@0)
X13 is used as HF input.

(@1)
X14 is used as HF input.

*RST: (@0)

Example: `ROUTe:HF (@1)`

ROUTe: HF[:INPut]?

This query returns the antenna input socket which is configured for the HF tuner.

Return values:

<channel_list> #14(@0) | #14(@1))

#14(@0)
X13 is used as HF input.

#14(@1)
X14 is used as HF input.

Example: `ROUTe:HF?` -> #14(@1)

ROUTe:OPEN:ALL

Do not select antenna (antenna number 0 is set. This command is an event).

Example: ROUTe:OPEN:ALL

Note:

This command has no more function but is still available for reasons of compatibility with earlier receivers.

ROUTe:POLarization <polarization>

This command sets the polarization of the antenna. If antenna control is set to automatic mode, an antenna with the corresponding polarization is selected automatically.

Parameters:

<polarization> VERTical | HORizontal | LEFT | RIGHt

VERTical
Vertical polarization.

HORizontal
Horizontal polarization.

LEFT
Left-hand circular polarization.

RIGHt
Right-hand circular polarization.

Example: `ROUT:POL HOR`

ROUTe:POLarization?

This query returns the antenna polarization.

Return values:

<polarization> VERT | HOR | LEFT | RIGH

VERT
Vertical polarization.

HOR
Horizontal polarization.

LEFT
Left-hand circular polarization.

RIGHt
Right-hand circular polarization.

Example: `ROUT:POL?` -> HOR

ROUTe:SELect <channel_list>

This command corresponds to the following combination of commands:

`ROUTe:OPEN:ALL` on page 251

`ROUTe:CLOSe` on page 249

Parameters:

<channel_list> <number> | UP | DOWN | MINimum | MAXimum

<channel_list>
Must contain exactly one number (0 to 99).

UP
Moves one position up in the list of antennas.

DOWN
Moves one position down in the list of antennas.

MINimum
Selects the antenna with the lowest number.

MAXimum
Selects the antenna with the highest number.

*RST: @1

Example: `ROUTe:SELect (@23)`

Note:

This command has no more function but is still available for reasons of compatibility with earlier receivers.

ROUTe:VUHF[:INPut] <channel_list>

This command selects the antenna input socket for the VUHF tuner.

Parameters:

<channel_list> (@0)

(@0)
X13 is used as VUHF input.

*RST: (@0)

Example: `RROUTe:VUHF (@0)`

ROUTe: VUHF[:INPut]?

This query returns the antenna input socket which is configured for the VUHF tuner.

Return values:

<channel_list> #14(@0)

#14(@0)
X13 is used as VUHF input.

Example: `ROUTe:VUHF?` -> #14(@0)

4.5.13 SENSe Subsystem

[SENSe:]BANDwidth|BWIDth[:RESolution] <demod_bandwidth>

This command sets the demodulation bandwidth.

Parameters:

<demod_bandwidth> **<numeric_value>**
Value of the bandwidth to be set.

UP
Next bandwidth.

DOWN
Previous bandwidth.

MINimum
Minimum bandwidth.

MAXimum
Maximum bandwidth.

*RST: 100 kHz or the nearest bandwidth

Example: `BANDwidth 2.4 kHz`

[SENSe:]BANDwidth|BWIDth[:RESolution]? <query_param>

This query returns the current demodulation bandwidth.

Query parameters:

<query_param>	none | MINimum | MAXimum **none** Returns the current bandwidth. **MINimum** Returns the minimum bandwidth. **MAXimum** Returns the maximum bandwidth.

Return values:

<demod_bandwidth>	IF bandwidth in Hz without unit specified.

Example: `BANDwidth?` -> 2400

[SENSe:]BANDwidth|BWIDth:DFINder|DF? <query_param>

This query returns the direction finder's bandwidth.

This command is only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

Query parameters:

<query_param>	none | MINimum | MAXimum **none** Returns the current bandwidth. **MINimum** Returns the minimum bandwidth. **MAXimum** Returns the maximum bandwidth.

Return values:

<df_bandwidth>	DF bandwidth.

Example: `BAND:DFIN?` -> 6000

SENSe:DATA? <data_handle>

This query returns the current measurement values of the active sensor functions.

The keyword `SENSe` must not be omitted as `DATA?` can be confused with the `TRACe:DATA?` subsystem command.

When only command `SENSe:DATA?` is used to query the measurement values, the values reported back may be as old as 200 ms. For display on the device, the measurement values are captured every 200 ms and placed into a buffer.

To start a complete measurement, possibly by using a predefined measurement time, you should use the command combination `INIT;:SENSe:DATA?`. 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 measurement time has elapsed.

To avoid blocking remote-control communication during longer measurement times, the measurement value should only be queried when the measurement has been completed. The measurement value obtained is stored in "MTRACE", provided that the path to the result buffer "MTRACE" was enabled with command `TRACE:FEED:CONTrol MTRACE, ALWays`. The device 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").

Query parameters:

<data_handle> none | "[SENSe:]FREQuency:OFFSet" | "[SENSe:]VOLTage:AC" | "[SENSe:]FSTRength"

none
Output of the measured values of all active sensor functions; if no function is switched on, error -221, "Settings Conflict", will be generated.

"[SENSe:]FREQuency:OFFSet"
Output of offset value

"[SENSe:]VOLTage:AC"
Output of level value

"[SENSe:]FSTRength"
Output of field strength value

Return values:

<meas_value> Level in dBµV, offset in Hz.

Example:

`SENSe:DATA?` -> 23.4, -2500
`SENSe:DATA? "VOLT:AC"` -> 23.4
`SENSe:DATA? "FREQuency:OFFSet"` -> -2500
`SENSe:DATA? "FSTRength"` -> 62.4

If SW option "R&S EB500-IM" (ITU-Measurement) is installed, the measurement functions "AM modulation index" , "FM frequency deviation", "PM phase deviation" and "band width measurement" are available in addition to level and offset.

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 bandwidth measurement value

The output format will be generated with command `FORMat[:DATA]` on page 222 according to the setting:

ASCii	Normal ASCII output ● level in dBµV ● frequency offset in Hz ● field strength in dBµV/m ● 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
PACKed	<definite length block>: ● level in 1/10th dBµV (2 bytes) ● frequency offset in Hz (4 bytes) ● field strength in 1/10 dBµV/m(2 bytes) ● AM modulation index in 1/10th % (2 bytes) ● AM positive modulation index in 1/10th % (2 bytes) ● AM negative modulation index in 1/10th % (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 1/100th rad (2 bytes) ● bandwidth in Hz (4 bytes)

If DF upgrade R&S®EB500-DF (Direction Finding) is installed, the measurement functions "direction finding level", "azimuth", "direction finding quality" and "direction finding field strength" are available in addition to level and offset.

DFLevel	Output of direction finding level value
AZIMuth	Output of direction finding azimuth value
DFQuality	Output of direction finding quality value
DFFStrength	Output of direction finding field strength value

The output format will be generated with the command `FORMat[:DATA]` on page 222 according to the setting:

ASCii	Normal ASCII output ● direction finding level in dBuV ● direction finding azimuth in ° ● direction finding quality in % ● direction finding field stength in dBµV/m (2 bytes)
PACKed	<definite length block>: ● direction finding level in 1/10th dBuV (2 bytes) ● direction finding azimuth in 1/10th ° (2 bytes) ● direction finding quality in 1/10th % (2 bytes) ● direction finding field stength in 1/10th dBµV/m (2 bytes)

SENSe:DATA:MAXimum?

This query returns the maximum measured values of all active sensor functions.

Example: `SENS:DATA:MAX?` -> 31.7

SENSe:DATA:MAXimum:CLEar

This command resets the maximum measured values of all active sensor functions.

Example: `SENS:DATA:MAX:CLE`

[SENSe:]DEModulation <demodulator>

This command sets the demodulation mode.

Error message: Where the set bandwidth exceeds 9 kHz with "CW", "LSB" or "USB", error -221,"Settings conflict" will be generated if one of the SSB operating modes is to be switched on.

Parameters:

<demodulator> AM | FM | PULSe | PM | IQ | ISB | CW | LSB | USB

AM
Switch on AM demodulator.

FM
Switch on FM demodulator.

PULSe
Switch on pulse demodulator.

PM
Switch on PM demodulator.

IQ
Switch on IQ demodulator.

ISB
Switch on ISB demodulator.

CW
Switch on SSB demodulator 1 kHz beat.

LSB
Switch on SSB demodulator lower sideband.

USB
Switch on SSB demodulator upper sideband.

*RST: FM

Example: `DEModulation FM`

[SENSe:]DECoder:SELCall[:STATe] <decoder_state>

This command switches the SelCall analysis on or off.

The following selective call methods can be detected and decoded: "CCIR7(2)", "CCIR1", "CCITT", "EEA", "EIA", "EURO", "NATEL", "VDEW", "ZVEI1", "ZVEI2", "DTMF", "CTCSS", "DCS".

The decoder automatically detects the most probable code; only this code is output. If several codes of equal probability are detected then all codes are output. The codes are output exclusively via UDP (see chapter 6, "Mass Data Output", on page 403).

Required receiver settings:

Selective call methods are generally frequency and phase modulated (FM/PM). As a consequence, the receiver must be set for this type of demodulation. The bandwidth for the demodulation must conform to the signal, which is generally between 15 kHz and 30 kHz. The device provides a web interface at `<ip_address>/selcall.html`, which can be used to test the selective call functionality.

Note:

SelCall Analysis is only accessible with the installed software option R&S EB500-SL (Selcall).

Parameters:

<decoder_state> ON | 1 | OFF | 0

ON | 1
The decoder is switched on.

OFF | 0
The decoder is switched off.

*RST: 0

Example: `DEC:SELC ON`

[SENSe:]DECoder:SELCall[:STATe]?

This query returns the state of the SelCall analysis.

Return values:

<decoder_state> 0 | 1

0
The decoder is switched off.

1
The decoder is switched on.

Example: `DEC:SELC?` -> 1

Note:

SelCall Analysis is only accessible with the installed software option R&S EB500-SL (Selcall).

[SENSe:]DEModulation?

This query returns the demodulation mode.

Return values:

<demodulator> FM, AM, PULS, PM, IQ, ISB, CW, USB, LSB

Example: `DEModulation?` -> FM

[SENSe:]DEModulation:BFO <bfo_frequency>

This command sets the BFO frequency. The BFO is an auxiliary oscillator which, in "CW" mode, helps to recover carriers.

Parameters:

<bfo_frequency>

<numeric_value>
BFO frequency

MINimum
Minimum frequency.

MAXimum
Maximum frequency.

Range: -8000 Hz to 8000 Hz
*RST: 1000

Example: `DEModulation:BFO 1 kHz`

[SENSe:]DEModulation:BFO? <query_param>

This query returns the BFO frequency.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current BFO frequency.

MINimum
Returns the minimum BFO frequency.

MAXimum
Returns the maximum BFO frequency.

Return values:

<bfo_frequency> BFO frequency.

Example: `DEModulation:BFO?` -> 1000 (current frequency)

[SENSe:]DEModulation:PBT <pbt_frequency>

This command sets the PBT frequency (only with demodulation LSB or USB).

Parameters:

<pbt_frequency>

<numeric_value>
PBT frequency.

MINimum
Minimum frequency.

MAXimum
Maximum frequency.

Range: -8000 Hz to 8000 Hz
*RST: 0

Example: `DEModulation:PBT 1 kHz`

[SENSe:]DEModulation:PBT? <query_param>

This query returns the PBT frequency.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current PBT frequency.

MINimum
Returns the minimum PBT frequency.

MAXimum
Returns the maximum PBT frequency.

Return values:

<pbt_frequency> PBT frequency.

Example: `DEModulation:PBT?` -> 1000 (current frequency)

[SENSe:]DETector[:FUNCtion] <meas_proc>

This command sets the level measurement process.

Parameters:

<meas_proc> POSitive | PAVerage | FAST | RMS

POSitive
Measures the peak value (PEAK).

PAVerage
Measures the average value of the voltage (AVG).

FAST
Measures the current value (FAST).

RMS
Measures the average value of the power (RMS).

*RST: PAVerage

Example: `DETector POSitive`

[SENSe:]DETector[FUNCtion]?

This query returns the current level measurement process.

Return values:

<meas_proc> POS | PAV | FAST | RMS

POS
Measures the peak value (PEAK).

PAV
Measures the average value of the voltage (AVG).

FAST
Measures the current value (FAST).

RMS
Measures the average value of the power (RMS).

Example: `DETector?` -> POS

[SENSe:]FM:RDS:DATA?

This query returns the RDS data.

Return values:

<rds_data> Flags, PI Code, TP, TA, MS, DI. See the table below for details.

Example: `FM:RDS:DATA?` -> 6, 54035, 1, 0, 1, 1

Table 4-13: RDS data.

Flags	• Bit 0 -> Stereo pilot tone detected/not detected • Bit 1 -> ARI carrier detected/not detected • Bit 2 -> RDS synchronized/not synchronized
PI Code	Program Identifier
TP	Traffic Program (1=traffic radio transmitter, 0=no traffic radio transmitter)
TA	Traffic Anouncement (1=traffic anouncement running)
MS	Music/Speech (transmitting 1=music, 0=speech)
DI	Decoder Information • 0 mono • 1 stereo • 2 not assigned • 3 dummy head • 4 mono compressed • 5 stereo compressed • 6 not assigned • 7 dummy head compressed • 8 .. 15 not assigned

[SENSe:]FM:RDS:GROups:CLEar

This command resets the RDS group codes.

Example: `FM:RDS:GROups:CLEar`

[SENSe:]FM:RDS:GROups[:DATA]?

This query returns the RDS group code statistics.

Return values:

<group_code_stats> Group0 Version A, Group1 Version A,....Group15 Version A, Group0 Version B, Group1 Version B,....Group15 VersionB
Indicates the number of separately transmitted group codes (0-15) for version A and B.

Example: `FM:RDS:GRO?` -> 1727, 0, 866, 147, 5, 0, 439, 0, 384, 0, 0, 400, 0, 0, 880, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

[SENSe:]FM:RDS:PS?

This query returns the RDS program string name.

Return values:

<name> Definite length binary block. Identification of the radio station coded in binary data. '_' stands for characters not yet transmitted.

Example: `FM:RDS:PS?` -> #18BAYERN 3

[SENSe:]FM:RDS:RT?

This query returns the RDS radio text.

Return values:

<text> Definite length binary block.

Example: `FM:RDS:RT?` -> #264Bayern 3__- Klingt dreimal gut
____

[SENSe:]FM:RDS[:STATe] <decoder_state>

This command switches the RDS decoder on or off.

Parameters:

<decoder_state> 0 | OFF | 1 | ON

0 | OFF
The decoder is switched off.

1 | ON
The decoder is switched on.

*RST: 0

Example: `FM:RDS ON`

[SENSe:]FM:RDS[:STATe]?

This query returns the state of the RDS decoder.

Return values:

<decoder_state> 0 | 1

0
The decoder is switched off.

1
The decoder is switched on.

Example: `FM:RDS?` -> 1

[SENSe:]FM:STEReo[:STATe] <decoder_state>

This command switches the stereo decoder on or off.

Parameters:

<decoder_state> 0 | OFF | 1 | ON

0 | OFF
Switches the decoder off.

1 | ON
Switches the decoder on.

*RST: 0

Example: `FM:STEReo ON`

[SENSe:]FM:STEReo[:STATe]?

This query returns the state of the stereo decoder.

The RDS decoder and the stereo decoder require FM demodulation. The bandwidth must be between 120 kHz and 250 kHz. The detector flags work only when the detector is working (see also the description of the SCPI command FM:RDS:DATA?).

Stereo flag: The stereo decoder must be switched on.

ARI/RDS flag: The RDS decoder must be switched on.

If the stereo decoder detects the stereo pilot tone, it automatically switches the audio output over onto two-channel stereo. The stereo information in RDS field "DI" is then independent of the stereo code in the flags field. The device provides a web interface at `<ip_address>/rds.html`, which can be used to test the RDS functionality.

Return values:

<decoder_state> 0 | 1

0
The decoder is switched off.

1
The decoder is switched on.

Example: `FM:STEReo?` -> 1

[SENSe:]FREQuency[:CW|FIXed]:RANGe:HF[:UPPer] <receive_frequency>

This command sets the upper receive frequency to be received by the HF tuner. Frequencies above this setting will be received by the V/UHF tuner. This setting has no effect if an HF tuner is not installed.

Parameters:

<receive_frequency> **<numeric_value>**
Sets the upper receive frequency limit of the HF tuner.

MINimum
Sets the minimum HF tuner receive frequency.

MAXimum
Sets the maximum HF tuner receive frequency.

*RST: 20 MHz

Example: `FREQuency:RANGe:HF 31 MHz`

[SENSe:]FREQuency[:CW|FIXed]:RANGe:HF[:UPPer]? <query_param>

This query returns the upper receive frequency to be received by the HF tuner.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current HF tuner receive frequency.

MINimum
Returns the minimum HF tuner receive frequency.

MAXimum
Returns the maximum HF tuner receive frequency.

Return values:

<receive_frequency> Frequency value in Hz.

Example: `FREQuency:RANGe:HF?` -> 31000000

[SENSe:]FREQuency[:CW|FIXed] <rec_frequency>

This command sets the receiver frequency.

Parameters:

<rec_frequency> **<numeric_value>**
Frequency value.

UP
Increases the receiver frequency by the value set with command `[SENSe:]FREQuency:STEP[:INCRement]` on page 272.

DOWN
Decreases the receiver frequency by the value set with command `[SENSe:]FREQuency:STEP[:INCRement]` on page 272.

MINimum
Sets the minimum receiver frequency.

MAXimum
Sets the maximum receiver frequency.

*RST: 98.5 MHz

Example: `FREQuency 98.5 MHz`

[SENSe:]FREQuency[:CW|FIXed]? <query_param>

This query returns the receiver frequency.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current receiver frequency.

MINimum
Returns the minimum receiver frequency.

MAXimum
Returns the maximum receiver frequency.

Return values:

<rec_frequency> Frequency value in Hz.

Example: `FREQuency?` -> 98500000

[SENSe:]FREQuency:DEModulation <demod_frequency>

This command sets the demodulation frequency within the range of the current IF panorama span. The receiver frequency is not affected.

Parameters:

<demod_frequency> **<numeric_value>**
Value of the demodulation frequency.

UP
Increases the demodulation frequency by the value set with command [SENSe:]FREQuency:STEP[:INCRement] on page 272.

DOWN
Decreases the demodulation frequency by the value set with command [SENSe:]FREQuency:STEP[:INCRement] on page 272.

MINimum
Sets the minimum demodulation frequency.

MAXimum
Sets the maximum demodulation frequency.

*RST: 98.5 MHz

Example: `FREQuency:DEModulation 98.5 MHz`

[SENSe:]FREQuency:DEModulation? <query_param>

This query returns the demodulation frequency.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current demodulation frequency.

MINimum
Returns the minimum demodulation frequency.

MAXimum
Returns the maximum demodulation frequency.

Return values:

<demod_frequency> Frequency value in Hz.

Example: `FREQuency:DEModulation?` -> 98500000

[SENSe:]FREQuency:MODE <op_mode>

This command sets the operating mode of the receiver.

Parameters:

<op_mode> CW | FIXed | FFM | SWEep | MSCan | PSCan

CW | FIXed | FFM
Sets the receiver to monitor a frequency (`CW` and `FIXed` are synonymous for the same mode).

SWEep
Sets the receiver to frequency scan mode (see `SENSe:SWEep`).

MSCan
Sets the receiver to memory scan mode (see `SENSe: MSCan`).

PSCan
Sets the receiver to panorama scan mode (see `SENSe: PSCan`).

*RST: CW

Example: `FREQuency:MODE SWEep`

Options:

[SENSe:]FREQuency:MODE?

This query returns the operating mode of the receiver.

Return values:

<op_mode> CW | SWE | MSC | PSC

CW
The receiver is set to monitor a frequency.

SWE
The receiver is set to frequency scan mode.

MSC
The receiver is set to memory scan mode.

PSC
The receiver is set to panorama scan mode.

Example: `FREQuency:MODE?` -> SWE

[SENSe:]FREQuency:PSCan...

If the STARt and/or the STOP frequency is changed, CENTer or SPAN is matched. If CENTer and/or SPAN is changed, STARt and STOP frequency are matched. In a command, only CENTer and SPAN or STARt and STOP frequency can be changed simultaneously. Other combinations of parameters are rejected.

Options: PSCan functions are only accessible with the installed software option Panorama Scan.

[SENSe:]FREQuency:PSCan:CENTer <center_frequency>

This command sets the the center frequency of the panorama scan. Corrects `STARt` and `STOP` frequency.

Parameters:

<center_frequency> **<numeric_value>**
Value of the center frequency.

MINimum
Sets the minimum center frequency.

MAXimum
Sets the maximum center frequency.

*RST: 97.5 MHz

Example: `FREQuency:PSCan:CENTer 118 MHz`

[SENSe:]FREQuency:PSCan:CENTer? <query_param>

This query returns the center frequency of the panorama scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current center frequency.

MINimum
Returns the minimum center frequency.

MAXimum
Returns the maximum center frequency.

Return values:

<center_frequency> Value of the center frequency in Hz.

Example: `FREQuency:PSCan:CENTer?` -> 118000000

[SENSe:]FREQuency:PSCan:SPAN <range>

This command sets the display range of the panorama scan. Corrects `STARt` and `STOP` frequency.

Parameters:

<range> **<numeric_value>**
Frequency value.

MINimum
Sets the minimum display range.

MAXimum
Sets the maximum display range.

*RST: 25 MHz

Example: `FREQuency:PSCan:SPAN 10 MHz`

[SENSe:]FREQuency:PSCan:SPAN? <query_param>

This query returns the display range of the panorama scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current display range.

MINimum
Returns the minimum display range.

MAXimum
Returns the maximum display range.

Return values:

<range> Frequency value in Hz.

Example: `FREQuency:PSCan:SPAN?` -> 10000000

[SENSe:]FREQuency:PSCan:STARt <start_frequency>

This command sets the start frequency of the panorama scan.

Parameters:

<start_frequency> **<numeric_value>**
Frequency value.

MINimum
Sets the minimum start frequency.

MAXimum
Sets the maximum start frequency.

*RST: 85 MHz

Example: `FREQuency:PSCan:STARt 118 MHz`

[SENSe:]FREQuency:PSCan:STARt? <query_param>

This query returns the start frequency of the panorama scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current start frequency.

MINimum
Returns the minimum start frequency.

MAXimum
Returns the maximum start frequency.

Return values:

<start_frequency> Frequency value in Hz.

Example: `FREQuency:PSCan:STARt?` -> 118000000

[SENSe:]FREQuency:PSCan:STOP <start_frequency>

This command sets the stop frequency of the panorama scan.

Parameters:

<stop_frequency> **<numeric_value>**
Frequency value.

MINimum
Sets the minimum stop frequency.

MAXimum
Sets the maximum stop frequency.

*RST: 110 MHz

Example: `FREQuency:PSCan:STOP 136 MHz`

[SENSe:]FREQuency:PSCan:STOP? <query_param>

This query returns the stop frequency of the panorama scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current stop frequency.

MINimum
Returns the minimum stop frequency.

MAXimum
Returns the maximum stop frequency.

Return values:

<stop_frequency> Frequency value in Hz.

Example: `FREQuency:PSCan:STOP?` -> 136000000

[SENSe:]FREQuency:SPAN <range>

This command sets the frequency range of the IF panorama. The following ranges are available: 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz, 50 kHz, 100 kHz, 200 kHz, 500 kHz, 1 MHz, 2 MHz, 5 MHz, 10 MHz and 20 MHz. The entered frequency must exactly correspond to the upper values. It is not rounded.

Parameters:

<range> **<numeric_value>**
Frequency range.

UP
Sets the range following the current frequency range.

DOWN
Sets the range preceding the current frequency range.

MINimum
Sets the minimum frequency range.

MAXimum
Sets the maximum frequency range.

*RST: 100 kHz

Example: `FREQuency:SPAN 20 kHz`

[SENSe:]FREQuency:SPAN? <query_param>

This query returns the frequency range of the IF panorama.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current frequency range.

MINimum
Returns the minimum frequency range.

MAXimum
Returns the maximum frequency range.

Return values:

<frequency_range> Frequency value in Hz.

Example: `FREQuency:SPAN?` -> 20000

[SENSe:]FREQuency:STARt <start_frequency>

This command sets the start frequency of a frequency scan.

Parameters:

<start_frequency> **<numeric_value>**
Frequency value.

MINimum
Sets the minimum start frequency.

MAXimum
Sets the maximum start frequency.

*RST: 87.5 MHz

Example: `FREQuency:STARt 118 MHz`

[SENSe:]FREQuency:STARt? <query_param>

This query returns the start frequency of a frequency scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current start frequency.

MINimum
Returns the minimum start frequency.

MAXimum
Returns the maximum start frequency.

Return values:

<start_frequency> Frequency value in Hz.

Example: `FREQuency:STARt?` -> 118000000

[SENSe:]FREQuency:STEP[:INCRement] <step_width>

This command sets the step width for command [SENSe:]FREQuency[:CW|FIXed] UP|DOWN.

Parameters:

<step_width>

<numeric_value>
Frequency step width.

MINimum
Sets the minimum step width.

MAXimum
Sets the maximum step width.

*RST: 1 kHz

Example: `FREQuency:STEP 25 kHz`

[SENSe:]FREQuency:STEP[:INCRement]? <query_param>

This query returns the step width.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current step width.

MINimum
Returns the minimum step width.

MAXimum
Returns the maximum step width.

Return values:

<step_width> Frequency value in Hz.

Example: `FREQuency:STEP?` -> 25000

[SENSe:]FREQuency:STOP <stop_frequency>

This command sets the stop frequency of a frequency scan.

Parameters:

<stop_frequency>

<numeric_value>
Frequency value.

MINimum
Sets the minimum stop frequency.

MAXimum
Sets the maximum stop frequency.

*RST: 108 MHz

Example: `FREQuency:STOP 136 MHz`

[SENSe:]FREQuency:STOP? <query_param>

This query returns the stop frequency of a frequency scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current stop frequency.

MINimum
Returns the minimum stop frequency.

MAXimum
Returns the maximum stop frequency.

Return values:

<stop_frequency> Frequency value in Hz.

Example: `FREQuency:STOP?` -> 136000000

[SENSe:]FUNCtion...

If the sensor function(s) is (are) changed, the trace data set MTRACE is always deleted.

[SENSe:]FUNCtion:CONCurrent <state>

This command determines whether or not several sensor functions can be switched at the same time. If `CONCurrent` is `OFF`, command `[SENSe:]FUNCtion[:ON]` on page 274 has the effect of a 1-out-of-n selection (one is switched on, the previously activated is automatically switched off). If `CONCurrent` is `ON`, the command `[SENSe:]FUNCtion[:ON]` on page 274 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:

<state> ON | OFF

ON
Switches CONCurrent on.

OFF
Switches CONCurrent off.

*RST: ON

Example: `FUNCtion:CONCurrent ON`

[SENSe:]FUNCtion:CONCurrent?

This query returns whether or not several sensor functions can be switched at the same time.

Return values:

<state> 0 | 1

0
CONCurrent is switched off.

1
CONCurrent is switched on.

Example: `FUNCtion:CONCurrent?` -> 1

[SENSe:]FUNCtion:OFF sensor_function> {,<sensor_function>}

This command switches off one or several sensor functions.

Parameters:

sensor_function> {,<sensor_function>} See `[SENSe:]FUNCtion[:ON]` on page 274.
*RST: "FREQ:OFFS"

Example: `FUNCtion:OFF "FREQ:OFFS"`

[SENSe:]FUNCtion:OFF?

This query returns the sensor functions being switched off.

Return values:

<sensor_function> "VOLTage:AC" | "FREQuency:OFFSet"

"VOLT:AC"
Level measurement is off.

"FREQ:OFFS"
Offset measurement is off.

Example: `FUNCtion:OFF?` -> "FREQ:OFFS"

[SENSe:]FUNCtion:OFF:COUNt?

This query returns the number of inactive sensor functions.

Return values:

<function_count> Number of inactive sensor functions.

Example: `FUNCtion:OFF:COUNt?` -> 2

[SENSe:]FUNCtion[:ON] <sensor_function> {,<sensor_function>}

This command switches on one of several sensor functions.

Error message: If `CONCurrent` is `OFF`, error -108, "Parameter not allowed" will be generated for ten or more parameters.

Parameters:

<sensor_function> "VOLTage:AC" | "FREQuency:OFFSet"

"VOLTage:AC"
Switches level measurement on.

"FREQuency:OFFSet"
Switches offset measurement on.

*RST: Number of sensor functions being inactive

Example: `FUNCtion "VOLT:AC", "FREQ:OFFS"`

The offset measurement works only with signals whose signal energy, however, may vary but must not disappear completely. At QAM or 100 % AM-modulated signals, the offset measurement cannot provide correct values.

Note:

With SW option R&S EB500-IM (ITU-Measurement) installed, the measurement functions "AM modulation index", "FM frequency deviation", "PM phase deviation" and "bandwidth measurement" are available in addition to level and offset.

Table 4-14: ITU-Measurement sensor functions

"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

With Option R&S®EB500-DF (Direction Finding) installed, the measurement functions direction finding level, direction finding azimuth, direction finding quality and direction finding field strength are available in addition to level and offset.

Table 4-15: Direction Finding sensor functions

"DFLevel"	switch on DF level measurement
"AZIMuth"	switch on azimuth measurement
"DFQuality"	switch on DF quality measurement
"DFFStrength"	switch on DF field strength measurement

[SENSe:]FUNCtion[:ON]?

This query returns the sensor functions being switched on.

Return values:

<function_list> List of active sensor functions. If no function is active, a zero string ("") is returned. See the table below for the specific list order and strings to be expected.

Example: `FUNCtion?` -> "VOLT:AC", "FREQ:OFFS"

Table 4-16: List 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
12	Direction finding level measurement
13	Direction finding azimuth measurement
14	Direction finding quality measurement
15	Direction finding field strength measurement

Table 4-17: Strings returned.

"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
"DFL"	Direction finding level measurement
"AZIM"	Direction finding azimuth measurement

"DFQ"	Direction finding quality measurement
"DFFS"	Direction finding field strength measurement

[SENSe:]FUNCtion[:ON]:COUNt?

This query returns the number of active sensor functions.

Return values:
<function_count> Number of active sensor functions.

Example: `FUNCtion:COUNt?` -> 2

[SENSe:]GCONtrol:AUTO:TIME <gainctrl_time>

This command sets the gain control time.

Parameters:
<gainctrl_time> SLOW | DEFault | FAST

SLOW
Slow gain control time.

DEFault
Default gain control time.

FAST
Fast gain control time.

*RST: DEF

Example: `GCONtrol:AUTO:TIME FAST`

[SENSe:]GCONtrol:AUTO:TIME?

This query returns the gain control time.

Return values:
<gainctrl_time> SLOW | DEF | FAST

SLOW
Slow gain control time.

DEF
Default gain control time.

FAST
Fast gain control time.

Example: `GCONtrol:AUTO:TIME?` -> FAST

[SENSe:]GCONtrol[:FIXed | MGC] <mgc_value>

This command sets the MGC value.

Parameters:

<mgc_value> **<numeric_value>**
Gain control factor in dBµV.
-30 dBµV = no gain control -> maximum sensitivity.
110 dBµV = maximum gain control -> minimum sensitivity.

UP
Increases the MGC value by 1

DOWN
Decreases the MGC value by 1.

MINimum
Sets the minimum MGC value.

MAXimum
Sets the maximum MGC value.

*RST: 50 dBµV

Example: `GCONtrol 50`

[SENSe:]GCONtrol[:FIXed|MGC]?

This query returns the MGC value.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current MGC value.

MINimum
Returns the minimum MGC value.

MAXimum
Returns the maximum MGC value.

Return values:

<mgc_value> Gain control value.

Example: `GCONtrol?` -> 50

[SENSe:]GCONtrol:MODE <gainctrl_mode>

This command sets the gain control mode.

Parameters:

<gainctrl_mode> FIXed | MGC | AUTO | AGC

FIXed | MGC
Gain control is determined by the MGC value.

AUTO | AGC
Gain control is determined automatically (AGC).

*RST: AUTO

Example: `GCONtrol:MODE AUTO`

[SENSe:]GCONtrol:MODE?

This query returns the gain control mode.

Return values:

<gainctrl_mode> FIX | AUTO

FIX
Gain control is determined by the MGC value.

AUTO
Gain control is determined automatically (AGC).

Example: `GCONtrol:MODE?` -> AUTO

[SENSe:]MSCan:CHANnel <name>

This command sets the current memory channel.

The memory channels are addressed by text "MEM0" to "MEM9999" (memory channel 0 to memory channel 9999); the next free memory channel is addressed by ACTUAL. This command is not permitted during the memory scan.

Parameters:

<name> MEM0 to MEM9999 or NEXT.

*RST: MEM0

Example: MSCan:CHANnel MEM357

[SENSe:]MSCan:CHANnel?

This query returns the current memory channel.

Return values:

<channel_number> Number of the current memory channel.

Example: `MSCan:CHANnel?` -> 357

[SENSe:]MSCan:CONTrol:OFF <control_function> {,<control_function>}

This command switches one or several scan-control functions off.

Parameters:

<control_function> "STOP:SIGNal"

Switches signal-controlled dwell time on.

*RST: No control function is enabled following *RST

Example: `MSCan:CONTrol:OFF "STOP:SIGN"`

[SENSe:]MSCan:CONTrol:OFF?

This query returns a list of the scan-control functions which are switched off.

Return values:

<function_list> "STOP:SIGNal"

Signal-controlled dwell time is switched off.

Example: `MSCan:CONTrol:OFF?` -> "STOP:SIGN"

[SENSe:]MSCan:CONTrol[:ON] <control_function> {,<control_function>}

This command switches the STOP:SIGNal functions on.

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> "STOP:SIGNal"

Switches signal-controlled dwell time on.

*RST: No control function is enabled following *RST

Example: `MSCan:CONTrol "STOP:SIGN"`

[SENSe:]MSCan:CONTrol[:ON]?

This query returns a list of the scan-control functions which are switched on. If none are switched on, a zero string ("") is returned.

Return values:

<function_list> "STOP:SIGN" | ""

"STOP:SIGN"
Signal-controlled dwell time is switched on.

""
No control function is switched on.

Example: `MSCan:CONTrol?` -> "STOP:SIGN"

[SENSe:]MSCan:COUNt <scan_num>

This command sets the number of MSCANs.

Parameters:

<scan_num> **<numeric_value>**
Number of scans.

MINimum
Minimum number of scans.

MAXimum
Maximum number of scans.

INFinity
Infinite number of scans.

*RST: INFinity

Example: `MSCan:COUNt 100`

[SENSe:]MSCan:COUNt? <query_param>

This query returns the number of MSCANs.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current number of scans.

MINimum
Returns the minimum number of scans.

MAXimum
Returns the maximum number of scans.

Return values:

<scan_num> Number of scans. If the number is infinite, 9.9E37 is returned.

Example: `MSCan:COUNt?` -> 100

[SENSe:]MSCan:DIRection <direction>

This command sets the scan direction.

Parameters:

<direction> UP | DOWN

UP
Scans in the direction of ascending memory numbers.

DOWN
Scans in the direction of descending memory numbers.

*RST: UP

Example: MSCan:DIRection DOWN

[SENSe:]MSCan:DIRection?

This query returns the scan direction.

Return values:

<direction> UP | DOWN

UP
Scans in the direction of ascending memory numbers.

DOWN
Scans in the direction of descending memory numbers.

Example: `MSCan:DIRection?` -> DOWN

[SENSe:]MSCan:DWELl <dwell_time>

This command sets the dwell time with the hold criterion fulfilled.

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 the R&S EB500 if the squelch is switched off. The hold criterion is then fulfilled for each step.

Parameters:

<dwell_time>

<numeric_value>
Dwell time in seconds.

MINimum
Minimum dwell time.

MAXimum
Maximum dwell time.

INFinity
Infinite dwell time.

Range: 0.000 s to 10.000 s
Increment: 0.001 s
*RST: 0.500 s

Example: `MSCan:DWELl 10 ms`

[SENSe:]MSCan:DWELl? <query_param>

This query returns the dwell time.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current dwell time.

MINimum
Returns the minimum dwell time.

MAXimum
Returns the maximum dwell time.

Return values:

<dwell_time> Dwell time in seconds. If the number is infinite, 9.9E37 is returned.

Example: `MSCan:DWELl?` -> 0.010

[SENSe:]MSCan:HOLD:TIME <hold_time>

This command sets the hold time during signal-controlled scan continuation.

If the signal disappears during the dwell time, the hold time is started. As soon as the hold time expires, the scan is continued with the next frequency even if the dwell time has not yet expired.

If the signal exceeds the squelch threshold during the hold time, 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 insignificant unless control function "STOP:SIGNal" (see [SENSe:]MSCan:CONTrol[:ON] on page 280) is switched on.

Parameters:

<hold_time>

<numeric_value>
Hold time in seconds.

MINimum
Minimum hold time.

MAXimum
Maximum hold time.

Range: 0.000 s to 10.000 s
Increment: 0.001 s
*RST: 0.000 s

Example: `MSCan:HOLD:TIME 10 ms`

[SENSe:]MSCan:HOLD:TIME? <query_param>

This query returns the hold time.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current hold time.

MINimum
Returns the minimum hold time.

MAXimum
Returns the maximum hold time.

Return values:

<hold_time> Hold time in seconds.

Example: `MSCan:HOLD:TIME?` -> 0.010

[SENSe:]PSCan...

The PSCan system checks the frequency function of the unit in case a panorama scan was initiated by `[SENSe:]FREQuency:MODE`. Each scan is started only by `INITiate[:IMMediate]`.

Options: PSCan functions are only accessible with the installed software option Panorama Scan.

[SENSe:]PSCan:COUNt <cycle_count>

This command sets the number of cycle counts.

Parameters:

<cycle_count>

<numeric_value>
Number of cycles.

MINimum
Minimum number of cycles.

MAXimum
Maximum number of cycles

INFinity
Infinite number of cycles.

*RST: INFinity

Example: `PSCan:COUNt 100`

[SENSe:]PSCan:STEP <res_bandwidth>

This command sets the channel spacing and corresponding resolution bandwidth.

Parameters:

<res_bandwidth>

<numeric_value>
The following discrete values can be set:
100 Hz, 125 Hz, 200 Hz, 250 Hz, 500 Hz, 625 Hz, 1 kHz, 1.25 kHz, 2 kHz, 2.5 kHz, 3.125 kHz, 5 kHz, 6.25 kHz, 8.33 kHz, 10 kHz, 12.5 kHz, 20 kHz, 25 kHz, 50 kHz, 100 kHz, 200 kHz, 500 kHz, 1000 kHz, 2000 kHz

UP
Sets the next smaller resolution bandwidth.

DOWN
Sets the next larger resolution bandwidth.

MINimum
Sets the minimum resolution bandwidth.

MAXimum
Sets the maximum resolution bandwidth.

*RST: 100 kHz

Example: `PSCan:STEP 25 kHz`

[SENSe:]PSCan:STEP? <query_param>

This query returns the resolution bandwidth in PSCAN.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current resolution bandwidth.

MINimum
Returns the minimum resolution bandwidth.

MAXimum
Returns the maximum resolution bandwidth.

Return values:
<res_bandwidth> Resolution bandwidth in Hz.

Example: `PSCan:STEP?` -> 25000

SENSe:ROSCillator:EXTernal:FREQuency?

This query returns the external reference frequency.

Return values:
<ext_frequency> External reference frequency.

Example: `ROSCillator:EXTernal:FREQuency?` -> 10000000

[SENSe:]ROSCillator[:INTernal]:FREQuency?

This query returns the internal reference frequency.

Return values:
<int_frequency> Internal reference frequency.

Example: `ROSCillator:FREQuency?` -> 10000000

[SENSe:]ROSCillator:SOURce <source>

This command sets the reference frequency to be used.

Parameters:
<source> INTernal | EXTernal

INTernal
Internal reference oscillator.

EXTernal
External reference oscillator.

Example: `ROSCillator:SOURce EXTernal`

[SENSe:]ROSCillator:SOURce?

This query returns the reference oscillator to be used.

Return values:
<source> INT | EXT

INT
Internal reference oscillator.

EXT
External reference oscillator.

Example: `ROSCillator:SOURce?` -> EXT

[SENSe:]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]`.

[SENSe:]SWEep:CONTrol:OFF <control_function> {,<control_function>}

This command switches one or several control functions off.

Parameters:

<control_function> "STOP:SIGNal"

Switches signal-controlled scan continuation off.

*RST: No control function is switched on following *RST.

Example: `SWEep:CONTrol:OFF "STOP:SIGN"`

[SENSe:]SWEep:CONTrol:OFF?

This query returns the scan-control functions which are switched off.

Return values:

<function_list> "STOP:SIGN" | ""

"STOP:SIGN"
Signal-controlled scan continuation is switched off.

""
Zero string: no function is switched off.

Example: `SWEep:CONTrol?` -> "STOP:SIGN"

[SENSe:]SWEep:CONTrol[:ON] <control_function> {,<control_function>}

This command switches the "STOP:SIGNal" functions on.

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` on page 289.

Parameters:

<control_function> "STOP:SIGNal"

Switches signal-controlled scan continuation on.

*RST: No control function is switched on following *RST.

Example: `SWEep:CONTrol "STOP:SIGN"`

[SENSe:]SWEep:CONTrol[:ON]?

This query returns the scan-control functions which are switched on.

Return values:

<function_list> "STOP:SIGN" | ""

"STOP:SIGN"
Signal-controlled scan continuation is switched on.

""
Zero string: no function is switched on.

Example: `SWEep:CONTrol?` -> "STOP:SIGN"

[SENSe:]SWEep:COUNt <sweep_count>

This command sets the number of sweeps.

Parameters:

<sweep_count>

<numeric_value>
Number of sweeps.

MINimum
Minimum number of sweeps.

MAXimum
Maximum number of sweeps.

INFinity
Infinite number of sweeps.

*RST: INFinity

Example: `SWEep:COUNt 100`

[SENSe:]SWEep:COUNt? <query_param>

This query returns the number of sweeps.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current number of sweeps.

MINimum
Returns the minimum number of sweeps.

MAXimum
Returns the maximum number of sweeps.

Return values:

<sweep_count> Number of sweeps. If the number is infinite, 9.9E37 is returned.

Example: `SWEep:COUNt?` -> 100

[SENSe:]SWEep:DIRection <direction>

This command sets the scan direction.

Parameters:

<direction> UP | DOWN

UP
Scan with increasing frequency.

DOWN
Scan with decreasing frequency.

*RST: UP

Example: `SWEep:DIRection DOWN`

[SENSe:]SWEep:DIRection?

This query returns the scan direction.

Return values:

<direction> UP | DOWN

UP
Scan with increasing frequency.

DOWN
Scan with decreasing frequency.

Example: `SWEep:DIRection?` -> DOWN

[SENSe:]SWEep:DWELl <dwell_time>

This command sets the dwell time with the hold criterion fulfilled.

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 the R&S EB500 if the squelch is switched off. The hold criterion is then fulfilled for each step.

Parameters:

<dwell_time> **<numeric_value>**
Dwell time in seconds.

MINimum
Minimum dwell time.

MAXimum
Maximum dwell time.

INFinity
Infinite dwell time.

Range: 0.000 s to 10.000 s
Increment: 0.001 s
*RST: 0.500 s

Example: `SWEep:DWELl 10 ms`

[SENSe:]SWEep:DWELl? <query_param>

This query returns the dwell time.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current dwell time.

MINimum
Returns the minimum dwell time.

MAXimum
Returns the maximum dwell time.

Return values:

<dwell_time> Dwell time in seconds. If the dwell time is infinite, 9.9E37 is returned.

Example: `SWEep:DWELl?` -> 0.010

[SENSe:]SWEep:HOLD:TIME <hold_time>

This command sets the hold time during signal-controlled scan continuation.

If the signal disappears during the dwell time, the hold time is started. As soon as the hold time expires, the scan is continued with the next frequency even if the dwell time has not yet expired. If the signal exceeds the squelch threshold during the hold time, the hold time is reset.

The hold time is insignificant unless control function "STOP:SIGNal" (see `[SENSe:]SWEep:CONTrol[:ON]` on page 286) is switched on.

Parameters:

<hold_time> **<numeric_value>**
Hold time in seconds.

MINimum
Minimum hold time.

MAXimum
Maximum hold time.

Range: 0.000 s to 10.000 s
Increment: 0.001 s
*RST: 0.000 s

Example: `SWEep:HOLD:TIME 10 ms`

[SENSe:]SWEep:HOLD:TIME? <query_param>

This query returns the hold time during signal-controlled scan continuation.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current hold time.

MINimum
Returns the minimum hold time.

MAXimum
Returns the maximum hold time.

Return values:

<hold_time> Hold time in seconds.

Example: `SWEep:HOLD:TIME?` -> 0.010

[SENSe:]SWEep:STEP <step_width>

This command sets the step width for the frequency scan.

Parameters:

<step_width> **<numeric_value>**
Frequency value.

MINimum
Minimum frequency step width.

MAXimum
Maximum frequency step width.

Range: 1 Hz to 100 MHz
Increment: 1 Hz
*RST: 100 kHz

Example: `SWEep:STEP 25 kHz`

[SENSe:]SWEep:STEP? <query_param>

This query returns the step width for the frequency scan.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current step width.

MINimum
Returns the minimum step width.

MAXimum
Returns the maximum step width.

Return values:

<step_width> Step width in Hz.

Example: `SWEep:STEP?` -> 25000

[SENSe:]SWEep:SUPPress

This command inserts the current frequency into the suppress list. The range is obtained from the bandwidth according to the following formulae:

- SSTARTn = SENSe: FREQ - SENSe:BAND/2
- SSTOPn = SENSe: FREQ + SENSe: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, error -223 "Too much data" is generated.

This command is an event.

Example: `SWEep:SUPPress`

[SENSe:]SWEep:SUPPress:SORT

Sort and condense 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.

This command is an event.

Example: `SWEep:SUPPress:SORT`

4.5.14 STATus Subsystem

This subsystem controls the SCPI-defined status-reporting structures.

STATus:EXTension:CONDition?

This query returns the contents of the condition section of the "EXTension" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred as a decimal, binary or hexadecimal value in the ASCII code.

Example: `STATus:EXTension:CONDition?` -> #H0008

STATus:EXTension:ENABle <numeric_value>

This command sets the "Enable" section of the "EXTension" status register.

Parameters:

<numeric_value> Value of the "ENABLe" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:EXTension:ENABle #H0008`

STATus:EXTension:ENABle?

This query returns the contents of the "Enable" section of the "EXTension" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:ENABle?` -> #H0008

STATus:EXTension[:EVENt]?

This query returns the contents of the "Event" section of the "EXTension" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension?` -> #H0008

STATus:EXTension:FANout:CONDition?

This query returns the contents of the condition section of the "EXTension FANout" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred as a decimal, binary or hexadecimal value in the ASCII code.

Example: `STATus:EXTension:FANout:CONDition?` -> #H0008

STATus:EXTension:FANout:ENABle <numeric_value>

This command sets the "Enable" section of the "EXTension FANout" status register.

Parameters:

<numeric_value> Value of the "ENABLe" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:EXTension:FANout:ENABle #H0008`

STATus:EXTension:FANout:ENABle?

This query returns the contents of the "Enable" section of the "EXTension FANout" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:FANout:ENABle?` -> #H0008

STATus:EXTension:FANout[:EVENt]?

This query returns the contents of the "Event" section of the "EXTension FANout" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:FANout?` -> #H0008

STATus:EXTension:FANout:NTRansition <numeric_value>

This command sets the negative transition filter of the "EXTension FANout" status register.

Parameters:

<numeric_value> Value of the "NTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:EXTension:FANout:NTRansition #H0000`

STATus:EXTension:FANout:NTRansition?

This query returns the negative transition filter of the "EXTension FANout" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:FANout:NTRansition?` -> 0

STATus:EXTension:FANout:PTRansition <numeric_value>

This command sets the positive transition filter of the "EXTension FANout" status register.

Parameters:

<numeric_value> Value of the "PTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:EXTension:FANout:PTRansition #B11111111`

STATus:EXTension:FANout:PTRansition?

This query returns the positive transition filter of the "EXTension FANout" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:FANout:PTRansition?` -> 255

STATus:EXTension:NTRansition <numeric_value>

This command sets the negative transition filter of the "EXTension" status register.

Parameters:

<numeric_value> Value of the "NTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:EXTension:NTRansition #H0000`

STATus:EXTension:NTRansition?

This query returns the negative transition filter of the "EXTension" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:NTRansition?` -> 0

STATus:EXTension:PTRansition <numeric_value>

This command sets the positive transition filter of the "EXTension" status register.

Parameters:

<numeric_value> Value of the "PTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:EXTension:PTRansition #B11111111`

STATus:EXTension:PTRansition?

This query returns the positive transition filter of the "EXTension" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:EXTension:PTRansition?` -> 255

STATus:OPERation:CONDition?

This query returns the contents of the condition section of the "OPERation" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred as a decimal, binary or hexadecimal value in the ASCII code.

Example: `STATus:OPERation:CONDition?` -> #H0008

STATus:OPERation:ENABle <numeric_value>

This command sets 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: Not changed by *RST

Example: `STATus:OPERation:ENABle #H0008`

STATus:OPERation[:EVENt]?

This query returns the contents of the "Event" section of the "OPERation" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:OPERation?` -> #H0008

STATus:OPERation:NTRansition <numeric_value>

This command sets 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: Not changed by *RST

Example: `STATus:OPERation:NTRansition #H0000`

STATus:OPERation:NTRansition?

This query returns the negative transition filter of the "OPERation" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:OPERation:NTRansition?` -> 0

STATus:OPERation:PTRansition <numeric_value>

This command sets 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: Not changed by *RST

Example: `STATus:OPERation:PTRansition #B11111111`

STATus:OPERation:PTRansition?

This query returns the positive transition filter of the "OPERation" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:OPERation:PTRansition?` -> 255

STATus:PRESet

This command sets the status registers to default values:

Register	ENABle/PTR/NTR	PRESet value
STATus:OPERational	ENABle PTR NTR	0 65535 0
STATus:QUEStionable	ENABle PTR NTR	0 65535 0
STATus:TRACe	ENABle PTR NTR	65535 65535 0

Register	ENABle/PTR/NTR	PRESet value
STATus:EXTension	ENABle PTR NTR	65535 65535 0
STATus:OPERation:SWEep	ENABle PTR NTR	65535 65535 0

This command is an event.

Example: `STATus:PRESet`

STATus:QUEStionable:CONDition?

This query returns the contents of the condition section of the "QUEStionable" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred as a decimal, binary or hexadecimal value in the ASCII code.

Example: `STATus:QUEStionable:CONDition?` -> #H0008

STATus:QUEStionable:ENABle <numeric_value>

This command sets the "Enable" section of the "QUEStionable" status register.

Parameters:

<numeric_value> Value of the "ENABLe" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:QUEStionable:ENABle #H0008`

STATus:QUEStionable:ENABle?

This query returns the contents of the "Enable" section of the "QUEStionable" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:QUEStionable:ENABle?` -> #H0008

STATus:QUEStionable[:EVENt]?

This query returns the contents of the "Event" section of the "QUEStionable" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:QUEStionable?` -> #H0008

STATus:QUEStionable:NTRansition <numeric_value>

This command sets the negative transition filter of the "QUEStionable" status register.

Parameters:

<numeric_value> Value of the "NTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:QUEStionable:NTRansition #H0000`

STATus:QUEStionable:NTRansition?

This query returns the negative transition filter of the "QUEStionable" status register.

Return values:

<reg_contents> Depending on the setting by command `FORMat:SREGister` on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:QUEStionable:NTRansition?` -> 0

STATus:QUEStionable:PTRansition <numeric_value>

This command sets the positive transition filter of the "QUEStionable" status register.

Parameters:

<numeric_value> Value of the "PTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:QUEStionable:PTRansition #B11111111`

STATus:QUEStionable:PTRansition?

This query returns the positive transition filter of the "QUEStionable" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:QUEStionable:PTRansition?` -> 255

STATus:QUEue[:NEXT]?

This query returns the next entry from the error queue.

Return values:

<entry> Next entry in the error queue.

Example: `STATus:QUEue?` -> 0, "No Error"

STATus:TRACe:CONDition?

This query returns the contents of the condition section of the "TRACe" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred as a decimal, binary or hexadecimal value in the ASCII code.

Example: `STATus:TRACe:CONDition?` -> #H0008

STATus:TRACe:ENABle <numeric_value>

This command sets the "Enable" section of the "TRACe" status register.

Parameters:

<numeric_value> Value of the "ENABLe" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:TRACe:ENABle #H0008`

STATus:TRACe:ENABle?

This query returns the contents of the "Enable" section of the "TRACe" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:TRACe:ENABle?` -> #H0008

STATus:TRACe[:EVENt]?

This query returns the contents of the "Event" section of the "TRACe" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:TRACe?` -> #H0008

STATus:TRACe:NTRansition <numeric_value>

This command sets the negative transition filter of the "TRACe" status register.

Parameters:

<numeric_value> Value of the "NTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:TRACe:NTRansition #H0000`

STATus:TRACe:NTRansition?

This query returns the negative transition filter of the "TRACe" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:TRACe:NTRansition?` -> 0

STATus:TRACe:PTRansition <numeric_value>

This command sets the positive transition filter of the "TRACe" status register.

Parameters:

<numeric_value> Value of the "PTRansition" section (0..65535 or #H0000..#HFFFF or #B0..#B1111111111111111).

*RST: Not changed by *RST

Example: `STATus:TRACe:PTRansition #B11111111`

STATus:TRACe:PTRansition?

This query returns the positive transition filter of the "TRACe" status register.

Return values:

<reg_contents> Depending on the setting by command FORMat:SREGister on page 224, the contents of the register are transferred decimally, binary or hexadecimally in the ASCII code.

Example: `STATus:TRACe:PTRansition?` -> 255

4.5.15 SYSTem Subsystem

SYSTem:ANTenna:FACTor:CATalog?

This query returns the names of the available antenna-factor data sets.

Return values:

<name_list> Comma-separated list of strings.

Example: `SYST:ANT:FACT:CAT?` -> "HE200 0.009-30MHz", "HE200 20-200MHz", "HE200 200-500MHz", "HE200 500-3000MHz", "HALFWAVE DIPOL", "HK033", "HK014 100-1300MHz", "HK014V12 80-1600MHz"

SYSTem:ANTenna:PROPerty:FREQuency:STARt? <name>

This query returns the lowest usable frequency of the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<frequency> Lowest usable frequency.

Example: `SYST:ANT:PROP:FREQ:STAR? "ADD071"` -> 1300000000

SYSTem:ANTenna:PROPerty:FREQuency:STOP? <name>

This query returns the highest usable frequency of the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<frequency> Highest usable frequency.

Example: `SYST:ANT:PROP:FREQ:STOP? "ADD071"` -> 3000000000

SYSTem:ANTenna:PROPerty:CODE? <name>

This query returns the identification code of the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<code> DF antenna identification code (0 .. 255).

Example: `SYST:ANT:PROP:CODE? "ADD071"` -> 11

SYSTem:ANTenna:PROPerty:TYPE? <name>

This query returns the type of the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<type> **RX**
Antenna type is "Receiver".
DF
Antenna type is "Direction Finder".

Example: `SYST:ANT:PROP:TYPE? "ADD071"` -> DF

SYSTem:ANTenna:PROPerty:PREAmplifier? <name>

This query returns whether or not the named antenna has a switchable preamplifier.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<preamplifier> 0 | 1
0
The antenna does not have a switchable preamplifier.
1
The antenna has an integrated switchable preamplifier.

Example: `SYST:ANT:PROP:PREA? "ADD071"` -> 0

SYSTem:ANTenna:PROPerty:ELEVation? <name>

This query returns whether or not the named antenna can be used for elevation measurements.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<elevation> 0 | 1
0
The antenna cannot be used for elevation measurements.
1
The antenna can be used for elevation measurements.

Example: `SYST:ANT:PROP:ELEV? "ADD071"` -> 0

SYSTem:ANTenna:RX[:SETup]:CLEar[<numeric_suffix]

This command clears the entry in the row addressed by the numeric suffix.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Example: `SYST:ANT:RX:CLE2`

SYSTem:ANTenna:RX[:SETup]:FACtor[<numeric_suffix>] <name>

This command sets the antenna factor data set.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Parameters:

<name> Name of the antenna factor data set.

Example: `SYST:ANT:RX:FACT2 "HE200 20-200MHZ"`

SYSTem:ANTenna:RX[:SETup]:FACtor[<numeric_suffix>]?

This query returns the name of the antenna factor data set.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Return values:

<name> Name of the antenna factor data set.

Example: `SYST:ANT:RX:FACT2?` -> "HE200 20-200MHZ"

SYSTem:ANTenna:RX[:SETup]:FREQuency:RANGe:HF [<numeric_suffix>][:UPPer] <upper_limit>

This command sets the upper receive frequency limit of the HF tuner for the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Parameters:

<upper_limit>

<numeric_value>
Upper receive frequency limit of the HF tuner.

MINimum
Sets the upper receive frequency limit to the minimum value.

MAXimum
Sets the upper receive frequency limit to the maximum value.

Example: `SYST:ANT:RX:FREQ:RANG:HF 27 MHz`

SYSTem:ANTenna:RX[:SETup]:FREQuency:RANGe:HF [<numeric_suffix>][:UPPer]? <query_param>

This query returns the upper receive frequency limit of the HF tuner for the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the upper receive frequency limit of the HF tuner.

MINimum
Returns the minimum value of the upper receive frequency limit of the HF tuner.

MAXimum
Returns the maximum value of the upper receive frequency limit of the HF tuner.

Return values:

<upper_limit> Upper receive frequency limit.

Example: `SYST:ANT:RX:FREQ:RANG:HF?` -> 27000000

SYSTem:ANTenna:RX[:SETup]:FREQuency:STARt[<numeric_suffix>] <frequency>

This command sets the lowest used frequency of the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Parameters:

<frequency> **<numeric_value>**
Lowest used frequency value.

MINimum
Sets the lowest used frequency to the minimum value.

MAXimum
Sets the lowest used frequency to the maximum value.

Example: `SYST:ANT:RX:FREQ:STAR 20 MHz`

SYSTem:ANTenna:RX[:SETup]:FREQuency:STARt [<numeric_suffix>]? <query_param>

This query returns the lowest used frequency of the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the lowest used frequency.

MINimum
Returns the minimum value of the lowest used frequency.

MAXimum
Returns the maximum value of the lowest used frequency.

Return values:

<frequency> Frequency value.

Example: `SYST:ANT:RX:FREQ:STAR?` -> 20000000

SYSTem:ANTenna:RX[:SETup]:FREQuency:STOP[<numeric_suffix>] <frequency>

This command sets the highest used frequency of the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Parameters:

<frequency> **<numeric_value>**
Highest used frequency value.

MINimum
Sets the highest used frequency to the minimum value.

MAXimum
Sets the highest used frequency to the maximum value.

Example: `SYST:ANT:RX:FREQ:STOP 180 MHz`

SYSTem:ANTenna:RX[:SETup]:FREQuency:STOP[<numeric_suffix>]? <query_param>

This query returns the highest used frequency of the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the highest used frequency.

MINimum
Returns the minimum value of the highest used frequency.

MAXimum
Returns the maximum value of the highest used frequency.

Return values:

<frequency> Frequency value.

Example: `SYST:ANT:RX:FREQ:STOP?` -> 200000000

SYSTem:ANTenna:RX[:SETup]:NAME[<numeric_suffix>] <name>

This command sets the antenna name.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Parameters:

<name> Name of the antenna.

Example: `SYST:ANT:RX:NAME2 "HE200 20-200MHZ_A0"`

SYSTem:ANTenna:RX[:SETup]:NAME[<numeric_suffix>]?

This query returns the antenna name.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Return values:

<name> Name of the antenna.

Example: `SYST:ANT:RX:NAME2?` -> "HE200 20-200MHZ_A0"

SYSTem:ANTenna:RX[:SETup]:OUTPut:BYTAux [<numeric_suffix>][:STATe] <byte_value>

This command sets the low byte at X4 AUX on the rear panel.

Parameters:

<byte_value> Value of the AUX bytes (0 to 255, #H00 to #HFF or #B0 to #B11111111).

Example: `SYST:ANT:RX:OUTP:BYTA 7`

SYSTem:ANTenna:RX[:SETup]:OUTPut:BYTAux [<numeric_suffix>][:STATe] ? <byte_value>

This command returns the low byte at X4 AUX on the rear panel.

Parameters:

<byte_value> Value of the AUX bytes (0 to 255, #H00 to #HFF or #B0 to #B11111111).

Example: `SYST:ANT:RX:OUTP:BYTA?`

SYSTem:ANTenna:RX[:SETup]:ROUTe:POLarization[<numeric_suffix>] <polarization>

This command sets the polarization of the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Parameters:

<polarization> AUTO | VERTical | HORizontal | LEFT | RIGHt

AUTO
Automatic or no polarization.

VERTical
Vertical polarization.

HORizontal
Horizontal polarization.

LEFT
Left-hand circular polarization.

RIGHt
Right-hand circular polarization.

Example: `SYST:ANT:RX:ROUT:POL HOR`

SYSTem:ANTenna:RX[:SETup]:ROUTe:POLarization[<numeric_suffix>]?

This query returns the polarization of the antenna.

Suffix:

<numeric_suffix> Row to be addressed within the table of RX antenna definitions. The table comprises a maximum of twelve rows.

Return values:

<polarization> AUTO | VERT | HOR | LEFT | RIGH

AUTO
Automatic or no polarization.

VERT
Vertical polarization.

HOR
Horizontal polarization.

LEFT
Left-hand circular polarization.

RIGH
Right-hand circular polarization.

Example: `SYST:ANT:RX:ROUT:POL?` -> AUTO

SYSTem:ANTenna[:SETup]:COMPass <name>,<compass>

This command sets the used compass for the named antenna.

Parameters:

<name> Name of the antenna, e.g. "ADD071".

<compass> Name of the used compass e.g "COMPASS_SW".

Example: `SYST:ANT:COMP "ADD071","COMPASS_SW"`

SYSTem:ANTenna[:SETup]:COMPass? <name>

This query returns the used compass for the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<compass> Name of the used compass e.g "COMPASS_SW".

Example: `SYST:ANT:COMP? "ADD071"` -> "COMPASS_SW"

SYSTem:ANTenna[:SETup]:FREQuency:STARt <name>,<numeric_value>

This command sets the lowest used frequency of the named antenna.

Parameters:

<numeric_value> Lowest frequency to be used.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Example: `SYST:ANT:FREQ:STAR "ADD071",1400000000`

SYSTem:ANTenna[:SETup]:FREQuency:STARt? <name>

This query returns the lowest used frequency of the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<frequency> Lowest used frequency.

Example: `SYST:ANT:FREQ:STAR? "ADD071"` -> 1400000000

SYSTem:ANTenna[:SETup]:FREQuency:STOP <name>,<numeric_value>

This command sets the highest used frequency of the named antenna.

Parameters:

<numeric_value> Highest frequency to be used.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Example: `SYST:ANT:FREQ:STOP "ADD071",2800000000`

SYSTem:ANTenna[:SETup]:FREQuency:STOP? <name>

This query returns the highest used frequency of the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<frequency> Highest used frequency.

Example: `SYST:ANT:FREQ:STOP? "ADD071"` -> 2800000000

SYSTem:ANTenna[:SETup]:NORTh <name>,<numeric_value>

This command sets the north correction for the named antenna.

Parameters:

<name> Name of the antenna, e.g. "ADD071".

<numeric_value> North correction in degrees (0.0 … 359.9).

Example: `SYST:ANT:NORT "ADD071",1.5`

SYSTem:ANTenna[:SETup]:NORTh? <name>

This query returns the north correction for the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "ADD071".

Return values:

<north_correction> North correction value in degrees (0.0 … 359.9).

Example: `SYST:ANT:NORT? "ADD071"` -> 1.6

SYSTem:ANTenna[:SETup]:ROUTe:HF[:INPut] <name>,<channel_list>

This command sets the used HF antenna input for the named antenna.

Parameters:

<name> Name of the antenna, e.g. "HE200 0.009-30MHZ_A0".

<channel_list> Used HF antenna input:
(@0) for antenna input HF/V/UHF (X13)
(@1) for antenna input HF (X14)

Example: `SYST:ANT:ROUT:HF "HE200 0.009-30MHZ_A0",(@1)`

SYSTem:ANTenna[:SETup]:ROUTe:HF[:INPut]? <name>

This query returns the used HF antenna input for the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "HE200 0.009-30MHZ_A0".

Return values:

<channel_list> Used HF antenna input:
#14(@0) for antenna input HF/V/UHF (X13)
#14(@1) for antenna input HF (X14)

Example: `SYST:ANT:ROUT:HF? "HE200 0.009-30MHZ_A0"` -> #14(@1)

SYSTem:ANTenna[:SETup]:ROUTe:VUHF[:INPut] <name>,<channel_list>

This command sets the used VUHF antenna input for the named antenna.

Parameters:

<name> Name of the antenna, e.g. "ADD071".

<channel_list> Used VUHF antenna input:
(@0) for antenna input HF/V/UHF (X13)

Example: `SYST:ANT:ROUT:VUHF "ADD071",(@0)`

SYSTem:ANTenna[:SETup]:ROUTe:VUHF[:INPut]? <name>

This query returns the used VUHF antenna input for the named antenna.

Query parameters:

<name> Name of the antenna, e.g. "HE200 0.009-30MHZ_A0".

Return values:

<channel_list> Used VUHF antenna input:
#14(@0) for antenna input HF/V/UHF (X13)

Example: `SYST:ANT:ROUT:VUHF? "ADD071"` -> #14(@0)

SYSTem:ANTenna:USED?

This query returns the name of the currently used antenna.

The usage depends on current frequency, application mode ("RX" or "DF") and polarization. For a list of available antennas, see also command `DIAGnostic[:SERVice]:INFO:PERipheral` on page 214.

Return values:

<antenna_name> Name of the antenna used.

Example: `SYST:ANT:USED?` -> "ADD197_V"

SYSTem:AUDio:BALance <balance>

This command sets the AF balance for the headphones.

The parameter is rounded to the next discrete value which can be set internally.

Parameters:

<balance>

<numeric_value>
AF balance for the headphones.

MINimum
Only left AF channel.

MAXimum
Only right AF channel.

Range: -0.50 (left) to 0.50 (right)
Increment: 0.01
*RST: 0.00

Example: `SYSTem:AUDio:BALance 0.5`

SYSTem:AUDio:BALance? <query_param>

This query returns the AF balance for the headphones.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current balance.

MINimum
Returns the minimum balance.

MAXimum
Returns the maximum balance.

Return values:

<balance> AF balance.

Example: `SYSTem:AUDio:BALance?` -> 0.5

SYSTem:AUDio:DEModulator:INVerse:FREQuency <osc_frequency>

This command sets the oscillator frequency for the inverse AF demodulation.

Query parameters:

<osc_frequency> **<numeric_value>**
Oscillator frequency in Hz or kHz.

UP
Increases the oscillator frequency by 1 Hz.

DOWN
Decreases the oscillator frequency by 1 Hz.

MIN
Sets the minimum oscillator frequency.

MAX
Sets the maximum oscillator frequency.

*RST: 1000 Hz

Example: `SYST:AUD:DEM:INV:FREQ` 1.5 kHz

SYSTem:AUDio:DEModulator:INVerse:FREQuency? <query_param>

This query returns the oscillator frequency for the inverse AF demodulation.

Parameters:

<osc_frequency> Oscillator frequency value in Hz.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current oscillator frequency.

MINimum
Returns the minimum oscillator frequency.

MAXimum
Returns the maximum oscillator frequency.

Example: `SYST:AUD:DEM:INV:FREQ?` 1500

SYSTem:AUDio:DEModulator:INVerse[:STATe] <dem_audio_state>

This command switches the inverse AF demodulation on or off.

Query parameters:

<dem_audio_state> ON | OFF

ON
Inverse demodulation AF on.

OFF
Inverse demodulation AF off.

*RST: OFF

Example: `SYST:AUD:DEM:INV` ON

SYSTem:AUDio:DEModulator:INVerse[:STATe]?

This query returns the state of the inverse AF demodulation.

Return values:

<dem_audio_state> 0 | 1

0
Inverse AF demodulation is switched off.

1
Inverse AF demodulation is switched on.

Example: `SYST:AUD:DEM:INV?` 1

SYSTem:AUDio:DEModulator:BALance <dem_balance>

This command sets the balance of the receiver demodulation path.

Query parameters:

<dem_balance>

<numeric_value>
balance of the receiver demodulation path

MINimum
Only left channel

MAXimum
Only right channel.

Range: -0.50 (left) to 0.50 (right)
Increment: 0.01
*RST: ON

Example: `SYST:AUD:DEM:BAL` 0.5

SYSTem:AUDio:DEModulator:BALance?

This query returns the balance of the receiver demodulation path.

Parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current balance of the receiver demodulation path.

MINimum
Returns the minimum value.

MAXimum
Returns the maximum value.

Return values:

<dem_balance> Balance of the receiver demodulation path.

Example: `SYST:AUD:DEM:BAL?` 0.50

SYSTem:AUDio:DEModulator:STATe <dem_audio_state>

This command switches the AF demodulation on or off.

Query parameters:

<dem_audio_state> ON | OFF

ON
Demodulation AF on.

OFF
Demodulation AF off.

*RST: ON

Example: `SYST:AUD:DEM` OFF

SYSTem:AUDio:DEModulator:STATe?

This query returns the state of the demodulation AF.

Return values:

<dem_audio_state> 0 | 1

0
Demodulation AF is switched off.

1
Demodulation AF is switched on.

Example: `SYST:AUD:DEM?` 0

SYSTem:AUDio:DEModulator:VOLume <dem_volume>

This command sets the demodulation volume.

Query parameters:

<dem_volume> **<numeric_value>**
Demodulation volume from 0 to 1.
0 = no demodulation volume
1 = full demodulation volume

MINimum
No AF

MAXimum
Full demodulation volume.

Range: 0.00 to 1.00
Increment: 0.01
*RST: 0.00

Example: `SYST:AUD:DEM:VOL` 0.5

SYSTem:AUDio:DEModulator:VOLume?

This query returns the demodulation volume.

Parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current demodulation volume.

MINimum
Returns the minimum demodulation volume.

MAXimum
Returns the maximum demodulation volume.

Example: `SYST:AUD:DEM:VOL?` 0.50

SYSTem:AUDio:REMote:MODe <af_mode>

This command sets the mode of the digital AF that is transferred via the remote control interface per UDP. See also chapter 7, "LAN Configuration", on page 429 .

Parameters:

<af_mode> Modes 0 to 12 of digital AF. See the table below for details.

*RST: 0

Example: `SYSTem:AUDio:REMote:MODe 5`

Table 4-18: AF modes.

Mode	Sampling rate [kHz]	Bits per sam-ple	Channels	Data rate [kbyte/s]	Length per frame [bytes]
0	-	-	-	0	
1	32	16	2	128	4
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

SYSTem:AUDio:REMote:MODe?

This query returns the current digital AF mode.

Return values:
<af_mode> AF mode. See table 4-18 for details.

Example: `SYSTem:AUDio:REMote:MODe?` -> 5

SYSTem:AUDio:VOLume <volume>

This command sets the volume of AF for loudspeakers and headphones.

The parameter is rounded to the next internally settable discrete value.

Parameters:
<volume>
<numeric_value>
Volume of AF from 0 to 1.
MINimum
No AF.
MAXimum
full volume of AF

Range: 0 (off) to 1 (full)
Increment: 0.01
*RST: 0.00

Example: `SYSTem:AUDio:VOLume 0.5`

SYSTem:AUDio:VOLume? <query_param>

This query returns the AF volume.

Parameters:
<query_param> none | MINimum | MAXimum
none
Returns the current volume.
MINimum
Returns the minimum volume.
MAXimum
Returns the maximum volume.

Return values:
<volume> AF volume.

Example: `SYSTem:AUDio:VOLume?` -> 0.5

SYSTem:CLOCk:ORIGin?

This query returns the origin of the latest clock setting.

Return values:

<origin> MAN | BAC | GPS | NTS

MAN
The clock was set manually.

BAC
The clock was set upon booting according to the real time clock.

GPS
The clock was set by a connected GPS.

NTS
The clock was set by querying a network time server (NTS).

Example: `SYST:CLOC:ORIG?` -> BAC

SYSTem:CLOCk:SETDate?

This query returns the date the clock was last set.

Return values:

<date> The date the clock was last set in the format <year>,<month>,<day>.

Example: `SYST:CLOC:SETD?` -> 2011,05,17

SYSTem:CLOCk:SETTime?

This query returns the time the clock was last set.

Return values:

<time> The time the clock was set in the format <hour>,<minute>,<second>.

Example: `SYST:CLOC:SETT?` -> 05,58,01

SYSTem:COMMunicate:CLIents?

This query returns information on the clients currently connected.

Return values:

<client_list> Comma-separated list of IP addresses identifying the connected clients. The requesting client is named first in the list. A client connected via the serial interface is indicated by “0.0.0.0”

Example: `SYST:COMM:CLI?` -> "10.8.10.230","172.16.2.10"

SYSTem:COMMunicate:LAN|SOCKet:ACTual:ADDress <ip_address>

This command sets the actual IP address for the LAN interface

Example: SYSTem:COMMunicate:LAN:ACTual:ADDRess "089.010.011.023"

SYSTem:COMMunicate:LAN|SOCKet:ACTual:PORT <port_number>

This command sets the actual port number for the LAN interface.

Example: SYSTem:COMMunicate:LAN:PORT 6000

SYSTem:COMMunicate:LAN|SOCKet:PING:PERiod <period>

This command sets the period or repetition time for the periodic `ping` function in seconds. The minimum time is 1 second.

Parameters:

<period>

<numeric_value>
Period in seconds.

MINimum
Minimum period.

MAXimum
Maximum period.

*RST: 5 s

Example: `SYST:COMM:LAN:PING:PER 5`

SYSTem:COMMunicate:LAN|SOCKet:PING:PERiod? <query_param>

This query returns the period set for the `ping` function.

Parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current period.

MINimum
Returns the minimum period.

MAXimum
Returns the maximum period.

Return values:

<period> Period set for the `ping` function.

Example: `SYST:COMM:LAN:PING:PER?` -> 5

SYSTem:COMMunicate:LAN|SOCKet:PING[:STATe] <state>

This command switches the periodic `ping` on or off. For safety reasons, connection monitoring by periodic `ping` is switched on after power-on.

The `ping` subsystem controls the monitoring of connections with UDP clients.

If a client configures the device to send UDP data, the connection to this client is continuously monitored by a periodic `ping`. If there is no response after the 5th attempt, the UDP data output to this client is stopped. The device continues `ping`ing the client to see whether or not it has come alive again. If it has, the UDP data output is switched on again.

Implementation of this behavior was necessary because some switches in a network react to disconnection of a client with broadcasting the UDP data to all their outputs. This may lead to a network collapse.

On `*RST` the parameters of this subsystem are not affected.

Parameters:

<state> ON | OFF

ON
Switches the periodic `ping` on.

OFF
Switches the periodic `ping` off.

*RST: Not affected

Example: `SYST:COMM:LAN:PING OFF`

SYSTem:COMMunicate:LAN|SOCKet:PING[:STATe]?

This query returns the state of the periodic `ping` function.

Return values:

<state> 0 | 1

0
The periodic `ping` is switched off.

1
The periodic `ping` is switched on.

Example: `SYST:COMM:LAN:PING?` -> 0

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]:DGATeway <gateway>

This command sets the persistently stored gateway for the LAN interface.

Example: SYSTem:COMMunicate:LAN:DGATeway "089.000.008.015"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]:SMASk <subnet_mask>

This command sets the persistently stored subnet mask for the LAN interface.

Example: SYSTem:COMMunicate:LAN:SMASk "255.000.000.000"

SYSTem:COMMunicate:LAN|SOCKet:PING[:STATe] <state>

This command switches the periodic `ping` on or off. For safety reasons, connection monitoring by periodic `ping` is switched on after power-on.

The ping subsystem controls the monitoring of connections with UDP clients.

If a client configures the device to send UDP data, the connection to this client is continuously monitored by a periodic ping. If there is no response after the 5th attempt, the UDP data output to this client is stopped. The device continues pinging the client to see whether or not it has come alive again. If it has, the UDP data output is switched on again.

Implementation of this behavior was necessary because some switches in a network react to disconnection of a client with broadcasting the UDP data to all their outputs. This may lead to a network collapse.

On *RST the parameters of this subsystem are not affected.

Parameters:

<state> ON | OFF

ON
Switches the periodic ping on.

OFF
Switches the periodic ping off.

*RST: Not affected

Example: `SYST:COMM:LAN:PING OFF`

SYSTem:COMMunicate:LAN|SOCKet:PING[:STATe]?

This query returns the state of the periodic ping function.

Return values:

<state> 0 | 1

0
The periodic ping is switched off.

1
The periodic ping is switched on.

Example: `SYST:COMM:LAN:PING?` -> 0

SYSTem:COMMunicate:LAN|SOCKet:PING:PERiod <period>

This command sets the period or repetition time for the periodic ping function in seconds. The minimum time is 1 second.

Parameters:

<period> **<numeric_value>**
Period in seconds.

MINimum
Minimum period.

MAXimum
Maximum period.

*RST: 5 s

Example: `SYST:COMM:LAN:PING:PER 5`

SYSTem:COMMunicate:LAN|SOCKet:PING:PERiod? <query_param>

This query returns the period set for the `ping` function.

Parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current period.

MINimum
Returns the minimum period.

MAXimum
Returns the maximum period.

Return values:

<period> Period set for the `ping` function.

Example: `SYST:COMM:LAN:PING:PER?` -> 5

SYSTem:COMMunicate:SERial:BYTeesc

Switching the Byte-Escaping mechanism for serial transmission on or off.

Return values:

<boolean> ON | OFF

ON
Byte-Escaping on.

OFF
Byte-Escaping off.

Example: `SYST:COMM:SER:BYT` ON

SYSTem:COMMunicate:SERial:BYTeesc?

Query of the state of the Byte-Escaping mechanism whether it's set on or off for serial transmission.

Example: `SYST:COMM:SER:BYT?` -> 1

SYSTem:COMPass:COMMand <compass_name>,<compass_cmd>

This command sends a command to the named compass.

Parameters:

<compass_name> The name of the compass.

<compass_cmd> The command to be sent to the compass.

Example: `SYST:COMP:COMM "GH150@ADD0119","=ce1"`

SYSTem:COMPass:DATA? <name>

This query returns the compass value and the heading type of the named compass. The two resulting values are separated by a comma.

Query parameters:

<name>	Name of the compass in string form, e.g. "COMPASS_SW" or "COMPASS_NMEA".

Return values:

<compass_data>	<compass_value>, <heading_type> **<compass_value>** Compass value in degrees (0.0 … 359.9). **<heading_type>** The heading type is one of the following: UNKN: Compass with unknown heading. COMP: Compass value uncorrected. MAGN: Compass value corrected to magnetic north. TRUE: Compass value corrected to true heading. BAD: Compass value of GPS compass is bad because the movement is too slow.
Example:	`SYST:COMP:DATA? "COMPASS_NMEA"` -> 272.2,COMP

SYSTem:COMPass:HEADing <name>,<compass_value>

This command sets the heading value of the SW compass.

Parameters:

<name>	Name of the compass. This must be "COMPASS_SW".
<compass_value>	Heading value. *RST: 0
Example:	`SYST:COMP:HEAD "COMPASS_SW",272.2`

SYSTem:COMPass:HEADing? <name>

This query returns the heading value of a real or SW compass.

Query parameters:

<name>	Name of the compass in string form, e.g. "COMPASS_SW" or "COMPASS_NMEA".

Return values:

<compass_value>	Heading value of the compass.
Example:	`SYST:COMP:HEAD? "COMPASS_NMEA"` -> 272.2,COMP

SYSTem:COMPass:HEADing:OFFSet <name>,<offset>

This command sets the mechanical offset (e.g against the vehicle axis) of the named compass.

Parameters:

<name>	Name of the compass in string form, e.g. "COMPASS_SW" or "COMPASS_NMEA".
<offset>	**<numeric_value>** Compass heading offset (0.0 …359.9). **OFF** Compass heading offset not used.

Example: `SYST:COMP:HEAD:OFFS "COMPASS_NMEA",1.7`

SYSTem:COMPass:HEADing:OFFSet? <name>

This query returns the mechanical offset (e.g against the vehicle axis) of the named compass.

Query parameters:

<name>	Name of the compass in string form, e.g. "COMPASS_SW" or "COMPASS_NMEA".

Return values:

<offset>	**<numeric_value>** Compass heading offset (0.0 …359.9). **OFF** Compass heading offset not used.

Example: `SYST:COMP:HEAD:OFFS? "COMPASS_NMEA"` -> 1.7

SYSTem:COMPass:REPLy? <compass_name>

This query returns the latest reponse from the compass.

Parameters:

<compass_name>	The name of the compass.

Return values:

<compass_reply>	Latest response from the compass.

Example: `SYSTem:COMPass:REPLy? <compass_name>` -> “> 225.0”

SYSTem:DATE <date>

This command sets the date of the clock in the processor board.

Parameters:

<date> <year>,<month>,<day>

<year>
Four-digit number greater than 2000.

<month>
1 to 12.

<day>
1 to 31 (depending on month and year).

*RST: Not affected.

Example: `SYSTem:DATE 2008,4,17`

SYSTem:DATE?

This query returns the current date.

Return values:

<date> Current date.

Example: `SYSTem:DATE?` ->2008,4,17

SYSTem:DECLination?

This query returns the declination value.

Return values:

<declination> <declin_value> | 9.91E37

<declin_value>
Current declination in degrees (0.0 …359.9).

9.91E37
"NAN" ("Not A Number"). No valid declination available. The reason for this can be:
SYST:DECL:AUTO in state OFF or
SYST:DECL:AUTO in state GPS and no GPS connected or
the connected GPS does not supply valid data.

Example: `SYST:DECL?` -> 1.6

SYSTem:DECLination:AUTO <source>

This command sets the source for the declination value.

Parameters:

<source> OFF | MANual | GPS

OFF
No declination value used. The compass shows magnetic heading.

MANual
The manual declination input value is used to calculate true heading compass values.

GPS
A connected GPS supplies the current declination for true heading compass values.

*RST: GPS

Example: `SYSTem:DECLination:AUTO MANual`

SYSTem:DECLination:AUTO?

This query returns the source for the declination value.

Return values:

<source> OFF | MAN | GPS

OFF
No declination value used. The compass shows magnetic heading.

MAN
The manual declination input value is used to calculate true heading compass values.

GPS
A connected GPS supplies the current declination for true heading compass values.

*RST: GPS

Example: `SYSTem:DECLination:AUTO?` -> MAN

SYSTem:ERRor?

This query returns the next entry from the error queue.

Return values:

<entry> Next entry in the error queue. If the error queue is empty, 0, "No Error" is output.

Example: `SYSTem:ERRor?` -> 0, "No Error"

SYSTem:ERRor:ALL?

This query queries the error queue for all unread entries and removes them from the queue.

Return values:

<entry_list> Comma-separated list of number/string pairs in FIFO order. If the queue is empty, the query returns 0,"No error".

Example: `SYSTem:ERRor:ALL?` ->-113,"Undefined header;SYS-TEM:EROR?",-113,"Undefined header;SYTEM:ERROR?"

SYSTem:ERRor:COUNt?

This query returns the number of unread entries in the error queue. As errors and events may occur at any time, more entries may be present in the queue at the time it is actually read.

Return values:

<entry_count> Number of unread entries. If the queue is empty, the query returns 0.

Example: `SYSTem:ERRor:COUNt?` -> 2

SYSTem:GPS:DATA?

This query returns all GPS data in case the data source is switched to GPS with command SYST:GPS:DATA:AUTO ON. If no GPS is available, the data source can be switched to manual with command `SYST:GPS:DATA:AUTO OFF`. In this case, the manual location and internal time will be output.

Return values:

<gps_data> Comma-separated list, see the table below for details.

Example: `SYST:GPS:DATA?` -> GPS,1,1239090583,220,4,N,48,7,40.33,E, 11,36,47.42,2009,4,7,7,49,42,0.00,18.89,359.40,554

Table 4-19: List elements.

Data source	The data source is a connected GPS or MAN (manual) input of location data.
Valid flag	Denotes whether GPS data are to be considered valid (1 = valid; 0 = not valid).
Time	Absolute time in seconds since January 1,1970.
Horizontal dilution	Horizontal dilution * 100; 50 (best) .. 9999 (worst); only valid if GGA msg is received, else -1 (GPS_UNDEFINDED).
Satellites	Number of satellites in view 0 -12; only valid if GGA msg is received, else -1 (GPS_UNDEFINDED).
Latitude reference	'N' or 'S' for north or south.
Latitude degrees	0 … 90
Latitude minutes	0 … 59
Latitude seconds	0 … 59.99
Longitude reference	'E' or 'W' for east or west

Longitude degrees	0 … 180
Longitude minutes	0 ... 59
Longitude seconds	0 … 59.99
Year	Absolute time: year
Month	Absolute time: month
Day	Absolute time: day
Hour	Absolut time: hour
Minute	Absolute time: minute
Second	Absolute time: second
Speed	Speed over ground [knots/100]
Track made good	Track made good over ground [grad/100]
Magnetic variation	Magnetic variation [grad/100]
Altitude	Antenna altitude above/below mean sea level (geoid) [m]

SYSTem:GPS:DATA:AUTO <state>

This command sets the data source for location and time.

Parameters:

<state> ON | OFF

ON
The data source is a connected GPS.

OFF
The data source is a manual input of location data. See command `SYSTem:MANual:LOCation`.

*RST: ON

Example: `SYST:GPS:DATA:AUTO OFF`

SYSTem:GPS:DATA:AUTO?

This query returns the data source for location and time.

Return values:

<state> 0 | 1

0
The data source is a manual input of location data.

1
The data source is a connected GPS.

Example: `SYST:GPS:DATA:AUTO?`-> 1

SYSTem:GPS:TIME:OFFSet <time_offset>

This command sets the time offset for the GPS time. This depends on the type of GPS used. The offset determines when the time string (RMC message) sent to the R&S EB500 by the GPS receiver is to be terminated. The offset can be measured using an oscilloscope.

Parameters:

<time_offset> Offset ranging from 0.000 ms to 0.999 ms in increments of 1 ms.

Example: `SYST:GPS:TIME:OFFS 0.550`

SYSTem:GPS:TIME:OFFSet?

This query returns the time offset for the GPS time.

Return values:

<time_offset> The current time offset, ranging from 0 ms to 0.999 ms.

Example: `SYST:GPS:TIME:OFFS?` -> 0.550

SYSTem:GPS:TRIGger[:SEQuence]:SLOPe <slope>

This command sets the configuration of the GPS_1s trigger input X12 on the rear panel.

Parameters:

<slope> POSitive | NEGative

POSitive
The positive slope triggers.

NEGative
The negative slope triggers.

*RST: Not affected

Example: `SYST:GPS:TRIG:SLOP POS`

SYSTem:GPS:TRIGger[:SEQuence]:SLOPe?

This query returns the configuration of the GPS_1s trigger input X12 on the rear panel.

Return values:

<slope> POS | NEG

POS
The positive slope triggers.

NEG
The negative slope triggers.

Example: `SYST:GPS:TRIG:SLOP?` -> POS

SYSTem:IF:REMote:MODE <if_mode>

This command sets the mode of the digital IF that is transferred via the remote control interface per UDP.

Parameters:

<if_mode> OFF | SHORt | LONG | ASHort | ALONg

OFF
Digital IF switched off.

SHORt
Digital IF format 16 bit I and 16 bit Q.

LONG
Digital IF format 32 bit I and 32 bit Q.

ASHort
Digital IF with AMMOS format 16 bit I and 16 bit Q.

ALONg
Digital IF with AMMOS format 32 bit I and 32 bit Q.

*RST: OFF

Example: `SYSTem:IF:REMote:MODe SHORT`

SYSTem:IF:REMote:MODE?

This query returns the mode of the digital IF.

Return values:

<if_mode> OFF | SHOR | LONG | ASH | ALON

OFF
Digital IF switched off.

SHOR
Digital IF format 16 bit I and 16 bit Q.

LONG
Digital IF format 32 bit I and 32 bit Q.

ASH
Digital IF with AMMOS format 16 bit I and 16 bit Q.

ALON
Digital IF with AMMOS format 32 bit I and 32 bit Q.

Example: `SYSTem:IF:REMote:MODE?` -> SHOR

SYSTem:LOCK:OWNer?

This query returns the session which owns a lock on the device. If no session owns a lock then “NONE” is returned. The session is identified by its IP address.

Return values:

<lock_owner> NONE | <ip address>

NONE
No session owns a lock.

<ip address>
The session identified by <ip address> owns a lock on the device.

Example: `SYSTem:LOCK:OWN?` -> “10.8.10.230”

SYSTem:LOCK:RELease

This event releases the lock if owned by this session. If this session does not have the lock, this command has no effect. This command has no query form.

Example: `SYST:LOCK:REL`

SYSTem:LOCK:REQuest?

This event is only implemented as a query. It attempts to attain the lock on this device and returns 1 if successful and 0 if it fails. If this query command is sent from a session which has already successfully attained the lock, a 1 is returned again.

Return values:

<request_result> 0 | 1

0
Another session has already attained the lock.

1
The current session has successfully attained the lock.

Example: `SYST:LOCK:REQ?` -> 1

SYSTem:MANual:DECLination <declin_value>

This command sets the manual declination value.

Parameters:

<declin_value> 0.0 … 359.9 degrees

*RST: 0.0

Example: `SYST:MAN:DECL 1.6`

SYSTem:MANual:DECLination?

This query returns the manual declination value.

Return values:

<declin_value> Manual declination value in degrees (0.0…359.9).

Example: `SYST:MAN:DECL?` -> 1.6

SYSTem:MANual:LOCation:LATitude:DIRection <direction>

This command sets the direction of the manual location latitude.

Parameters:

<direction> NORTh | SOUTh

NORTh
The direction is north.

SOUTh
The direction is south.

*RST: NORT (position of Munich, Germany)

Example: `SYST:MAN:LOC:LAT:DIR NORT`

SYSTem:MANual:LOCation:LATitude:DIRection?

This query returns the direction of the manual location latitude.

Return values:

<direction> NORT | SOUT

NORT
The direction is north.

SOUT
The direction is south.

Example: `SYST:MAN:LOC:LAT:DIR?` -> NORT

SYSTem:MANual:LOCation:LATitude:DEGRees <numeric_value>

This command sets the degree value of the manual location latitude.

Parameters:

<numeric_value> Degree value of manual location latitude (0 … 90).

*RST: 48 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LAT:DEGR 48`

SYSTem:MANual:LOCation:LATitude:DEGRees?

This query returns the degree value of the manual location latitude.

Return values:

<degrees> Degree value of manual location latitude (0 ... 90).

Example: `SYST:MAN:LOC:LAT:DEGR?` -> 48

SYSTem:MANual:LOCation:LATitude:MINutes <numeric_value>

This command sets the minutes value of the manual location latitude.

Parameters:

<numeric_value> Minutes value of manual location latitude (0 ... 59).

*RST: 7 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LAT:MIN 8`

SYSTem:MANual:LOCation:LATitude:MINutes?

This query returns the minutes value of the manual location latitude.

Return values:

<minutes> Minutes value of manual location latitude (0 ... 59).

Example: `SYST:MAN:LOC:LAT:MIN?` -> 8

SYSTem:MANual:LOCation:LATitude:SEConds <numeric_value>

This command sets the seconds value of the manual location latitude.

Parameters:

<numeric_value> Seconds value of manual location latitude (0.00 ... 59.99).

*RST: 38.99 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LAT:SEC 41.33`

SYSTem:MANual:LOCation:LATitude:SEConds?

This query returns the seconds value of the manual location latitude.

Return values:

<seconds> Seconds value of manual location latitude (0.00 ... 59.99).

*RST: 7 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LAT:SEC?` -> 8

SYSTem:MANual:LOCation:LONGitude:DIRection <direction>

This command sets the direction of the manual location longitude.

Parameters:

<direction> EAST | WEST

EAST
The direction is east.

WEST
The direction is west.

*RST: EAST (position of Munich, Germany)

Example: `SYST:MAN:LOC:LONG:DIR EAST`

SYSTem:MANual:LOCation:LONGitude:DIRection?

This query returns the direction of the manual location longitude.

Return values:

<direction> EAST | WEST

EAST
The direction is east.

WEST
The direction is west.

Example: `SYST:MAN:LOC:LONG:DIR?` -> EAST

SYSTem:MANual:LOCation:LONGitude:DEGRees <numeric_value>

This command sets the degree value of the manual location longitude.

Parameters:

<numeric_value> Degree value of manual location longitude (0 … 180).

*RST: 11 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LONG:DEGR 11`

SYSTem:MANual:LOCation:LONGitude:DEGRees?

This query returns the degree value of the manual location longitude.

Return values:

<degrees> Degree value of manual location longitude (0 … 180).

Example: `SYST:MAN:LOC:LONG:DEGR?` -> 48

SYSTem:MANual:LOCation:LONGitude:MINutes <numeric_value>

This command sets the minutes value of the manual location longitude.

Parameters:

<numeric_value> Minutes value of manual location longitude (0 ... 59).

*RST: 36 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LONG:MIN 8`

SYSTem:MANual:LOCation:LONGitude:MINutes?

This query returns the minutes value of the manual location longitude.

Return values:

<minutes> Minutes value of manual location longitude (0 … 59).

Example: `SYST:MAN:LOC:LONG:MIN?` -> 8

SYSTem:MANual:LOCation:LONGitude:SEConds <numeric_value>

This command sets the seconds value of the manual location longitude.

Parameters:

<numeric_value> Seconds value of manual location longitude (0.00 ... 59.99).

*RST: 45.59 (position of Munich, Germany)

Example: `SYST:MAN:LOC:LONG:SEC 46.33`

SYSTem:MANual:LOCation:LONGitude:SEConds?

This query returns the seconds value of the manual location longitude.

Return values:

<seconds> Seconds value of manual location longitude (0.00 ... 59.99).

Example: `SYST:MAN:LOC:LONG:SEC?` -> 38

SYSTem:NTS <ip_address>

This command queries a network time server for the current time.

Parameters:

<ip_address> IP address of the network time server to be queried.

Example: `SYSTem:NTS "10.0.2.166"`

SYSTem:RESet:COLD

This command forces a cold reboot of the main processor. Device parameters are set to factory settings. All communication interfaces are closed.

Example: `SYSTem:RESet:COLD`

SYSTem:RESet[:WARM]

This command forces a warm reboot of the main processor. Device parameters are not set to factory settings. All communication interfaces are closed. This command is useful for starting a firmware update procedure using the Update 32 Tool.

Example: `SYSTem:RESet`

SYSTem:SECurity:OPTion:INFormation?

This query returns the extended information of all active software options.

Return values:

<opt_info> Comma-separated list of parameters, one software option per line. <Index>,<OptionName>,<MaterialNo>,<OptionKey>,<Format>,<Privilege>,<Timestamp>,<LicenseCount>,<ActivationType>,<ValidFrom>,<ValidTo>,<TimeToExpiration>

Example: `SYST:SEC:OPT:INF?` ->
0,EB500-DO,
4072.9700.02,275119031620069050211389333868,0,Demo,
2011-08-12 07:58,1,Temporary Duration,2011-08-26
07:00,2012-08-20 07:00,7804 h;
1,EB500-PS,
4072.9200.02,319717638117516715740363696879,0,Customer
Order,2011-06-01 03:54,1,Permanent,-,-,-;
2,EB500-IM,
4072.9100.02,099625631107944673374178502552,0,Customer
Order,2011-06-01 03:54,1,Permanent,-,-,-;
5,EB500-DF,
4072.9400.02,148307713737173248273852389026,0,Customer
Order,2011-06-01 03:54,1,Permanent,-,-,-;
9,EB500-FE,
4072.9300.02,153873093928365265912807466951,0,Customer
Order,2011-06-01 03:54,1,Permanent,-,-,-;

SYSTem:SPEaker:STATe <speaker_state>

This command switches the built-in loudspeaker on or off.

Parameters:

<speaker_state> ON | OFF

ON
Loudspeaker on.

OFF
Loudspeaker off.

*RST: ON

Example: `SYSTem:SPEaker:STATe OFF`

SYSTem:TIME <time>

This command sets the time of the clock in the processor board.

Parameters:

<time> <hour>, <minute>, <second>

<hour>
0 to 23.

<minute>
0 to 59.

<second>
0 to 59.

*RST: Not affected.

Example: `SYSTem:TIME 14,32,0`

SYSTem:TIME?

This query returns the current time, which the correct universal coordinated time (also known as UCT, Zulu, Greenwich Mean Time) only when the time zone values are set to 0,0 (see `SYSTem:TZONe` on page 336).

Example: `SYSTem:TIME?` ->14,33,17

SYSTem:TZONe <time_zone>

This command sets the time zone of the clock in the processor board. If each field is subtracted from the value of the TIME command, the result is the correct universal coordinated time (also known as UCT, Zulu, Greenwich Mean Time).

Parameters:

<time_zone> <hour>,<minute>

<hour>
-12 to +12.

<minute>
-59 to +59.

*RST: Not affected.

Example: `SYSTem:TZONe 2,0`

SYSTem:TZONe?

This query returns the time zone.

Return values:

<time_zone> Current time zone.

Example: `SYSTem:TZONe?` ->2,0

SYSTem:VERSion?

This query returns the SCPI standard used by the device.

Return values:

<version> Version in format YYYY.V, where YYYY stands for the corresponding version year and V for the corresponding revision number of that year.

Example: `SYSTem:VERSion?` -> 1996.0

SYSTem:VIDeo:REMote:MODE <video_mode>

This command sets the mode of the digital video output that is transferred via the remote control interface per UDP. The output depends on the demodulator switched on.

Parameters:

<video_mode> OFF | SHORT | LONG

OFF
Digital video output switched off.

SHORT
Digital video output format 16 bit (I or AM) and 16 bit (Q or FM).

LONG
Digital video output format 32 bit (I or AM) and 32 bit (Q or FM).

*RST: OFF

Example: `SYSTem:VIDeo:REMote:MODe SHORT`

SYSTem:VIDeo:REMote:MODE?

This query returns the mode settings of the digital video output.

Return values:

<video_mode> OFF | SHORT | LONG

OFF
Digital video output switched off.

SHORT
Digital video output format 16 bit (I or AM) and 16 bit (Q or FM).

LONG
Digital video output format 32 bit (I or AM) and 32 bit (Q or FM).

Example: `SYSTem:VIDeo:REMote:MODE?` -> SHORT

4.5.16 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 comb spectrum is fed in at the antenna input and the receiver is set to the comb 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 comb frequency of the test spectrum is set and measured.

TEST? <test_type>,<messages>

This command triggers the "short test" or "long test".

Parameters:

<test_type> SHORt | LONG

SHORt
Performs a "short test".

LONG
Performs a "long test".

<messages>	REPort | QUIet **REPort** Generates error messages as plain text. **QUIet** No error messages are generated.
Return values:	
<error_status>	0 | ≠ 0 **0** No error detected. **≠ 0** Error detected. Error messages can be read with the command `SYST:ERR:ALL?`
Example:	`TEST? LONG, QUIET` -> 1

4.5.17 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 MTRACE 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 the sensor functions which are 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 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

Spectrum data can be queried via Trace IFPAN. The command

`TRACe:FEED:CONTrol IFPAN, ALWays`

starts the loading of the IFPAN Trace.

The IF panorama is always running in FFM mode.

The data will be output in a raw form, i.e. like they are calculated by the DSP. The spectrum length is dependent on the chosen IF panorama step and varies between 11 and 3201. If the data is available in the IFPAN trace, the number of points can be queried by the following 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 first frequency is lower than the second 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.

Suppress table input :

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	Suppression of frequency 118.375 MHz
0	123400000	Suppression of frequency 123.4 MHz
127675000	127675000	Suppression of frequency 127.675 MHz

In the status reporting system, the states of the traces are coded in status bits (see chapter 4.7, "Status Reporting System", on page 350).

TRACe? SSTART|SSTOP

This query causes that the data to be taken from the corrected table. Instead of command word `TRACe`, you can also use `DATA`.

Suppress table output:

1st frequency	2nd frequency
118000000	136000000
98450000	98550000
0	0
118375000	118375000
123400000	123400000
127675000	127675000

Parameters:

<trace_name> Name of the desired trace as <Character Data> (SSTART, SSTOP).

TRACe:CATalog?

This query returns all defined trace names.

Return values:

<trace_names> **"MTRACE", "ITRACE", "IFPAN", "SSTART", "SSTOP", "UDP", "TCP"**

TRACe[:DATA] <trace_name>, <numeric_value> {, <numeric_value>} | <block>

This command writes data to a trace. Only the suppress traces can be written to.

Clearing the suppress lists must always include both commands (`TRAC SSTART, 0; TRAC SSTOP, 0`).

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.

Parameters:

<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. 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, 8 bytes per frequency.

*RST: No change of trace contents at *RST.

Example: `TRACe SSTART, 123.475 MHz, 118000000, 98550 kHz`

TRACe[:DATA]? <trace_name>

This query returns the data of the named trace.

Error message: If the trace name is unknown, an error -141,"Invalid character data" will be generated.

Parameters:

<trace_name> Name of the desired trace as <Character Data> (MTRACE, ITRACE, IFPAN or SSTART, SSTOP).

Return values:

<result> See below for details.

The following applies to ITRACE:
Output of channel number and receive frequency.
Depending on the setting, the output format is defined by command FORMat[:DATA] on page 222 :
ASCii -> normal ASCII output:
- channel number without unit
- frequency in Hz
PACKed -> <Definite Length Block>: (see "Block data")
LLPacked -> <Definite Length Block>: (see "Block data")
- channel number (2 Byte)
- frequency in Hz (4 Byte)

The following applies to MTRACE:
Output of measured values for all sensor functions are 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 PSCAN to identify the range limit. If measurements can't be carried out due to current settings (eg offset measurement with I/Q, CW, ISB or SSB), it is indicated by the NINF value – 9.9E37.
With SW-option R&S EB500-IM (ITU Measurement) installed, not only level and offset measurement is available but also the additional measurement functions: AM modulation index, FM frequency deviation, PM phase deviation and bandwidth measurement are provided.
Depending on the setting, the output format is defined by command FORMat[:DATA] on page 222:
ASCii -> normal ASCII output:
- level in dBuV
- offset in Hz
- field strength in dBuV/m
- AM - modulation index in %
- AM:POS - positive modulation index in %
- AM:NEG - negative modulation index in %
- FM - frequency deviation in Hz
- FM:POS - positive frequency deviation in Hz
- FM:NEG - negative frequency deviation in Hz
- PM - phase deviation in rad
- BAND - bandwidth in Hz
PACKed -> <Definite Length Block>: (see "Block data")
- level in 1/10 dBuV (2 bytes)
- offset in Hz (4 Byte)
- field strength in 1/10 dBuV/m (2 bytes)
- AM - modulation index in 1/10 % (2 bytes)

- AM:POS - positive modulation index in 1/10 % (2 bytes)
- AM:NEG - negative modulation index in 1/10 % (2 bytes)
- FM - frequency deviation in Hz (4 bytes)
- FM:POS - positive frequency deviation in Hz (4 bytes)
- FM:NEG - negative frequency deviation in Hz (4 bytes)
- PM - phase deviation in 1/100 rad (2 bytes)
- BAND - bandwidth in Hz (4 bytes)

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 BAND = 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 always be measured.

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 (e.g. `TRACE? MTRACE;TRACE? ITRACE`).
Example:
`TRACe? MTRACE` -> 23.4, -2500, 18.5, 1500
The following applies to 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]` on page 222.
ASCii -> normal ASCII output:
- level in dBμV

PACKed -> <Definite Length Block>:
- level in 1/10 dBμV (2 bytes)

The following applies to 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]` on page 222:
ASCii ->Normal ASCII output:
- list of frequencies in Hz
PACKed -> <Definite Length Block>:
- list of frequencies in Hz, 4 bytes per frequency
LLPacked -> <Definite Length Block>:
- list of frequencies in Hz, 8 bytes per frequency
Example:
`TRACE? SSTART` -> 123475000, 118000000, 98550000

TRACe:FEED? <trace_name>

This query returns the data block name 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]?` on page 340.

Return values:

<block_name> Name of the block coupled to the trace.
For MTRACE: "SENS"
For ITRACE: "FREQ"
For IFPAN: "SENS"

Example: `TRACe:FEED? MTRACE` -> "SENS"

TRACe:FEED:CONTrol <trace_name>,<store>

This command controls trace loading.

Error message: If trace name is unknown, an error -141, "Invalid character data" will be generated.

Parameters:

<trace_name> See `TRACe[:DATA]?` on page 340.

<store> ALWays | SQUelch | NEVer

ALWays
All data is stored.

SQUelch
Data is first stored if the signal has exceeded the squelch threshold defined in subsystem OUTPut:SQUelch.

NEVer
Do not store any data in the trace.

*RST: NEVer

Example: `TRACe:FEED:CONTrol MTRACE, ALWays`

TRACe:FEED:CONTrol? <trace_name>

This query returns information on 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]?` on page 340.

Return values:

<store> ALW, SQU, NEV

Example: `TRACe:FEED:CONTrol? MTRACE` -> ALW

TRACe:LIMit[:UPPer] <trace_name>,<limit>

This command sets 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]?` on page 340.

<limit> **<numeric_value>**
Limit in percent of the maximum trace length.

MINimum
Minimum limit.

MAXimum
Maximum limit.

*RST: 50 PCT

Example: `TRACe:LIMit MTRACE, 50 PCT`

TRACe:LIMit[:UPPer]? <trace_name>[,limit]

This query returns the 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]?` on page 340.

[limit] MINimum | MAXimum. If this parameter is omitted, the query returns the current limit.

MINimum
Returns the minimum limit.

MAXimum
Returns the maximum limit.

Return values:
<limit> Limit in percent of maximum trace length.

Example: `TRACe:LIMit? MTRACE` -> 50

TRACe:POINts? <trace_name>[,number_values]

This query returns the 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 IFPAN trace is dependent on the chosen IF panorama step and varies between 11 and 3201.

Error message: If the trace name is unknown, an error -141, "Invalid character data" will be generated.

Parameters:
<trace_name> See `TRACe[:DATA]?` on page 340.

[number_values] MINimum | MAXimum. If this parameter is omitted, the query returns the current number.

MINimum
Returns the minimum number.

MAXimum
Returns the maximum number.

Return values:
<number_values> Number of values.

Example: `TRACe:POINts? MTRACE, MAX` -> 2048

TRACe:POINts:AUTO? <trace_name>

This query returns the trace-length auto adjust setting.

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]?` on page 340.

Return values:

<auto-adjust> 0 | 1

0
No auto-adjust for trace length.

1
Auto-adjust for trace length.

Example: `TRACe:POINts:AUTO? MTRACE;AUTO? ITRACE` -> 1;1

TRACe:VALue <trace_name>, <index>, <numeric_value>

This command sets an element of a trace. 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: See TRACe[:DATA]

Example: `TRACe:VALue SSTART, 13, 98.550 MHz`

TRACe:VALue? <trace_name>, <index>

This query returns the frequency value of an element of a trace in Hz.

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.

Return values:

<freq_value> Frequency value of the element of a trace in Hz.

Example: `TRACe:Value? SSTART, 13` -> 98550000

4.6 Device Model and Command Processing

Following figure shows the basic structure of the unit under firmware aspects. The actual receiver is isolated from the remote control units by a central data memory. This memory is at the core of the R&S EB500 firmware and deals with the following tasks:

- Administration of connected modules (receiver, remote clients)

- Making data available to the receiver (e.g. receive frequency, scan parameters, etc.)
- Sequentialization of settings for simultaneous operation
- Sending messages on parameter changes to all modules

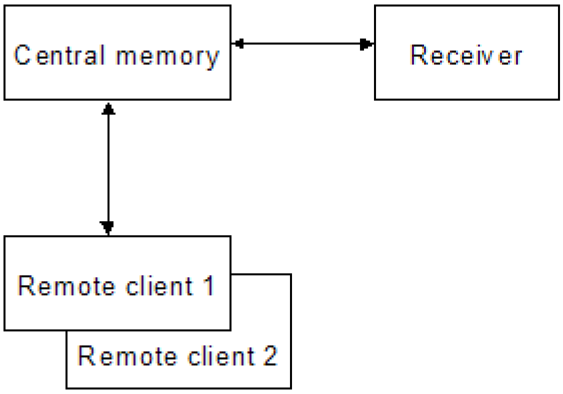


Fig. 4-2: Device model with remote control

This central data memory can be controlled simultaneously from one or several remote control units (remote clients) in a competitive control scheme. Upon system start, the receiver is logged into the data memory automatically. When a host computer sets up a link to the receiver, the remote clients are logged in. The receiver obtains the required data (receiver frequency, bandwidth, etc.) from the memory and has no data storage facility of its own. Therefore, it 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 and the central memory signals to the receiver that a new frequency is set. Remote client 2 (if connected) is then supplied with the new frequency and every remote client receives a modification report (see "STATus:EXTension Register", chapter 4.7, "Status Reporting System", on page 350).

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.

Client control

Every client can obtain the information of which clients are connected to the device. The query command `SYSTem:COMMunicate:CLIents?` on page 317 returns a comma separated list of IP addresses of the connected clients. A client can attempt to obtain exclusive use of the device by requesting a lock. For details see command subsystem `SYSTem:LOCK:REQuest?` on page 330.

Remote client

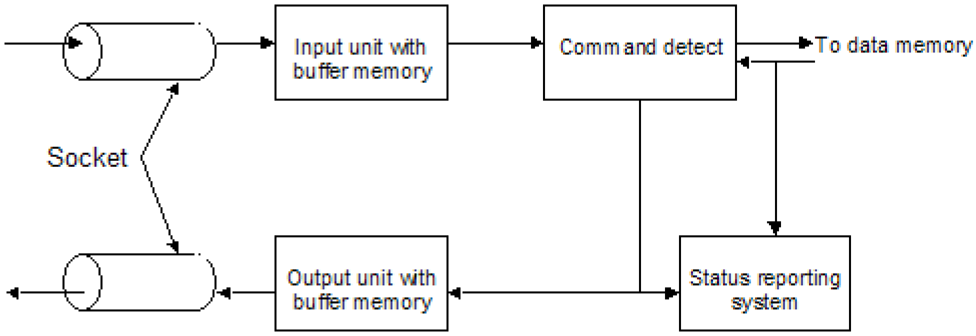


Fig. 4-3: Structure of a remote client within the firmware

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 the R&S EB500). These two protocols are in turn based on the Internet Protocol (IP). Following figure shows the layer model of the sockets.

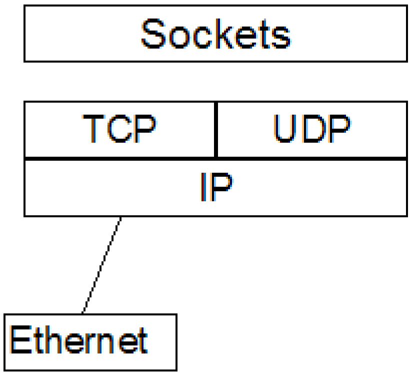


Fig. 4-4: Sockets layer model

The transmission media are located beneath the IP layer.

The use of sockets has several advantages:

- The protocols used (PPP, IP, TCP, UDP) are standardized and implemented on all customary operating systems (Windows XP, Windows NT, Windows 95, 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 (e.g. 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 R&S EB500 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 R&S EB500 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 excecuted 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:

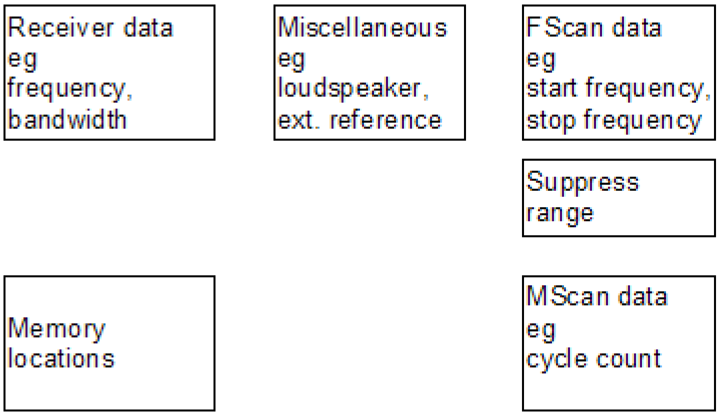
The output unit collects all data in the output buffer that were generated in response to query commands. If the command detect identifies the end of an SCPI command (by the <Program Message Terminators>), it causes the output unit to send the data in the output buffer to the host computer via the socket.

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 (e.g. error statuses, availability of results, data modifications by other users, etc.) to the host computer.

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 stores all the information of the present operating state of the device, e.g. the device is carrying out sweep, some errors have been logged etc. This information is stored in the status registers and 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), the standard event status enable register (ESE), the non-SCPI defined registers STATus:TRACe and STATus:EXTension, the SCPI commands STATus:OPERation and STATus:QUEStionable, and both the message and error queues. (ESR is defined in IEEE488.2.)

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.

4.7.1 Structure of a SCPI Status Register

Each SCPI register consists of five sections, each having a width of 16 bits and different functions. 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.

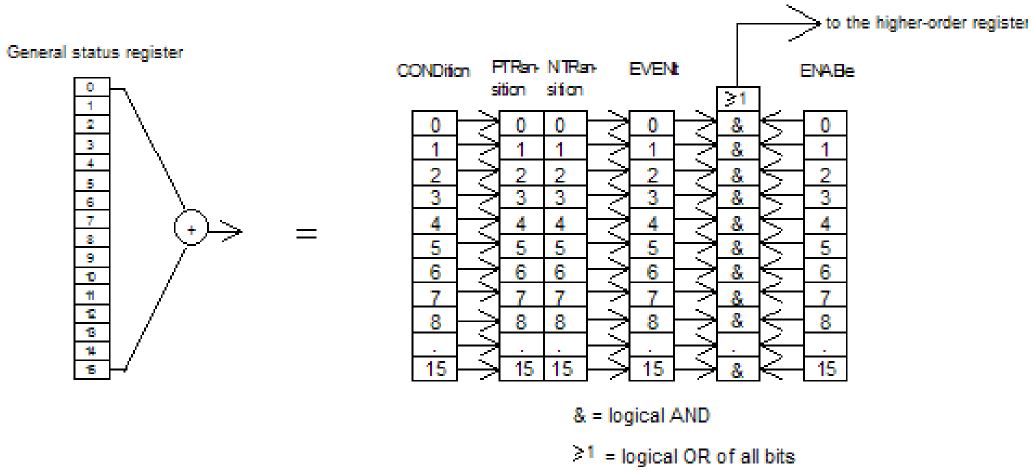


Fig. 4-5: Status register model.

CONDition section

The CONDition section of a register reflects the state of the hardware directly. This register section can only be read and its contents cannot be changed while reading. Alternatively, each bit in the CONDition register can be configured to reflect the summary information of the front-connected status registers. In this case, the bits are cleared when 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 are 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 and it only indicates events passed on by the edge filters. This section is permanently updated by the device and can only be read. When reading, its content 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 are 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.

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

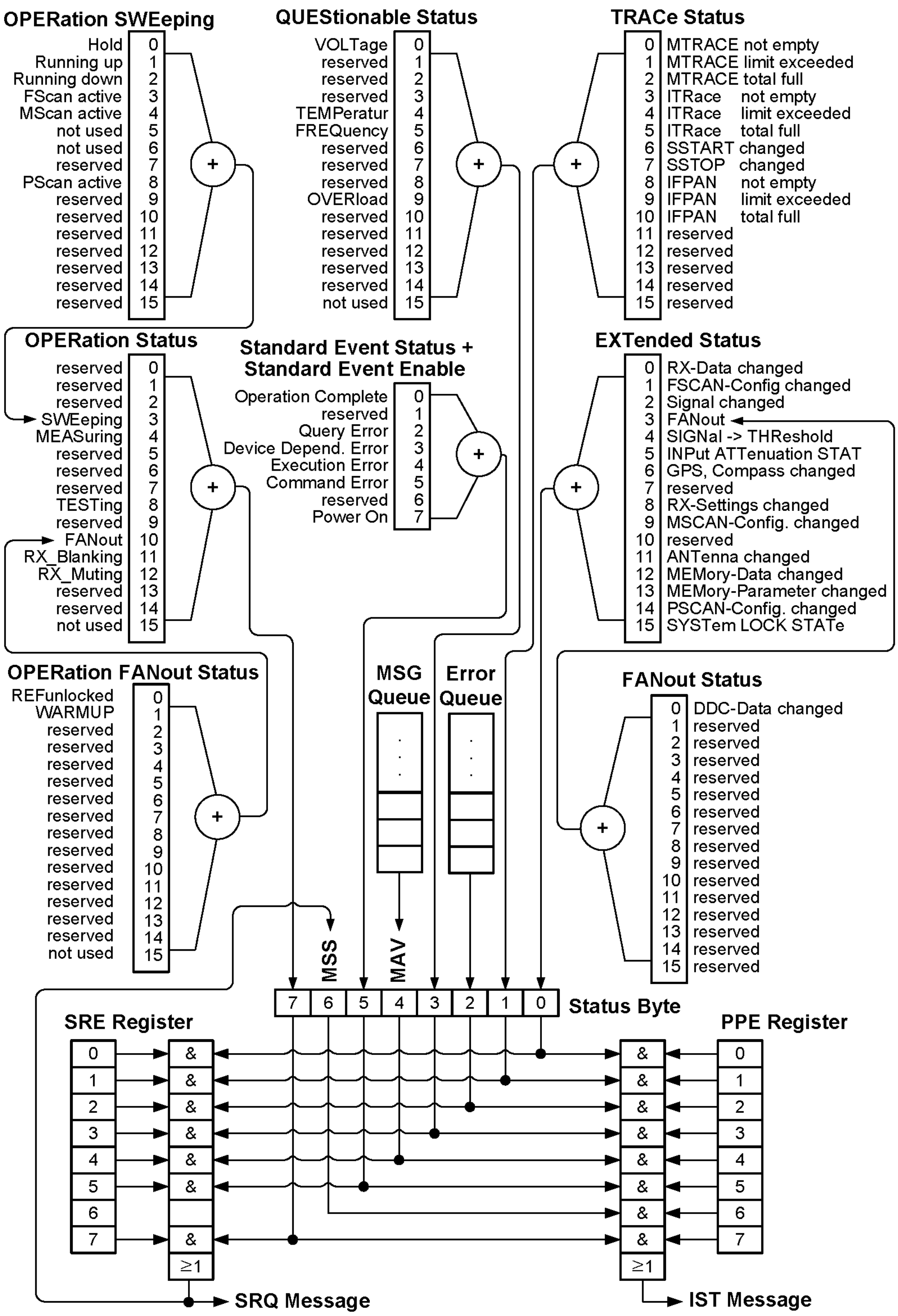


Fig. 4-6: Overview of the status registers.

4.7.3 Description of the Status Registers

Status Byte (STB) and Service Request Enable Register (SRE)

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. Thus it can be compared with the CONDition section of a 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. Its functionality corresponds to the ENABle section of the SCPI register. A bit in the SRE is assigned to each bit of the STB and bit 6 is ignored. If one of the bits is set in the SRE and the associated bit in the STB changes from 0 to 1, a Service Request (SRQ) is generated. This triggers an interrupt in the controller, provided it is appropriately configured.

The SRE can be set using command `*SRE` and read using `*SRE?`.

Table 4-20: 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 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.

IST Flag and Parallel Poll Enable Register (PPE)

Analogous to the SRQ, the IST flag combines the entire status information into a single bit and can be queried using command `*IST?`. First, the bits of the STB register are ANDed with the corresponding bits of the parallel poll enable register (PPE).

In contrast to SRE, bit 6 is used here. Next, the results are ORed to form the IST flag. As such, the PPE register determines which bits of the STB contribute to the IST flag and it can be set/read using the `*PRE`/`*PRE?` command.

Event Status Register (ESR) and Event Status Enable Register (ESE)

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 4-21: 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.
1	**Reserved**
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 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 chapter 5.1.5.1, "Error Messages", on page 368).
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 chapter 5.1.5.1, "Error Messages", on page 368).

Bit no.	Meaning
6	**Reserved**
7	**Power On (supply voltage on)** This bit is set when the device is switched on.

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 4-22: Bit allocation of STATus:OPERation register.

Bit no.	Meaning
0 - 3	**Reserved**
4	**MEASuring** This bit is set as long as a measurement is carried out.
5 - 7	**Reserved**
8	**TESTing** This bit is set if the self-test has been triggered.
9 - 10	**Reserved**
11	**BLANking** This bit is set if the blanking input has been activated.
12	**Muting** This bit is set if the blanking input has been activated.
13 - 14	**Reserved**
15	**Not used**

STATus:OPERation:FANout Register

This register is an additional fanout to the STATus:OPERation register and contains in the CONDition part further information on different receiver states which cannot be assigned to the other registers. Information about the actions the unit has carried out since the last read out are stored in the EVENt part. The corresponding registers can be queried with the commands `STATus:OPERation:FANout:CONDition?` or `STATus:OPERation:FANout[:EVENt]?`.

Table 4-23: Bit allocation of STATus:OPERation:FANout register.

Bit no.	Meaning
0	**REFSettling** This bit is set during settling of the 10 MHz reference frequency PLL.
1	**WARMingup** This bit is set if the OCXO is still warming up.

Bit no.	Meaning
2 - 14	**Reserved**
15	**Not used**

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, PSCAN). The state is determined by the `[SENSe:]FREQuency:MODE` command with the CW|FIXed state being characterized by deleting bits 3 to 5 in the STATus:OPERation:SWEeping register.

Table 4-24: 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 channels.
2	**Running down** This bit is set if scanning is to be carried out to decreasing frequency values or memory channels.
3	**FSCAN active** This bit is set if FREQ:MODE is set on SWEep.
4	**MSCAN active** This bit is set if FREQ:MODE is set on MSCan.
5 - 7	**Reserved**
8	**PSCAN active** This bit is set if FREQ:MODE is set on PSCan (software option R&S EB500-PS).
9 -14	**Reserved**
15	**Not used**

STATus:QUEStionable Register

This register contains information on ambiguous device states. For example, they can occur when the device operates outside its specification range. It can be queried using the commands `STATus:QUEStionable:CONDition?` or `STATus:QUEStionable[:EVENt]?`.

Table 4-25: Bit allocation of STATus:QUEStionable register.

Bit no.	Meaning
0	**VOLTage** This bit is set if an ambiguous supply voltage occurs. Due to that all test points of the supply voltage are checked.
1 - 3	**Reserved**

Bit no.	Meaning
4	**TEMPerature** This bit is set if the internal temperature is too high. All temperature test point in the equippment are tested.
5	**FREQuency** This bit is set if an internal oscillator frequency is ambiguous. Due to that the test points of the oscillators are checked.
6 - 8	**Reserved**
9	**OVERload** This bit is set if the IF section is overdriven by a too high input level. Then the result of a level measurement is questionable.
10 - 14	**Reserved**
15	**Not used**

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 4-26: 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.

Bit no.	Meaning
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.
11 - 14	**Reserved**
15	**Not used**

STATus:EXTension Register

This register has a CONDition part and an EVENt part. In the CONDition part the register contains the information of different receiver states which cannot be assigned to the other registers. Information about the actions the unit has 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?` and `STATus:EXTension[:EVENt]?` respectively.

Table 4-27: Bit allocation of STATus:EXTension register.

Bit no.	Meaning
0	**RX-Data changed** This bit is set if the receiver data was changed by another remote client (see also "Data Memory",).
1	**FSCAN-Configuration changed** This bit is set if the FSCAN data were changed by another remote client (see also "Data Memory").
2	**Signal changed** This bit is set if the received signal changes in level or offset.
3	**FANout** This bit is set if the summary bit of the STATus:EXTension:FANout bits is set.
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.
6	**GPS, Compass changed** This bit is set if the setup of GPS or Compass was changed by another remote client.
7	**Reserved**
8	**RX-Settings changed** This bit is set if a parameter was changed 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 another remote client.
10	**Reserved**

Bit no.	Meaning
11	**Antenna changed** This bit is set if the antenna definition, setup or property was changed by another remote client.
12	**MEMory-Data changed** This bit is set if memory data was changed by another remote client.
13	**MEMory-Parameter changed** This bit is set if the query bit was changed by another remote client.
14	**PSCAN-Configuration changed** This bit is set if the PSCAN data set is changed by another remote client (PSCAN is an option).
15	**SYSTem LOCK STATe** This bit is set if a client has attained a lock. (see also command subsystem SYSTem:LOCK).

With bits 0 to 3 and 6 to 15, the host can be informed about the parameter changes via the SRQ. Thus, cyclic polling of these settings on each of the remote interfaces is not required to reflect the changes on the signal parameters. In the CONDition section of the register, the change bits are set after a signal change and can be reset with special query commands. Changes performed by another remote client affect the change bits equally.

Table 4-28: Allocation of change bits in STATus:EXTension register.

Bit no.	Set upon 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, Aux bit(s), Aux output mode, measure time, measure mode, preselection mode, synthesizer mode, video mode, audio demodulation volume, audio demodulation balance, audio demodulation status	FREQ?, DEM?, BAND?, OUTP:SQU:THR?, GCON?, GCON:MODE?, ROUTe:CLOSe:STATe?, INP:ATT?, DET?, OUTP:SQU?, OUTP:SQU:CONT?, FUNC?, FREQ:AFC?, MEM:CONT? RX, OUTP:BITAx?, OUTP:BYTAx?, OUTP:AUX?, MEAS:TIME?, MEAS:MODE?, INP:ATT:MODE?, FREQ:SYNT:MODE?, OUTP:VID:MODE?, SYST:AUD:DEM:VOL?, SYST:AUD:DEM:BAL?, SYST:AUD:DEM?
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?
3	FANout status	STAT:EXT:FAN?
7	display mode, antenna name	DISP:MENU?, ROUT:PATH[:DEF]?
8	volume, balance, external reference	SYST:AUD:VOL?, SYST:AUD:BAL?, ROSC:SOUR?
9	MSCAN: number of scans, synchronization time, listening time, search mode	MSC:COUN?, MSC:DWEL?, MSC:HOLD:TIME?, MSC:DIR?; MSC:CONT?
10	Reserved	
11	antenna definition, antenna setup, antenna property, antenna factor, antenna used	SYST:ANT:RX:…?, SYST:ANT:SETUP…?, SYST:ANT:PROP….?, SYST:ANT:FACT:CAT?, SYST:ANT:USED?

Bit no.	Set upon change of	Reset by one of the commands
12	frequency, demodulation, bandwidth, threshold value, antenna no., attenuation, squelch actuation, AFC	MEM:CONT? MEM0 ... MEM9999, MEM: CONT: MPAR?, MEM0 ... MEM9999
13	query bit (set, set back)	MEM:CONT?, MEM0 ... MEM9999, MEM: CONT: MPAR?, MEM0 ... MEM9999
14	PSCAN: center frequency, span frequency, start frequency, stop frequency, number of scans, channel raster	FREQ:PSC:CENT?, FREQ:PSC:SPAN?, FREQ:PSC:STAR?, FREQ:PSC:STOP?, PSC:COUNT?, FREQ:PSC:STEP?
15	system lock	SYSTem:LOCK:OWNer?

STATus:EXTension:FANout Register

This register is an additional fanout of the STATus:EXTension register and it also has a CONDition part and an EVENt part. In the CONDition part the register contains the information of different receiver states which cannot be assigned to the other registers. Information about the actions the unit has carried out since the last read out are stored in the EVENt part. The corresponding registers can be queried with the commands `STATus:EXTension:FANout:CONDition?` and `STATus:EXTension:FANout[:EVENt]?` respectively.

Table 4-29: Bit allocation of STATus:EXTension:FANout register.

Bit no.	Meaning
0	**DDC-Data changed** This bit is set if the DDC data was changed by another remote client.
1 - 14	**Reserved**
15	**Not used**

With bit 0, the host can be informed about the parameter changes via the SRQ. Thus, cyclic polling of this setting on each of the remote interfaces is not required to reflect the changes on the signal parameter. In the CONDition section of the register, the change bits are set after a signal change and can be reset with special query commands. Changes performed by another remote client affect this bit equally.

Table 4-30: Allocation of change bits in STATus:EXTension:FANout register.

Bit no.	Set upon change of	Reset by one of the commands
0	DDC frequency DDC demodulation DDC bandwidth DDC squelch control DDC threshold value DDC audio balance DDC audio volume DDC audio state DDC frequency coupling	FREQ:DDC? DEM:DDC? BAND:DDC? OUTP:SQU:DDC? OUTP:SQU:DDC:THR? SYST:AUD:DDC:BAL? SYST:AUD:DDC:VOL? SYST:AUD:DDC? FREQ:DDC:COUP?

4.7.4 Use of the Status Reporting System

In order to use the status reporting system effectively, information contained in the remote client has to be transmitted to the host for further processing. There are several methods for this, which are described below. Detailed programming examples can be found in chapter 8, "LAN Programming Examples", on page 436.

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 Figure figure 4-5 shows, an SRQ is always initiated if one or several bits of bit 0, 1, 2, 3, 4, 5 or 7 of the status byte is/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, any bits in any status register can be configured to 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.

Example 1:

Use command `*OPC` to generate an SRQ.

- Set bit 0 in the ESE (Operation Complete).
- Set bit 5 in the SRE.

After the changes to the settings have completed, the device generates an SRQ.

Example 2:

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 now 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 chapter 8, "LAN Programming Examples", on page 436 .

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". 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".

Command `SYSTem:ERRor:ALL?` returns all entries from the error queue. 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 as the faulty commands from the controller to the device are recorded as well.

4.7.4.4 Resetting Values of the Status Reporting System

The following table comprises 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 4-31: Resetting device functions.

Event	**Switching on supply voltage**	**DCL, SDC**			
		(Device Clear, Selected Device Clear)	*RST	STATus:PRE-Set	*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	---

Event	**Switching on supply voltage**	**DCL, SDC**			
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 Service

5.1 Maintenance

5.1.1 General

5.1.1.1 Cleaning

Clean the outside of the R&S EB500 using a soft, lint-free dust cloth.

NOTICE

Damage caused by cleaning agents

Cleaning agents contain substances that may damage the R&S EB500, e.g. solvent-containing cleaning agents may damage the front panel labeling or plastic parts. Never use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances.

5.1.1.2 Storing and Packing

The R&S EB500 can be stored at the temperature range quoted in the specifications (see chapter 1.4, "Specifications", on page 13). When it is stored for a longer period of time, the R&S EB500 should be protected against dust. The original packing should be used, particularly the protective caps at the front and rear, when the R&S EB500 is to be transported or dispatched. If the original packing is no longer available, use a sturdy cardboard box of suitable size and carefully wrap the R&S EB500 to protect it against mechanical damage.

5.1.1.3 Powering the device

The R&S EB500 is supplied with the following:

a) Desktop AC/DC Power Adapter (R&S P/N: 3586.4426.00)

b) DC power cable (R&S P/N: 4072.7036.00)

The device should only be powered with either item (a) above or a 10V to 32V DC source (100W to 150W) connected via (b).

5.1.2 Alignment of the 10-MHz Reference Oscillator Crystal

In order to ensure accurate receiver frequencies, the internal 10-MHz reference needs to be trimmed. In particular, OCXO (oven controlled crystal oscillator) must be trimmed every year:

- Connect a frequency counter with a tolerance of less than/equal to $1x10^{-8}$ to X11 REF OUT at the rear panel.
- Switch to internal reference.
- The warm-up time of the devices before start of calibration is 5 minutes.
- Trim the frequency to 10 MHz ± 0.1 Hz at room temperature for OCXO.
  Trim the frequency to 10 MHz ± 1 Hz at room temperature for TCXO.

OCXO Calibration via GUI

See "Receiver Calibration Dialog" on page 134.

OCXO Calibration via Remote

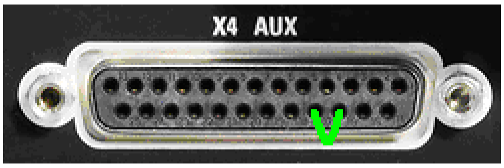
The alignment can be carried out via remote control and is described in detail in chapter 4.5.3, "CALibration Subsystem", on page 211.

- Query on the current calibration value and date:
  `CALibration:ROSC?`
  `CALibration:ROSCillator:DATE?`
- Reduce the values:
  `CALibration:ROSC down`
- Increase the values:
  `CALibration:ROSC up`
- Store the calibration value and calibration date:
  `CALibration:ROSCillator:DATE Year,Month,Day;STORe`

The trimmed value is stored nonvolatile in the synthesizer module and not affected from reset or factory reset.

5.1.3 Restore Default Settings

User's settings stored inside the non-volatile memory of the device could be restored to its factory default values by triggering a hardware reset.



This hardware reset could be activated as follows:

1. Short the signal line "EXT_RST" (pin 16 of connector X4) at the rear panel to ground (pin 17 of connector X4) for about 1 second and then disconnect the wire (as shown in figure above).

2. Wait for the system to startup. Once the system startup is complete, the default settings will be restored.

The data for the configuration of the LAN interface is stored in an EEPROM. It is not affected by power failures and cannot be changed by a reset.

5.1.4 Built-in Self-Tests

The R&S EB500 has two built-in self-tests. They can be activated with the key sequence shown below.

The self tests are as follows:

Short Test

A message “Test passed; RF range and signal path” will be displayed on the GUI if the test result is a PASS.

Long Test

A message “Test passed; RF ranges and signal paths” will be displayed on the GUI if the test result is a PASS. If any failure is detected, error message(s) will be shown on the GUI. These error messages can be found in chapter 5.1.5, "Troubleshooting", on page 368.

Long Test

If the result for the Long Test is a PASS, it indicates that the R&S EB500 is fully functional.

5.1.5 Troubleshooting

5.1.5.1 Error Messages

Error message	Cause	Action
Processor defective	The processor (R&S EB500-P1) indicates an error.	Contact qualified Rohde & Schwarz service personnel
Preselector HF defective	The HF preselection (R&S EB500-HF) indicates an error.	
Preselector defective	The frontend (R&S EB500-V1) indicates an error.	
Synthesizer defective	The synthesizer (R&S EB500-S1) indicates an error.	
Check external reference	The R&S EB500 is switched to external reference and there is no valid 10MHz reference signal.	Check whether a suitable external 10MHz reference signal is connected. Otherwise change to internal reference by setting "Reference Mode" in SETUP > "Receiver" to "Internal"

5.1.5.2 Testpoints

There are voltage and temperature checks at many testpoints of the R&S EB500 modules. These testpoints can be viewed or monitored through the following means:

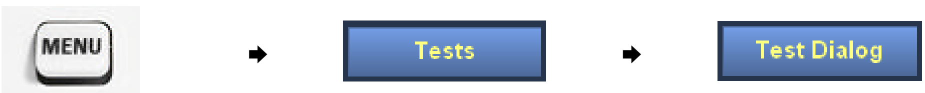
SCPI Commands

Command DIAGnostic[:SERVice]:MODule:STATe? ALL provides information on the state of all modules.

Command DIAGnostic[:SERVice]:MONitor? ALL

provides information on all test points of all modules.

GUI



The above key sequence will display the testpoints table as shown below.

	Module	Test Point	Current	Lower Limit	Upper Limit	1 Error
21	EB500PB:	+6V	837	750	910	✓
22	EB500PB:	+8V4	822	750	910	✓
23	EB500PB:	+28V	905	810	990	✓
24	EB500PB:	+0V9	899	810	990	✓
25	EB500PB:	+1V6	879	790	970	✓
26	EB500PB:	+1V2	872	790	970	✓
27	EB500PB:	+1V8	898	810	990	✓
28	EB500PB:	+3V_BAT	939	810	990	✓
29	EB500PB:	+3V3	869	780	960	✓
30	EB500PB:	TEMP_LM83	44	-40	125	✓
31	EB500PB:	TEMP_PPC	43	-40	125	✓
32	EB500PB:	TEMP_ADC	57	-40	125	✓
33	EB500PB:	TEMP_DCDC	41	-40	125	✓
34	PRESEL HF:	TPREAMP_P	1670	800	2000	✓
35	PRESEL HF:	TPREAMP_N	798	400	1200	✓
36	PRESEL HF:	TTEMP	1638	800	2200	✓
37	PRESEL HF:	T_+9V	1240	1050	1350	✓
38	PRESEL HF:	T_-9V	1212	1050	1350	✓
39	PRESEL HF:	T_-5V	661	500	800	✓
40	PRESEL HF:	T_CLK	1165	1000	1400	✓
41	PRESEL HF:	T_CORE	1770	1700	1900	✓

Modules failure could be identified by its corresponding name indicated under the column “Module”. Their corresponding names are as follows:

- "BBFRONTEND" refers to the RF Frontend module
- "BBSYNTHESIZER" refers to the Synthesizer module
- "PRESEL HF" refers to the HF Preselector module
- "EB500PB" refers to the Processor module

5.2 Repair

5.2.1 Procedure in Case of Service and Ordering of Spare Parts

This chapter contains information on shipping products to your service center and ordering spare parts.

5.2.1.1 Shipping a Product

Please contact your local Rohde & Schwarz service center if you need service or repair work done on your product. You can find the address of your representative on our website at www.rohde-schwarz.com under "Service & Support"/"Service Locations".

We need the following information in order to process your request and to determine whether the warranty is still valid for your product:

- Model name
- Serial number
- Firmware version
- Does the product have to be returned with this particular firmware version?
- Detailed error description in case of repair
- Indication of desired calibration
- Person to be contacted for any questions

In some countries, an RMA process is available for the return shipment of the product. For details, contact your local representative.

When shipping the product, be careful to provide for sufficient mechanical and antistatic protection. Use the original packaging for transporting or shipping the product. The protective caps for the front and rear prevent damage to the operating elements and the connectors.

If you do not use the original packaging, provide for sufficient padding to prevent the product from slipping inside the box. Wrap antistatic packing foil around the product to protect it from electro-static charging.

5.2.1.2 Shipping Defective Modules

When shipping a module, be careful to provide for sufficient mechanical and antistatic protection.

- Ship the module in a sturdy, padded box.
- Wrap the module in antistatic foil.

If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the tightly fitting packaging is conductive.

Modules containing a battery

If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

5.2.1.3 Ordering Spare Parts

Please contact your local Rohde & Schwarz service center if you need service or repair work done on your product. You can find the address of your representative on our website at www.rohde-schwarz.com under "Service & Support" or "Service Locations".

To deliver spare parts promptly and correctly, we need the following information:

- Stock number (see list of mechanical parts and spare parts in this section)
- Designation
- Component number according to list of mechanical parts and spare parts

- Quantity
- Product type for which the spare part is needed
- Product stock number
- Product serial number
- Person to be contacted for any questions

5.2.1.4 Refurbished Modules (RF Modules Only)

Refurbished modules are an economical alternative to original modules. Bear in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use, but they are electrically and mechanically equivalent to new modules.

Your Rohde & Schwarz representative will be happy to inform you about which modules are available as refurbished modules.

5.2.2 Disassembling the R&S EB500

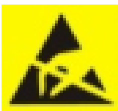
DANGER

Shock hazard

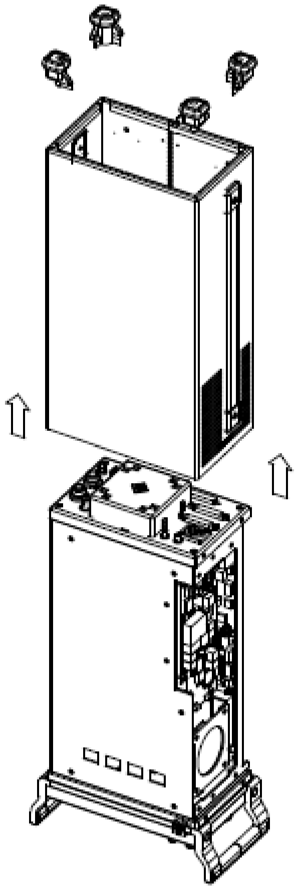
For all disassembly and reassembly work, ensure that the R&S EB500 is switched off and disconnected from the power supply by removing the plug from the AC and DC power connector, respectively.

CAUTION

Electrostatic Discharge Protection (ESD)



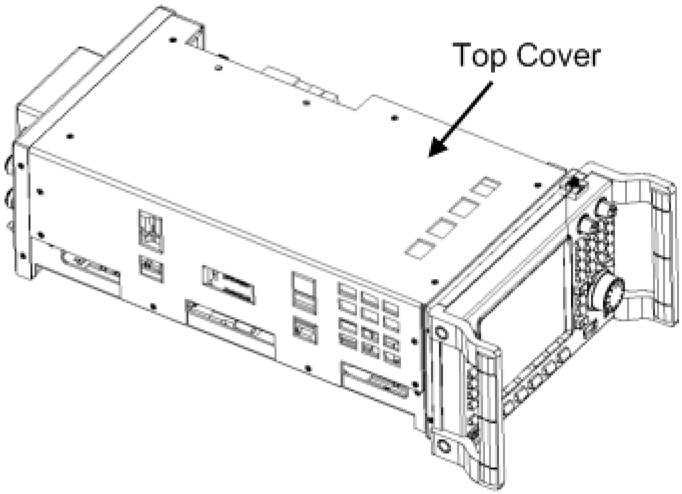
Please ensure ESD handling precautions are observed while handling the boards/modules in the R&S EB500 device.



Listed below are the steps to remove the casing (as shown above):

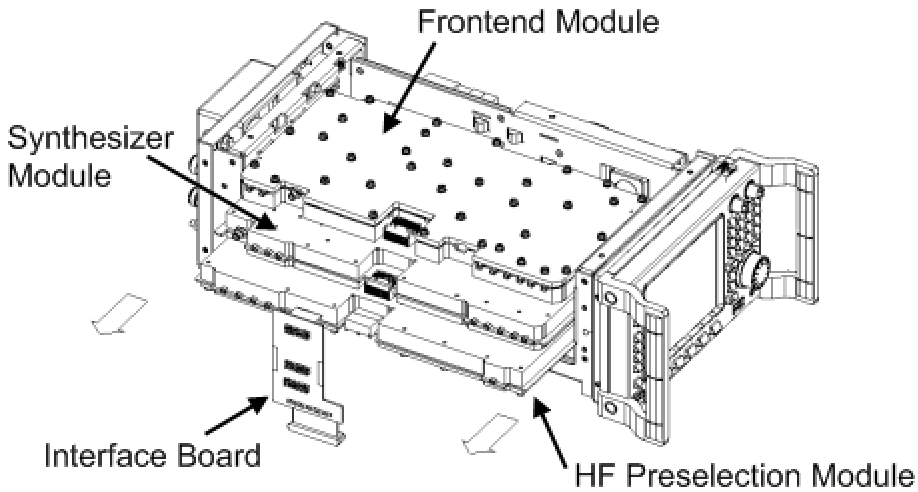
- Switch off the R&S EB500 and unplug the power cable.
- Place the R&S EB500 on handles at the front.
- Remove the 4 recessed screws on the cabinet feet.
- Slide the casing upwards and remove it.

5.2.3 Removing / Installing a Module



Module Removal

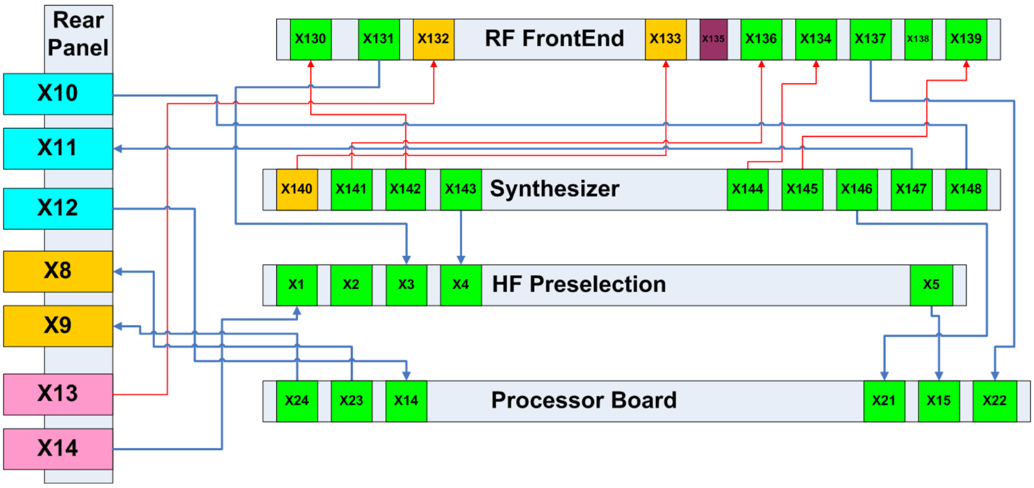
- Loosen the screws of the top cover bracket as shown in figure above.
- Remove the top cover bracket.



- Disconnect the RF cables connected to the module.
- Disconnect the Interface board as shown in figure above.
- Carefully pull out the desired RF module board.

RF Cables Connection on Modules

Diagram below gives an overview of the RF cables interconnections between the modules and processor board.



Each RF cable has been labelled at both its connecting ends as shown in figure below.

Hence, connecting and disconnecting of the RF cables can be done easily by matching the labels on the cable and the connection diagram above.

Module Installation

Installation

- Insert new module in the appropriate slot.
- Connect the RF cables of the module.
- Connect the Interface board
- Close the top cover bracket.
- Put on the screws for the top cover bracket.
- Perform a "Long Test". Refer to chapter 5.1.4, "Built-in Self-Tests ", on page 367

5.2.4 Disassembling the Front Panel Unit

R&S EB500 model 03

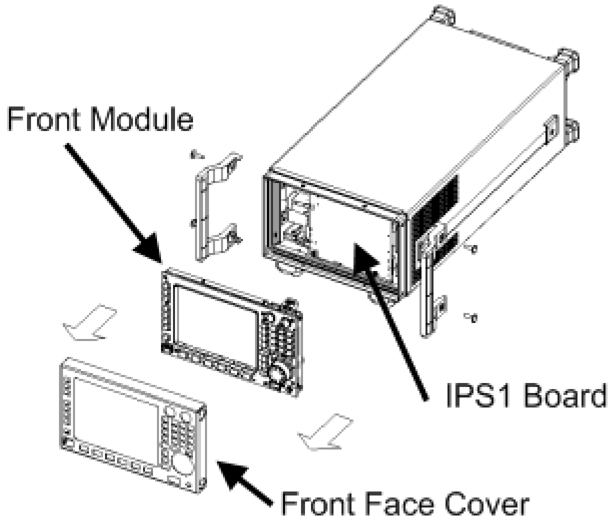


Figure above shows an exploded view of the front panel unit for model 03.

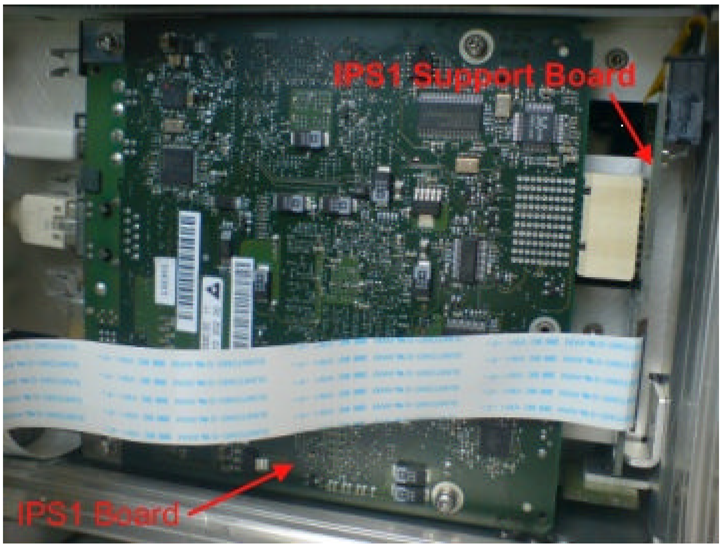


Figure above gives a close up view of the front panel controller (IPS1) board.

R&S EB500 model 02

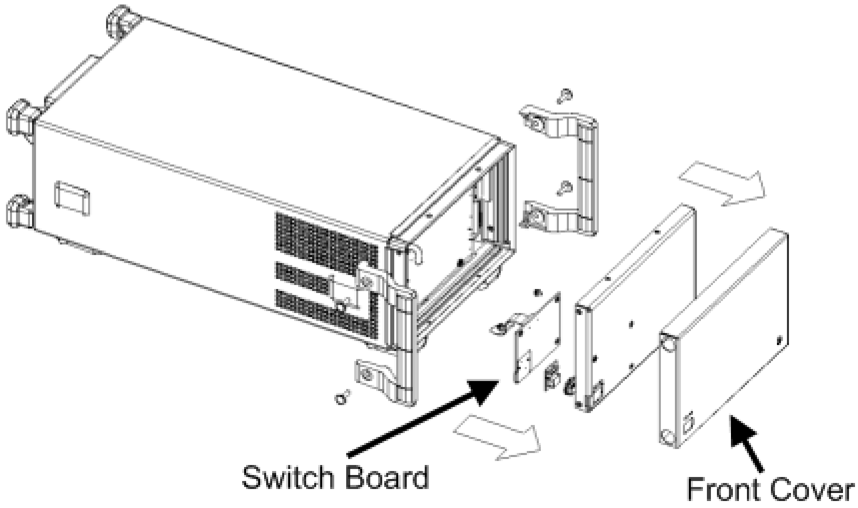
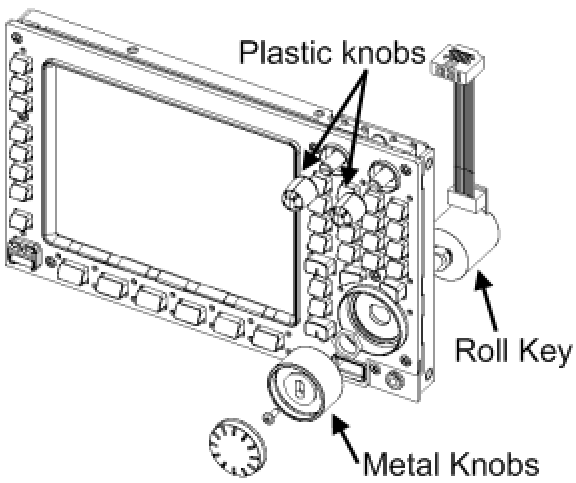


Figure above shows an exploded view of the front panel unit for model 02.

5.2.5 Replacing LCD or FPC Board

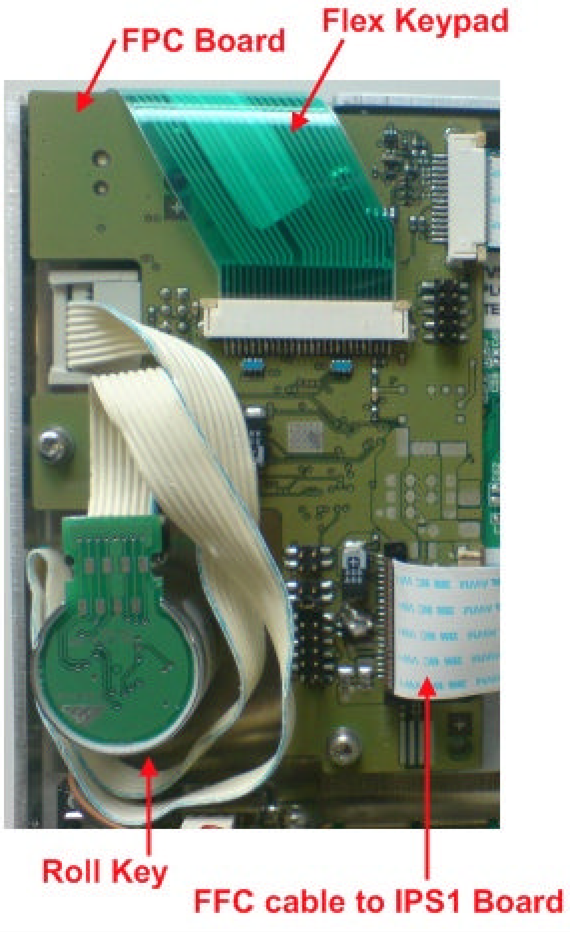
Sub-assembly removal

The LCD and FPC boards are only accessible after removing the parts shown below.



FPC Board

Figure below gives a close up view of a Flex Keypad connection to the FPC board. This Flex Keypad connection has to be removed from the FFC connector before removing the FPC board.



LCD Unit

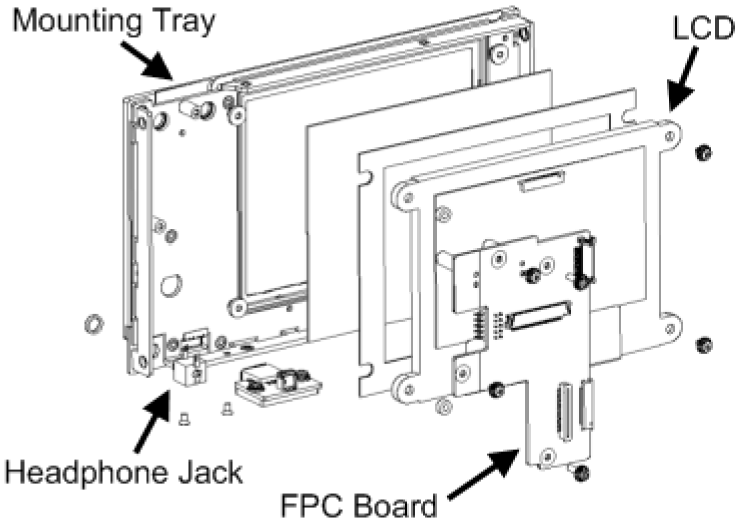


Figure above shows an exploded view of the mounting of the FPC board and LCD. The FPC board has to be removed in order to get access to the LCD.

5.2.6 Replacing a NAND Flash Card on Front Panel Controller (IPS1 Board)

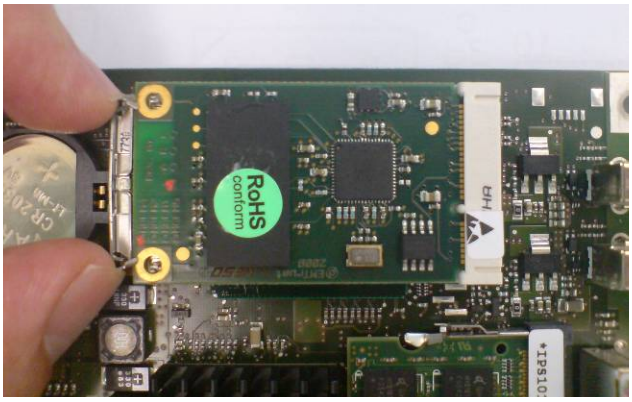


Figure above shows the location of the NAND Flash card on the IPS1 board.

Listed below are the steps in replacing the NAND Flash card.

- Disassemble the front panel unit.
- Loosen the screws on the front panel controller (IPS1 board).
- Remove the NAND Flash card by pressing the levers as shown above.
- Replace with a new NAND Flash card.

After installation of the new NAND Flash card, the GUI software running on the front panel controller (IPS1) needs to be installed. See chapter 5.4, "Receiver Firmware and GUI Update for Model 03", on page 382 for instructions.

5.2.7 Replacing the Batteries

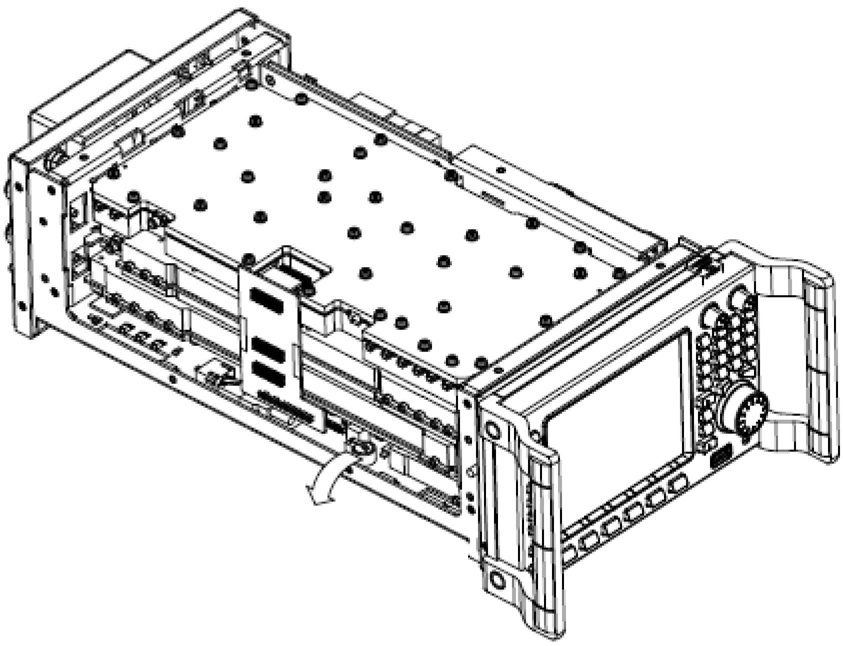
There is a lithium battery on the processor board and the front module controller board behind the front panel.

CAUTION

Lithium batteries

- Lithium batteries must not be exposed to high temperatures or fire.
- Keep away from children.
- If the battery is replaced improperly, there is a danger of explosion. Use only R&S type batteries for replacement.
- Lithium batteries are hazardous waste and must be disposed of in dedicated containers.
- Carefully lift and remove the battery.

Processor Board



Carefully lift and remove the battery as shown in the figure above.

Battery on processor board

3.0 V lithium battery (12.5 mm diameter, 1.6 mm thick). R&S order no. 3585.9999.00

CAUTION

Short circuit

Do not short-circuit the battery!

Frontpanel Controller

- Disassemble the front panel unit (see chapter 5.2.4, "Disassembling the Front Panel Unit", on page 375).
- Loosen the screws on the front panel controller (IPS1 board).
- Remove and replace the battery. Location of battery is as shown above.

Battery on front panel controller board

3.0 V lithium battery (CR2032). R&S order no. 0858.2049.00

5.2.8 Assembling the R&S EB500

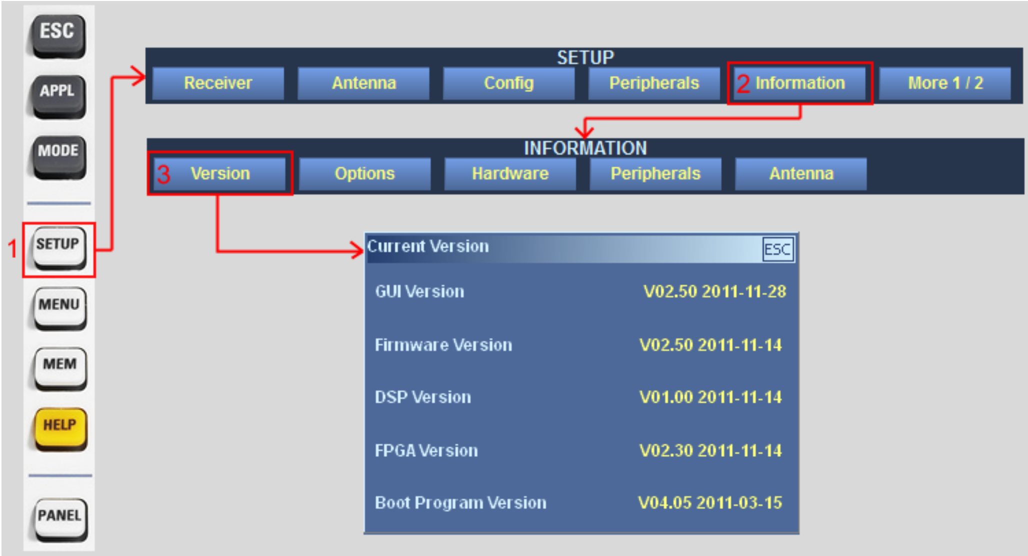
Please note that the cables at the side of the R&S EB500 have to be very close to the body of the device to prevent them from being damaged.

Reinstalling the casing:

- Fit the casing and cabinet feet in the reverse order described in chapter 5.2.2, "Disassembling the R&S EB500", on page 371.
- Replace the seal at the cabinet feet.

5.3 Retrieve Firmware Versions

The following key sequence allows to retrieve the various firmware revisions of the R&S EB500.



The "Firmware Version" refers to the version of the firmware which runs on the main processor board. It provides the main control functions of the receiver.

The “GUI Version” refers to the GUI software in use:

- If the menu is obtained from the R&S EB500 front panel (model 03), it refers to the Front Panel GUI.
- If the menu is obtained from Remote Access, it refers to the Remote Access GUI.

The GUI software runs on its own processor on the frontpanel hardware. This processor is different from the one on the main processor board and has its own operating system, which is different from the receiver firmware.

The "DSP Version" and "FPGA Version" are part of the firmware image and cannot be updated seperately.

The "Boot Program Version" refers to a stand-alone program whose only purpose is to boot-up the R&S EB500.

For R&S EB500 Model 03, it is therefore sufficient to update the receiver firmware and GUI software. This will update all the images required for normal operation to the latest versions. The receiver firmware and GUI software will be updated in the same procedure. This keeps the update process simple and prevents any version conflict.

For R&S EB500 Model 02, only the receiver firmware needs to be updated.

CD-ROM and Downloads

The R&S EB500 is shipped together with a “EB500 Software and Documentation CD ROM” which contains the same firmware and GUI versions as in the R&S EB500 at the time of shipment. The latest versions can be downloaded from GLORIS.

The CD-ROM will autostart and launch the opening menu where the various options are available. If the CD-ROM does not autostart or if the files are obtained from the company website, launch the menu by running the `start.htm` in a suitable browser. Recommended is `Internet Explorer 7`.

The next few sections explain the steps needed for updating the receiver firmware and GUI software (for Model 03) or only the receiver firmware (for Model 02) respectively.

5.4 Receiver Firmware and GUI Update for Model 03

The update process for the R&S EB500 Model 03 is a combined procedure which updates the receiver firmware and GUI software in one single process. This process makes it tansparent for the user which component is actually being updated and version conflict will be avoided.

5.4.1 Preparations

Checking the GUI version number

Refer to the section chapter 5.3, "Retrieve Firmware Versions", on page 380 to obtain the current version of the receiver firmware and GUI software in the device, if necessary.

Required files and accessories

You will need the following files and accessories to perform an update:

- A self-extracting EB500 installation file.
- USB flash drive with at least 128 Mb free space (A new or formatted one is recommended). The MBR of the flash drive will be overwritten to make it bootable.

Prepare USB Flash drive

The update process is done from the USB flash drive. The device boots up from the USB flash drive, and the update continues from there.

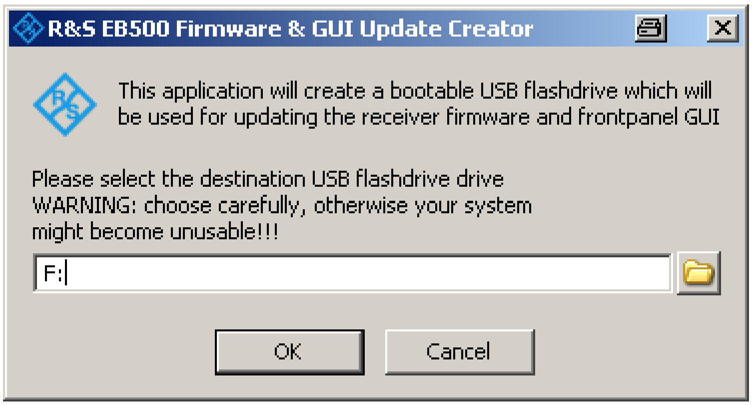
The following steps are necessary for installing files on the USB flash drive:

- Obtain the EB500 update installation file. This file can be retrieved from either one of the locations mentioned at "CD-ROM and Downloads" on page 381.
- Plug the USB flash drive into a USB port of the PC (or Notebook). Take note of the drive letter assigned to this USB flash drive.
- Execute the installation by clicking on `Receiver Firmware and GUI Installation`. Allow access if there are security warnings. The dialog box shown below will appear. It will ask for the path of the USB flash drive. Check the drive letter before clicking "OK". This must be the drive letter which is assigned to your USB flash drive after plugging it into your Windows host.

SFX image on USB Flash drive

This installer is built as a compressed SFX image. This is a self-extracting image which will install on the storage destination that is given as parameter: here it is the USB flash drive. The image also contains a MBR section (Master Boot Record) so that it can boot-up from the USB flash drive.

Not every USB flash drive can be converted into a bootable drive. If a flash drive still can not boot-up after following the procedures above then it is advised to change to a different brand USB flash drive.



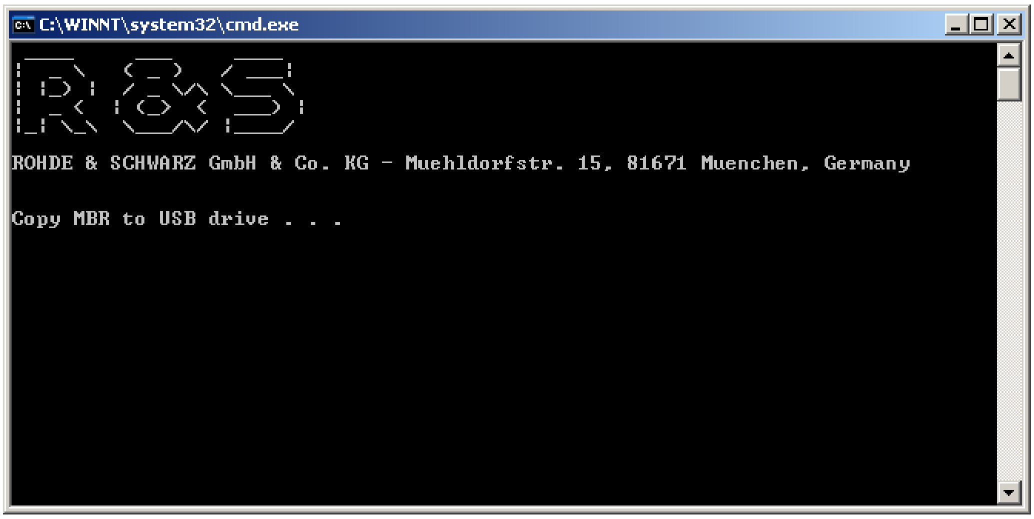
CAUTION

SFX Installer

Be careful to use the correct drive letter that is assigned to the flash drive (e.g. F: or G:). If a wrong drive letter is used (e.g. C:), the boot-loader might get accidentally installed on the host system, which will result in a unusable host.

After double-checking the drive letter and clicking "OK" the SFX image will self-extract to the USB flash drive. This process will take less than one minute for a USB 2.0 drive. In case a USB 1.1 flash drive is used it will take much longer.

The last step for the SFX installer is copying the MBR section to the USB flash drive. This is shown in a console window.

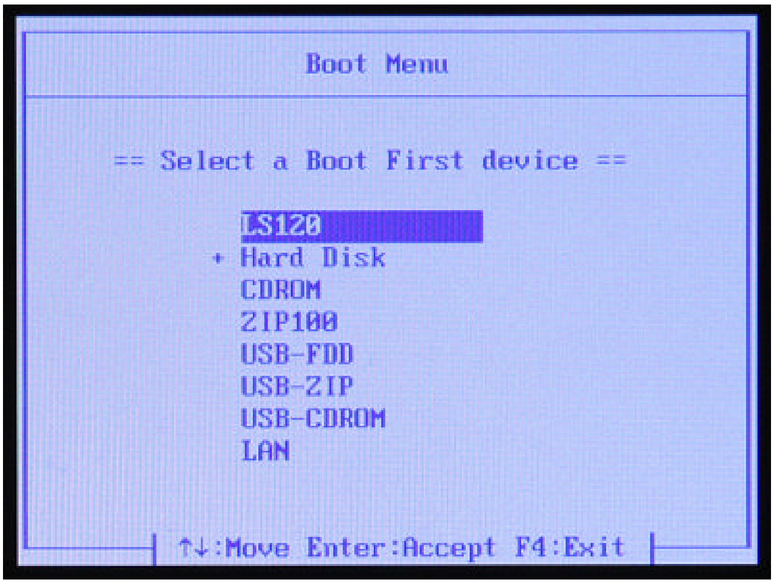


After the console window has closed, the USB flash drive can be removed. It now contains the updated installation file.

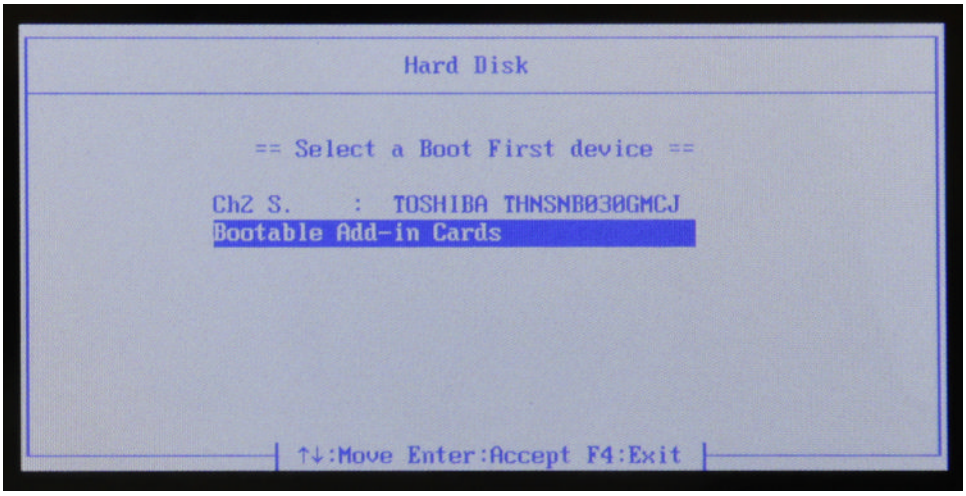
5.4.2 Installation / Update Procedure

Power off the R&S EB500, plug-in the USB flash drive into the USB port on the R&S EB500 front-panel and restart.

Wait for the R&S logo to appear and press ESC to go into the boot menu. In the boot-up screen that follows, use the arrow keys on the front-panel to move to "Hard Disk" (see screenshot below) and press ENT.



If the USB flash drive can be detected by BIOS, as shown in the screenshot below, select the USB flash drive as the "Boot First" device.



If BIOS does not recognize the USB flash drive, select "Bootable Add-in Cards" and press ENT to enable booting from the USB flash drive.

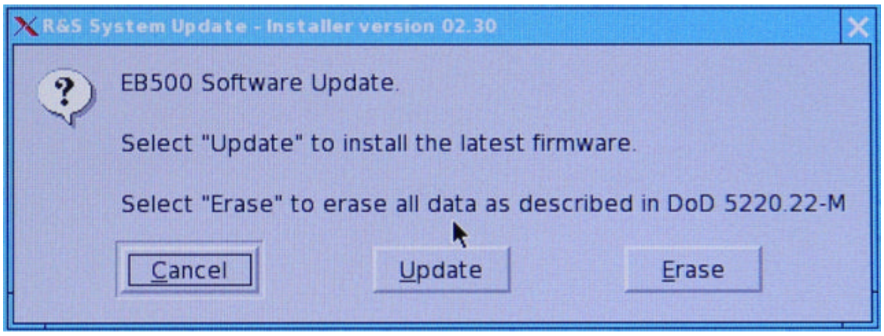
"Ch0 S. : 4GB NANDrive" is the internal drive of the R&S EB500. If this is selected by mistake, the device will start up as normal and the GUI Update procedure should be restarted.

In the next dialog select "Update" using the CURSOR LEFT / CURSOR RIGHT or ROTARY KNOB and the ENT key. See chapter 3.1, "Front-Panel Tour", on page 24.

NOTICE

Erasing the Data Partition

The Update utility also has an option to erase the data partition, according to DoD 5220.22-M standard. This utility provides the same sanitizing feature as what is provided by the "Sanitizing" option under the MENU key.



CAUTION

Uninterrupted Power

From this point onwards, ensure that power to the device is not interrupted. Failing to do so might result in a non-functional front panel.

The updater will then check if the FPC2 firmware (for the frontpanel key controller) needs to be updated. FPC2 firmware will only be updated when the version on the USB flash drive is newer than the version currently installed.

NOTICE

FPC2 Update

Do not interrupt the updating of the FPC2 firmware (e.g. removing the USB flash drive or resetting the device). Keys on the front-panel might become unusable if the updating process were interrupted.

Should the keys on front panel become unusable (not responsive), an external keyboard (and a USB hub) would be needed to redo the FPC2 update.

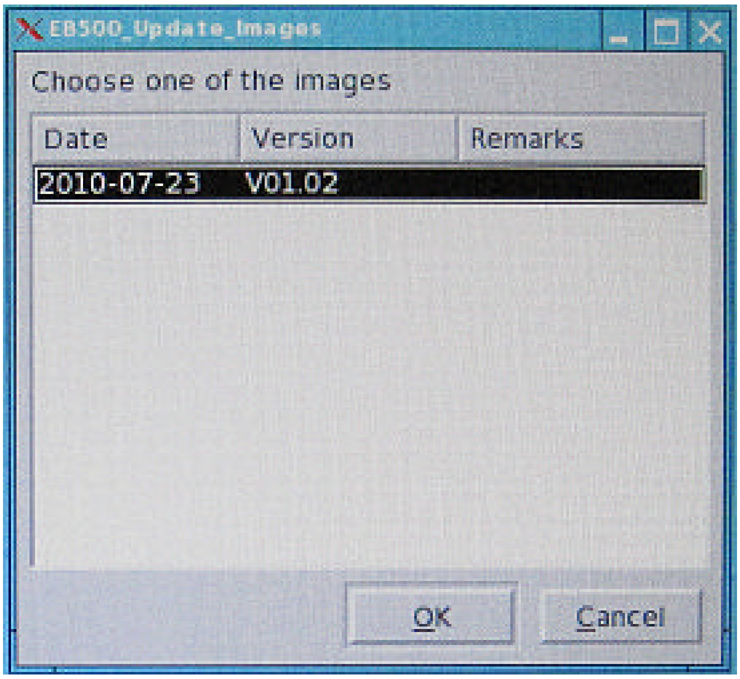
Finally the actual update of the receiver firmware and the GUI software can start. The update process can cater for more than one image. If the update was installed on a USB flash drive that was previously used for updates, the menu below will show more than one installer image. Use the ROTARY KNOB to select an image and press ENT.

NOTICE

Version of Updater Program

Make sure that the version of the updater program is the same or higher than the version of the firmware image you want to install. The version of the updater program is shown in the dialog title of the first dialog.

If for some reason the version of the R&S EB500 updater program is lower than the firmware you want to install (e.g. because you installed an older version of the firmware), just copy again the update installation file to the USB flash drive, following the steps explained in chapter 5.4.1, "Preparations", on page 382. This will overwrite the original updater program so that both the firmware and the updater program have the same version on the USB flash drive.



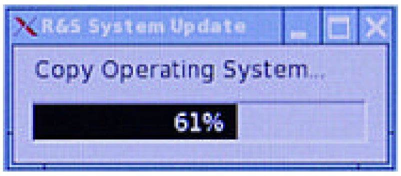
One image will contain an updated version of the receiver firmware as well as the GUI. The receiver firmware will be updated first. The firmware will be copied from USB flash drive to EEPROM on the processor board. The EEPROM needs to be erased first, after which the program code will be downloaded and the checksum calculated.

NOTICE

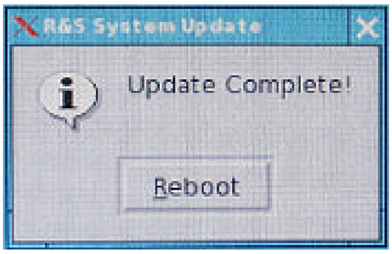
Flash erase and update

While updating a device, portions of the flash memory will be erased. This erase process may take up to two minutes, after which the new firmware will be loaded. This will usually take about one minute for the R&S EB500. The update progress is visualized by means of notification dialogs and progress bars.

Then, while the receiver resets, the GUI will be updated. The GUI runs on a dedicated processor (IPS1) and has its own operating system. This processor also needs to reboot once the update completed.



At the end of the process, when the dialog below is shown, press ENT to reboot. Now both the receiver firmware and the GUI are updated with the latest version. This can be verified after reboot by following the steps shown in chapter 5.3, "Retrieve Firmware Versions", on page 380.



NOTICE

If update procedure fails.

If the update procedure fails, simply switch off the device and restart the update procedure.

NOTICE

Updating the R&S EB500 Model 02

The R&S EB500 without frontpanel (Model 02) cannot be updated with this method. In order to update the Model 02 receiver firmware you will need the Update32 tool. The method of updating by using the Update32 tool is described in chapter 5.5, "Receiver Firmware Update for Model 02", on page 388.

NOTICE

Remote GUI on Notebook / desktop PC

If you want to install the GUI for use on a notebook or desktop PC, you should follow the procedure described in chapter 5.6, "Remote Access GUI Installation", on page 393.

NOTICE

If the R&S EB500 cannot reboot

Due to the fact that the R&S EB500 also can be updated using the Update32 Tool (see "Updating the R&S EB500 Model 03" on page 393), there is a chance that the R&S EB500 cannot reboot. Follow the steps described in "If the R&S EB500 cannot reboot" on page 393 to deal with this problem.

5.5 Receiver Firmware Update for Model 02

This model requires a different update method which makes use of the device's LAN interface (X7 on the rear panel). The method uses the "Update32" tool, which runs under Windows NT, Windows 2000 and Windows XP.

Retrieve Update32

The firmware required for the update can be retrieved from either one of the locations mentioned at "CD-ROM and Downloads" on page 381.

Click on `Firmware Update Program` and `File Explorer` will be launched into the directory `Update32XP`. The `Update32` tool can be installed by clicking on `Setup`. If your browser does not launch `File Explorer`, you should launch it manually and navigate to the `Update32XP` directory on the CD-ROM where you can run `Setup`.

NOTICE

Flash erase and update

While updating a device, portions of the flash memory will be erased. This erase process may take up to two minutes, after which the new firmware will be loaded. This will usually take about one minute for the R&S EB500. The update progress is visualized by the progress bar of the "Update32" tool.

WARNING

Interrupted Power to Device

Switching off the device's power supply during the update procedure is not recommended but will not harm the device as the "bootprog" is still available for subsequent firmware update of the system.

5.5.1 Preparations

Checking the device firmware version number

Refer to the section chapter 5.3, "Retrieve Firmware Versions", on page 380 to obtain the current version of the firmware in the device, if necessary.

System requirements

For a firmware update you will need

- an IBM-compatible PC running Windows NT, Windows 2000 or Windows XP with LAN interface.
- a standard LAN cable with RJ45 connectors.
- "Update32" tool for Windows XP requires a WinPcap installation. Installing the latest version of the tool will also install the latest version of WinPcap (please note the disclaimer and the information in WinPcap's "About" box).

Connecting the device

Proceed as follows to connect the device:

- Use the LAN cable to connect the Ethernet port of your PC directly to LAN interface X7 of the R&S EB500 or
- Use the LAN cable to connect the LAN interface X7 of the R&S EB500 to a network hub which is in the same LAN network as your PC.

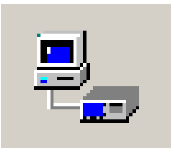
Network adapters

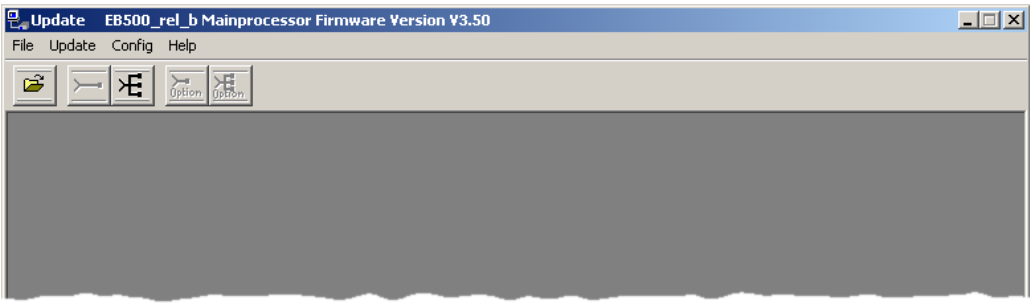
If you have more than one network adapter in your computer, the "Update32" tool will take the first as the default adapter and try to use it for the update. To change the network adapter, select "Network Adapter" in the "Config" menu of the "Update32" tool.

5.5.2 Firmware Update Using the Update32 Tool

First steps

- Power off the R&S EB500 device. It has to be switched on later in the update procedure.
- Make sure the R&S EB500 and the PC running the "Update32" tool are connected either directly using a LAN cable or through the same network switch/hub. It is NOT recommended that the PC and the R&S EB500 be connected across different routers when performing firmware update with "Update32" because special network packets required by the process may be discarded by the router.
- Run the "Update32" tool by clicking on `Firmware Update Program`. Allow access if there are security warnings. Below is a screenshot of the Update32 application.

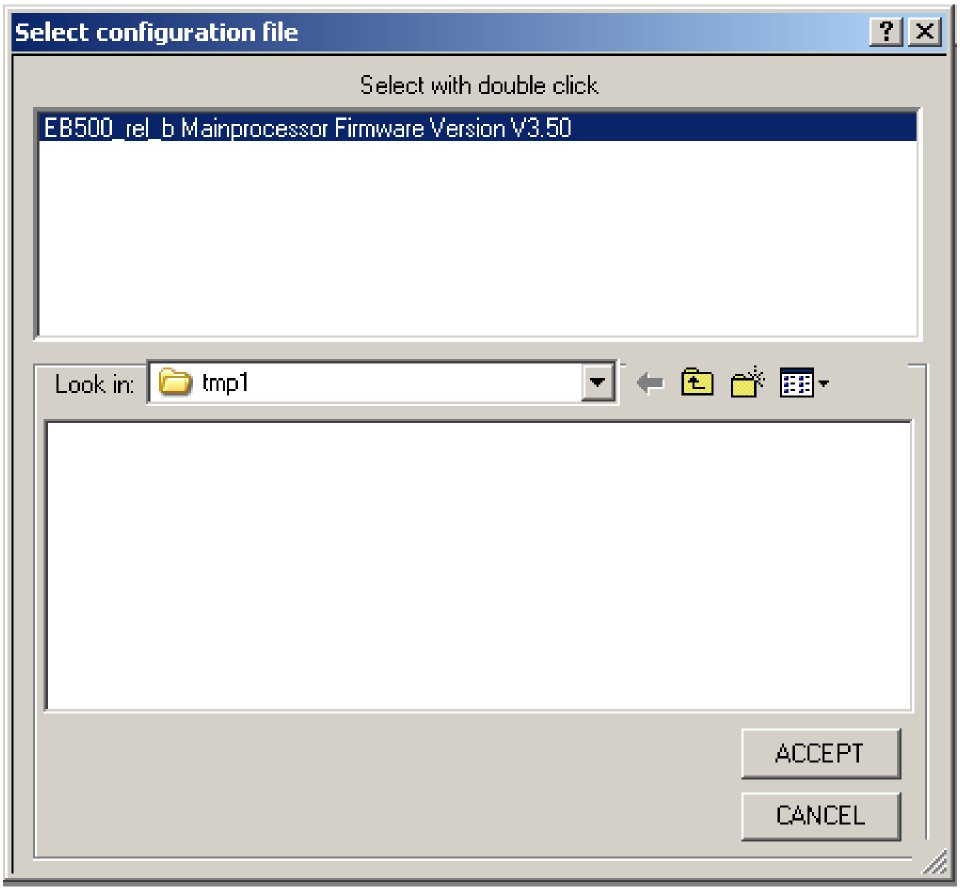




Selecting the configuration file

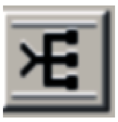
- To update a device, the correct update configuration file has to be selected. Click on the following button to open the corresponding dialog:

- Navigate to the folder that contains the configuration files under the “Look in:” field. Next, select the desired configuration file in the upper portion of the dialog and click the "ACCEPT" button.

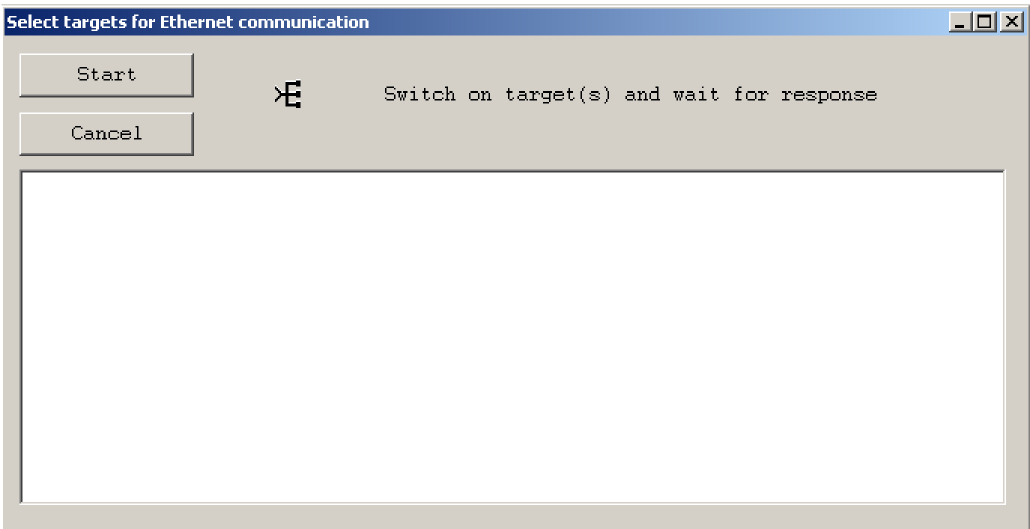


Starting the update

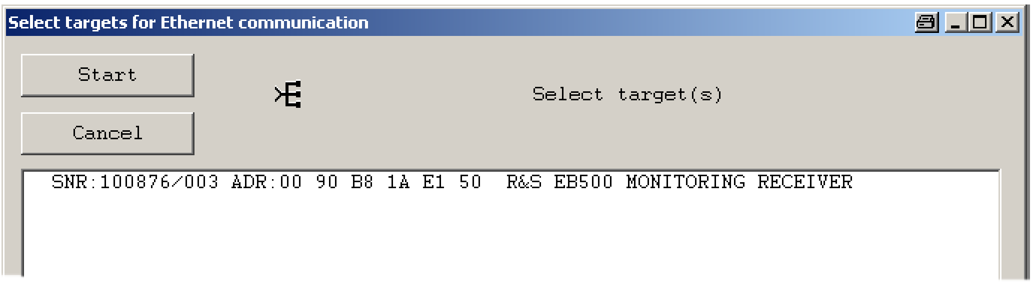
- Click on the "Update" button:



and the following dialog will appear.



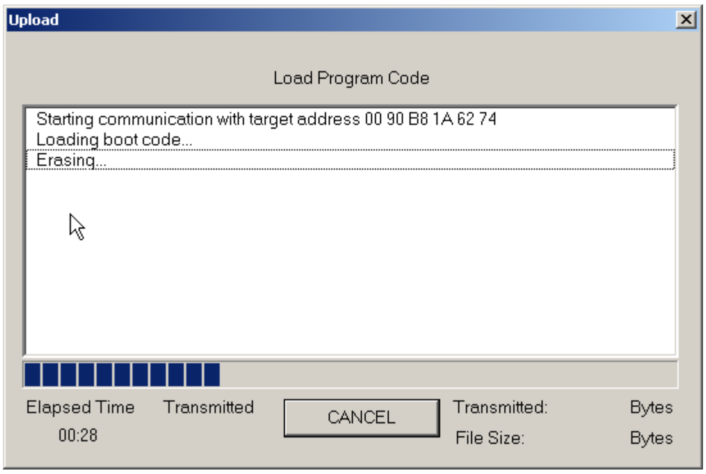
- Switch ON the power to the device ("target") to be updated. After a short period a new entry will be shown in the list of target devices as shown in figure below.



- Select the desired target device and click the "Start" button.

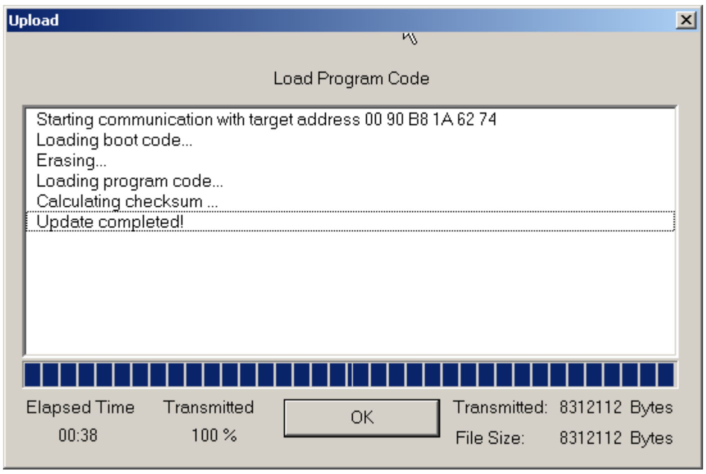
Updating process

The following dialog appears when the update starts. In the process, the flash is being erased and then the new firmware is loaded into the flash.



Completing the update

After the update is completed, close the dialog by clicking on the "OK" button. The R&S EB500 will restart automatically.



NOTICE

If update procedure fails.

If the update procedure fails, simply switch off the device and restart the update procedure.

NOTICE

Updating the R&S EB500 Model 03

The R&S EB500 with frontpanel (Model 03) can also be updated using the method with the Update32 tool. Please take note that this method cannot update the GUI. This might cause version conflicts between receiver firmware and GUI. For updating the R&S EB500 Model 03, use the method described in chapter 5.4, "Receiver Firmware and GUI Update for Model 03", on page 382.

WARNING

If the R&S EB500 cannot reboot

Because the Update32 Tool performs its firmware updates over the LAN, there could be a conflict if another user is running the tool in the same network. The R&S EB500 might "hang" after a reboot because the bootloader gets "trapped" by this Update32 on the network. In such cases the best advise is: unplug the network cable during boot-up and find out who else is running Update32 on the corporate network.

5.6 Remote Access GUI Installation

This section explains how to install the Remote GUI for use on a notebook or desktop PC.

Internal installation

For GUI software installation on the R&S EB500, follow the procedure described in . chapter 5.4, "Receiver Firmware and GUI Update for Model 03", on page 382

5.6.1 Preparations

Checking the GUI version number

Refer to the section chapter 5.3, "Retrieve Firmware Versions", on page 380 to obtain the current version of your remote GUI software, if necessary.

Required files and accessories

The Remote Access GUI can be retrieved from the location mentioned at "CD-ROM and Downloads" on page 381

Retrieving the IP address of a R&S EB500

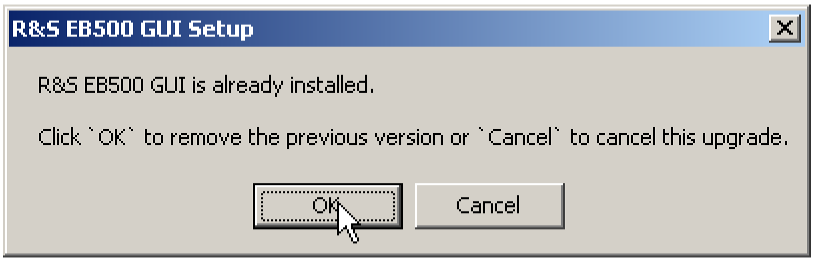
Refer to chapter 5.7, "Change Device IP Address", on page 398 for the steps required to retrieve the IP address of a R&S EB500.

5.6.2 Installation Procedure

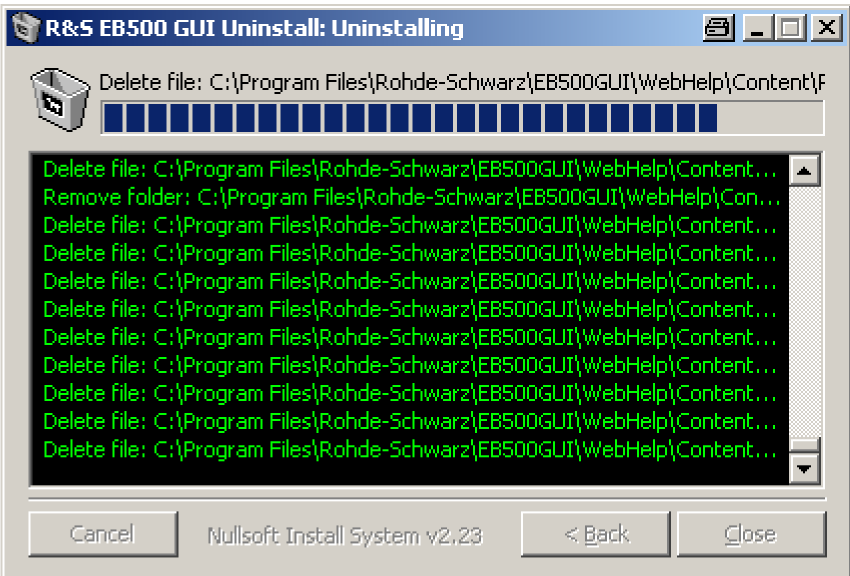
Execute the Remote Access GUI installer by clicking on `GUI Installation for Remote Access` on the html menu. Allow access if there are security warnings.

Uninstalling an earlier version of the GUI

If an earlier version of the GUI exists, it must be uninstalled before the installation of a new GUI can proceed. A dialog will appear first, which requests to uninstall this earlier version:

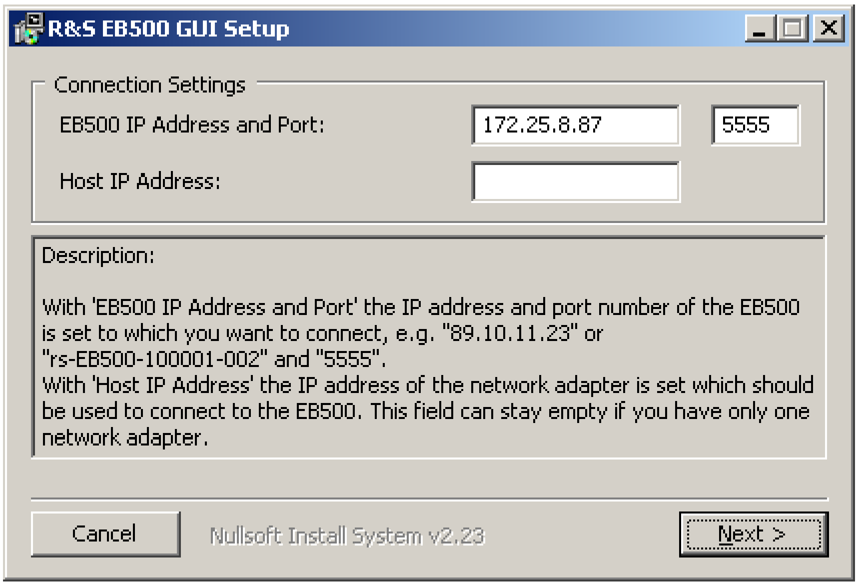


Click OK and wait for the uninstall to proceed.

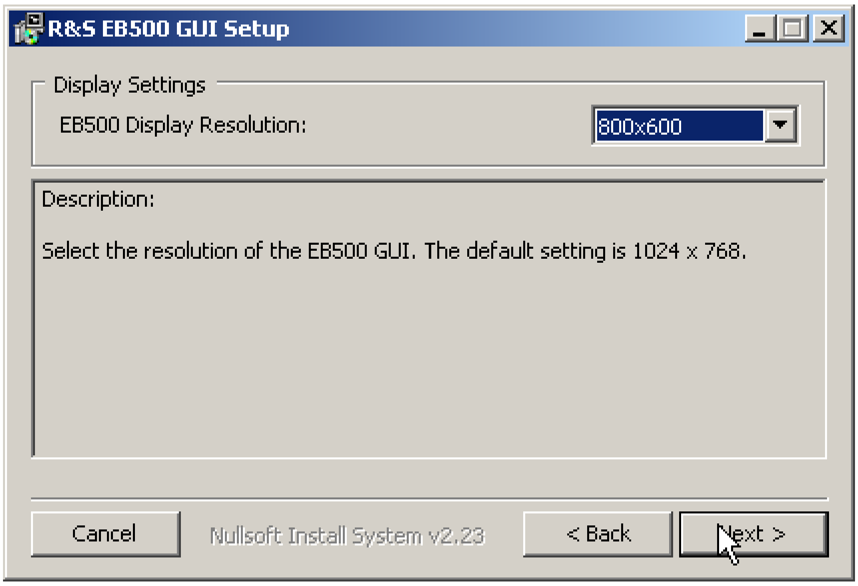


Once uninstall is completed, the installation can go ahead. The first step is to key-in the IP address and port number of the R&S EB500. You can find it under "Current IP Address" and "Current Port" after opening the "Network Configuration" dialog (SETUP > "Config" > "Network") on the front panel.

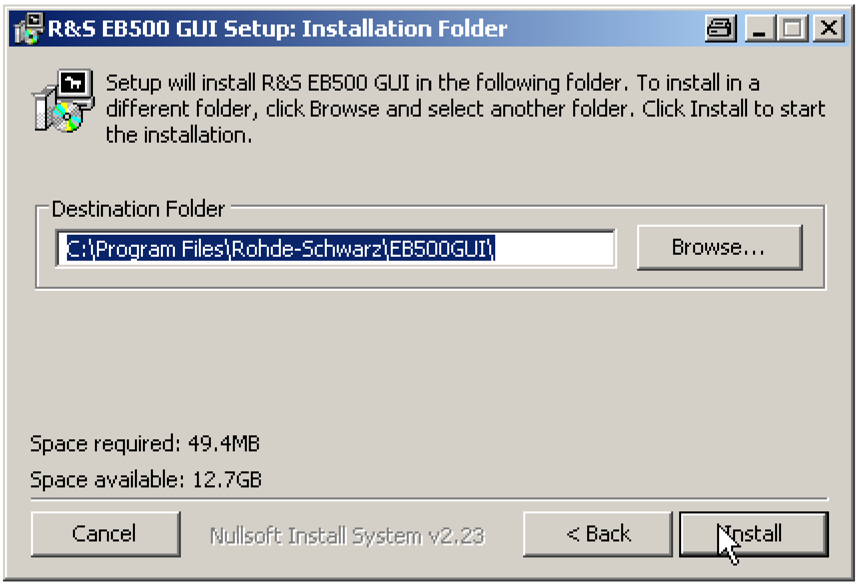
If your local network has a DNS server and you know the serial number of the R&S EB500, it can be more convenient to use DHCP with the name under which the device is known: for a device with serial number e.g. 100001-002 the DHCP name will be: "rs-eb500-100001-002".



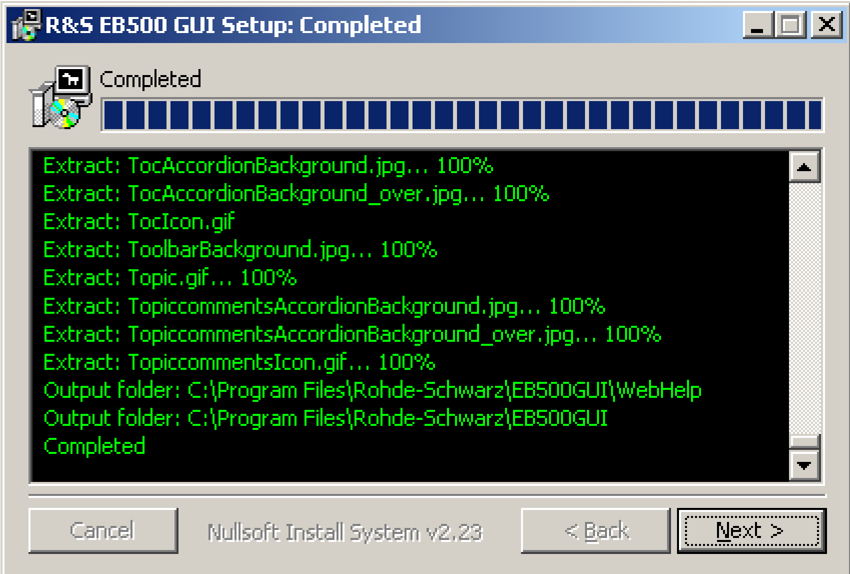
In the next step, you choose the display resolution. Note that the resolution refers to the panel resolution. When the emulated front panel buttons are included, the resolution of your PC monitor must be higher than the size stated in the settings below, otherwise the buttons might not fit in the screen. A resolution of 800x600 will fit on most monitors.



Finally configure the installation folder.

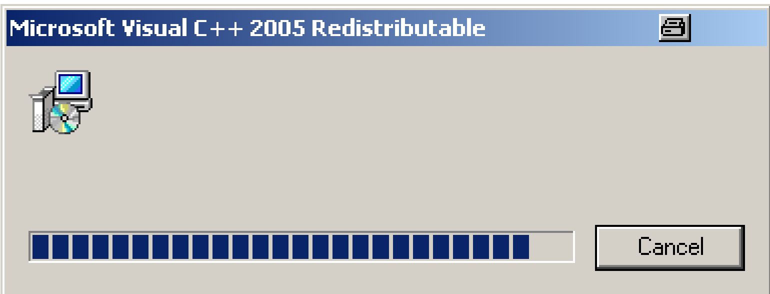


Installation will take a few minutes. Click "Next" when completed.



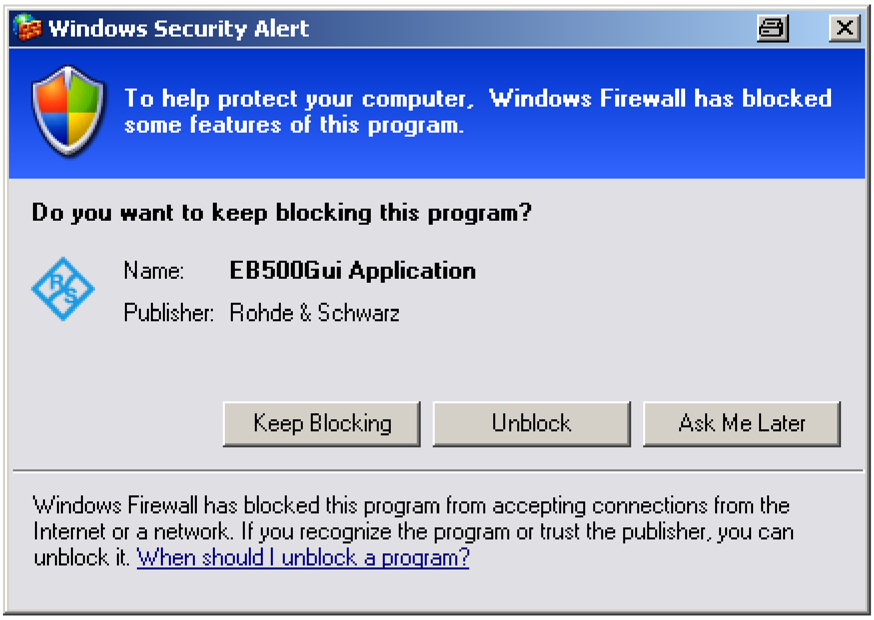
The Remote Access GUI requires an additional "Redistributable" package, distributed by Microsoft for the deployment of certain software built for the Windows operating system. It is included in the installation file as well, so there is no need to download it from the Microsoft website.

Click OK to install the "Redistributable" package. Installation will take a few minutes.



Start the Remote Access GUI via "Start" -> "Programs" -> "R&S EB500 GUI". The following dialog may appear due to the Windows Firewall. Click on "Unblock" to allow the traffic to/from the R&S EB500

As a last step, you may have to change the Windows Firewall settings to enable the network traffic of the R&S EB500 GUI. For this reason, start the GUI via "Start" -> "Programs" -> "R&S EB500 GUI". When the GUI is displayed, the following dialog may also appear.



Click "Unblock" and the Windows Firewall is set to enable the network traffic of the R&S EB500 GUI.

5.7 Change Device IP Address

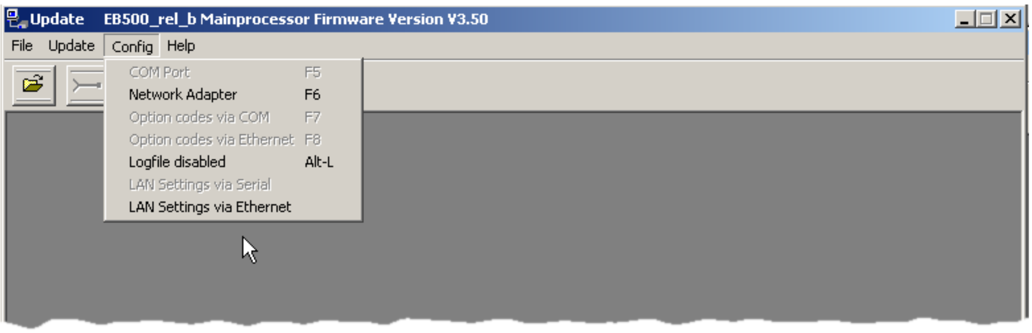
5.7.1 Using Update32 Tool (Model 02/03)

The IP address of the R&S EB500 can be changed using the "Update32" tool. By default, the R&S EB500 is shipped with DHCP enabled.

Refer to "Retrieve Update32" under chapter 5.5, "Receiver Firmware Update for Model 02", on page 388 to find out how to retrieve and run the "Update32" tool.

Starting the procedure

Run `Update32` and allow access if there are security warnings. If a configuration is not loaded previously, refer to "Selecting the configuration file" under chapter 5.5.2, "Firmware Update Using the Update32 Tool", on page 390 to select an appropriate configuration file. Select "Config" -> "LAN Settings via Ethernet" as shown below:



Selecting the target device

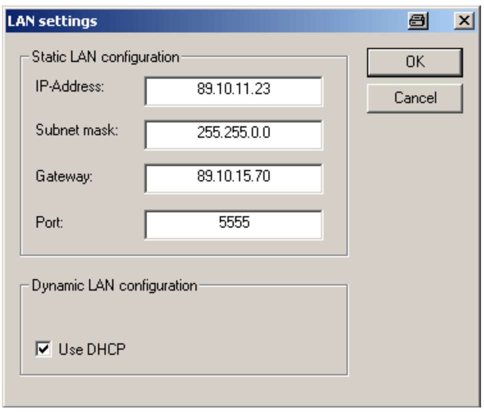
Switch on the device you want to update. Make sure there is a LAN connection between the device and the PC. After a short period, a new entry will be shown in the list of target devices as shown in chapter 5.5.2, "Firmware Update Using the Update32 Tool", on page 390. Select the appropriate target device and press the "Start" button.

Changing the IP address

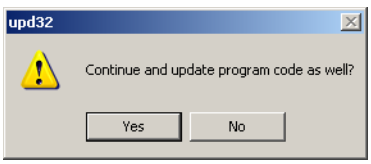
Make the desired changes in the LAN settings dialog as shown below. Select “DHCP” if the device is to be connected to a DHCP server.

Address conflict

Do NOT set the IP address to "192.168.255. 252/253/254/255". This IP address is already occupied for internal use.



After a successful change of the IP address, a dialog (shown below) with the option to update the program (firmware) code appears.



Selecting "No" will reset the R&S EB500, such that the new IP address will take effect.

Selecting "Yes" will continue with the update of program (firmware) code as defined in the configuration file. Refer to chapter 5.5.2, "Firmware Update Using the Update32 Tool", on page 390 for details.

5.7.2 Using GUI (Model 03 or Remote Access GUI)

The IP address of the R&S EB500 is needed during the GUI Installation for Remote Access. This can be obtained from the front panel of the R&S EB500 Model 03 with the key sequence SETUP -> "Config" -> "Network". Refer to the Operating Manual for more details.

5.8 Clearing User Data

The "Sanitizing" key will start a sanitizing process that will clear all the user data.

The Sanitizing function is explained in detail in "Sanitizing" on page 113.

5.9 Documents

This section provides information on the available parts for ordering.

5.9.1 Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.

DANGER

Shock hazard

For module replacement, ensure that the R&S EB500 is switched off and disconnected from the power supply by removing the plug from the AC and DC power connector. Read all safety instructions at the beginning of this manual carefully before module replacement!

NOTICE

Risk of module damage

When shipping a module, be careful to provide for sufficient mechanical and antistatic protection.

Part Description	Part Number	Model	Refurbished Availability
Wideband Frontend	4066.5806.02	02, 03	Y
Wideband Synthesizer	4066.5906.02	02, 03	Y
HF Preselection	4066.2007.03	02, 03	Y
Processor Board	4072.6100.02	02, 03	N
EB500 Interface Board	4072.6430.02	02, 03	N
EB500 DC Power Board	4072.6369.02	02, 03	N
Desktop Adapter 24V, 150W	3586.4426.00	02, 03	N
Guard Grill 80x80	0852.0573.00	02, 03	N
EB500 Fan 80x80	4072.7207.00	02, 03	N
EB500 Printing Front Cover w/o LCD	4072.5333.00	02	N
EB500 Switch Board	4072.6700.02	02	N
EB500 Printing Front face cover	4072.5279.00 4091.7073.00	03	N
IPS1	1206.0330.00	03	N
Flash-Disk for IPS1 4GB SLC	1206.2084.00	03	N
EB500 IPS1 Support Board	4072.6552.02	03	N
EB500 FELX. Switch Board	4072.6675.00	03	N
EB500 USB Board	4072.6746.02	03	N
EB500 FPC Board	4072.6498.02	03	N
Rotary Pulse-generator	4072.5340.00	03	N
28mm Knob cap	4072.5479.00	03	N
TFT 5.7 VGA LVDS LED	3586.0750.00	03	N

5.9.2 Available Power Cables

Stock no.	Earthed-contact connector	Primarily used in
DS 0006.7013.00	BS1363: 1967' 10 A, 250 V complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12, 10 A, 250 V complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland

Stock no.	Earthed-contact connector	Primarily used in
DS 0006.7036.00	Type 498/13, 10 A, 250 V complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0041.4752.00	GB2099, GB1002, 10 A, 250 V approvals CCC	China
DS 0041.6232.00	JIS C 8303, 7A, 125 V AC approvals PSE (JET)	Japan
DS 0006.7107.00	Type SAA3, 10 A, 250 V complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V straight approvals VDE, ÖVE, CEBEC, KEMA, S, D, N, FI, LCIE, IMQ, UCIEE	Europe (except Switzerland)

6 Mass Data Output

This chapter describes mass data output via UDP or TCP data streaming.

6.1 General

The mass data output of the receiver is used to transfer scan result data, measurement data, spectrum data, audio data and IQ data to an external client via the network. The data transfer can be configured in different ways. Beside the traditional way with MTRACE and ITRACE via TCP/IP, it is also possible to configure the receiver to transfer streaming data via UDP or TCP. In contrast to data transmission via MTRACE and ITRACE over TCP/IP, streaming data output improves performance in making trace data available. With a view to this, data is made available in a self-descriptive form. This should enable the evaluation of data by host applications without SCPI data interface.

System Topology

The device acts as a data server which is configured from a client via the TCP control path with SCPI commands. The data path can be connected to the same or to another client. The client opening a control connection is responsible for having knowledge of the data connection to be configured. If this connection is on a separate machine this is not trivial. It is up to the system design to solve this issue. The data path can be a "UDP path" or a "TCP path".

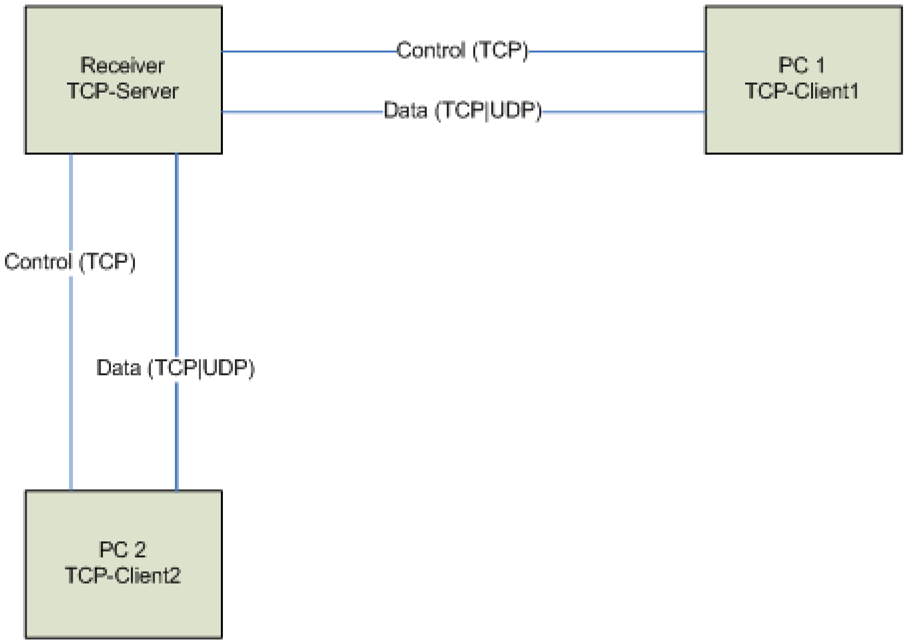


Fig. 6-1: System Topology.

Configuration

The configuration of the various "UDP path" or "TCP path" entries contains first of all the type of the data. The different trace types can be configured by means of "tags" while "flags" are used to specify the trace data more precisely.

6.2 Data Streaming via UDP

UDP is connectionless. There is no acknowledgement that the data has reached the addressee. In the UDP case, the socket starts sending immediately following configuration.

Addressing

The "UDP path" concept is intended for the distribution of data. A UDP path contains an IP address, a specific port number and configuration data. A UDP path 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 UDP paths (different port numbers with different configurations).

Survey of Connection

A separate proprietary protocol (with PING) ensures that the peer is actually available on the network. As long as this is not the case, data is not sent on the socket . For configuring the survey PING, see also command `SYST:COMM:LAN:PING OFF`

6.3 Data Streaming via TCP

TCP keeps track of the data transmission and resends packets in case they get lost. On the other hand, this also means that TCP adds overhead to the protocol, which leads to lower throughput. Another difference is that TCP is a data stream rather than a packet oriented protocol. This means that there is no starting or end point of the data. In the TCP case, the connection must be initiated first by the client side.

Addressing

The "TCP path" concept is intended for the distribution of data. A TCP path contains an IP address, a specific port number and configuration data. A host can also serve several TCP paths (different port numbers with different configurations).

If a client tries to connect a data socket before there is a configuration available, the connection is set up anyway but no data is sent until a configuration is available. On the other hand, it is possible to configure data for a data socket that is not already connected. In this case, the entry is kept in the data base until a matching socket is connected. This covers the situation where a client is temporarily unavailable. The socket may be closed after the usual timeouts and may be re-established when the client comes back again. This must be done by the client, since the receiver is always the server. The server has to ensure that the data stream for a new connection always starts with header information.

Survey of Connection

Since TCP sockets survey the connection already, no separate protocol is needed. The availability is detected by the TCP protocol.

6.4 EB200 Protocol

This chapter describes the required protocol named "EB200 protocol", which can be output via UDP or TCP with EB200 datagrams. The various data types are identified by means of tags and are provided with length information. Host applications can filter out and process specific data and need not implement the complete protocol specification.

Each EB200 datagram contains a header that clearly identifies a data item of the protocol. It is followed by one or several data units denoted as "GenericAttribute", which can be distinguished by dedicated tags.

Generally all data is transferred in network byte order i.e. in big-endian order. This is especially important for host applications running on a PC (Intel) base since the data must be converted to the little-endian format first. However, the datagrams might also be transmitted in little-endian order if configured. In this case the endianess conversion is done internally by the receiver. But this is an expensive operation and might lead to considerable performance impact.

```
EB200Datagram {
EB200Header
GenericAttribute_1
GenericAttribute_2
...
GenericAttribute_n
}
```

Header

The header marks the beginning of each EB200 datagram.

Table 6-1: Description of the EB200Header.

Data type	Parameter	Description
UINT32	MagicNumber	This is a constant value which never changes. 0x000EB200 (also for R&S EB500)
UINT16	VersionMinor	0x40 for this version; see version history below.
UINT16	VersionMajor	0x02 for this version.
UINT16	SequenceNumber	This starts at a certain value and is incremented by one for every new packet per UDP path. When the highest value is reached, a wrap-around takes place.

Data type	Parameter	Description
UINT16	reserved	This element is reserved for future extensions.
UINT32	DataSize	Size of the complete datagram in bytes.

Description of the version history:

The "VersionMinor" is incremented by appending tags or changing the tags in an upward-compatible form. The "VersionMajor" is incremented by the non-compatible change of the tags or general structural changes (the latter will be extremely rare).

MinorVersion changes

- From "VersionMinor" 0x25 upward, the additional AGC value is transmitted in the "OptionalHeader" in the case of IF or VIDEO data.
- From "VersionMinor" 0x26 upward, the additional AGC value is replaced by the RxAttenuation value for IF or VIDEO data. For AUDIO, IF and VIDEO data a string with the current demodulation is added.
- From "VersionMinor" 0x30 upward, the additional selectorflag FREQ HIGH was introduced to enable frequency ranges with 64 bit datatypes.
- From "VersionMinor" 0x31 upward, the parameter DataSize is added to the EB200Header.
- From "VersionMinor" 0x40 upward, the Timestamps are added to most Optional-Headers .

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.

Table 6-2: Description of the GenericAttribute.

Data type	Parameter	Description
UINT16	Tag	Determines the content of the "GenericAttribute".
UINT16	Length	Specifies the length of the "GenericAttribute" in bytes but not of the elements "Tag" and "Length".
Length * UINT8	Data[Length]	Contains useful data. The length of this data area is determined by the preceding data element "Length".

There is a common structure for the Tags currently defined (FSCan, MSCan, AUDio, IFPan, CW, IF, VIDeo, VDPan, SELCall, DFPan, PIFPan, AIF and PSCAN). It is described later in this chapter. This structure is contained in element "Data" of the "GenericAttribute".

Table 6-3: Description of Tags.

Symbolic tag name	Data type	Numeric tag value (decimal)
FSCan	Data from frequency-scan measurements	101
MSCan	Data from memory-scan measurements	201

Symbolic tag name	Data type	Numeric tag value (decimal)
reserved	not for R&S EB500	301
AUDio	Digital audio signal	401
IFPan	Spectrum of the IF signal	501
CW	Data from measurements (triggered manually or periodically)	801
IF	Digital IF signal (I/Q data, non-regulated)	901
VIDeo	Digital video signal (AM/FM or I/Q regulated)	1001
VDPan	Spectrum of the video signal	1101
PSCan	Panorama-scan level data	1201
SELCall	Selcall-analysis data	1301
DFPan	Direction-finding data	1401
PIFPan	Polychrome IF panorama data	1601
GPSCompass	GPS Compass aata	1801
AIF	AMMOS IF data	not relevant with AMMOS data format
ADDC	AMMOS DDC data	not relevant with AMMOS data format

TraceAttribute

This describes the common structure of all trace data defined up to now.

Table 6-4: Description of the TraceAttribute.

Data type	Parameter	Description
UINT16	NumberOfTraceItems	Number of values per data type in PeriodicTraceData
UINT8	ChannelNumber	This element denotes the receiver channel (currently there is only one channel): 0 receiver 0x77 receiver up to VersionMinor 0x31
UINT8	OptionalHeaderLength	Size of the "OptionalHeader" in bytes
UINT32	SelectorFlags	Exact specification of data; see table below
n * UINT8	OptionalHeader	This is described accurately for the corresponding trace. "n" denotes the length of the OptionalHeader in bytes.
m * UINT8	PeriodicTraceData	Actual trace data; depending on selectorFlags or tag and OptionalHeader "m" denotes the length of the "DataSize" in bytes.

Upward compatibility:

The value of "OptionalHeaderLength" should always be referenced to access the actual trace data in the "PeriodicTraceData". Upward compatibility is thus ensured even for "MinorVersion" modifications. The "SelectorFlags" are dealt with here in general but are only partly useful when applied to the individual traces.

Table 6-5: Description of selectorFlags.

selectorFlag	Hexadecimal value	Data type	Corresponding flags
LEVEL	0x01	short	"VOLTage:AC"
OFFSET	0x02	long	"FREQuency:OFFSet"
FSTRENGTH	0x04	short	"FSTRength"
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"
DF_LEVEL	0x800	short	DFLevel
AZIMUTH	0x1000	short	AZImuth
DF_QUALITY	0x2000	short	DFQuality
DF_FSTRENGTH	0x4000	short	DFFStrength
CHANNEL	0x00010000	short	"CHANnel"
FREQ LOW	0x00020000	unsigned long	"FREQuency:RX"
FREQ HIGH	0x00200000	unsigned long	"FREQuency:HIGH:RX"
SWAP	0x20000000	-	"SWAP"
SIG-NAL_GREATER_SQUELCH	0x40000000	-	"SQUelch"
OPTIONAL_HEADER	0x80000000	-	"OPTional"

The "SelectorFlags" describe the data to be found in the "PeriodicTraceData", whether an "OptionalHeader" has been transmitted and whether the trace data is of "SIG-NAL_GREATER_SQUELCH" data. If the SelectorFlag "SWAP" is set, the useful data is transmitted in little-endian order. The sequence of the data in the "PeriodicTraceData" corresponds to the sequence indicated in table 6-5, i.e. depends on the set "selector-Flags".

The flags are determined by the corresponding configuration command `TRAC:UDP:......`, the set sensor functions and whether this setting is allowed by the trace type in the first place. If all these settings allow a specific data item, the latter is sent in the protocol trace and the corresponding "SelectorFlag" set.

FScan

All data specified in the "selectorFlags" is relevant for this trace type.

The "OptionalHeader" contains the following data structure FScanTraceHeader to describe the contents of every data packet:

Table 6-6: Description of the FScanTraceHeader.

Data type	Parameter	Description
INT16	CycleCount	Number of sweeps. If the number is infinite, CycleCount is set to -1.
INT16	HoldTime	Hold time in milliseconds for the signal controlled scan. See also parameter StopSignal below.
INT16	DwellTime	Dwell time in milliseconds. If the dwell time is infinite, DwellTime is set to -1.
INT16	DirectionUp	Scan direction 0 decreasing frequency 1 increasing frequency
INT16	StopSignal	Signal controlled scan 0 off 1 on
UINT32	StartFreq_low	Lower part of the start frequency as a 64-bit value [Hz]
UINT32	StopFreq_low	Lower part of the stop frequency as a 64-bit value [Hz]
UINT32	StepFreq	Step frequency [Hz]
UINT32	StartFreq_high	Upper part of the start frequency as a 64-bit value [Hz * 65536]
UINT32	StopFreq_high	Upper part of the stop frequency as a 64-bit value [Hz * 65536]
2 * UINT8	reserved[2]	24 bytes reserved for 64-bit alignment
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

Table 6-7: Example of a complete FScanAttribute.

Data type	Parameter	Description
UINT16	NumberOfTraceValues	Corresponds to the NumberOfTraceItems
INT8	reserved	Not used
UINT8	OptionalHeaderLength	As described above length is 0 or 40 bytes
UINT32	SelectorFlags	See description of SelectorFlags
40 bytes	OptionalHeader	FScanTraceHeader as described above
INT16	level_1	Level [1/10 dBµV] of the first channel
INT16	level_2	Level [1/10 dBµV] of the second channel

Data type	Parameter	Description
n * INT16	level_n	Level [1/10 dBµV] of the n channel n is NumberOfTraceValues
INT16	offset_1	Offset [Hz] of the first channel
INT16	offset_2	Offset [Hz] of the second channel
n * INT16	offset_n	Offset [Hz] of the n channel n is NumberOfTraceValues
INT16	am_1	am [1/10 %] of the first channel
INT16	am_2	am [1/10 %] of the second channel
n * INT16	am_n	am [1/10 %] of the n channel n is NumberOfTraceValues
	etc.	See SelectorFlags table for sequence
UINT32	Freq_low_1	Lower part of the frequency [Hz] of the first channel
UINT32	Freq_low_2	Lower part of the frequency [Hz] of the second channel
n * UINT32	Freq_low_n	Lower part of the frequency [Hz] of the n channel n is NumberOfTraceValues
UINT32	Freq_high_1	Higher part of the frequency [Hz] of the first channel
UINT32	Freq_high_2	Higher part of the frequency [Hz] of the second channel
n * UINT32	Freq_high_n	Higher part of the frequency [Hz] of the n channel n is NumberOfTraceValues

Upward compatibility:

In the future, elements may well be added or, more precisely, appended to the "OptionalHeader". If an application with "OptionalHeaderLength" exceeds the optional header to get to the trace data, there will be no problems for the existing programs (upward compatibility).

MScan

This trace has the same structure as the "FScanTrace", except that the "OptionalHeader" does not contain certain elements of the "FScanTrace" optional header.

Description of the "OptionalHeader":

Table 6-8: Description of the MScanTraceHeader.

Data type	Parameter	Description
INT16	CycleCount	Number of sweeps. If the number is infinite, CycleCount is set to -1.
INT16	HoldTime	Hold time in milliseconds for the signal controlled scan. See also parameter StopSignal below.
INT16	DwellTime	Dwell time in milliseconds. If the dwell time is infinite, DwellTime is set to -1.

Data type	Parameter	Description
INT16	DirectionUp	Scan direction 0 decreasing frequency 1 increasing frequency
INT16	StopSignal	Signal controlled scan 0 off 1 on
6 * UINT8	reserved[2]	6 bytes reserved for 64-bit alignment
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

The "OptionalHeaderLength" is thus either 0 or 24.

PScan

"selectorFlags" for "PScanTrace" can contain:

"LEVEL"

"SIGNAL_GREATER_SQELCH"

"OPTIONAL_HEADER"

Description of the "OptionalHeader":

Table 6-9: Description of the PScanTraceHeader.

Data type	Parameter	Description
UINT32	StartFreq_low	Lower part of the start frequency as a 64-bit value [Hz]
UINT32	StopFreq_low	Lower part of the stop frequency as a 64-bit value [Hz]
UINT32	StepFreq	Step frequency [Hz]
UINT32	StartFreq_high	Upper part of the start frequency as a 64-bit value [Hz * 65536]
UINT32	StopFreq_high	Upper part of the stop frequency as a 64-bit value [Hz * 65536]
4 * UINT8	reserved[4]	4 bytes reserved for 64-bit alignment
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

The "OptionalHeaderLength" is thus either 0 or 32.

Selcall

"selectorFlags" for "SELCallTrace" can contain:

"SWAP"

"OPTIONAL_HEADER"

Description of the "OptionalHeader":

Table 6-10: Description of the SelcallTraceHeader.

Data type	Parameter	Description
UINT32	Freq_low	Lower part of the current receive frequency as a 64-bit value [Hz]
UINT32	Bandwidth	Current demodulation bandwidth
UINT16	Demodulation	Current demodulation mode: 0 FM 1 AM 2 PULS 3 PM 4 IQ 5 ISB 6 CW 7 USB 8 LSB
8 * UINT8	DemodulationString[8]	Current demodulation mode as a string
UINT16	SelcallMode	Detected Selcall mode: 0 CCIR7 1 CCIR1 1 2 CCITT 3 EEA 4 EIA 5 EURO 6 NATEL 7 VDEW 8 ZVEI1 9 ZVEI2 10 DTMF 11 CTCSS 12 DCS
10 * UINT8	SelcallModeString[10]	Detected Selcall mode as a string
UINT32	Freq_high	Upper part of the current receive frequency as a 64-bit value [Hz * 4294967296]
6 * UINT8	reserved[6]	6 bytes reserved for 64-bit alignment
UINT64	Timestamp	Nanoseconds since Jan 1st, 1970, without leap seconds

The data is always transmitted as a 32-bit value.

Table 6-11: Example of a complete SelcallAttribute.

Data type	Parameter	Description
UINT16	NumberOfCodes	Corresponds to the NumberOfTraceItems
INT8	Reserved	Not used

Data type	Parameter	Description
UINT8	OptionalHeaderLength	As described above, length is 0 or 48 bytes
UINT32	SelectorFlags	See description of SelectorFlags
48 bytes	OptionalHeader	FScanTraceHeader as described above
n * UINT32	Codes[n]	n Selcall codes n is NumberOfCodes

Example of a code sequence for number 08941290:

NumberOfCodes = 8

Codes[0] = 0x0

Codes[1] = 0x8

Codes[2] = 0x9

Codes[3] = 0x4

Codes[4] = 0x1

Codes[5] = 0x2

Codes[6] = 0x9

Codes[7] = 0x0

The CTCSS codes are coded as CTCSS frequencies in 1/10th Hz (e.g. 151.4 Hz are coded as 1514).

Required receiver settings:

Selective calling is generally frequency and phase modulated (FM/PM). Therefore the receiver must be set for this type of demodulation. The bandwidth for the demodulation must conform to the signal, which is generally between 15 and 30 kHz. See also the description of remote-control command `[SENSe:]DECoder:SELCall on|off|1|0`.

AUDio

"selectorFlags" for audio data can only contain "OPTIONAL_HEADER".

Description of the "OptionalHeader":

Table 6-12: Description of the AudioTraceHeader.

Data type	Parameter	Description
INT16	AudioMode	See remote command SYSTem:AUDio:REMote:MODe
INT16	FrameLength	Specifies the number of bytes per frame
UINT32	Freq_low	Lower part of the current receive frequency as a 64-bit value [Hz]
UINT32	Bandwidth	Current demodulation bandwidth

Data type	Parameter	Description
UINT16	Demodulation	Current demodulation mode: 0 FM 1 AM 2 PULS 3 PM 4 IQ 5 ISB 6 CW 7 USB 8 LSB
8 * UINT8	DemodulationString[8]	Current demodulation mode as a string
UINT32	Freq_high	Upper part of the current receive frequency as a 64-bit value [Hz * 65536]
6 * UINT8	reserved[6]	6 bytes reserved for 64-bit alignment
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

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 remote command `SYSTem:AUDio:REMote:MODe`.

No audio data is available because "Signal < threshold" and "Squelch ON" was chosen. In this case, this can be recognized as parameter "audio_mode" is 0 in this case. In the PCM modes ("audio_mode" 1 to 12), a frame contains one or two channels, and each channel is 16 bits wide. Depending on the configuration, each frame contains 1, 2 or 4 bytes.

IFPan

"selectorFlags" for the IF panorama can contain:

"LEVEL"

"OPTIONAL_HEADER"

Description of the "OptionalHeader":

Table 6-13: Description of the IFPanTraceHeader.

Data type	Parameter	Description
UINT32	Freq_low	Lower part of the IF panorama center frequency as a 64-bit value [Hz]
UINT32	FreqSpan	Frequency span [Hz]
INT16	AvgTime	Not used and always set to 0

Data type	Parameter	Description
INT16	AvgType	0 MINimum 1 MAXimum 2 AVERage | SCALar 3 CLRWRITE | OFF
INT32	MeasureTime	Measure time [µs]
UINT32	Freq_high	Upper part of the IF panorama center frequency as a 64-bit value [Hz * 65536]
INT32	DemodFreqChannel	This index points to the channel of the demodulation frequency.
UINT32	DemodFreq_low	Lower part of the demodulation frequency as a 64-bit value [Hz]
UINT32	DemodFreq_high	Upper part of the demodulation frequency as a 64-bit value [Hz * 65536]
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

Table 6-14: Example of a complete IFPanAttribute.

Data type	Parameter	Description
UINT16	NumberOfTraceValues	Corresponds to the NumberOfTraceItems
INT8	Reserved	Not used
UINT8	OptionalHeaderLength	As described above, length is 0 or 40 bytes
UINT32	SelectorFlags	See description of SelectorFlags
40 bytes	OptionalHeader	FScanTraceHeader as described above
INT16	level_1	Level [1/10 dBµV] of the first channel
INT16	level_2	Level [1/10 dBµV] of the second channel
n * INT16	level_n	Level [1/10 dBµV] of the n channel n is NumberOfTraceValues

VDPan

"selectorFlags" for the video panorama can contain:

"LEVEL"

"OPTIONAL_HEADER"

Description of the "OptionalHeader":

Data type	Parameter	Description
UINT32	Freq_low	Lower part of the IF panorama center frequency as a 64-bit value [Hz]
UINT32	FreqSpan	Frequency span [Hz]
INT16	AvgTime	Not used and always set to 0

Data type	Parameter	Description
INT16	DispayVariant	2 AM | LEFT 3 FM | RIGHt 4 IQ 5 AMSquare 6 FMSquare 7 IQSquare
INT32	MeasureTime	Not used and always set to 0
UINT32	Freq_high	Upper part of the IF panorama center frequency as a 64-bit value [Hz * 65536]
INT32	DemodFreqChannel	Not used and always set to 0
UINT32	DemodFreq_low	Lower part of the demodulation frequency as a 64-bit value [Hz]
UINT32	DemodFreq_high	Upper part of the demodulation frequency as a 64-bit value [Hz * 65536]
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

Table 6-15: Example of a complete VDPanAttribute.

Data type	Parameter	Description
UINT16	NumberOfTraceValues	Corresponds to the NumberOfTraceItems
INT8	Reserved	Not used
UINT8	OptionalHeaderLength	As described above, length is 0 or 40 bytes
UINT32	SelectorFlags	See description of SelectorFlags
40 bytes	OptionalHeader	FScanTraceHeader as described above
INT16	level_1	Level [1/10 dBµV] of the first channel
INT16	level_2	Level [1/10 dBµV] of the second channel
n * INT16	level_n	Level [1/10 dBµV] of the n channel n is NumberOfTraceValues

Required receiver settings:

The VDPan data stream can be configured with the commands

`DISPlay:MENU OFF|DEFault|LEFT|AM|RIGHt|FM|IQ|AMSQuare|FMSQuare|IQSQuare`

and

`SYSTem:VIDeo:REMote:MODe OFF|SHORT|LONG`.

CW

With this trace type, as with "FScanTrace", all data specified in the "selectorFlags" is relevant.

Description of the "OptionalHeader":

Table 6-16: Description of the CWTraceHeader.

Data type	Parameter	Description
UINT32	Freq_low	Lower part of the current receive frequency as a 64-bit value [Hz]
UINT32	Freq_high	Upper part of the current receive frequency as a 64-bit value [Hz * 65536]
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

IF

"selectorFlags" for IF data can only contain "OPTIONAL_HEADER" .

Description of the "OptionalHeader":

Table 6-17: Description of the IFTraceHeader.

Data type	Parameter	Description
INT16	IFMode	See command `SYSTem:IF:REMote:MODE OFF|SHORT|LONGe` 0 OFF 1 SHORT 2 LONG
INT16	FrameLength	Specifies the number of bytes per frame
UINT32	SampleRate	Current sampling rate
UINT32	Freq_low	Lower part of the current receive frequency as a 64-bit value [Hz]
UINT32	Bandwidth	Current demodulation bandwidth [Hz]
UINT16	Demodulation	current demodulation mode: 0 FM 1 AM 2 PULS 3 PM 4 IQ 5 ISB 6 CW 7 USB 8 LSB
INT16	RxAttenuation	Current receiver attenuation from antenna to IQ
UINT16	Flags	Bit0 SignalValid (0 --> not valid; 1-> valid) Bit1 Blanking (0 --> not active; 1-> active) Bit15 KFactor (0 --> invalid; 1 --> valid)
INT16	KFactor	K factor for field strength measurement [1/10 dB/m]
INT16	reserved	Reserved for 64-bit alignment
8 * UINT8	Demodulation-String[8]	Current demodulation mode as a string
UINT64	SampleCount	Number of 1st Sample

Data type	Parameter	Description
UINT32	Freq_high	Upper part of the current receive frequency as a 64-bit value [Hz * 65536]
4 * UINT8	reserved2[4]	4 bytes reserved for 64-bit alignment
UINT64	StartTimestamp	Time stamp at start of sampling in nanoseconds since Jan 1st, 1970, without leap seconds

The power level at the antenna can be calculated with the parameter "RxAttenuation". LevelAntenna = level_IQ_RMS + RxAttenuation

Table 6-18: Example of a complete IFAttribute with IFMode set to SHORT.

Data type	Parameter	Description
UINT16	NumberOfTraceValues	Corresponds to the NumberOfTraceItems
INT8	Reserved	Not used
UINT8	OptionalHeaderLength	As described above, length is 0 or 56 bytes
UINT32	SelectorFlags	See description of SelectorFlags
56 bytes	OptionalHeader	IFTraceHeader as described above
INT16	I_sample_1	I part of of the first sample
INT16	Q_sample_1	Q part of of the first sample
INT16	I_sample_2	I part of the second sample
INT16	Q_sample_2	Q part of the second sample
	...	
	...	
INT16	I_sample_n	I part of the n sample n is NumberOfTraceValues
INT16	Q_sample_n	Q part of the n sample n is NumberOfTraceValues

VIDEO

"selectorFlags" for VIDEO data can only contain "OPTIONAL_HEADER".

Description of the "OptionalHeader":

Table 6-19: Description of the VideoTraceHeader.

Data type	Parameter	Description
INT16	VideoMode	See command `SYSTem:VIDEO:REMote:MODE OFF|SHORT|LONG` 0 OFF 1 SHORT (16 Bit) 2 LONG (32 Bit)
INT16	FrameLength	Specifies the number of bytes per frame

Data type	Parameter	Description
UINT32	SampleRate	Current sampling rate
UINT32	Freq_low	Lower part of the current receive frequency as a 64-bit value [Hz]
UINT32	Bandwidth	Current demodulation bandwidth [Hz]
UINT16	Demodulation	Current demodulation mode: 0 FM 1 AM 2 PULS 3 PM 4 IQ 5 ISB 6 CW 7 USB 8 LSB
INT16	RxAttenuation	Current attenuation from antenna to IQ
INT16	Flags	Bit0 SignalValid (0 --> not valid; 1-> valid) Bit1 Blanking (0 --> not active; 1-> active)
INT16	reserved	Reserved for 64-bit alignment
8 * UINT8	DemodulationString[8]	Current demodulation mode as a string
UINT64	SampleCount	Number of 1st sample
UINT32	Freq_high	Upper part of the current receive frequency as a 64-bit value [Hz * 65536]
4 * UINT8	reserved2[4]	4 bytes reserved for 64-bit alignment
UINT64	StartTimestamp	Time stamp at start of data sampling in nanoseconds since Jan 1st, 1970, without leap seconds

Table 6-20: Example of a complete VideoAttribute with VideoMode set to SHORT and Demodulation set to AM or FM.

Data type	Parameter	Description
UINT16	NumberOfTraceValues	Corresponds to the NumberOfTraceItems
INT8	Reserved	Not used
UINT8	OptionalHeaderLength	As described above, length is 0 or 56 bytes
UINT32	SelectorFlags	See description of SelectorFlags
56 bytes	OptionalHeader	FScanTraceHeader as described above
INT16	AM_sample_1	AM part of of the first sample
INT16	FM_sample_1	FM part of of the first sample
INT16	AM_sample_2	AM part of the second sample
INT16	FM_sample_2	FM part of the second sample
	...	

Data type	Parameter	Description
	...	
INT16	AM_sample_n	AM part of the n sample n is NumberOfTraceValues
INT16	FM_sample_n	FM part of the n sample n is NumberOfTraceValues

DFPan

Direction-finding functions

Direction-finding functions are only accessible with the installed DF-upgrade R&S EB500-DF (Direction Finding).

The following data can be output additionally as "OptionalHeader":

Table 6-21: Description of the DFPanTraceHeader.

Data type	Parameter	Description
UINT32	Freq_low	Lower part of the current receive frequency as a 64-bit value [Hz]
UINT32	Freq_high	Upper part of the current receive frequency as a 64-bit value [Hz * 65536]
UINT32	FreqSpan	Frequency span [Hz]
INT32	DFThresholdMode	Direction finding threshold mode: 0 OFF 1 GATE 2 NORM
INT32	DFThresholdValue	Current direction finding averaging level threshold [dBµV]
UINT32	DFBandwidth	Current direction finding bandwidth [Hz]
UINT32	StepWidth	Current stepwidth [Hz]
INT32	DFMeasureTime	Direction finding measure time [µs]
INT32	DFOption	Direction finding option: Bit 0 = 1 -> direction finding possible Bit 0 = 0 -> direction finding not possible as no antenna found for current frequency
UINT16	CompassHeading	Heading of a connected compass [1/10 °]
INT16	CompassHeadingType	Heading type of the connected compass: 0 compass with unknown heading 1 compass value uncorrected 2 compass value corrected to magnetic north 3 compass value corrected to true heading
INT32	AntennaFactor	Antenna factor for field strength measurement [1/10 dB/m]
INT32	DemodFreqChannel	Channel number of the demodulation frequency

Data type	Parameter	Description
UINT32	DemodFreq_low	Lower part of the demodulation frequency as a 64-bit value [Hz]
UINT32	DemodFreq_high	Upper part of the demodulation frequency as a 64-bit value [Hz * 65536]
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds
	GPSHeader	GPS header, see below

Table 6-22: Description of the GPSHeader.

Data type	Parameter	Description
INT16	Valid	Denotes whether GPS data is to be considered valid: 0 not valid 1 valid
INT16	NoOfSatInView	Number of satellites in view 0-12; only valid if GGA msg is received, else -1 (GPS_UNDEFINDED)
INT16	LatRef	Latitude direction ('N' or 'S')
INT16	LatDeg	Latitude degrees [°]
FLOAT	LatMin	Geographical latitude in minutes [']
INT16	LonRef	Longitude direction ('E' or 'W')
INT16	LonDeg	Longitude degrees [°]
FLOAT	LonMin	Geographical longitude in minutes [']

Data is then sent depending on the "SelectorFlags" set; the order corresponds to the significance of the "SelectorFlags". The number of values is defined in the "TraceAttribute" ("NumberOfTraceItems").

PIFPan

With PIFPan (polychrome IF panorama) data, a picture is transferred as a bitmap. Each pixel is represented by one byte. A GUI can evaluate the byte value to different colors using a color set table. Every picture is transferred in several data packets which contain horizontal stripes (pieces) of the picture.

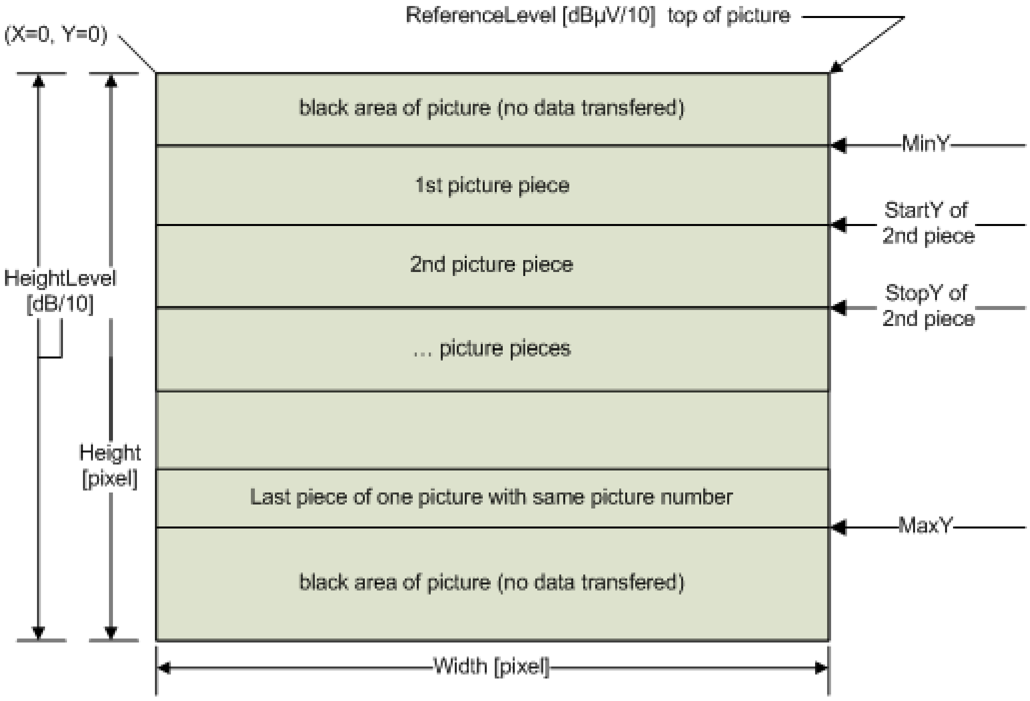


Fig. 6-2: PIFPan picture.

The "OptionalHeader" contains the following data `struct PIFPanHeader` to describe the contents of every data packet:

Data type	Parameter	Description
UINT32	Freq_low	Lower part of the receive frequency as a 64-bit value [Hz]
UINT32	Freq_high	Upper part of the receive frequency as a 64-bit value [Hz * 65536]
UINT32	FreqSpan	Frequency span [Hz]
INT32	ReferenceLevel	Absolute level of the top picture line [dBµV/10]
INT32	HeightLevel	Upper part of the receive frequency height of the picture [dB/10]
INT32	Height	Picture height resolution [pixel]
INT32	Width	Picture width resolution [pixel]
INT32	MaxY	Maximum used Y coordinate (exclusive)
INT32	MinY	Minimum used Y coordinate (inclusive)
INT32	StartY	Start pixel line of picture piece (inclusive)
INT32	StopY	Stop pixel line of picture piece (inclusive)
UINT32	PictureNumber	Piece belonging to picture number
UINT64	OutputTimestamp	Time stamp at data output in nanoseconds since Jan 1st, 1970, without leap seconds

The data part of every packet contains ((StopY - StartY + 1) * Width) bytes.

With firmware version 2.10 , "Height" is 240 and "Width" is 800 in polychrome mode `HISTogram` and 1601 in polychrome mode `PULSe`. These values may differ in future versions. Therefore interface programmers are recommended to use the parameters of the "OptionalHeader" instead of constant values to keep the interface compatible for the future.

AIF

AIF data is special structured data used for AMMOS systems.

6.5 Remote Commands

As the commands for the configuration of the data paths for UDP and TCP are very similar, they are described together. There is a fixed number of maximum configurable UDP and TCP path entries. With UDP, the first entry (index 0) is always the default entry. With TCP, there is no default path.

A data path is always made up of an IP address (as a string) and a port number (as an integer), e.g. "89.10.11.23", 18457.

Byte order of the 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, for instance, in the TCP/IP protocol. Using the "SWAP" flag described below, this behavior can be altered. If this flag is set, the data involved is 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 is used as protocol.

Registration of tags and flags for a data path

The flags are registered independently of the tags.

Table 6-23: Description of flags.

Possible flags	Data output
"VOLTage:AC"	Level
"FREQuency:OFFSet"	Offset
"FSTRength"	Field strength
"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

Possible flags	Data output
"BANDwidth"	Bandwidth
"CHANnel"	Channel number
"FREQuency:RX"	Frequency (lower part)
"FREQuency:HIGH:RX"	Frequency (upper part)
"SWAP"	In little-endian order
"SQUelch"	Only level values above squelch threshold
"OPTional"	Additional OptionalHeader

If SW option R&S EB500-IM (ITU-Measurement) is installed, the measurement functions AM modulation index, FM frequency deviation, PM phase deviation and bandwidth measurement are available in addition to the level and offset.

TRACe:UDP|TCP:TAG[:ON] <ip_address>, <port_number>, <tag_list>

This command registers a tag for a specific UDP or TCP path.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be registered as an integer e.g. 18457.

Range: 1 to 65535

<tag_list> Possible tags: FSCan, MSCan, PSCan, AUDio, IFPan, CW, IF, VIDeo, VDPan, SELCall, DFPan, PIFPan, AIF (see table 6-3).

Example: `TRAC:UDP:TAG "89.10.20.30", 17222, FSC, MSC`

TRACe:UDP:DEFault:TAG[:ON] <ip_address>, <port_number>, <tag_list>

This command registers a tag for the default UDP. The default UDP path is reserved for the internal GUI.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be registered as an integer e.g. 18457.

Range: 1 to 65535

<tag_list> FSCan, MSCan, PSCan, AUDio, IFPan, CW, IF, VIDeo, VDPan, SELCall, DFPan (see table 6-3).

Example: `TRAC:UDP:DEF:TAG "89.10.20.30", 17222, FSC, MSC`

TRACe:UDP|TCP:FLAG[:ON] <ip_address>, <port_number>, <flag_list>

This command registers a flag for a specific UDP or TCP path.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be registered as an integer e.g. 18457.

Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "FREQuency:OFFSet", "AM","AM:POSitive", "AM:NEGative",...(see table 6-23).

Example:
```
TRAC:UDP:
FLAG "89.255.255.255", 18457, "VOLTage:
AC", "FREQuency:OFFSet", "OPT"
```

TRACe:UDP:DEFault:FLAG[:ON] <ip_address>, <port_number>, <flag_list>

This command registers a flag for the default UDP path. The default UDP path is reserved for the internal GUI.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be registered as an integer e.g. 18457.

Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "FREQuency:OFFSet", "AM","AM:POSitive", "AM:NEGative",...(see table 6-23).

Example:
```
TRAC:UDP:DEF:
FLAG "89.255.255.255", 18457, "VOLTage:
AC", "FREQuency:OFFSet", "OPT"
```

TRACe:UDP|TCP:TAG:OFF <ip_address>, <port_number>, <tag_list>

This command deregisters a tag for a specific UDP or TCP path.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be deregistered as an integer e.g. 18457.

Range: 1 to 65535

<tag_list> Possible tags: FSCan, MSCan, PSCan, AUDio, IFPan, CW, IF, VIDeo, VDPan, SELCall, DFPan, PIFPan, AIF (see table 6-3).

Example:
```
TRAC:UDP:TAG:OFF "89.10.20.30", 17222, FSC, MSC
```

TRACe:UDP:DEFault:TAG:OFF <ip_address>, <port_number>, <tag_list>

This command deregisters a tag for the default UDP path. The default UDP path is reserved for the device internal GUI.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be deregistered as an integer e.g. 18457.

Range: 1 to 65535

<tag_list> FSCan, MSCan, PSCan, AUDio, IFPan, CW, IF, VIDeo, VDPan, SELCall, DFPan, PIFPan, AIF (see table 6-3).

Example: `TRAC:UDP:DEF:TAG:OFF "89.10.20.30", 17222, FSC, MSC`

TRACe:UDP|TCP:FLAG:OFF <ip_address>, <port_number>, <flag_list>

This command deregisters a flag for a specific UDP or TCP path.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be deregistered as an integer e.g. 18457.

Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "FREQuency:OFFSet", "AM","AM:POSitive", "AM:NEGative",...(see table 6-5).

Example:
```
TRAC:UDP:FLAG:
OFF "89.255.255.255", 18457, "VOLTage:
AC", "FREQuency:OFFSet", "OPT"
```

TRACe:UDP:DEFault:FLAG:OFF <ip_address>, <port_number>, <flag_list>

This command deregisters a flag for the default UDP path. The default UDP path is reserved for the internal GUI.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be deregistered as an integer e.g. 18457.

Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "FREQuency:OFFSet", "AM","AM:POSitive", "AM:NEGative",...(see table 6-5).

Example: `TRAC:UDP:DEF:FLAG: OFF "89.255.255.255", 18457, "VOLTage: AC", "FREQuency:OFFSet", "OPT"`

TRACe:UDP|TCP:DELete <ip_address>, <port_number>

This command deletes a UDP or TCP path from the list, provided it can be found. The default UDP path can also be deleted in this way.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30".

<port_number> Port number of the host to be deregistered as an integer e.g. 18457.

Range: 1 to 65535

Example: `TRAC:UDP:DELete "89.255.255.255", 18457`

TRACe:UDP|TCP:DELete ALL

This command deletes all UDP or TCP paths except the default path.

Example: `TRAC:UDP:DELete ALL`

TRACe:TCP:DELete:INACtive

This command deletes inactive TCP data paths. An inactive TCP path is a configured TCP data path with closed socket.

Example: `TRAC:TCP:DEL:INAC`

TRACe:TCP:SOCKet?

This query returns a comma-separated list of all open TCP path sockets.

Example: `TRAC:TCP:SOCK?`-> "10.8.10.230",2946, "10.8.10.231",435

TRACe:UDP:DEFault:DELete ALL

This command deletes the default UDP path. The default UDP path is reserved for the device internal GUI.

Example: `TRAC:UDP:DEFault:DELete ALL`

TRACe:UDP|TCP? <query_param>

This query returns all or a specific registered UDP or TCP path, or the highest available UDP or TCP path count.

Parameters:

<query_param>

none
Returns a numbered list of all registered paths.

<numeric_value>
Returns a specific registered path.

MAXimum
Returns the highest available UDP or TCP path count.

DEFault
Returns the default registered path.

Example: `TRAC:UDP? MAX`-> 7

Example: `TRAC:UDP? 0`-> DEF "89.10.20.30", 18457, FSC, MSC, "VOLT:AC", "OPT"

Example: `TRAC:UDP? 3`-> 003 "255.255.255.255", 17222, PSC, "VOLT:AC", "OPT"

7 LAN Configuration

7.1 General and Default Settings

You can control the R&S EB500 via LAN in SCPI syntax style. For control commands see chapter 4, "Remote Control via LAN Interface", on page 191.

I/Q data, audio data and scan data test output on LAN is ESMB compatible (see chapter 6, "Mass Data Output", on page 403).

Default settings:

- IP address: 089.010.011.023
- Port number: 5555
- Gateway: 089.000.008.015
- Subnet mask: 255.000.000.000

7.2 Configuration of the LAN Interface with SERIAL Interface

You can configure the parameters of the LAN interface via RS232 terminal on connector "X6 COM1" by simple terminal communication. The settings are stored in an EEPROM.

The parameters of the SERIAL interface can be set to 4800 or 9600 bauds, 8 data bits, no parity, 1 stop bit and no handshake. To configure the R&S EB500 you need a personal computer with a serial interface and a simple terminal program (e.g. "Hyperterminal"), a null-modem cable (RX and TX crossed with 9-pole sockets) and an adapter (9-pole to "X6 COM1").

NOTICE

Changing the baud rate of the SERIAL interface

By using the settings of the terminal program, the baud rate can be changed. The default baud rate is 4800. By following the steps below it can be changed into 9600 baud.

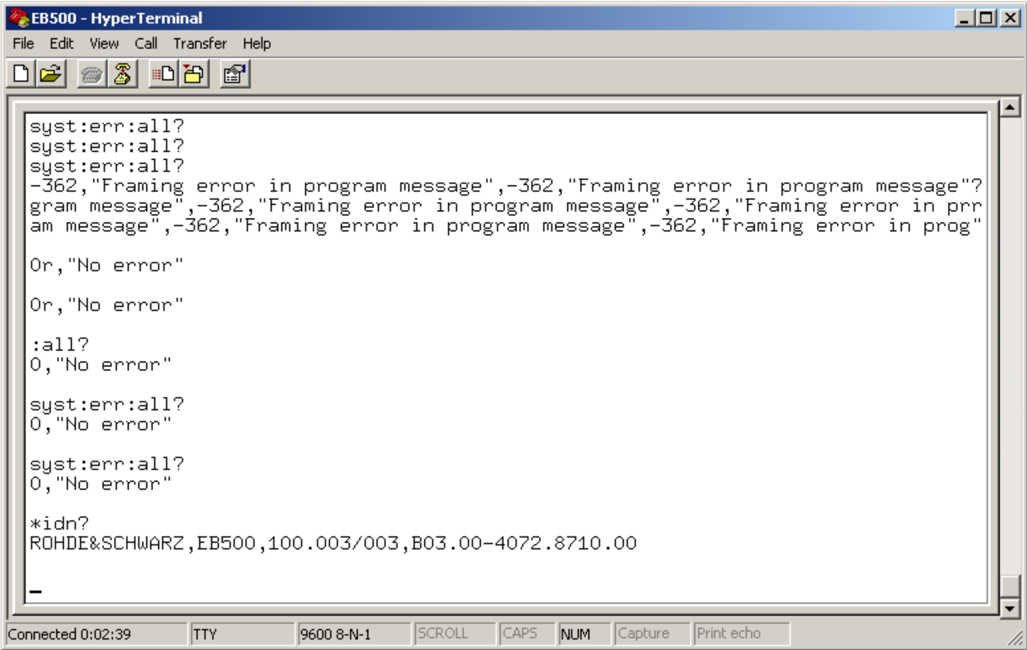
1. Open the connection, using the default settings (4800 baud)

2. Change the baud rate into 9600

3. Flush the errors by repeatedly sending the SCPI error query `syst:err:all?`. Alternatively send a text file which contains e.g. ten times the `syst:err:all?`

4. Use the SCPI command `*idn?` to check whether the new connection settings are accepted.

The output after sending the error query and `*idn?` will be similar to the SCPI reply as shown in the figure below.



The configuration commands are available both on the RS232 interface and the LAN remote-control interface. However, the currently set parameters are only known as factory setting. A general rule for all interface configuration commands is that the values are not influenced by an `*RST` command.

Configuration commands

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]ADDRess <ip_address>

This command sets the persistently stored IP address for the LAN interface.

Parameters:

<ip_address> IP address

Example: SYSTem:COMMunicate:LAN:ADDRess "089.010.011.023"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]ADDRess?

This query returns the persistently stored IP address for the LAN interface.

Return values:

<ip_address>	IP address
Example:	SYSTem:COMMunicate:LAN:ADDRess -> "089.010.011.023"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]DGATeway <gateway>

This command sets the persistently stored gateway for the LAN interface.

Parameters:

<gateway>	IP address
Example:	SYSTem:COMMunicate:LAN:DGATeway "089.000.008.015"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]DGATeway?

This query returns the persistently stored gateway for the LAN interface.

Return values:

<gateway>	Persistently stored gateway for the LAN interface
Example:	SYSTem:COMMunicate:LAN:DGATeway? -> "089.000.008.015"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]PORT <port_number>

This command sets the persistently stored port number for the LAN interface.

Parameters:

<port_number>	**<numeric_value>** Port number **MINimum** Lowest port number **MAXimum** Highest port number
Example:	SYSTem:COMMunicate:LAN:PORT 6000

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]PORT? <query_param>

This query returns the persistently stored port number for the LAN interface.

Parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current port number.

MINimum
Returns the lowest port number

MAXimum
Returns the highest port number

Return values:

<port_number> Port number.

Example: SYSTem:COMMunicate:LAN:PORT? -> 6000

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]SMASk <subnet_mask>

This command sets the persistently stored subnet mask for the LAN interface.

Parameters:

<subnet_mask> Subnet mask

Example: SYSTem:COMMunicate:LAN:SMASk "255.000.000.000"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]SMASk?

This query returns the persistently stored subnet mask for the LAN interface.

Return values:

<subnet_mask> Subnet mask

Example: SYSTem:COMMunicate:LAN:SMASk? -> "255.000.000.000"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]AUTO <auto_setting>

This command sets the persistently stored configuration for automatic network setting via DHCP.

Parameters:

<auto_setting> NONE | DHCP

None
Fixed network setting

DHCP
Automatic network setting via DHCP

Example: SYSTem:COMMunicate:LAN:AUTO DHCP

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]AUTO?

This query returns the persistently stored configuration for automatic network setting via DHCP.

Return values:

<auto_setting> NONE | DHCP

NONE
Fixed network setting

DHCP
Automatic network setting via DHCP

Example: SYSTem:COMMunicate:LAN:AUTO? -> DHCP

SYSTem:COMMunicate:LAN|SOCKet:ACTual:ADDRess <ip_address>

This command sets the actual IP address for the LAN interface.

Parameters:

<ip_address> IP address

Example: SYSTem:COMMunicate:LAN:ACTual:ADDRess "089.010.011.023"

SYSTem:COMMunicate:LAN|SOCKet:ACTual:ADDRess?

This query returns the actual IP address for the LAN interface.

Return values:

<ip_address> IP address

Example: SYSTem:COMMunicate:LAN:ACTual:ADDRess? -> "089.010.011.023"

SYSTem:COMMunicate:LAN|SOCKet:ACTual:DGATeway?

This query returns the actual gateway for the LAN interface.

Return values:

<gateway> Gateway

Example: SYSTem:COMMunicate:LAN:ACTual:DGATeway? -> "089.000.008.015"

SYSTem:COMMunicate:LAN|SOCKet:ACTual:PORT <port_number>

This command sets the actual port number for the LAN interface.

Parameters:

<port_number> **<numeric_value>**
Port number

MINimum
Lowest port number

MAXimum
Highest port number

Example: SYSTem:COMMunicate:LAN:PORT 6000

SYSTem:COMMunicate:LAN|SOCKet:ACTual:PORT? <query_param>

This query returns the actual port number for the LAN interface.

Parameters:

<query_param> none | MINimum | MAXimum

none
Current port number

MINimum
Lowest port number

MAXimum
Highest port number

Return values:

<port_number> Port number.

Example: SYSTem:COMMunicate:LAN:ACTual:PORT? -> 6000

SYSTem:COMMunicate:LAN|SOCKet:ACTual:SMASk <subnet_mask>

This command sets the actual subnet mask for the LAN interface.

Parameters:

<subnet_mask> Actual subnet mask

Example: SYSTem:COMMunicate:LAN:ACTual:SMASk "255.000.000.000"

SYSTem:COMMunicate:LAN|SOCKet:ACTual:SMASk?

This query returns the actual subnet mask for the LAN interface.

Return values:

<subnet_mask> Actual subnet mask

Example: SYSTem:COMMunicate:LAN:ACTual:SMASk? -> "255.000.000.000"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]ETHernet?

This query returns the persistently stored Ethernet address of the LAN interface.

Return values:

<ethernet_address> Ethernet address, 6 bytes in hexadecimal notation
Note: If there is no LAN interface, this query returns "00-00-00-00-00-00".

Example: SYSTem:COMMunicate:LAN:ETHernet? -> "00-90-B8-10-01-11"

SYSTem:COMMunicate:LAN|SOCKet[:SAVE]|ACTual:ETHernet[:ADDRess]?

This query returns the persistently stored Ethernet address of the LAN interface.

Return values:

<ethernet_address> Ethernet address, 6 bytes in hexadecimal notation
Note: If there is no LAN interface, this query returns "00-00-00-00-00-00".

Example: SYSTem:COMMunicate:LAN:ETHernet? -> "00-90-B8-10-01-11"

7.3 Configuration of the LAN Parameters with the "Update32" Tool

The "Update32" Tool, version 3.51 (or higher), is delivered together with the firmware. This tool allows you to set the LAN parameters via the Ethernet interface or serial interface, i.e. to change the IP address, port number, gateway and subnet mask. When it is switched on anew, it connects with the R&S EB500 and shows the current parameters regardless of the current LAN parameters. These parameters can be changed and sent back to the R&S EB500. They are then stored in the R&S EB500 non-volatile memory. For more information, see chapter 5.7, "Change Device IP Address", on page 398.

8 LAN Programming Examples

The following chapters explain step by step how to program the R&S EB500 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 require little effort as all socket calls used are defined by the "Berkeley Institute". This chapter is confined to programming the R&S EB500. If you want to learn more about the basics of socket programming and network technology, please refer to one of the many books available on these topics, e.g. "TCP/IP Illustrated", Volume 1, by W. Richard Stevens.

8.1 Setting up a Connection

Before you can remote-control the R&S EB500, you must set up a LAN connection. If you want to set up a TCP connection, you need to know the IP address of the TCP server and its service number (also referred to as "port number"). You can query and change these parameters via the serial interface (see chapter 7, "LAN Configuration", on page 429). If the R&S EB500 is connected to a LAN, the IP network settings (including the subnetwork numbers) of the host computer and the R&S EB500 must be the same. Some examples:

Table 8-1: Examples of IP network settings.

IP address of the host computer	Subnetwork mask of host computer	IP address of the R&S EB500	Subnetwork	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 R&S EB500 to be controlled from outside the local subnetwork, a suitable gateway must be made known to it. You can also set the corresponding gateway IP address via the serial interface (see chapter 7, "LAN Configuration", on page 429).

Please note that IP addresses must be unambiguous. If an IP address is used for more than one component, the potential consequences are highly unpredictable and may bring a network down entirely. For this reason, IP addresses are normally assigned by the network administrator. The network administrator knows which IP addresses have already been assigned and how to make the remaining network settings (subnetwork mask and gateway).

The following programming example shows how to establish a socket connection to an R&S EB500 with the IP address "89.10.11.23" 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 a valid socket descriptor.
   Now set up a connection request to the device. */
   memset(&addr, 0, sizeof(addr));
   addr.sin_family = AF_INET;
   /* Fill out IP address */
   addr.sin_addr.s_addr = inet_addr("89.10.11.23");
   addr.sin_port = htons(5555);
   /* Now establish the connection */
   err = connect(nSocketID, (struct sockaddr *)&addr, sizeof(addr));
   if (!err)
   {
      /* Connection has been accepted by the device.
      Now do some initializations. */

      /* Disable Nagle algorithm to get better realtime responses */
      int i = 1;
      setsockopt(nSocketID, IPPROTO_TCP, TCP_NODELAY, (char*)&i,
      sizeof(i));
      /* Do something with the device */
   }

}
```

The routine following the connect call improves 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 some interaction between commands and polls.

8.2 Initializing the Unit

At first, the device should be put into a defined state. Command `*CLS` clears the status reporting system, while command `*RST` loads the default values for all setting parameters.

8.3 Transmitting Device-Setting Commands

The following example illustrates setting the 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);
```

8.4 Reading Device Settings

The parameters set in chapter 8.3, "Transmitting Device-Setting Commands", on page 437 are read out again. This is done by sending three polling commands in a SCPI string. The response is then read 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, it should be noted that the response packets to "recv" calls may be smaller than expected. In this case, the remaining data has to be read through 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);
```

8.5 Processing SRQs

SRQs are a means of 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 device with the controller. The R&S EB500 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, 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 in 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.

8.6 Program Example

The supplied CD-ROM "R&S EB500 Utilities" contains a short program for controlling the R&S EB500 ("CExample.c"). You can use it to write programs of your own. The example is written in ANSI C and was tested using Visual C 5.0. Make sure to link with the `wsock32.lib` library when configuring the project in Visual C. Both programs initialize a search between 118 MHz and 136 MHz with a step width of 25 kHz. The search is then started and the measurement results are displayed. To make the progress of the scan visible, the change in frequency is also displayed.

8.7 Program Example UDP

If configured accordingly, the R&S EB500 is able to send datagrams (UDP data). See chapter 6, "Mass Data Output", on page 403.

The supplied CD-ROM "R&S EB500 Utilities" contains a short UDP program ("UDPExample.exe" and the associated C source coude). This program shows how to configure the R&S EB500 for the transmission of datagrams. Irrespective of the operating mode ("CW", "FSCAN", "MSCAN", "PSCAN", "IF", "IFPAN", "VIDEO", "VDPAN", "AUDIO", "SELCall", "DFPAN"), the program receives datagrams from the R&S EB500, evaluates the data and displays the status information continuously.

When an audio mode ≠ 0 is selected for the call parameters in the UDP example (see also the table describing command `SYSTem:AUDio:REMote:MODe` on page 315), the AF is transmitted via the remote-control interface in the data format selected and then reproduced via the sound card of the PC. The LAN remote-control interface is capable of handling AF signals in any data format or audio mode without any gaps. This application may be started in parallel to any remote-control application.

9 Measurement Functions

Due to its versatility, the R&S EB500 is capable of handling diverse measurement tasks. It offers two measuring modes, four level detectors and a user-selectable measuring time. This chapter describes the device's fields of application and the differences between the individual parameters.

9.1 Detectors

The following level detectors can be activated in the R&S EB500:

- Peak-value detector ("PEAK")
- Average-value detector ("AVG")
- Realtime 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 based on 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.

Real-time Detector ("FAST")

The "FAST" detector has negligable rise and fall time. Therefore it follows the input voltage without any delays.

The "FAST" detector determines the current input voltage when the measuring time has elapsed. It is recommended for Memory Scan and Frequency Scan.

Peak-Value Detector ("PEAK")

The "PEAK" detector operates with negligable rise-time constant and follows the input voltage when the latter increases. However, when it decreases, a distinctly longer fall-time constant becomes active.

The "PEAK" detector determines the maximum input voltage. It is recommended for EMC measurement.

Average-Value Detector ("AVG")

With the "AVG" detector, the rise and fall-time constants are identical.

It determines the linear average value of the input voltage and is recommended for voltage averaging.

Root-Mean-Square Value Detector ("RMS")

With the "RMS" the rise and fall-time constants are also identical. In "RMS" detection mode the input voltage is squared and fed to the detector. Following this, the root is extracted. In this way, the instantaneous power is subjected to exponential averaging.

It determines the RMS value of the input voltage and is recommended for power averaging with noise measurement or spread spectrum measurement.

Step Response

The different detectors show the following step responses:

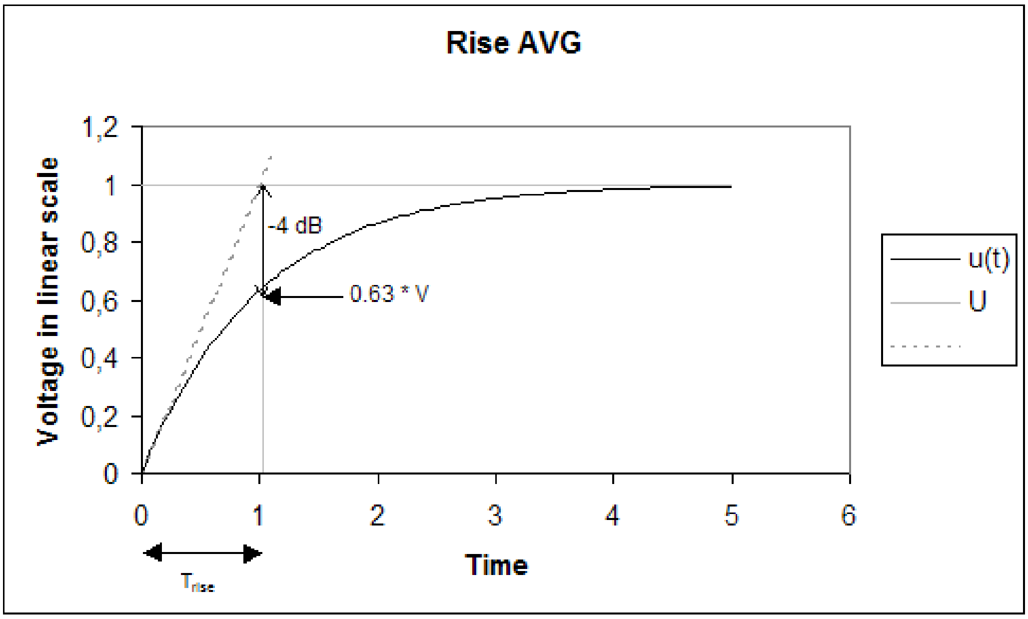


Fig. 9-1: Rise AVG.

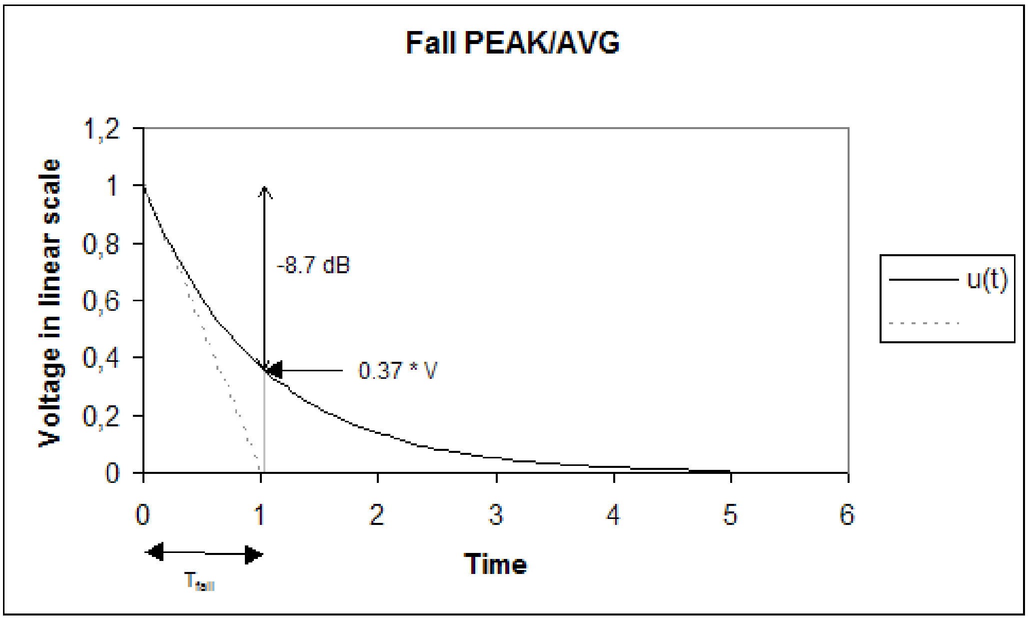


Fig. 9-2: Fall PEAK/AVG.

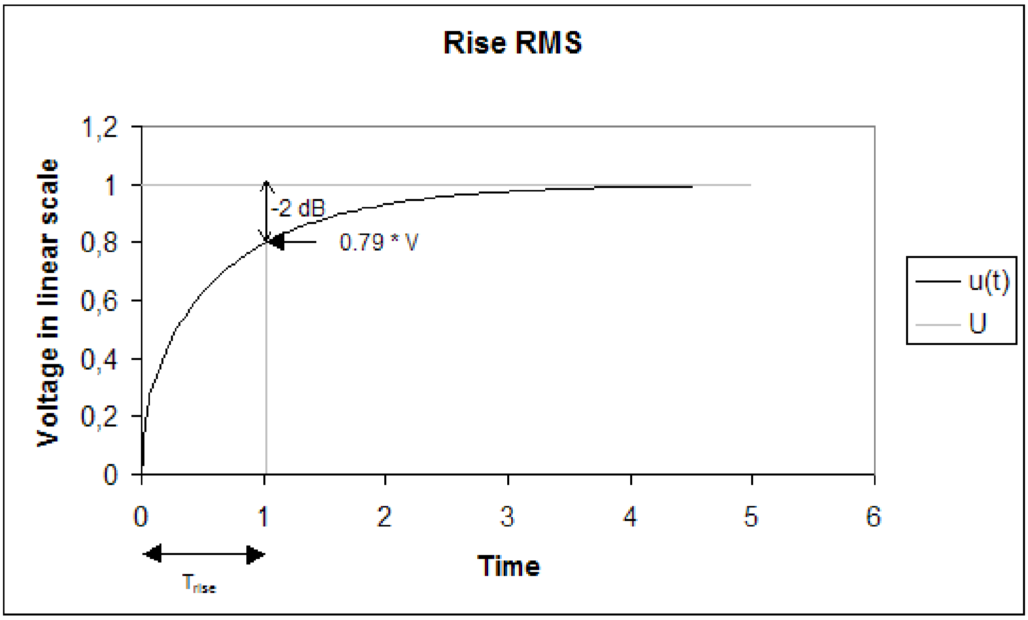


Fig. 9-3: Rise RMS.

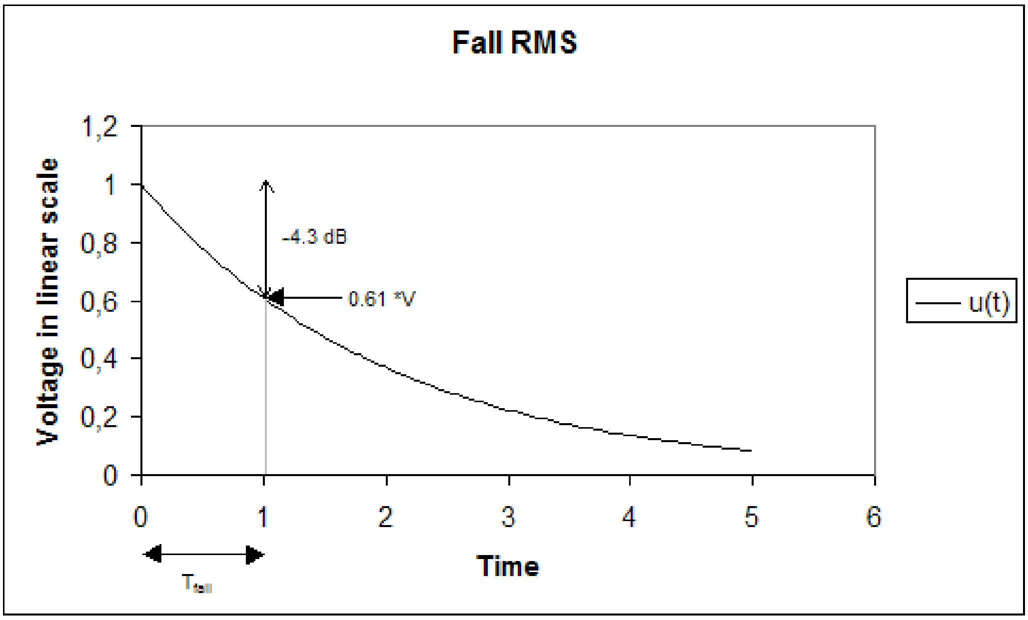


Fig. 9-4: Fall RMS.

When powering up the R&S EB500 for the first time after a reset (command `*RST`), the measuring time is set to "DEFAULT". These predefined measuring times must be selected so that correct measured values can be expected for the bandwidth and level measurement mode. With "DEFAULT" measuring time, the following bandwidth-dependent rise and fall times are established with level detectors "PEAK", "AVG", "RMS", "FAST" and offset measurement with "AM", "FM" and "PM".

Table 9-1: Bandwidth-dependent rise and fall times.

Bandwidth [Hz]	Level PEAK T_{rise} [µs]	Level PEAK T_{fall} [µs]	Level AVG/RMS $T_{rise} = T_{fall}$ [µs]	Level FAST $T_{rise} = T_{fall}$ [µs]	Offset AM $T_{rise} = T_{fall}$ [µs]	Offset FM / PM $T_{rise} = T_{fall}$ [µs]
100	1000	2000000	200000	1000	100000	200000
150	1000	2000000	200000	1000	100000	200000
300	1000	2000000	100000	1000	100000	200000
600	500	2000000	100000	500	100000	200000
1000	500	1000000	50000	500	100000	100000
1500	500	1000000	50000	500	100000	100000
2100	250	1000000	25000	250	50000	100000
2400	250	1000000	25000	250	50000	100000
2700	250	1000000	25000	250	50000	100000
3100	250	1000000	25000	250	50000	100000
4000	125	1000000	25000	125	50000	100000

Bandwidth [Hz]	Level PEAK T_{rise} [µs]	Level PEAK T_{fall} [µs]	Level AVG/RMS $T_{rise} = T_{fall}$ [µs]	Level FAST $T_{rise} = T_{fall}$ [µs]	Offset AM $T_{rise} = T_{fall}$ [µs]	Offset FM / PM $T_{rise} = T_{fall}$ [µs]
4800	125	1000000	25000	125	50000	100000
6000	63	1000000	12000	63	50000	100000
9000	63	1000000	6000	63	50000	100000
12000	63	1000000	4000	63	20000	100000
15000	63	1000000	3000	63	20000	100000
30000	32	1000000	3000	32	20000	100000
50000	32	1000000	3000	32	20000	100000
120000	7	1000000	3000	7	10000	50000
150000	7	1000000	3000	7	10000	50000
250000	7	1000000	3000	7	5000	25000
300000	4	1000000	3000	4	5000	25000
500000	4	1000000	2000	4	2000	10000
800000	2	1000000	2000	2	2000	10000
1000000	2	1000000	1000	2	1000	5000
1250000	1	1000000	1000	1	1000	5000
1500000	1	1000000	1000	1	1000	5000
2000000	1	1000000	1000	1	1000	5000
5000000	0	1000000	1000	0	1000	5000
8000000	0	500000	1000	0	1000	5000
10000000	0	500000	1000	0	1000	5000
12500000	0	500000	1000	0	1000	5000
15000000	0	500000	1000	0	1000	5000
20000000	0	500000	1000	0	1000	5000

With modulation depth, frequency deviation and phase deviation, the rise time, T_{rise}, is always 0.

With modulation depth measurement, the fall time, T_{fall}, is equivalent to the fall time of the current active detector for level measurement.

With frequency or phase deviation, the fall time, T_{fall}, is equivalent to the fall time of the offset measurement. The time of the offset measurement depends on the selected demodulation mode.

The measurement of phase deviation is only possible with demodulation mode "PM".

9.2 CONTINUOUS Measurement Mode

In "CONTINUOUS" mode, the R&S EB500 polls the current value of the level detector every 200 ms and displays this value. According to remote-control command `SENSe:DATA?` on page 254, the value is output. This means that the detector is not explicitly queried when using `SENSe:DATA?` on page 254 and it may be displaying a value from 200 ms ago.

Remote-control command `INITiate[:IMMediate]` on page 224 or `INITiate:CONM[:IMMediate]` on page 225 forms an explicit request for querying the detector. In addition, the detectors are cleared.

When receive parameters are altered or when there is a frequency change in "FSCAN" or "MSCAN" mode, the detectors are reset (cleared). The detectors then need to settle again. In this context, a new time parameter is introduced, i.e. the measuring time.

9.3 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 again.

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 input voltage when the measuring time has elapsed.

The factory setting for the measuring time in the R&S EB500 is "DEFAULT". Thus it follows the bandwidth (or demodulation mode) selected:

Table 9-2: Measuring time.

Bandwidth [Hz]	Level AVG/ RMS [µs]	Level PEAK [µs]	Level FAST [µs]	Offset AM [µs]	Offset FM / PM [µs]
100	200000	500000	1000	100000	200000
150	200000	500000	1000	100000	200000
300	100000	400000	1000	100000	200000
600	100000	200000	500	100000	200000
1000	50000	100000	500	100000	100000
1500	50000	100000	500	100000	100000
2100	25000	60000	250	50000	100000

Bandwidth [Hz]	Level AVG/ RMS [µs]	Level PEAK [µs]	Level FAST [µs]	Offset AM [µs]	Offset FM / PM [µs]
2400	25000	60000	250	50000	100000
2700	25000	60000	250	50000	100000
3100	25000	60000	250	50000	100000
4000	25000	60000	125	50000	100000
4800	25000	60000	125	50000	100000
6000	12000	30000	63	50000	100000
9000	6000	20000	63	50000	100000
12000	4000	10000	63	20000	100000
15000	3000	10000	63	20000	100000
30000	3000	5000	32	20000	100000
50000	3000	4000	32	20000	100000
120000	3000	2000	7	10000	50000
150000	3000	2000	7	10000	50000
250000	3000	1000	7	5000	25000
300000	3000	1000	4	5000	25000
500000	2000	1000	4	2000	10000
800000	2000	1000	2	2000	10000
1000000	1000	1000	2	1000	5000
1250000	1000	1000	1	1000	5000
1500000	1000	1000	1	1000	5000
2000000	1000	1000	1	1000	5000
5000000	1000	1000	0	1000	5000
8000000	1000	1000	0	1000	5000
10000000	1000	1000	0	1000	5000
12500000	1000	1000	0	1000	5000
15000000	1000	1000	0	1000	5000
20000000	1000	1000	0	1000	5000

The measuring time for modulation-depth measurement is equivalent to the measuring time of the currently active detector for level measurement.

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]` on page 224 or `INITiate:CONM[:IMMediate]` on page 225
- measuring mode "PERIODIC"

9.4 "PERIODIC" Measuring Mode

In "PERIODIC" mode, the detectors are cleared in a cyclic fashion and the cycle depends on the measuring time. Whenever the measuring time is up, the measured values are displayed and the detectors are cleared. In this mode, the 200 ms active display rate in "CONTINUOUS" mode is deactivated. Remote-control command, `SENSe:DATA?` on page 254, always queries the most recent measured value. When a parameter (e.g. the frequency) is changed, this value is marked as being invalid (indicated by "----" in the display). In the event that "MTRACE" is enabled (e.g. by using remote-control command `TRAC:FEED:CONT MTRACE,ALW`, see `TRACe:FEED:CONTrol` on page 343), the measured values are automatically stored in "MTRACE".

9.5 Measuring Time Different from DEFAULT

All information given up to this stage refers to the default measuring time. However, certain measuring tasks require the measuring time to be user-selectable. For instance, pulse-shaped signals (e.g. ignition sparks) cannot be measured exactly unless the measuring time exceeds the signal pulse duration. With the measuring time being set to a value other than "DEFAULT", the detectors' rise time and fall time are also determined by this measuring time. In addition, the user-selectable measuring time does not depend on other parameters (e.g. bandwidth, demodulation mode). All other information concerning step response, "CONTINUOUS" or "PERIODIC" mode continues to apply.

Table 9-3: Measuring time different from "DEFAULT".

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	0 ms
T_{fall} Deviation/mod. depth	set measuring time

9.6 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.

9.7 Availability of Measuring Functions

Whether a measurement can be carried out depends on the demodulation mode set.

Table 9-4: Measuring functions.

			Measuring functions					
Demodu-lation mode	IF band-width	Video output	Level	Fre-quency	Mod. depth (AM)	Fre-quency deviation	Phase deviation	Band-width
AM	150 Hz - 20 Mhz	AM/FM	X	X	X	X		X
FM	150 Hz - 20 MHz	AM/FM	X	X	X	X		X
PM	150 Hz - 20 MHz	AM/PM	X	X	X		X	X
Puls-AM	150 Hz - 20 MHz	AM/FM	X	X	X	X		X
I/Q	150 Hz - 20 MHz	I/Q	X	X	X	X		X
CW	150 Hz - 9 kHz	I/Q	X	X	X	X		X
SSB	150 Hz - 9 kHz	SSB	X	X	X	X		X
ISB	600 Hz - 20 MHz	I/Q	X	X	X	X		X

9.8 Direction-Finding Measurement

DF upgrade

Direction-Finding Measurement is only possible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

As any other measurement function implemented in the R&S EB500, direction finding can be started as required. In this case a single measurement is performed. Upon completion of averaging time, the DF results are output. For a single measurement it is sufficient to activate a single DF sensor function. After the measurement has been started by command INIT, all receiver sensor functions are served. Thereafter, DF operation is activated and the bearings are taken. The results can then be accessed via the usual methods.

Examples:

Activate DF sensor function

Command: FUNC "AZIM","DFQ","DFL"

Start measurement trace

Command: TRAC:FEED:CONT MTRACE,ALW

Configure measurement time

Command: MEAS:DF:TIME <value>

Note: <value> in seconds, e.g. 0.1 for 100 ms.

Turn off squelch mode

Command: MEAS:DF:MODE OFF

Start measurement

Command: INIT

Read data

Command: TRAC? MTRACE

Data format: <level>,<DF level>,<azimuth>,<DF Quality>

If the measurement has not yet been completed, the command above returns "9.91E37". The trace is empty. Polling is required to determine when a measurement result is present.

10 IF Panorama

10.1 General Information

An FFT ("Fast Fourier Transform") computed within the device generates the spectral data for the IF panorama. The FFTs computed have a length between 16 and 4096 points.

10.2 Frequency Mode

In receiver mode "FFM", the IF panorama operates in "AF" mode. During scanning, the IF panorama is switched off but is reactivated when dwelling in "FSCAN" or "MSCAN".

SCPI commands:

- `FREQ:MODE FFM`
- `MEAS:APPL RX`

GUI:

- Select "FFM" by pressing the MODE -> "FFM" key.
- Press the APPL key and select "RECEIVER" from the resulting selector.

Span, step

The IF panorama frequency range shown is determined by the "SPAN" parameter. The step width of the spectral representation is determined by the "STEP" parameter. A span can only be combined with specific steps. If a particular combination is not possible, it will be rejected the system. See the table below for details.

Step [kHz] \ Span [kHz]	1	2	5	10	20	50	100	200	500	1000	2000	5000	10000	20000
0,00063	def	x												
0,00125	x	def												
0,0025	x	x	x											
0,00313	x	x	def	x										
0,00625	x	x	x	def	x									
0,0125	x	x	x	x	def									
0,025	x	x	x	x	x	x								
0,03125	x	x	x	x	x	def	x							
0,05	x	x	x	x	x	x	x							
0,0625	x	x	x	x	x	x	def	x						
0,1	x	x	x	x	x	x	x	x						
0,125	x	x	x	x	x	x	x	def						
0,2		x	x	x	x	x	x	x	x					
0,25		x	x	x	x	x	x	x	x					
0,3125			x	x	x	x	x	x	def	x				
0,5			x	x	x	x	x	x	x	x				
0,625			x	x	x	x	x	x	x	def	x			
1				x	x	x	x	x	x	x	x			
1,25				x	x	x	x	x	x	x	def			
2					x	x	x	x	x	x	x	x		
2,5					x	x	x	x	x	x	x	x		
3,125						x	x	x	x	x	x	def	x	
5						x	x	x	x	x	x	x	x	
6,25						x	x	x	x	x	x	x	def	x
8,333							x	x	x	x	x	x	x	x
10							x	x	x	x	x	x	x	x
12,5							x	x	x	x	x	x	x	def
20								x	x	x	x	x	x	x
25								x	x	x	x	x	x	x
50									x	x	x	x	x	x
100										x	x	x	x	x
200											x	x	x	x
500												x	x	x
1000													x	x
2000														x

Yellow cells denote possible span/step combinations. Green cells show the default step values when the step is determined automatically based on the span.

SCPI commands:

- `FREQ:SPAN <value>`
- `CALC:IFPAN:STEP <value>`
- `CALC:IFPAN:STEP:AUTO ON|OFF`

When you run a remote application which queries the device for possible combinations, you can proceed as follows:

1. Set the step to "AUTO" (`CALC:IFPAN:STEP:AUTO ON`).
2. Set the span to "MINIMUM" (`FREQ:SPAN MIN`).
3. Query the span (`FREQ:SPAN?`).
4. Set the step to "MINIMUM" (`CALC:IFPAN:STEP MIN`).
5. Query the step (`CALC:IFPAN:STEP?`).
6. Set the next step (`CALC:IFPAN:STEP UP`).
7. If there is no error message (`SYST:ERR?`), proceed with step 5.
8. Set the step to "AUTO" (`CALC:IFPAN:STEP:AUTO ON`).
9. Set the next span (`FREQ:SPAN UP`).

10. If there is no error message (`SYST:ERR?`), proceed with step 4.

GUI:

- Select the IF panorama using the PANEL key.
- Press button "SPAN" or "STEP" in the softkey bar (first level) and select the desired value from the resulting selector.

10.3 FFT Selectivity, FFT Bandwidth (Read-only)

The FFT bandwidth is an important parameter for every spectral representation. In the IF panorama, the FFT bandwidth is determined by the step and selectivity. Unfortunately, you cannot use every selectivity with every span/step combination. In such cases, a best match with the desired selectivity is determined automatically. The resulting -6 dB bandwidth can be queried using the FFT bandwidth parameter. The shape factor does not depend on the current selectivity. It is invariably: shape factor (-60 dB/-6dB) = 2.4.

SCPI commands:

- `CALC:IFPAN:SEL AUTO|NORM|NARR|SHAR`
- `CALC:IFPAN:BAND?`

In "AUTO" mode the device sets a suitable selectivity, depending on the current mode ("FFM AF", "PSCAN"). You can suggest a particular selectivity via the options "NORMal", "NARRow" and "SHARp". If the current span/step combination does not allow the selectivity you wish to set, the device chooses the next suitable selectivity. However, you can always select "NORMal".

GUI:

- Select the IF panorama using calc:ifpan:aver:type
- Press button "SELECTIVITY" in the softkey bar and select the desired value via the related selector.

10.4 IF Panorama Mode, Measurement Time, Measurement Mode

In the simplest case, the spectral data generated from the FFTs are displayed "as is". As the display lags behind the FFT computations, many spectral data are lost. Short-time signals may not be visible. A user-definable level analysis resolves this problem. The set measurement time forms a time-related weighing, with each IF panorama mode determining the kind of weighing:

CLRWRITE

No time-related weighing is done. In "PERIODIC" measurement mode, the display is updated in line with the measurement time. In "CONTINUOUS" mode, the display is updated 20 times per second.

Advantages of "CLRWRITE":

- A good representation of frequency and time-agile signals, especially in the form of a waterfall.
- Modulations (AM/FM) are represented very well.

Disadvantages of "CLRWRITE":

- Short-time signals may not be visible.
- The noise floor is very unstable.
- Weak signals are difficult to discern from noise.

AVERAGE

The "AVERAGE" mode performs averaging using the measurement time as a time constant. If the measurement mode is set to "PERIODIC", linear averaging is performed. Averaging is restarted in line with the measurement time, and the display is updated.

In "CONTINUOUS" mode, continuous exponential averaging is performed (this conforms to a first-order low pass or an RC low pass from analog technology). The measurement time determines the time constant (tau) of the low pass used. The display is updated 20 times per second.

Advantages of "AVERAGE":

- Smoothes the noise floor.
- Makes weak signals well discernible from noise.
- Smoothes the spectrum.

Disadvantages of "AVERAGE":

- Short-time signals are not visible at all or may not be represented with their true level.
- Modulations are not discernible.
- No time-related behavior is discernible.

MAXIMUM

Each maximum is shown immediately and then held. In "PERIODIC" measurement mode, the maximum search is restarted in line with the measurement time and the display is updated.

In "CONTINUOUS" mode, there is a continuous maximum search. Maxima are aged via exponential fading. The time constant for the fading mechanism is determined by the measurement time. The display is updated 20 times per second.

Advantages of "MAXIMUM":

- Short-time signals are visible all the time.
- Perfectly suitable when searching for interfering pulses.

Disadvantages of "MAXIMUM":

- Raises the noise floor.
- Weak signals are hard to discern from noise.
- Modulations are not discernible.
- No time-related behavior is discernible.

MINIMUM

Each minimum is displayed immediately and held. In "PERIODIC" measurement mode, the minimum search is restarted in line with the measurement time and the display is updated.

In "CONTINUOUS" mode, there is a continuous minimum search. The minima are aged via exponential fading. The time constant for the fading mechanism is determined by the measurement time. The display is updated 20 times per second.

Advantages of "MINIMUM":

- Stationary signals are clearly visible.
- Any non-stationary signals are suppressed.
- The noise floor is strongly reduced.
- Very weak stationary signals are clearly discernible.

Disadvantages of "MINIMUM":

- Suitable only for displaying stationary signals.

SCPI commands:

- `MEAS:MODE CONT|PER`
- `MEAS:TIME <value>|DEF`
- `CALC:IFPAN:AVER:TYPE MIN|MAX|SCAL|OFF`

GUI:

- Select the IF panorama using PANEL key.
- Press button "FFT MODE" in the softkey bar and select the desired value from the selector shown.
- Press button "MEAS MODE" in the softkey bar and select the desired value from the selector shown.
- Press button "MEAS TIME" in the softkey bar and enter the desired value via the numeric pad, or choose between value and "AUTO" by pressing "MEAS TIME" again.

10.5 Clear Panorama

Restarts analysis of the spectral data in modes "AVERAGE", "MAXIMUM" and "MINIMUM".

SCPI command:

- `CALC:IFPAN:CLE`

GUI:

- Not applicable.

10.6 Demodulation Frequency

The demodulator is largely independent of the IF panorama. The demodulator center frequency is normally determined by the current receive frequency, which is also the center frequency of the IF panorama. Parameter "demodulator center frequency" makes it possible to decouple the demodulator center frequency from the receive frequency and set it to any frequency within the IF panorama span. However, if the center frequency of the IF panorama is changed, the demodulator center frequency is automatically re-coupled to this frequency.

SCPI commands:

- `FREQ:DEM <value>`
- `FREQ <value>`

GUI:

- Select the IF panorama using keys PANEL SELECT, PREV/NEXT.
- Press button "DEMOD FREQ" in the softkey bar (first level) and enter the desired value via the numeric pad (or using the ROLLKEY).

10.7 Peak Search, Squelch On/Off, Squelch Threshold

The IF panorama spectral display shows signals in the vicinity of the current receive frequency. Use the "PEAK SEARCH" function to change the frequency to that of adjacent signals. You can change either the IF panorama center frequency (= receive frequency) or the demodulator center frequency. If you change the receive frequency, you will also change the demodulator center frequency as it is coupled to the receive frequency (see chapter 10.6, "Demodulation Frequency", on page 456).

You can use the "PEAK SEARCH" function to search for the absolute maximum or the next relative maximum to the left or right of the receive frequency/demodulator center frequency. Searching for relative maxima requires a threshold. If squelch is off, the threshold is determined automatically from the IF panorama's spectral data. If squelch is on, the threshold is identical with the squelch value.

SCPI commands:

- `CALC:IFP:MARK:MAX LEFT|RIGH|PEAK`
- `CALC:IFP:MARK:DEM:MAX LEFT|RIGH|PEAK`
- `OUTP:SQU ON|OFF`
- `OUTP:SQU:THR <value>`

GUI:

- Select the IF panorama using thePANELkey.
- Press button "PEAK SEARCH" in the softkey bar and select the desired search option from the related selector bar.
- Turn squelch on or off by pressing the SQU key and the SELECT rotary knob. Turn the knob to change the squelch value.

11 Direction Finding

Direction finding

Direction finding functions are only accessible with the installed DF upgrade R&S®EB500-DF (Direction Finding).

This chapter describes DF systems which consist of the following components:

- direction finder
- HF, VHF/UHF, UHF DF antennas
- electronic compass GH 150

This documentation also describes the cabling of all available models. The models differ in cable lengths and the use of the two frequency sub-bands, i.e. 0.3 MHz to 20/30 MHz, 20/30 MHz to 1300 MHz and 1300 MHz to 3000 MHz. The type of antenna used determines the frequency sub-band. There are suitable cable sets DDF 1C-1, DDF 5C-1 and DDF 1C-7.

Table 11-1: Additional documentation.

HF DF Antenna	ADD 119	4053.6844.00
VHF/UHF DF Antenna	ADD 196	4077.3045.00
VHF/UHF DF Antenna	ADD 197	4068.1450.02
VHF/UHF DF Antenna	ADD 295	4070.9031.00
VHF/UHF DF Antenna	ADD 175	please contact R&S
UHF DF Antenna	ADD 071	4043.6412.00
UHF DF Antenna	ADD 075	4069.6655.00
Electronic Compass	GH 150	4041.8530.35

11.1 Component Overview

The frequency range of the direction finder is principally limited by its DF antennas.

Table 11-2: Suitable DF antennas.

HF range	ADD 119	300 kHz to 30 MHz
VHF/UHF range	ADD 196	20 MHz to 1300 MHz
VHF/UHF range	ADD 197	vertical polarization: 20 MHz to 1300 MHz horizontal polarization: 40 MHz to 1300 MHz
VHF/UHF range	ADD 295	20 MHz to 3000 MHz
VHF/UHF range	ADD 175	690 MHz to 2700 MHz

UHF range	ADD 071	1300 MHz to 3000 MHz
UHF range	ADD 075	1300 MHz to 6000 MHz

When using these antennas, the R&S EB500 derives its bearing results by the algorithm of the correlative interferometer. The HF DF antenna ADD 119 (300 kHz to 30 MHz) has the same dimensions as the ADD 196 and operates by the algorithm of the Watson Watt method.

As long as the R&S EB500 operates in the HF, VHF/UHF or UHF range, there is no problem with the connections between the DF unit and DF antennas ADD 119, ADD 196 or ADD 071 (cable set DDF 1C-1, DDF 1C-5 or DDF 1C-7: one cable, one control cable and a power supply IN 061, if applicable).

The DDF 1C-x cable sets required for antenna installation are available in many versions and have individual order numbers.

Table 11-3: Components

		Frequency Range [MHz]						
		0.5 to 30	20 to 3600	3600 to 6GHz	0.5 to 1300	0.5 to 3000		
DF model / contents of delivery		Option EB500-HF 4072.8003.02	Base unit	Option EB500-FE 4072.9300.02	-	stationary	mobile	stationary mast
EB500 Monitoring Receiver 4072.5004.02/03		x[1]						
ADD 119 HF DF-antenna 4053.6509.02		x[1]	-	-	x	x	x	2x
ADD 196 VHF/UHF DF-antenna 4077.3000.02		-	x[1]	-	x	x	x	x
ADD 197 VHF/UHF DF-antenna 4068.1450.02		-	x	-	x	x	x	x
ADD 071 UHF DF-antenna 4043.6006.02		-	x	-	-	x	x	x
GX 190 Connection board 4032.1508.02		-	-	-	x	x	x	x
Mast adapter ADD 150Z 4041.2655.02	S	x	x	x[1]	2x	2x	-	3x
Mast adapter ADD 071Z 4043.7002.02		-	-	x[1]	x	x	-	x
Mast adapter ADD 071Z 4043.7002.03		-	-	x[1]	x	x	-	x
Vehicle adapter AP 502 Z1 0515.1419.02	M	x	x	x	x	-	x	-

	Frequency Range [MHz]						
Tripod AP 502 Z2 0515.1719.02	(x)	-	-	x	-	x	-
	Recommended assessories						
GH150 Electronic compass 4041.8501.02	x	x	x (2x)	x (2x)	(x)	x / 2x / 3x	(x)
Cable set: DDF 190Z 4041.9514.xx	x	x	x	2x	2x	3x	x
Adapter set for 19" rack ZZA-T02 1109.4164.00	x	x	x	x	x	x	x

Components overview

- x^1: supplied wiwth VAR
- x: components
- 2x: two times required
- 3x: three times required
- (x): optional
- S: stationary
- M: mobile

Cable sets DDF 190 Z are available from 5 m to 95 m (5-meter steps). For cable lengths from 45 m, an external power supply IN 061 (4041.9514.00) is part of the equipment supplied.

Mobile direction finders are preferably fitted by Rohde & Schwarz. Based on extensive R&S experience, setups for practical applications have been developed. Therefore, turn-key solutions for virtually any application and climatic zone are available. In addition to the DF units in the vehicle, special attention has been paid to the ergonomic design of the operator's position, i.e. the consoles and seats, air conditioning, generating plant. In some cases, the antenna cables are special designs which deviate from the reference length of the cable sets DDF 190 Z. For mobile operation, you should use vehicle adapter AP 502 Z1, tripod AP 502 Z2 (for detached operation of the HF DF antenna ADD 119) and compass GH 150.

11.2 Rack-Mounting, Grounding and Power Supply

Specific National Procedures

Make sure any specific national procedures are applied!

For stationary operation, a continuous ground connection between the antenna, mast connectors, mounting platform and the ground (in this case of a central ground system) has to be provided. These measures have to be taken for any application, including operation without a lightning rod. If the individual mast connectors are isolated from one another, an additional grounding wire has to be run parallel to the mast. Moreover, all the units and metallic parts such as racks and shelter walls have to be connected to the central ground system.

Where antenna ADD 119, ADD 196 or ADD 197 is to be mounted onto a vehicle by means of vehicle adapter AP 502 Z1, a rotationally symmetrical ground connection between the antenna and the roof of the vehicle has to be provided. If the HF DF antenna ADD 119 is detached from the vehicle and operated on a tripod, the control and HF cable should be set up as perpendicular as possible. If the UHF antenna ADD 071 is mounted on a telescopic mast on the vehicle, the control and HF cable must be mechanically secured against tensile strain.

11.3 Antennas

11.3.1 Operating Principle

The DF concept is based on a receiver being supplied with signals from one path DF antennas. These antennas use a circular or symmetrical configuration of several active antenna elements sampled by the R&S EB500.

11.3.2 Choosing the Antenna Site

The specified DF accuracy and sensitivity apply only to those installations where the antenna is located in an undisturbed electromagnetic environment which is free of shadowing, reflections and spurious EMI (electronic smog) superimposed on the signals to be located.

The antenna should therefore be installed in an environment with the following characteristics:

- No obstacles outside a cone with an angle of 60° below the DF antenna.
- No obstacles up to a distance of 50 m from the antenna.
- Only low obstacles at a distance between 50 m and 100 m from the antenna.
- No large structures such as high-tension masts, high-rise buildings, etc. up to a distance of 400 m from the antenna.
- If the DF antenna is operated in the immediate vicinity of transmitting antennas, problems may be caused by intermodulation products formed in the antenna circuitry. Moreover, the DF equipment may be overdriven.

11.3.3 Antenna Installation and Accessories

Several adapters are available. These adapters can be ordered separately if they are not part of the equipment supplied, i.e. of the direction finder. A single-mast solution is recommended for stationary direction finders. In this case, two antennas (ADD 196 or ADD 197 and ADD 071) have to be stacked one above the other by means of adapters. If there is enough space, the antenna should be mounted at a suitable distance from disturbing structures, e.g. buildings, high-tension poles etc.

An arrangement side by side, i.e. in the same plane, would cause mutual shadowing and is not recommended.

These problems arise when vehicles are equipped for mobile operation. A practical solution lies in the use of a telescopic GRP mast for antenna ADD 071, which is attached to a suitable point on the vehicle. The larger of the two antennas is mounted to the roof top. This results in two planes of different height, and the GRP mast will be field-neutral. If the V/UHF DF antenna ADD 196 or ADD 197 is mounted on a roof, the HF antenna can be operated on a tripod on the ground.

Two different pitch circle diameters are used for screwing the mast together (see chapter 11.3.4, "Example of a Stationary Installation", on page 462). The larger diameter is used for flange ADD 150 A / ADD 071 Z (model 03) and between the mast and ADD 071 Z (model 02). The smaller flanges are assigned to antenna ADD 071. An incorrect assembly of the mast is prevented by the coding pins provided in the flanges.

Adapters ADD 071 Z

Adapters ADD 071 Z are available in two different mechanical designs. Please note the model number to avoid any confusion. Model 02 can be identified by two cable entries.

11.3.4 Example of a Stationary Installation

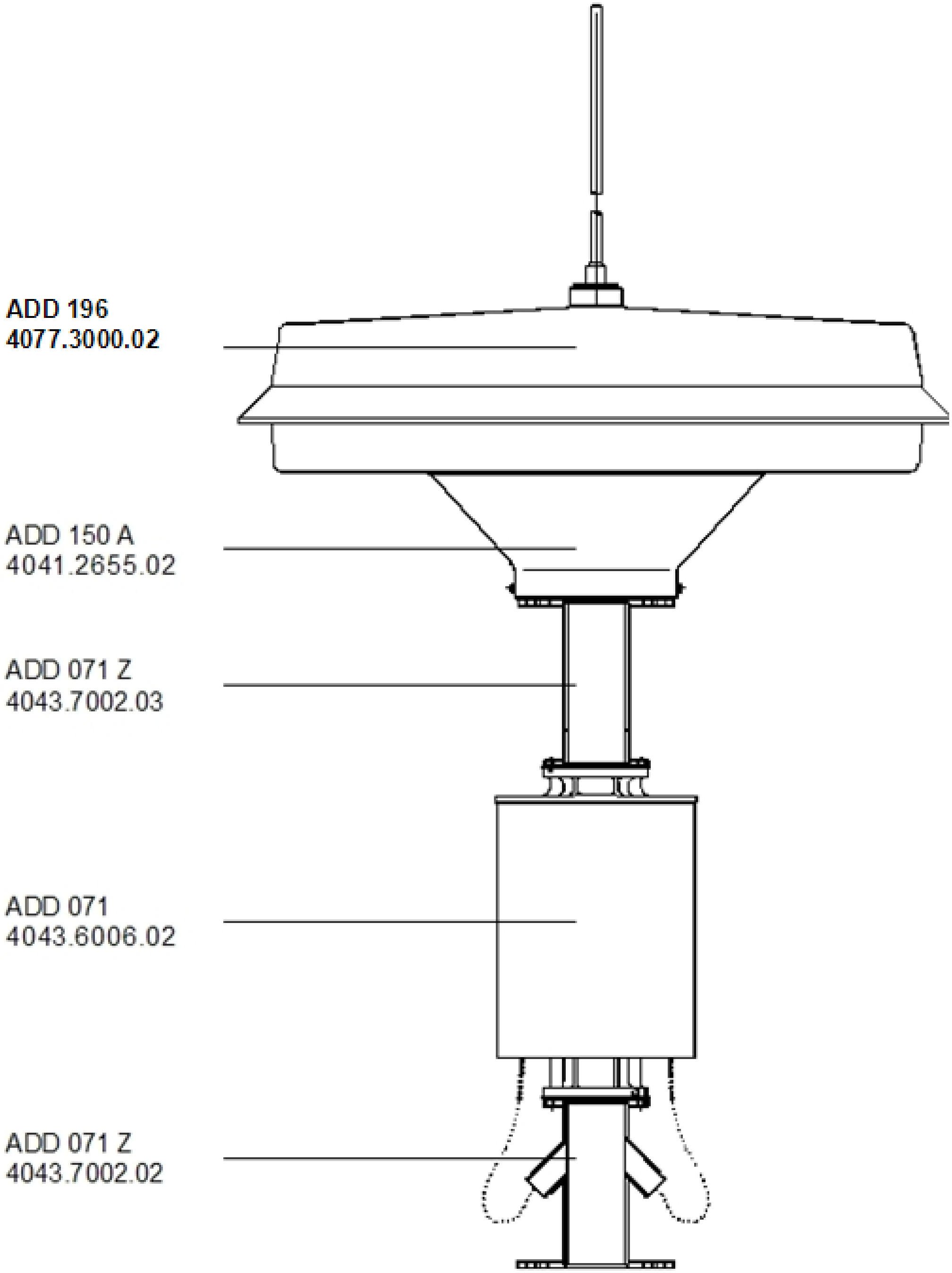


Fig. 11-1: A single-mast solution with adapters. The bottom end of component 4043.7002.02 is screwed to a tubular mast that also accommodates the cables.

11.3.5 DF Vehicles

The following two diagrams show examples of mobile radio monitoring. A typical feature is the telescopic GRP mast. In both cases, the antenna ADD 119 is mounted detached on a tripod and antenna ADD 196 or ADD 197 is fixed to the roof of the vehicle. The lighter antenna ADD 071, if required, is fixed to the mast. It thus shares the space with other antennas that are exchanged according to the task.

Antennas ADD 196 and ADD 197

Antenna ADD 196 or ADD 197 may be slightly affected by the neighboring telescopic mast. The antenna on this mast and the cables may impair the electromagnetic field. Bearings will be more accurate where the neighboring antenna is removed.

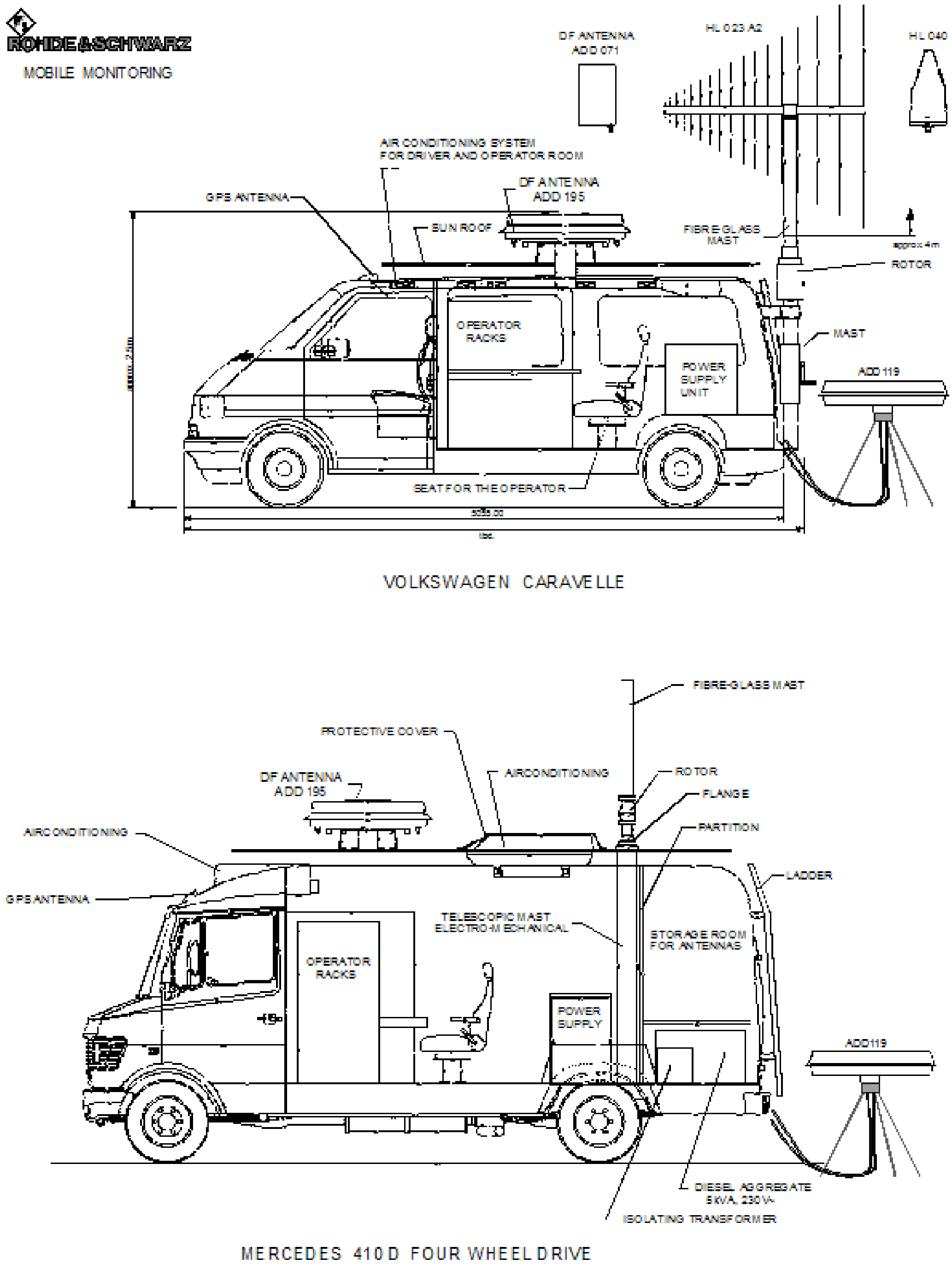


Fig. 11-2: Side views of mobile monitoring stations.

11.4 Electronic Compass

11.4.1 Use

Electronic compass GH 150, which is available as an option, is recommended for mobile use. The advantage is that all of the configurable DF data shown by the R&S EB500 can be used. The north adjustment or latent miscalculation of the magnetic reference are convenience features if a change of the site is required.

A DF indication with the following parameters is recommended for mobile use:

- the DF beam as a direction indicator.
- the compass value, i.e. the northern direction as a cross sign on a circle.
- a numeric display with reference to north, switchable to the direction of travel.

11.4.2 Installation

The compass can either be installed on antenna ADD 119, ADD 196, ADD 197 or on antenna ADD 071. For mobile operation, the compass can be mounted on all three antennas (fast mounting) to obtain a display of the signal in reference to north independently of the antenna north direction (↑N) (see GH 150-2). The mechanical coding of its flange represents the correct reference of radiator no. 1 ≡ (↑N). A 13-pin round connector forms the electrical interface. Data transmission to the R&S EB500 is done via the control cable of cable set DDF 190 Z.

11.4.3 Calibration

You should calibrate the compass once you have mounted it to an antenna. This will compensate for a number of interference factors and increase the accuracy of the compass.

If the magnetic environment changes (e.g. installation in a different vehicle), you should recalibrate the compass.

The direction finder provides a calibration menu (see "Compass Calibration Dialog" on page 159).

Calibration of Antenna Compass GH150

The calibration performed is the 8-point calibration, where the compass must be rotated in steps of 45° with a tolerance of +- 15°.

In the following calibration procedure for the compass GH150, only the compass commands are shown. The SCPI command to send a command string to the compass is

`SYSTem:COMPass:COMMand <compass_name>, <compass_command>`

e.g. `SYST:COMP:COMM ”GH150@ADD0119”,”=ce1”`

The SCPI command to get the reply from the compass is

```
SYSTem:COMPass:REPLy?  <compass_name>
```

You will always get the last reply from the compass, e.g.

```
syst:comp:repl? "gh150@add075"
">">
$225.0
"
```

Table 11-4: Antenna compass calibration procedure.

Step	Compass heading	Compass command	Compass reply

1	Begin with any heading	`=ce1`	`">`
			`$000.0`
			`"`

2	Turn compass 45° clockwise from begin heading	`=ce1`	`">`
			`$045.0`
			`"`

3	Turn compass 90° clockwise from begin heading	`=ce1`	`">`
			`$090.0`
			`"`

4	Turn compass 135° clockwise from begin heading	`=ce1`	`">`
			`$135.0`
			`"`

5	Turn compass 180° clockwise from begin heading	`=ce1`	`">`
			`$180.0`
			`"`

6	Turn compass 225° clockwise from begin heading	`=ce1`	`">`
			`$225.0`
			`"`

7	Turn compass 270° clockwise from begin heading	`=ce1`	`">`
			`$270.0`
			`"`

8	Turn compass 315° clockwise from begin heading	`=ce1`	`">`
			`$315.0`
			`"`

9	Turn compass back to the original direction	`=ce1`	`">`
			`>`
			`Field Calibration complete:`
			`Noise score: X, Y`
			`Calibration count Z`
			`"`

If the calibration was successful, the following result is displayed after the last step:

`Noise score: X, Y`

`Calibration count Z`

The first part of the Noise score (X) represents the quality of the calibration. The higher the quality, the more accurate the compass is working. Please refer to the following table:

Table 11-5: Antenna compass noise score coding.

Noise Score X	Accuracy
9	0.5° or better
8	1° or better
7	2° or better
6	4° or better
5	8° or better
4	16° or better
3	32° or better
2	64° or better
1	128° or better
0	256° or better
	7 2° or better

The second part of the Noise score (Y) is the Magnetic Environment Count representing the quality of the magnetic environment, where 9 again is the best and 0 is the worst result. The Calibration count (Z) gives the total number of already performed calibrations of the compass.

The calibration can be cancelled any time with the command `=cez`

WARNING

Improper calibration

If you don't cancel a calibration, it must be performed completely and deliberately. Otherwise you may destroy a proper compass calibration and your compass values may then become invalid.

The next table lists the most usable commands for the antenna compass GH150. For further information please refer the GH150 User Manual.

Table 11-6: Compass information and control.

Compass command	Compass reply	Description
=ce1	perform compass calibration Step	8-point-calibration
?cs2	"> ?cs2 X,Y,Z "	request last compass result: X: "Noise Score", Y: "Magnetic Environment", Z: "Calibration Count".
=cez	"> Calibration aborted "	cancel calibration
?w	"> ?w XXXXXXX,A,B,C100,99/99/99 "	request compass information XXXXXX … serial number, A … software version B … hardware version C … hardware type 99/99/99 manufacturer calibration date
zap		warm boot compass

11.5 Cable Sets DDF 1C-x

Cable sets 1C-x are used for installation in the vertical direction. Two paths have to be run, i.e. the coaxial RF cable and the multi-core control cable. The cable sets are available from 5 m to 95 m in steps of 5 m. For cables with a length of more than 45 m, an external power supply IN 061 (4041.9514.00) is part of the equipment supplied. This power supply compensates the voltage drop across the control cable by applying the supply voltage to the active antennas. In case of coaxial RF cables and longer runs, 3/8" low-loss Flexwell cables are used. If the cable length is less than 35 m, cable type RG 214 is sufficient.

The RF connectors are of N type. 22-pin military round connectors according to German standard VG 96912 are used for the control cables at the antenna end, whereas the 25-pin D system is used at the DF end. A three-pin power cable with sleeved ends comes with the external power supply.

11.5.1 Cable Coding

The frequency ranges of cable sets DDF 190 Z are distinguished in terms of different order numbers. The 9th and 10th figures stand for a number that corresponds to the cable length in meters. The simplest configuration consists of two cables and the maximum configuration uses eight cables. For cables longer than 45 m, the external power supply IN 061 is part of the equipment supplied.

Table 11-7: Cable coding.

		Cable for frequency range		
		DDF 1C-1 0,3 to 30 MHz	DDF 1C-5 20 to 1300 MHz	DDF 1C-7 20 to 3000 MHz
Cable set:		4077.6009.XX	4077.7005.XX	4007.8001.XX
05 m long	model 05	4077.6009.05	4077.7005.05	4007.8001.05
10 m long	model 10	4077.6009.10	4077.7005.10	4007.8001.10
etc.				
95 m long	model 95	4077.6009.95	4077.7005.95	4007.8001.95

11.5.2 Circuit Diagrams, Cable Numbers

Although a variety of cable sets is available, installation is reduced to three circuit diagrams. There is also a connection between the two antennas ADD 196 or ADD 197 and ADD 071, respectively (the required cables are included in the mast adapter set ADD 071 Z VAR 03). The following diagrams illustrate how antennas ADD 119 and ADD 196 or ADD 197 are connected to the R&S EB500. Three categories of cable length are shown. The standard integration of the frequency-range extending antenna ADD 071 by means of cables W202 and W211 is illustrated in the last diagram.

Labeling

All cables are labeled with a "W" number and a destination. Matching interfaces are marked with "X" numbers.

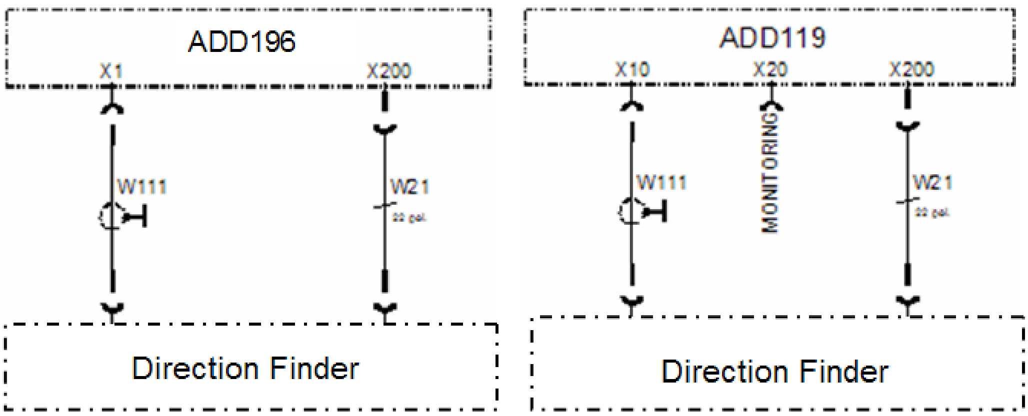


Fig. 11-3: Cable length 5 m to 30 m. RF cable W111 and control cable W21 in the corresponding lengths.

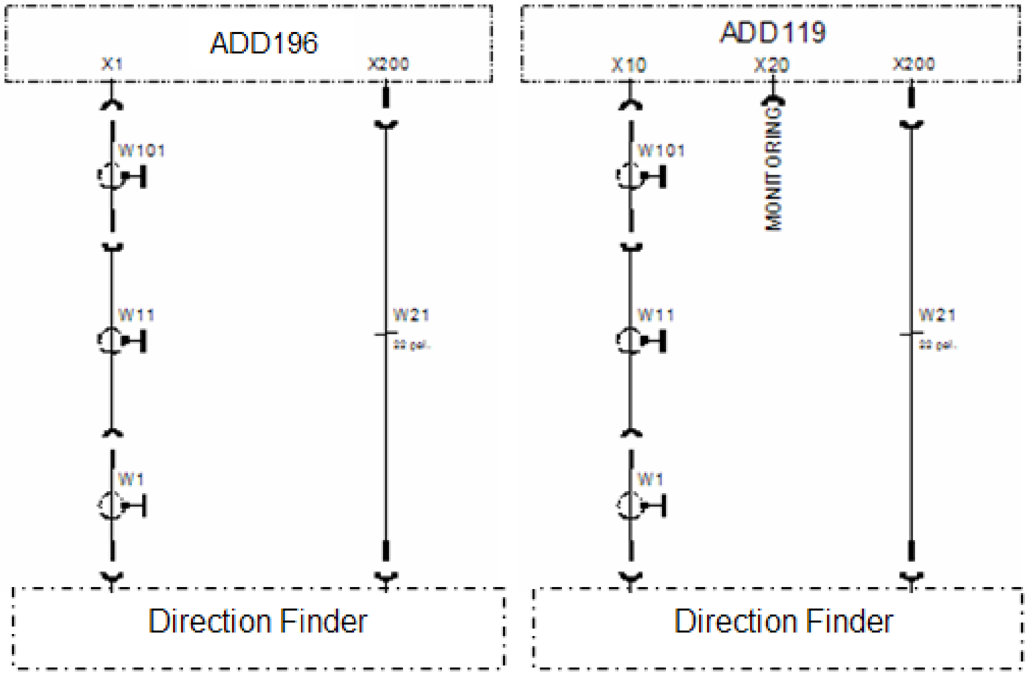


Fig. 11-4: Cable length 35 m and 40 m. The low-loss Flexwell cable W11 bridges the long RF path.

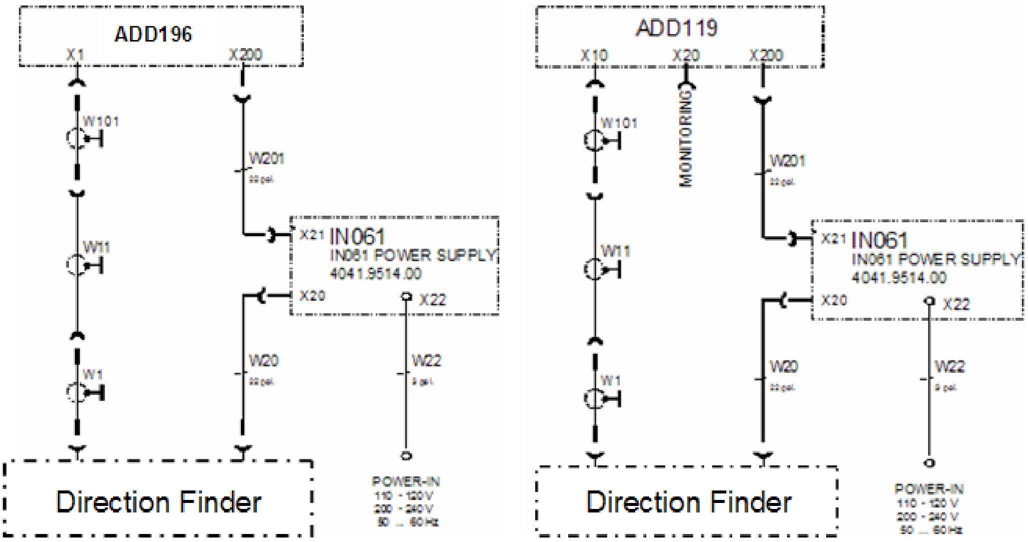


Fig. 11-5: Length 45 m to 95 m, with additional power supply IN 061 in control path.

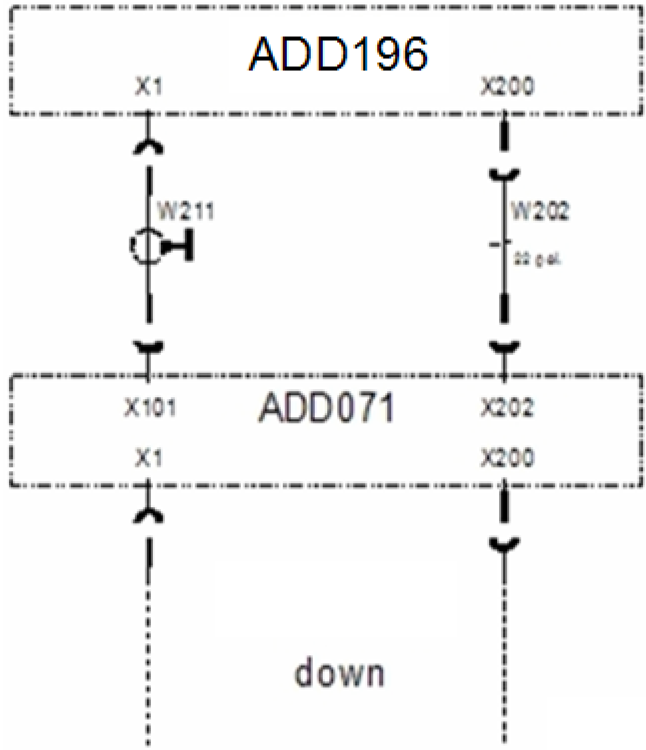


Fig. 11-6: Frequency-range extension 1300 MHz to 3000 MHz by integration of antenna ADD 071 below antenna ADD 196 or ADD 197. Cable lengths are 1.5 m.

11.6 North Adjustment

After setting up the direction finder, north adjustment is an important step to achieve a standardized bearing indication:

- In stationary operation, the angle between radiator 1 and the north direction at the site of operation is to be determined for both antennas. The electronic compass is not used.
- Using the compass (primarily in mobile operation), the offset between the magnetic and geographic north is to be determined where cartographic reference is employed. A label marks the north direction or radiator 1 for each antenna. Direction finders are fitted in the vehicle so that the direction of dipole 1 coincides with the vehicle axis (along the direction of travel). The pitch circle of the flange is mechanically coded so that the flange cannot be misaligned. A remaining angular deviation can be compensated electrically.

11.7 Installation Concepts

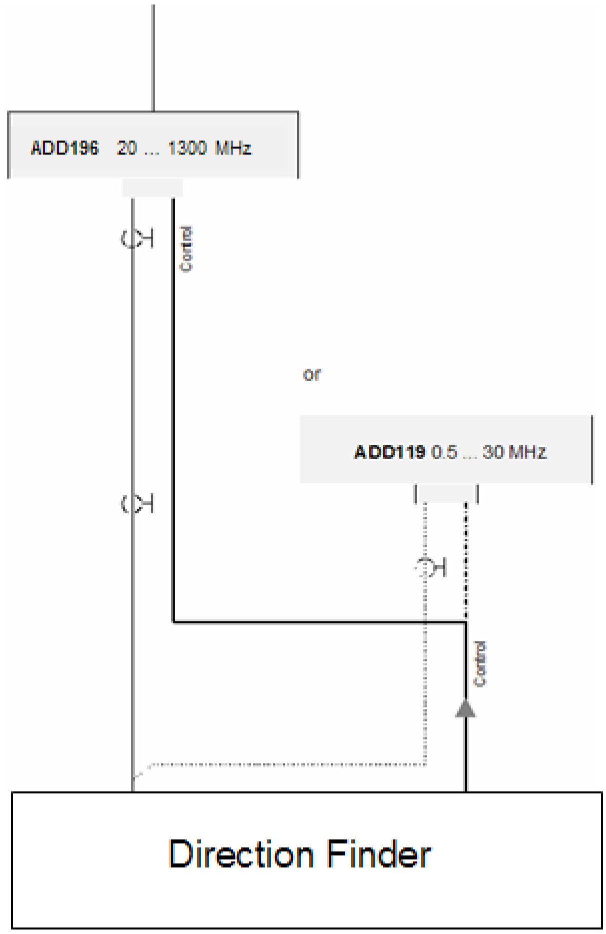


Fig. 11-7: Direction finder with antenna ADD 196 or ADD 197 (20 MHz to 1300 MHz) or ADD 119 (0.3 to 30 MHz).

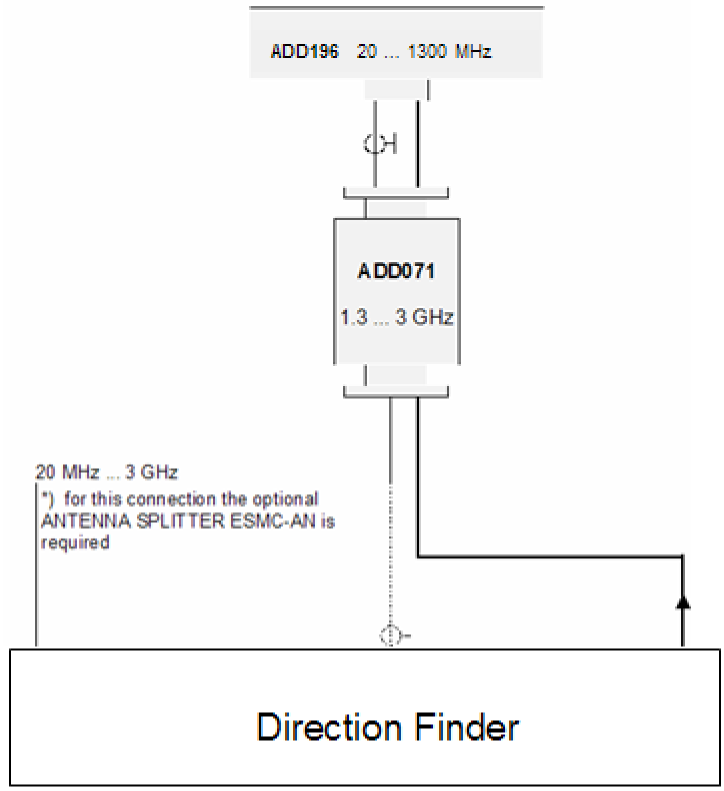


Fig. 11-8: Direction finder with antenna ADD 196 or ADD 197 and ADD 071 (20 MHz to 3000 MHz).

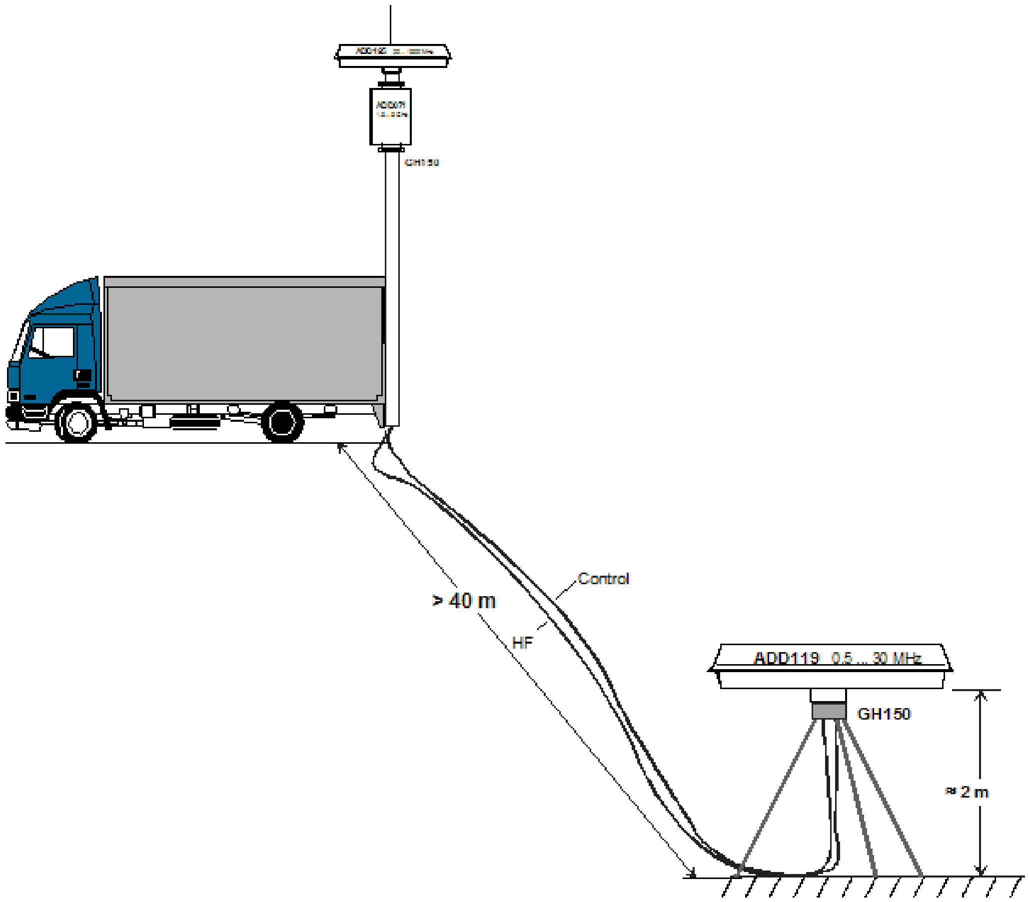


Fig. 11-9: Assembly dimensions, mobile (ADD 196 or ADD 197, ADD 071 and ADD 119).

11.8 Operation

11.8.1 General Instructions

The following instructions are intended as a check list for the user in performing the necessary steps required to obtain a DF result in manual mode.

- **Cabling**: Antenna cable, control cable, IF cable, power cable, grounding.
- **AC supply**: Select the correct AC supply voltage for all units (also IN 061, GX 119).
- **Switching on**: Receiver first.
- **DF mode**: Press key APPL and change application to "DF".
- **Radio monitoring**: Select the frequency of interest and press ENTER.

11.8.2 Most Frequently Used Settings

The direction finder is designed so that it can be optimally set to the desired signal. The following describes the settings most frequently used. They can be entered at the front panel.

AF DF MODE

"AF": This toggles the receiver mode. It shows the signal level in dBµV and the frequency deviation in kHz.

"DF": Direction finder mode.

SPAN

Setting of the DF panorama span width. Possible values range from 1 to 20 000 kHz.

DF-BANDWIDTH

This is the width of a frequency channel. The DF bandwidth can only be set indirectly via the FFT bandwidth and the FFT selectivity. With FFT selectivity set to sharp, the DF bandwidth is 0.6 times the FFT bandwidth. The DF bandwidth should correspond as much as possible to the bandwidth of the signal.

DF MEAS TIME

Smoothing average in seconds. Possible values are between 0.1 s and 10 s. Generally: The longer the "DF MEAS TIME" is set, the more steady the DF value and the required signal field strength. On the other hand, the display of the DF value slows down as averaging time increases. As such, there should be a compromise. For direction finding while driving, a value of 0.5 s is a good choice.

LEVEL SQU

This is the trigger level for the DF value. The valid range is between -30 dBµV and 130 dBµV.

SQU MODE

For direction finding while driving, mode "NORM" should be used. It serves the control of the averaging-value storage and the bearing-value display in modes "NORM" and "GATE".

Three modes are available:

- "OFF": DF results will be shown only if the level is above the DF bearing quality squelch regardless of the "OFF" / "GATE" / "NORM" mode of the level squelch.
- "GATE": This mode is used to find pulse signals and the averaging value will not be erased from memory if the signal level rises above the set limit.
- "NORM": The display is only updated if
  – the signal level is above the set squelch threshold.
  – the bearing quality is above the set minimum quality and the set "AVG" is equal to or less than the signal duration.

PEAK SEARCH

Navigation among peaks. Three modes available:

- "LEFT": Navigate to the next peak left.
- "RIGHT": Navigate to the next peak right.
- "PEAK": Navigate to the maximum peak.

DF PANEL

Configuration of the visible DF panel. The valid range is between -40 dBµV and 130 dBµV.

11.8.3 Operation in a Moving Vehicle

Note for Practical Operation

In an area with hills or buildings, the wave propagation between the transmitter and direction finder takes place in different ways (see figure 11-10).

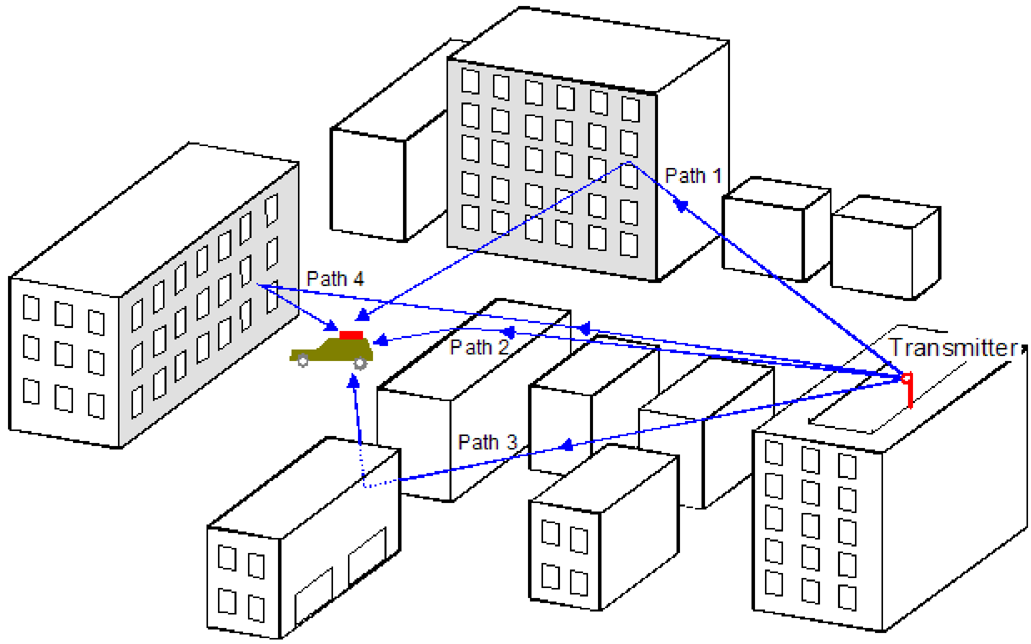


Fig. 11-10: Multi-path propagation in urban areas.

Basically, the following situations should be differentiated:

- Waves from the direction of the transmitter are dominant (e.g. Path 2 in figure 11-10): The direction finder displays near-correct values.
- Waves from the direction of a strong reflector are dominant (e.g. Path 1,3 and 4 in figure 11-10): Erroneous bearing values.
- None of the active waves is dominant: Erroneous and low-quality bearing values.

To achieve correct values in spite of situation 1 and 3, the direction finder must be moving. Only movement secures enough valid bearings to make a correct choice of the direction to take. The direction finder cannot automatically make the decision, due to its complexity, as to whether or not the bearing is correct.

Filtering of the bearing values by means of the quality criterion improves the situation significantly but additional analysis, based on the knowledge of the interferences in the vicinity of the DF vehicle, particularly in the city is required. For mobile DF operation, one should bear in mind that bearing-value variations of ±30° still represent a good result. The level indication also helps improve the situation since the level rises as the distance to the target decreases.

Example of mobile DF operation in the city

Assignment: An illegal FM transmitter with a known frequency must be located . The target has already been located via fixed radio location stations. It is enclosed by an area of 5 km x 5 km.

Polarization

The R&S EB500 is designed for vertically polarized signals (antenna ADD 196 and ADD 071). If there is a purely horizontally polarized signal, antenna ADD 197 must be used, otherwise a DF operation would not make sense.

- Trip to the target area.
- Search for a position with as less interference as possible (e.g. a hill if available). Set the R&S EB500:
  – Frequency: according to signal.
  – Span: according to signal.
  – Step: according to signal.
  – etc.
  – Squelch mode: "NORM".
  – Squelch level: according to signal.
  – Min. DF quality: 70.
  – DF MEAS TIME: 5 s.
- Drive in the indicated direction. Keep watching the bearing. Ignore erratic short variations but check out variations that last longer. If the vehicle is close to a big building or metallic fence, ignore the associated variation. In areas with small bearing-value variations (±30°), the results must be optically averaged and the trip be continued in this average direction. In this context, it is very useful to set a minimum DF quality. Changes in the signal level (this value must also be averaged while driving) indicate whether or not the direction of movement corresponds to the bearing direction.
- An erratic change in the bearing of 180° generally indicates that the target has just been passed. Approach the target at an angle of 90° to gain additional certainty.
- You have just located the building with the emitter in question. A further search within the building would be facilitated by using the "Miniport Receiver EB 200" with its directional antenna "HE 200".

11.9 Corrrection Data

Correction data is used to compensate for certain factors which have their origins outside the device and affect the device's measurement results. The correction data is stored within the flash file system of the R&S EB500. You will find more detailed information on correction data on the "Firmware & Utilities CD" (in subfolder "Utilities\Correction Data Examples").

The R&S EB500 can process the following correction data:

11.9.1 Antenna Factors

Antenna factors are required to convert an antenna's measured level into field strength level. The correction data for the standard R&S DF and RX antennas is provided as part of the firmware. In the case of a user defined antenna, you can generate the required antenna factors yourself and store them within the flash file system.

11.9.2 Cable Attenuation

Where higher frequencies and longer RF cables between the antenna and the device are involved, there is an additional attenuation of the antenna level. This additional attenuation can be corrected to allow for a precise field strength measurement.

11.9.3 Azimuth Correction

In the case of a mobile direction finder, the carrier vehicle's reflection characteristics near the DF antenna result in a more or less pronounced disturbance of the wave field. To a certain extent, this disturbance is of a systematic nature. The vehicle's interference can largely be compensated for. The required correction data depends on the antenna, the frequency and the measured azimuth. The correction function requires option R&S EB500-COR

11.9.4 Omniphase Correction

With antennas working on the Watson Watt principle, the carrier vehicle may cause an additional phase shift between the omni elements and the DF elements due to its reflection characteristics near the DF antenna. If the resulting phase difference exceeds ±90°, the DF value will be off by 180°. This kind of influence is of a systematic nature and can be corrected.

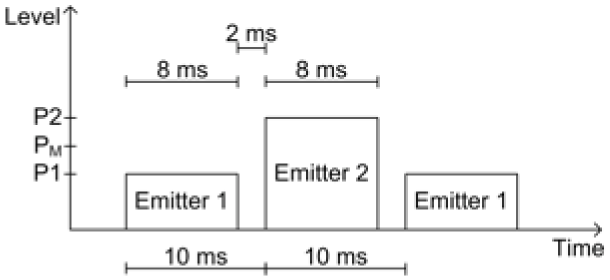
12 Polychrome IF Panorama

12.1 General Information

The polychrome IF panorama is a spectral representation of levels vs. frequency. The color of each level / frequency pair indicates the relative occupancy over time and signal duration. It differs from the "normal" IF panorama in the following way: With the normal IF panorama, all levels which belong to the same frequency are considered to come from one emitter and computed via the level analysis to give a single value.

Example:

Let us assume there are two signals on a particular frequency which are emitted in turns. The alternating rate is 100 per second, and each signal is active for 8 ms. The emitter then switches off to wait for the reply of the second emitter, which, after a pause of 2 ms, emits for 8 ms as well. The following levels can be seen on this frequency:



If the IF panorama is set to "AVERAGE" and the measurement time to 100 ms, the frequency will show a level which corresponds to the average from both emitters.

Pm = (P1 + P2)/2

The IF panorama thus combines both signals and represents them as a single signal (see figure below).

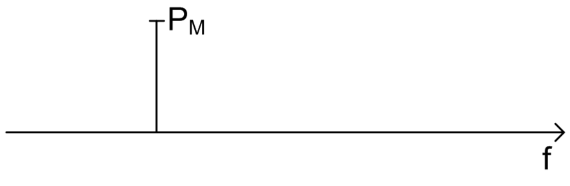


Fig. 12-1: Combined signals.

Histogram Mode

In "HISTOGRAM" mode, both signals are shown as two points, one above the other. The location of each point corresponds to levels P1 and P2, respectively. The color of these points is determined by the frequency of occurrence of levels P1 and P2.

Relative frequency of occurrence

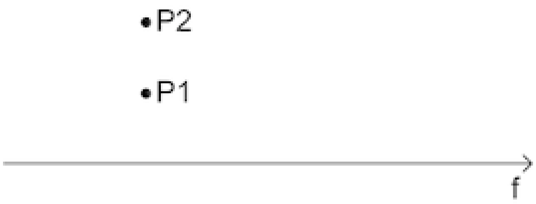
The term "relative frequency of occurrence" refers to a settable time `ta` which corresponds to an occupancy of 100%. Thus, 100% means a level / frequency pair has been active over the entire time `ta`. If the level / frequency pair has been active over half the time `ta` only, the relative frequency of occurrence is 50%. Although the activity of the level / frequency pair may be interrupted, its total must amount to ½ `ta`.

Observation time

As stated in the example above (50% occupancy), the activity of a level / frequency pair may be interrupted. Observation time `tb` is the integration time during which the total activity time is measured.

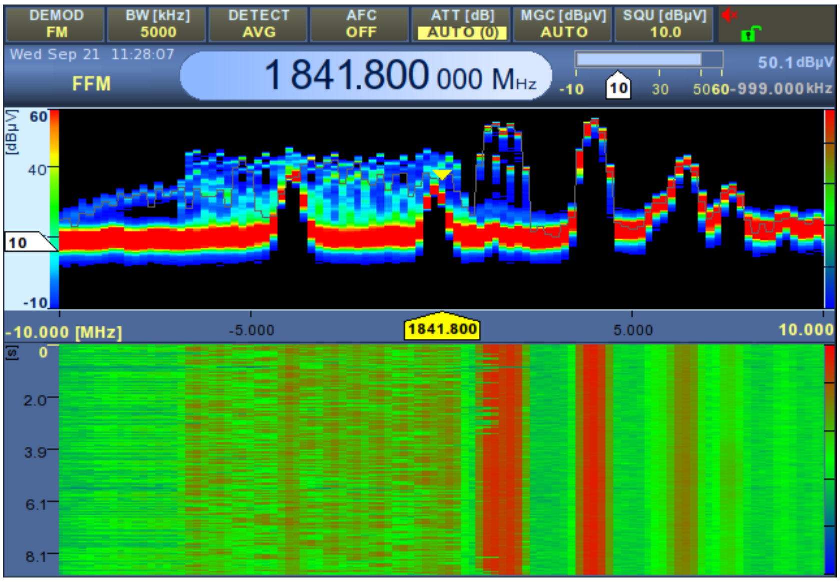
Example:

The relative frequency is set to 100 ms. The observation time is set to 1 s. Assuming the scenario shown at the beginning of this section, each emitter is active 50 times, each time for 8 ms, during a one-second period. Thus, the total activity duration is 400 ms, which is four times the relative frequency of 100 ms. Both points are therefore shown with maximum frequency of occurrence (see figure below).



Example:

The picture below shows a signal scenario from the GSM band. As can be seen, there are some frequencies where time slots are emitted with different levels.



The level / frequency pairs are generated via the FFT computation of the IF panorama. Span, step and FFT selectivity (described in chapter 10, "IF Panorama", on page 451) also apply to polychrome representation. The IF panorama spectrum shown additionally (in grey) can be operated with the same parameters as described in chapter 10, "IF Panorama", on page 451. The FFT time resolution is the most important factor. It is indirectly proportional to the FFT bandwidth, which depends on the step and selectivity (see chapter 10, "IF Panorama", on page 451). t = 2.4 / BW.

12.2 Squelch On/Off, Squelch Threshold

Pulse-duration measurements require a threshold. If squelch is turned off, the threshold is determined automatically. If squelch is turned on, the threshold is identical with the squelch value.

SCPI commands:

- `OUTP:SQU ON|OFF`
- `OUTP:SQU:THR <value>`

GUI:

- Turn squelch on or off by pressing the SQU key. Turn the key to change the squelch value.

12.3 Polychrome IF Panorama Mode

Determines the polychrome mode.

SCPI commands:

- `CALC:PIFP:MODE OFF|HIST`

GUI:

- Select the IF panorama using keys PANEL SELECT, PREV/NEXT.
- Press button "POLYCHROME" in the softkey bar (second level) and choose the desired value from the selector shown.

12.4 100% Time, Observation Time

These parameters are used to set the maximum activity duration and observation time/ persistence.

SCPI commands:

- `CALC:PIFP:ACTT <value>`
- `CALC:PIFP:OBST <value>`

GUI:

- Select the IF panorama using keys PANEL SELECT, PREV/NEXT.

- Press button "100% Time" in the vertical softkey bar (second level) and enter the desired value via the numeric pad or change it via the ROLLKEY.
- Press button "PERSISTENCE" in the vertical softkey bar (second level) and enter the desired value via the numeric pad or the ROLLKEY.

12.5 Lower Limit, Upper Limit

This parameter is used to filter the polychrome representation. For display, a subset of the color set is defined. This makes it possible to gather additional information, e.g. one can suppress short-time signals and make stationary signals stand out much clearer (and vice versa).

SCPI commands:

- none (display only)

GUI:

- Select the IF panorama using keys PANEL SELECT, PREV/NEXT.
- Press button "LOWER LIMIT" in the vertical softkey bar (second level) and enter the desired value using the numeric pad or the ROLLKEY.
- Press button "UPPER LIMIT" in the vertical softkey bar (second level) and enter the desired value using the numeric pad or the ROLLKEY.

12.6 Polychrome IF Panorama Clear

The polychrome display is cleared automatically if the receive frequency, 100% time or observation time is changed. It can also be cleared manually using this parameter.

SCPI commands:

- `CALC:PIFP:CLE`

GUI:

- Select the IF panorama using keys PANEL SELECT, PREV/NEXT.
- Press button "CLEAR PANORAMA" in the vertical softkey bar (second level).

13 Digital Down Converters

13.1 Introduction

With R&S EB500-DDC the R&S EB500 becomes a multi-channel receiver. In addition to the basic receiver channel, another four receive channels are available. These receive channels are realized with Digital Down Converters (DDCs) within the IF bandwidth.

Each DDC can demodulate AM, FM, PM, PULSe or IQ up to a bandwidth of 1 MHz and CW, LSB and USB up to a bandwidth of 9 kHz.

An independent audio volume and balance for each DDC as well as for the basic receiver channel enable flexible audio mixing and recording. Every DDC has a squelch and level measurement function. The DDC frequencies can be set independently or coupled to the basic receiver frequency. The demodulation parameters demodulation, bandwidth, squelch state and squelch threshold can also be set independently or coupled to the corresponding receiver parameters.

DDC Option

Digital Down Converter functions are only accessible with the installed software option R&S EB500-DDC (Digital Down Converter).

13.2 Device-Specific Commands for DDCs

Following is a description of device-specific commands as applicable to DDCs. The commands are listed by subsystem.

13.2.1 CALCulate Subsystem

CALCulate:IFPan:MARKer:DDC[<numeric_suffix>]:MAXimum[:PEAK]

This command sets the demodulation frequency of the selected DDC to the absolute level maximum within the IF panorama spectrum.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Example: `CALCulate:IFPan:MARKer:DDC3:MAXimum`

CALCulate:IFPan:MARKer:DDC[<numeric_suffix>]:MAXimum:LEFT

This command sets the demodulation frequency of the selected DDC to the next relative level maximum left of the marker when the squelch is off. When it is on, the demodulation frequency of the selected DDC is set to the next level maximum to the left which is above the squelch line.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Example: `CALCulate:IFPan:MARKer:DDC:MAXimum:LEFT`

CALCulate:IFPan:MARKer:DDC[<numeric_suffix>]:MAXimum:RIGHt

This command sets the demodulation frequency of the selected DDC to the next relative level maximum right of the marker when the squelch is off. When it is on, the demodulation frequency of the selected DDC is set to the next level maximum to the right which is above the squelch line.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Example: `CALCulate:IFPan:MARKer:DDC3:MAXimum:RIGHt`

CALCulate:IFPan:MARKer:DDC:NEXT:MAXimum:LEFT

This command sets the demodulation frequency of all unused DDCs to the next relative level maxima left to the center of the IF panorama. A DDC is unused if the squelch function is switched on and the signal is lower than the squech threshold.

Example: `CALCulate:IFPan:MARKer:DDC:NEXT:MAXimum:LEFT`

CALCulate:IFPan:MARKer:DDC:NEXT:MAXimum:RIGHt

This command sets the demodulation frequency of all unused DDCs to the next relative level maxima right to the center of the IF panorama. A DDC is unused if the squelch function is switched on and the signal is lower than the squech threshold.

Example: `CALCulate:IFPan:MARKer:DDC:NEXT:MAXimum:RIGHt`

13.2.2 OUTPut Subsystem

OUTPut:SQUelch:DDC[<numeric_suffix>][:STATe] <boolean>

This command switches the squelch of the selected DDC on or off.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<boolean> ON | OFF

ON
The squelch of the selected DDC is switched on.

OFF
The squelch of the selected DDC is switched off.

*RST: OFF

Example: `OUTP:SQU:DDC2 ON`

OUTPut:SQUelch:DDC[<numeric_suffix>][:STATe]?

This query returns the squelch setting of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<boolean> 0 | 1

0
The squelch of the selected DDC is off.

1
The squelch of the selected DDC is on.

Example: `OUTP:SQU:DDC2?` -> 1

OUTPut:SQUelch:DDC[<numeric_suffix>]:THReshold [:UPPer] <ddc_threshold>

This command sets the squelch threshold of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<ddc_threshold> **<numeric_value>**
Sets the squelch threshold in dBµv.

MINimum
Sets the minimum squelch threshold of the selected DDC.

MAXimum
Sets the maximum squelch threshold of the selected DDC.

*RST: 10 dBµV

Example: `OUTPut:SQUelch:DDC3:THReshold 35 dBuV`

OUTPut:SQUelch:DDC[<numeric_suffix>]:THReshold[:UPPer]? <query_param>

This query returns the squelch threshold of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current squelch threshold of the selected DDC.

MINimum
Returns the minimum squelch threshold of the selected DDC.

MAXimum
Returns the maximum squelch threshold of the selected DDC.

Return values:

<ddc_threshold> Squelch threshold value in dBµV.

Example: `OUTPut:SQUelch:DDC3:THReshold?` -> 35

13.2.3 SENSe Subsystem

[SENSe:]BANDwidth|BWIDth[:RESolution]:DDC[<numeric_suffix>] <ddc_bandwidth>

This command sets the demodulation bandwidth of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<ddc_bandwidth>

<numeric_value>
Value of the bandwidth to be set.

UP
Next bandwidth.

DOWN
Previous bandwidth.

MINimum
Minimum bandwidth.

MAXimum
Maximum bandwidth.

Range: 100 Hz to 1 MHz in 24 discrete steps
*RST: 120 kHz

Example: `BANDwidth:DDC3 2.4 kHz`

[SENSe:]BANDwidth|BWIDth[:RESolution]:DDC[<numeric_suffix>]? <query_param>

This query returns the current demodulation bandwidth of the selected DDC.

Suffix:

<numeric_suffix>	1 to 3 The suffix selects the desired DDC.

Query parameters:

<query_param>	none | MINimum | MAXimum **none** Returns the current bandwidth of the selected DDC. **MINimum** Returns the minimum bandwidth of the selected DDC. **MAXimum** Returns the maximum bandwidth of the selected DDC.

Return values:

<ddc_bandwidth>	IF bandwidth in Hz without unit specified.

Example: `BANDwidth:DDC3?` -> 2400

[SENSe:]DEModulation:DDC[<numeric_suffix>] <ddc_demodulator>

This command sets the demodulation mode of the selected DDC.

Error message: Where the set bandwidth exceeds 9 kHz with "CW", "LSB" or "USB", error -221,"Settings conflict" will be generated if one of the SSB operating modes is to be switched on.

Suffix:

<numeric_suffix>	1 to 3 The suffix selects the desired DDC.

Parameters:

<ddc_demodulator> AM | FM | PM | PULSe | A0 | IQ | A1 | CW | LSB | USB

AM
Switch on AM demodulator.

FM
Switch on FM demodulator.

PM
Switch on PM demodulator.

PULSe
Switch on pulse demodulator.

A0
Switch on IQ demodulator.

IQ
Switch on IQ demodulator.

A1
Switch on SSB demodulator 1 kHz beat.

CW
Switch on SSB demodulator 1 kHz beat.

LSB
Switch on SSB demodulator lower sideband.

USB
Switch on SSB demodulator upper sideband.

*RST: FM

Example: `DEM:DDC2 FM`

[SENSe:]DEModulation:DDC[<numeric_suffix>]?

This query returns the demodulation mode of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<ddc_demodulator> FM, AM, PM, PULS, IQ, CW, USB, LSB

Example: `DEM:DDC2?` -> FM

[SENSe:]FREQuency:DDC[<numeric_suffix>] <ddc_frequency>

This command sets the frequency of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<ddc_frequency>

<numeric_value>
Value of the DDC frequency.

UP
Increases the DDC frequency by the value set with command `[SENSe:]FREQuency:STEP[:INCRement]` on page 272.

DOWN
Decreases the DDC frequency by the value set with command `[SENSe:]FREQuency:STEP[:INCRement]` on page 272.

MINimum
Sets the minimum DDC frequency.

MAXimum
Sets the maximum DDC frequency.

*RST: 98.5 MHz

Example: `FREQ:DDC1 95.5 MHz`

[SENSe:]FREQuency:DDC[<numeric_suffix>]? <query_param>

This query returns the frequency of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current DDC frequency.

MINimum
Returns the minimum DDC frequency.

MAXimum
Returns the maximum DDC frequency.

Return values:

<ddc_frequency> Frequency value in Hz.

Example: `FREQ:DDC1?` -> 95500000

[SENSe:]DEModulation:DDC[<numeric_suffix>]:COUPling[:STATe] <function_state>

This command switches the DDC coupling function of the demodulation parameters on or off. The DDC coupling function decides whether the parameters demodulation, bandwidth, squelch state and squelch threshold of the selected DDC are coupled to the corresponding receiver parameters or not.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<function_state> ON | OFF

ON
Switches the DDC coupling function on.

OFF
Switches the DDC coupling function off.

*RST: OFF

Example: `DEM:DDC3:COUP ON`

[SENSe:]DEModulation:DDC[<numeric_suffix>]:COUPling[:STATe]?

This query returns the state of the DDC coupling function of the demodulation parameters.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<function_state> 0 | 1

0
The DDC coupling function is switched off.

1
The DDC coupling function is switched on.

Example: `DEM:DDC2:COUP?` -> 1

[SENSe:]FREQuency:DDC[<numeric_suffix>]:COUPling[:STATe] <function_state>

This command switches the DDC coupling function of the frequency on or off. The DDC coupling function decides whether the frequency of the selected DDC is coupled to the receiver frequency or not.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<function_state> ON | OFF

ON
Switches the DDC coupling function on.

OFF
Switches the DDC coupling function off.

*RST: OFF

Example: `FREQ:DDC3:COUP ON`

[SENSe:]FREQuency:DDC[<numeric_suffix>]:COUPling[:STATe]?

This query returns the state of the DDC coupling function of the frequency.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<function_state> 0 | 1

0
The DDC coupling function is switched off.

1
The DDC coupling function is switched on.

Example: `FREQ:DDC3:COUP?` -> 1

SENSe:DATA:DDC[<numeric_suffix>]?

This query returns the current level measurement value of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<meas_value> Level in dBµV.

Example: `SENS:DATA:DDC3?` -> 23.4

13.2.4 SYSTem Subsystem

SYSTem:AUDio:DDC[<numeric_suffix>]:BALance <ddc_balance>

This command sets the AF balance of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Query parameters:

<ddc_balance> **<numeric_value>**
AF balance.

MINimum
Only left AF channel.

MAXimum
Only right AF channel.

Range: -0.50 (left) to 0.50 (right)
Increment: 0.01
*RST: 0.00

Example: `SYST:AUD:DDC2:BAL 0.5`

SYSTem:AUDio:DDC[<numeric_suffix>]:BALance? <query_param>

This query returns the AF balance of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Query parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current balance.

MINimum
Returns the minimum balance.

MAXimum
Returns the maximum balance.

Return values:

<ddc_balance> AF balance.

Example: `SYST:AUD:DDC2:BAL?` -> 0.50

SYSTem:AUDio:DDC[<numeric_suffix>]:VOLume <ddc_volume>

This command sets the volume of AF of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<ddc_volume> **<numeric_value>**
Volume of AF.

MINimum
No AF.

MAXimum
Full volume of AF.

Range: 0.00 to 1.00
Increment: 0.01
*RST: 0.00

Example: `SYST:AUD:DDC3:VOL 0.5`

SYSTem:AUDio:DDC[<numeric_suffix>]:VOLume? <query_param>

This query returns the AF volume of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<query_param> none | MINimum | MAXimum

none
Returns the current volume.

MINimum
Returns the minimum volume.

MAXimum
Returns the maximum volume.

Return values:

<ddc_volume> AF volume.

Example: `SYST:AUD:DDC3:VOL?` -> 0.50

SYSTem:AUDio:DDC[<numeric_suffix>][:STATe] <ddc_audio_state>

This command switches the AF of the selected DDC on or off.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<ddc_audio_state> ON | OFF

ON
AF on.

OFF
AF off.

*RST: ON

Example: `SYST:AUD:DDC3 OFF`

SYSTem:AUDio:DDC[<numeric_suffix>][:STATe]?

This query returns the state of the AF of the selected DDC.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<ddc_audio_state> 0 | 1

0
AF is switched off.

1
AF is switched on.

Example: `SYST:AUD:DDC3?` -> 0

SYSTem:AUDio:DDC[<numeric_suffix>]:REMote:MODE <af_mode>

This command sets for the selected DDC the mode of the digital AF that is transferred via the remote control interface per UDP.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<af_mode> 0 | 1

0
Digital AF via remote is switched OFF

1
Digital AF via remote is set to 32 kHz samplingrate, 16 Bits per sample, 2 channels, 128 kbyte/s and 4 bytes per frame.

*RST: 0

Example: `SYST:AUD:DDC3:REM:MOD 1`

SYSTem:AUDio:DDC[<numeric_suffix>]:REMote:MODe?

This query returns for the selected DDC the current digital AF mode.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<af_mode> 0 | 1

0
Digital AF via remote is switched OFF

1
Digital AF via remote is set to 32 kHz samplingrate, 16 Bits per sample, 2 channels, 128 kbyte/s and 4 bytes per frame.

Example: `SYST:AUD:DDC3:REM:MOD?` -> 1

Table 13-1: Depending on the demodulation selected, the digital audio output will be as follows:

Demodulation	Left Channel	Right Channel
AM	AM	FM
PULS	AM	FM
FM	AM	FM
USB	I	Q
LSB	I	Q
CW	I	Q
IQ	I	Q
PM	AM	PM

SYSTem:IF:DDC[<numeric_suffix>]:REMote:MODE <if_mode>

This command sets for the selected DDC the mode of the digital IF that is transferred via the remote control interface per UDP.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Parameters:

<if_mode> OFF | SHORt | LONG | AShort | ALONg

OFF
Digital IF switched off.

SHORt
Digital IF format 16 bit I and 16 bit Q.

LONG
Digital IF format 32 bit I and 32 bit Q.

AShort
Digital IF with AMMOS format 16 bit I and 16 bit Q.

ALONg
Digital IF with AMMOS format 32 bit I and 32 bit Q.

*RST: OFF

Example: `SYSTem:IF:DDC2:REMote:MODe SHORT`

SYSTem:IF:DDC[<numeric_suffix>]:REMote:MODE?

This query returns for the selected DDC the mode of the digital IF.

Suffix:

<numeric_suffix> 1 to 3
The suffix selects the desired DDC.

Return values:

<if_mode> OFF | SHOR | LONG | ASH | ALON

OFF
Digital IF switched off.

SHOR
Digital IF format 16 bit I and 16 bit Q.

LONG
Digital IF format 32 bit I and 32 bit Q.

ASH
Digital IF with AMMOS format 16 bit I and 16 bit Q.

ALON
Digital IF with AMMOS format 32 bit I and 32 bit Q.

Example: `SYSTem:IF:DDC2:REMote:MODE?` -> SHOR

13.2.5 TRACe Subsystem

TRACe:DDC[<numeric_suffix>]:UDP|TCP:TAG[:ON] <ip_address>, <port_number>, <tag_list>

This command registers for the selected DDC a tag for a specific UDP or TCP path.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be registered as an integer e.g. 18457
Range: 1 to 65535

<tag_list> Possible tags: AUDio, IF (see "AUDio" on page 413 and "IF" on page 417).

Example: `TRAC:DDC2:UDP:TAG "89.10.20.30", 17222, AUD, IF`

TRACe:DDC[<numeric_suffix>]:UDP:DEFault:TAG[:ON] <ip_address>, <port_number>, <tag_list>

This command registers for the selected DDC a tag for the default UDP. The default UDP path is reserved for the internal GUI.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be registered as an integer e.g. 18457
Range: 1 to 65535

<tag_list> AUDio, IF (see "AUDio" on page 413 and "IF" on page 417).

Example: `TRAC:DDC2:UDP:DEF:TAG "89.10.20.30", 17222, AUD, IF`

TRACe:DDC[<numeric_suffix>]:UDP|TCP:FLAG[:ON] <ip_address>, <port_number>, <flag_list>

This command registers for the selected DDC a flag for a specific UDP or TCP path.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be registered as an integer e.g. 18457

Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC".

Example:
```
TRAC:DDC3:UDP:
FLAG "89.255.255.255", 18457, " VOLTage: AC",
"OPT"
```

TRACe:DDC[<numeric_suffix>]:UDP:DEFault:FLAG[:ON] <ip_address>, <port_number>, <flag_list>

This command registers for the selected DDC a flag for the default UDP path. The default UDP path is reserved for the internal GUI.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be registered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be registered as an integer e.g. 18457

Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "OPT",....

Example:
```
TRAC:DDC3:UDP:DEF:
FLAG "89.255.255.255", 18457, " VOLTage: AC",
"OPT"
```

TRACe:DDC[<numeric_suffix>]:UDP|TCP:TAG:OFF <ip_address>, <port_number>, <tag_list>

This command deregisters for the selected DDC a tag for a specific UDP or TCP path.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be deregistered as an integer e.g. 18457

Range: 1 to 65535

<tag_list> Possible tags: AUDio, IF (see "AUDio" on page 413 and "IF" on page 417).

Example: `TRAC:DDC4:UDP:TAG:OFF "89.10.20.30", 17222, AUD, IF`

TRACe:DDC[<numeric_suffix>]:UDP:DEFault:TAG:OFF <ip_address>, <port_number>, <tag_list>

This command deregisters for the selected DDC a tag for the default UDP path. The default UDP path is reserved for the device internal GUI.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be deregistered as an integer e.g. 18457
Range: 1 to 65535

<tag_list> AUDio, IF (see "AUDio" on page 413 and "IF" on page 417).

Example: `TRAC:DDC4:UDP:DEF:TAG:OFF "89.10.20.30", 17222, AUD, IF`

TRACe:DDC[<numeric_suffix>]:UDP|TCP:FLAG:OFF <ip_address>, <port_number>, <flag_list>

This command deregisters for the selected DDC a flag for a specific UDP or TCP path.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be deregistered as an integer e.g. 18457
Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "OPT",....

Example:
```
TRAC:DDC4:UDP:FLAG:
OFF "89.255.255.255", 18457, " VOLTage: AC",
"OPT"
```

TRACe:DDC[<numeric_suffix>]:UDP:DEFault:FLAG:OFF <ip_address>, <port_number>, <flag_list>

This command deregisters for the selected DDC a flag for the default UDP path. The default UDP path is reserved for the internal GUI.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be deregistered as an integer e.g. 18457
Range: 1 to 65535

<flag_list> Possible flags: "VOLTage:AC", "OPT",....

Example:
```
TRAC:DDC4:UDP:DEF:FLAG:
OFF "89.255.255.255", 18457, " VOLTage: AC",
"OPT"
```

TRACe:DDC[<numeric_suffix>]:UDP|TCP:DELete <ip_address>, <port_number>

This command deletes for the selected DDC a UDP or TCP path from the list provided it can be found. The default UDP path can also be deleted in this way.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<ip_address> IP address of the host to be deregistered as a string e.g. "89.10.20.30"

<port_number> Port number of the host to be deregistered as an integer e.g. 18457
Range: 1 to 65535

Example:
```
TRAC:DDC:UDP:DELete "89.255.255.255", 18457
```

TRACe:DDC[<numeric_suffix>]:UDP|TCP:DELete ALL

This command deletes for the selected DDC all UDP or TCP path except the default path.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Example:
```
TRAC:DDC:UDP:DELete ALL
```

TRACe:DDC[<numeric_suffix>]:UDP:DEFault:DELete ALL

This command deletes for the selected DDC the default UDP path. The default UDP path is reserved for the device internal GUI.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Example: `TRAC:DDC2:UDP:DEFault:DELete ALL`

TRACe:DDC[<numeric_suffix>]:UDP|TCP? <query_param>

Query for all or a specific registered for the selected DDC UDP or TCP path and query of the highest available UDP or TCP path count.

Suffix:

<numeric_suffix> 1 to 4
The suffix selects the desired DDC.

Parameters:

<query_param>

none
Returns a numbered list of all registered paths.

<numeric_value>
Returns a specific registered path.

MAXimum
Returns the highest available UDP or TCP path count.

DEFault
Returns the default registered path.

Example: `TRAC:DDC2:UDP? MAX`-> 7

Example: `TRAC:DDC2:UDP? 0`-> DEF "89.10.20.30", 18457, "VOLT:AC", "OPT"

Example: `TRAC:DDC2:UDP? 3`-> 003 "255.255.255.255", 17222, "VOLT:AC", "OPT"

List of Commands

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