

Version  
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## R&S® EB200 Miniport Receiver

Portable radiomonitoring from 10 kHz to 3 GHz

- ◆ Ergonomic design for portable use
- ◆ Continuous frequency range from 10 kHz to 3 GHz
- ◆ Detection of unknown signals
- ◆ Location of emissions by means of the R&S® HE200 handheld directional antenna and level sound
- ◆ Settable measurement time to safely locate interference sources
- ◆ Scanning modes
  - Frequency scanning
  - Memory scanning
- ◆ RF spectrum DIGI-Scan option
- ◆ IF panorama option
- ◆ Digital IF section with 12 bandwidths (150 Hz to 150 kHz)
- ◆ Fast, accurate level display over 120 dB dynamic range
- ◆ Remote-control interface (LAN option or RS-232-C)
- ◆ Audio available via LAN



**ROHDE & SCHWARZ**



## Brief description

The R&S®EB200 miniport receiver with the R&S®HE200 handheld directional antenna is a portable instrument for radiomonitoring in the wide frequency range from 10 kHz to 3 GHz. Whether used for monitoring emissions, detecting interference or locating miniature transmitters, the R&S®EB200 offers features unrivaled in its class. The favorably priced and compact receiver with optional LAN or RS-232-C interface may also be used in computer-based stationary systems.

The R&S®EB200 is characterized by high input sensitivity and frequency setting accuracy throughout the frequency range from 10 kHz to 3 GHz.

Its small dimensions and low weight make the R&S®EB200 ideal for use in places which cannot be reached with a vehicle. Its low power consumption permits battery operation of up to seven hours. The battery pack can be exchanged very quickly.

If the power supply is interrupted, all data is stored. Operation can thus be resumed immediately after the battery pack is exchanged.

The R&S®EB200 is suitable for the following tasks:

- ◆ Monitoring of specific frequencies, e.g. storage of up to 1000 frequencies, squelch setting, constant monitoring of a frequency or cyclical scanning of several frequencies

- ◆ Searching in the frequency range with user-selectable start and stop frequency and step widths from 1 kHz to 9.999 MHz
- ◆ Location of close-range to medium-range targets with the aid of the R&S®HE200 handheld directional antenna
- ◆ Detection of undesired emissions including pulsed emissions
- ◆ Detection of unlicensed transmitters communicating illegally or interfering with licensed transmission
- ◆ Protection against tapping by detecting miniature spy transmitters (bugs)
- ◆ Monitoring of one's own radio exercises in a service band
- ◆ Monitoring of selected emissions
- ◆ Remote-controlled operation via the R&S®RAMON, R&S®ARGUS software or user-specific

## Digital IF section

The R&S® EB200 covers the wide frequency range from 10 kHz to 3 GHz. Processing all signals available with optimum signal-to-noise ratio requires a large number of IF bandwidths. To make a wide variety of filters available when space is limited, the IF section of the R&S® EB200 was implemented by means of digital signal processors (DSP). Twelve IF bandwidths between 150 Hz and 150 kHz can thus be set. The following digital demodulators are available: AM, FM, LSB, USB, PULSE, I/Q and CW. With the IF panorama option, the number of selectable bandwidths is increased from 12 to 15 up to 1 MHz. The bandwidths beyond 150 kHz are provided for measurements without demodulation.

## Scanning modes

### Frequency scanning

It is possible to define a frequency range to which a complete data set can be allocated. In addition to receiver settings for start/stop frequency, bandwidth and demodulation, the following scan parameters may be included in the data set:



*R&S® EB200 and R&S® HE200: ergonomic design for on-body operation*

- ◆ Step width
- ◆ Signal threshold (dB $\mu$ V)
- ◆ Dwell time (s)
- ◆ Hold time (s)
- ◆ Signal-controlled continuation
- ◆ Suppression (individual frequencies or scan ranges)

the contents of programmed memory locations are automatically set on the receiver one after the other and the corresponding frequencies are scanned for activity.

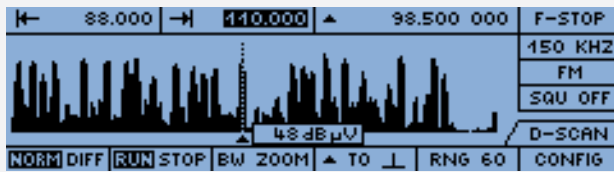
### Memory scanning

The R&S® EB200 uses 1000 definable memory locations. A complete data set such as frequency, demodulation mode, bandwidth, squelch level, attenuator pad and antenna number can be assigned to each memory location. When activating the memory scan (MSCAN),

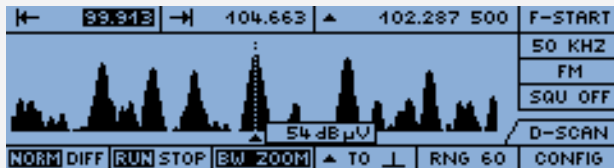
To activate an individual memory location, the receiver is set to the parameters of the corresponding memory location by pressing the RCL key.



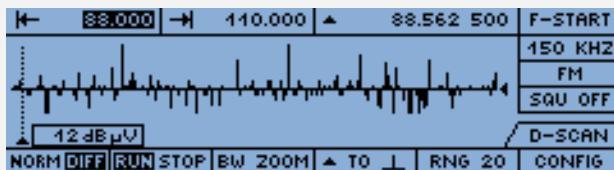
## Optimized view for every task ...



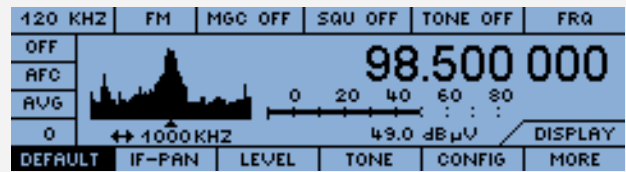
*DIGI-scan: scan mode ...*



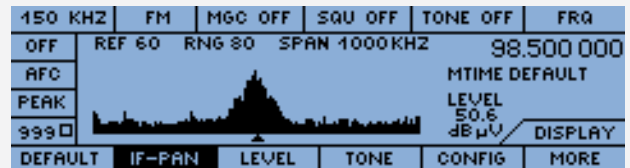
*... listen mode ...*



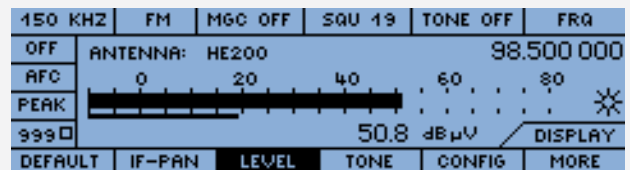
*... differential mode*



*Overview*



*IF panorama*



*Level (zoomed)*

### RF spectrum DIGI-Scan

Fitted with the optional RF spectrum DIGI-Scan, the R&S®EB200 scans the frequency range of interest with digital control and displays the associated spectrum in realtime. It provides a quick overview of the frequency spectrum occupancy. Variations in the spectrum caused by illegal radio services, interference sources, interference, temporary emissions, etc. can be seen at a glance. Aural monitoring of the information is possible by simply pressing a key. The R&S®EB200 then goes to the listen mode. The emission of interest is demodulated and can be aurally monitored.

Location of miniature transmitters at close range is possible in the differential mode of the optional RF spectrum DIGI-Scan. In this mode, the currently active spectrum is stored as a reference. Variations in the spectrum are superimposed on the reference spectrum, and any new signals or variations in signal strength

are clearly discernible as peaks. If the measurement is made with the distance, the field strength of transmitters at close range varies to a greater extent than that of transmitters located far away. The differential display ensures fast and reliable location of miniature transmitters even in case of spread-spectrum transmission.

### IF panorama

The optional R&S®EB200SU IF panorama is provided to accurately examine the signal environment. The current receive frequency forms the center of the spectrum display. The span can be set between  $\pm 75$  Hz and  $\pm 500$  kHz and can thus optimally be adapted to the tasks. MIN HOLD and MAX HOLD representations further expand the applications.

### Field-strength measurement software

The optional R&S®EB200FS field-strength measurement software allows the user to perform field-strength measurements, taking into account antenna factors. In addition to the level which

is displayed in dB $\mu$ V, also the field strength is displayed in dB $\mu$ V/m. User-defined k factor data sets can be loaded into the instrument via the remote-control interface. The k factor values for the R&S®HE200 handheld directional antenna and for a half-wave dipole have already been stored in the receiver.

### Triggered measurements

When equipped with the optional R&S®EB200CM coverage measurement software, the R&S®EB200 can also be used for coverage measurements. Up to 2000 triggered level measurements can be performed per second on a frequency, or up to 200 multichannel measurements (with any number of frequency hops). The option is only available via the remote-control interface.

Together with the R&S®ROMES coverage measurement software, the R&S®EB200 forms a coverage measurement system with outstanding price/performance ratio.

## State-of-the-art design

The receiver is designed for both mobile and stationary operation. Careful screening and filters in all the input and output lines ensure extremely low spurious as well as high immunity to interference.

## BITE

The receiver is permanently monitored by built-in test equipment. If deviations from the nominal are detected, an error message is output with a code informing on the type of fault.

## Serviceability

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

## Remote control

All the receiver functions can be remote-controlled via a controller. The optional LAN interface provides a hundred times faster speed as well as easy connection and control of multiple receivers from a PC. It is recommended if the receiver is equipped with the optional R&S®EB200DS RF spectrum DIGI-Scan and if it is controlled via a PC.

## Function

The R&S®EB200 is a heterodyne receiver with a third intermediate frequency of 10.7 MHz. In spite of its compact size, it was possible to implement an advanced receiver concept. The receiver input is equipped with a highpass/lowpass com-

bination or tracking preselection, as required, to reduce the signal sum load. Intermodulation suppression equals that of many receivers used in stationary applications.

The low degree of oscillator reradiation is a result of large-scale filtering. An advanced synthesizer concept featuring very low phase noise permits switching times of less than 3 ms. Effective frequency and memory scanning is thus possible.

## Operation

The operating concept of the R&S®EB200 meets all the requirements of an advanced radiomonitoring receiver, i.e. all the essential functions such as demodulation modes, bandwidths, etc, can directly be set via labeled keys.

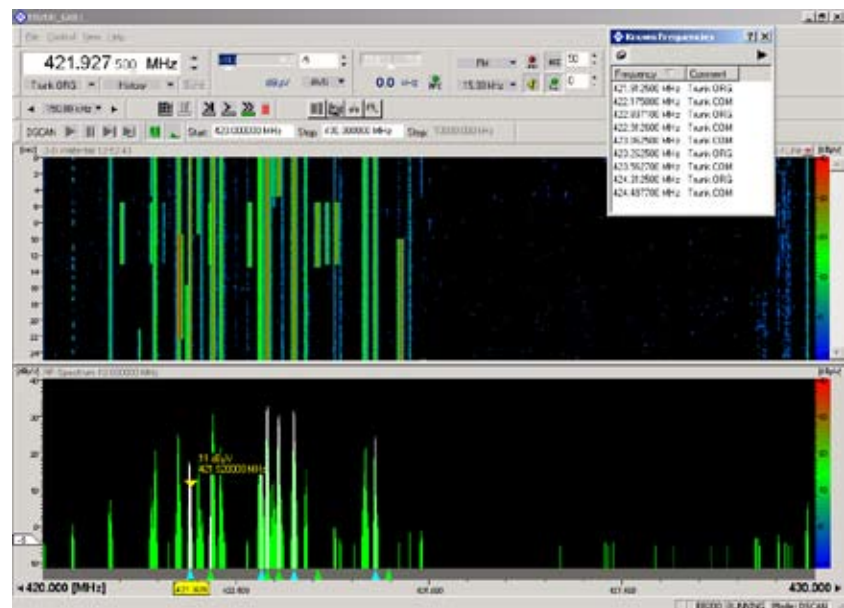
Settings that do not have to be used that often are available in submenus. The hierarchy of menu control is implemented according to priorities.

## Use in computer-controlled systems

All functions of the receiver can be used in the remote mode via LAN with a powerful PC and the R&S®ARGUS spectrum monitoring software or the R&S®RAMON coverage measurement software, for example.

R&S®RAMON, which is used in the military and security environment, allows fast frequency detection and frequency transmission to support monitoring receivers (focus on interactive operation and signal identification). R&S®ARGUS, by contrast, is intended for applications concentrating on measurements, e.g. for authorities with frequency management tasks such as long-term monitoring of specific frequency ranges.

Scan with 3D waterfall diagram



R&S®HE200HF



10 kHz to 20 MHz

R&S®HE200



20 MHz to 200 MHz



200 MHz to 500 MHz



0.5 GHz to 3 GHz



# Directional antennas

## Use

The handy and highly broadband R&S®HE200 handheld directional antenna in conjunction with portable receivers (e.g. the R&S®EB200) is ideal for locating transmitting and interfering sources. The direction is found by pointing the antenna toward the direction of maximum signal voltage. The operating frequency range from 10 kHz to 3 GHz is covered by four exchangeable broadband antenna modules, each with a distinct directional pattern. A low-noise broadband amplifier may be added to increase sensitivity in the active mode. The amplifier is bypassed in the passive mode and in this case, the antenna may also be used in the vicinity of strong transmitters.

## Description

The R&S®HE200 handheld directional antenna consists of a handle and three antenna modules. The antenna modules are connected with the handle via a quick-release catch and can thus be easily exchanged.

A broadband cardioid directional pattern is obtained in the frequency ranges 20 MHz to 200 MHz and 200 MHz to 500 MHz by using a loop antenna in two different sizes. A log-periodic dipole antenna with a distinct directional pattern covers the range 500 MHz to 3 GHz with a distinct directional pattern. In addition to these three antenna modules, another loop antenna is available as the R&S®HE200HF option for the lower frequency range from 10 kHz to 20 MHz.

- ◆ Unambiguous direction finding, i.e. directional pattern with the receive maximum pointing to the front in the frequency range 20 MHz to 3 GHz
- ◆ The maximum of the antenna output signal serves as a direction criterion (maximum direction finding)
- ◆ Handy size despite very wide broadband characteristic
- ◆ Weight is kept to a minimum due to the materials used and the antenna design
- ◆ Can be used for vertically and horizontally polarized signals in the frequency range 20 MHz to 3 GHz
- ◆ Wide dynamic range due to switchable passive and active mode

The handle consists of the following modules:

- ◆ Antenna electronics made up of low-noise amplifier and active/passive switchover circuit
- ◆ Active/passive switchover by means of relay
- ◆ Compass

The low-noise amplifier is bypassed in passive mode and has no supply voltage. The passive mode is thus also possible without batteries and external voltage supply. The antenna should only be switched to active mode if there are no strong transmitters in the close vicinity and if the sensitivity of the receiving system (antenna with receiver) in the passive mode is not sufficient to detect the signal. When the amplifier is activated, a yellow LED on the rear of the supply and display unit indicates whether the supply voltage of battery or external source has fallen below the permissible range.

## Specifications

Frequency range	10 kHz to 3 GHz
Frequency setting via keypad or rollkey	1 kHz, 100 Hz, 10 Hz, 1 Hz or in selectable increments up to 500 MHz
Frequency drift	$\leq \pm 0.5 \times 10^{-6}$ (–10 °C to +55 °C)
Aging	$\leq \pm 1 \times 10^{-6}$ /year
Synthesizer setting time	$\leq 3$ ms, typ. 1 ms
Oscillator phase noise	$\leq 100$ dBc (1 Hz) at 10 kHz offset
Max. input level	+20 dBm (nondestructive)
<b>Antenna input</b>	N-socket, 50 $\Omega$ , VSWR $\leq 3$ , typ. 2.5 SMA connector for rackmounting at rear panel
Oscillator reradiation at antenna input	–107 dBm
Input attenuation, can be set manually or automatically	
10 kHz to <50 kHz	typ. 32 dB
Input selection	
10 kHz to 20 MHz	highpass/lowpass
20 MHz to 1.5 GHz	tracking preselection
1.5 GHz to 3 GHz	highpass/lowpass
<b>Immunity to interference, nonlinearities</b>	
Image frequency rejection	$\geq 70$ dB, typ. 80 dB
IF rejection	$\geq 70$ dB, typ. 80 dB
2nd order intercept point	typ. 40 dBm
3rd order intercept point	typ. 2 dBm
Inherent spurious signals	$\leq -107$ dBm
<b>Noise figure/sensitivity</b>	
Noise figure	overall noise figure (including AF section)
20 MHz to 650 MHz	$\leq 14$ dB, typ. 12 dB
650 MHz to 1.5 GHz	$\leq 15.5$ dB, typ. 13 dB
1.5 GHz to 2.7 GHz	$\leq 14$ dB, typ. 12 dB
2.7 GHz to 3 GHz	$\leq 15$ dB, typ. 13 dB
Sensitivity	measurement with phone filter
AM, bandwidth 9 kHz, S/N = 10 dB, $f_{\text{mod}} = 1$ kHz, $m = 0.5$	
0.1 MHz	typ. 6 $\mu\text{V}$
1 MHz	typ. 4.5 $\mu\text{V}$
10 MHz	typ. 1.3 $\mu\text{V}$
20 MHz to 2.7 GHz	$\leq 1$ $\mu\text{V}$ , typ. 0.5 $\mu\text{V}$
2.7 GHz to 3 GHz	$\leq 1.3$ $\mu\text{V}$ , typ. 0.7 $\mu\text{V}$
FM, bandwidth 15 kHz, S/N = 25 dB, $f_{\text{mod}} = 1$ kHz, deviation = 5 kHz	
0.1 MHz	typ. 6 $\mu\text{V}$
1 MHz	typ. 3.5 $\mu\text{V}$
10 MHz	typ. 1.2 $\mu\text{V}$
20 MHz to 2.7 GHz	$\leq 1$ $\mu\text{V}$ , typ. 0.5 $\mu\text{V}$
2.7 GHz to 3 GHz	$\leq 1.3$ $\mu\text{V}$ , typ. 0.7 $\mu\text{V}$

<b>Signal-to-noise ratio</b>	
AM, bandwidth 6 kHz, $f_{\text{mod}} = 1$ kHz, $m = 0.5$ , $U_i = 200$ $\mu\text{V}$	$\geq 47$ dB
FM, bandwidth 15 kHz, $f_{\text{mod}} = 1$ kHz, deviation = 5 kHz, $U_i = 200$ $\mu\text{V}$	$\geq 50$ dB
<b>Demodulation</b>	AM, FM, LSB, USB, CW, PULSE, I/Q
IF bandwidths	150/300/600 Hz/1.5/2.4/6/9/15/30/50/120/150 kHz
IF bandwidths for level measurement	15 (150 Hz to 1 MHz) only with R&S®EB200SU IF panorama
Squelch	signal-controlled, can be set from –30 dB $\mu\text{V}$ to +110 dB $\mu\text{V}$
Gain control	AGC, MGC
IF control	110 dB
RF + IF control	140 dB
Automatic frequency control (AFC)	digital retuning for signals unstable in frequency
Deviation indication	graphically with tuning label/numerically, max. $\pm B/2$
Signal level indication	graphically as level line or numerically, from –30 dB $\mu\text{V}$ to +110 dB $\mu\text{V}$
Display errors	$\leq \pm 2$ dB, typ. 1.5 dB (+15 °C to +35 °C)
TONE operating mode	signal level is output acoustically by level sound
Measurement time	settable from 0.5 ms to 900 s
<b>IF panorama</b> (R&S®EB200SU option)	internal module, 2048 points FFT
Sensitivity	typ. –127 dBm (0.1 $\mu\text{V}$ ), span 50 kHz, AVG = 200 ms
REF (reference level)	–20 dB $\mu\text{V}$ to 120 dB $\mu\text{V}$ in 10 dB steps
RNG (range)	10 dB to 160 dB in 10 dB steps
Operating modes	MAX HOLD, MIN HOLD, AVG, CLR WRITE
Span	
coupled	span according to IF filter
manual	0.15 kHz to 1 MHz
<b>RF spectrum DIGI-Scan</b> (R&S®EB200DS option)	normal and differential mode
REF (reference level)	0 dB $\mu\text{V}$ to 110 dB $\mu\text{V}$ in 10 dB steps
RNG (range)	20/40/60/80 dB
Scan speed	up to 1.5 GHz/s at 150 kHz IF bandwidth LOW, NORM, HIGH or measurement time/channel
<b>Scan characteristics</b>	
Automatic memory scan	1000 definable memory locations, a complete data set can be allocated to each of these memory locations
Frequency scan	START/STOP/STEP definition with receiving data set
Scan speed for FSCAN and MSCAN	typ. 250 channels/s at 150 kHz IF bandwidth, dwell time 0 s

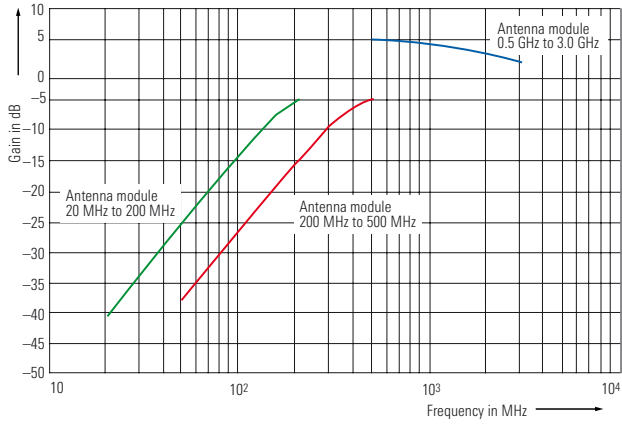


Inputs/outputs	
Digital IF output	serial data (clock, data, frame) up to 256 kbps: 2 × 16 bit
Bidirectional reference frequency connector	10 MHz, BNC
Input	0.1 V to 1 V; $R_i = 500 \Omega$
Output	0 dBm, $R_o = 50 \Omega$
Digital AF output	AES/EBU, in line with ANSI 4.40
I/Q output (digital)	AF signal, 2 × 16 bit
IF 10.7 MHz, broadband	±2.5 MHz, BNC, typ. 11 dB via RF input, uncontrolled
AF output, balanced	600 $\Omega$ , 0 dBm
Loudspeaker output	8 $\Omega$ , 500 mW (internal loudspeaker without function)
Headphones output	via volume control
Output log. signal level	0.9 V up to 4.5 V (−107 dBm to −27 dBm) B = 20 kHz for $B_{if} = 150$ Hz to 15 kHz B = 150 kHz for $B_{if} > 15$ kHz
<b>BITE</b>	monitoring of test signals by means of loop test
<b>Data interface</b>	LAN (Ethernet 10BaseT) or RS-232-C (PPP or standard)
General data	
Permissible temperature range	−10 °C to +55 °C
Operating temperature range	0 °C to +50 °C
Storage temperature range	−40 °C to +70 °C
Humidity	max. 95 %, cycle test 25/55 °C
Shock	in line with DIN IEC 68-2-27 (MIL-STD-810D, MIL-T-28800D), 40 g, shock spectrum 45 Hz to 2 kHz
Vibration (sinewave)	in line with DIN IEC 68-2-6 (MIL-T-28800D), 5 Hz to 55 Hz, 0.15 mm amplitude
Vibration (noise)	in line with DIN IEC 68-2-36, 10 Hz to 500 Hz, 1.9 g (rms)
Electromagnetic compatibility (EMC)	in line with EN 55011/22, MIL-STD-461, CE 03; RS 03; RE 02 is not applicable during loading of battery
Power supply	battery pack (>6 h) or 10 V to 30 V DC (max. 35 W, with battery charging)
Dimensions (W × H × D)	210 mm × 88 mm × 270 mm (8.27 in × 3.46 in × 10.63 in) ½ 19" × 2 height units
Weight without battery pack Battery pack	4 kg (8.82 lb) 1.5 kg (3.31 lb)

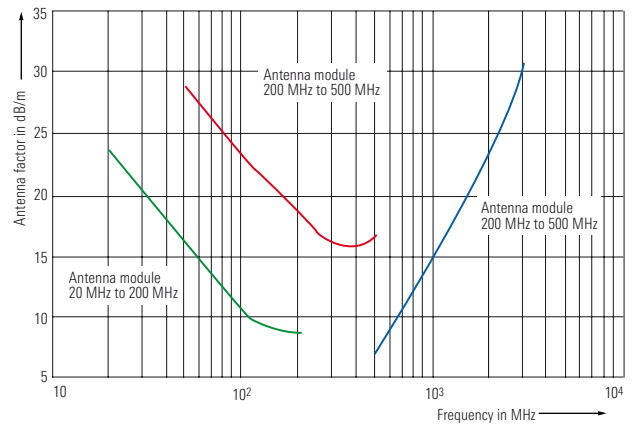
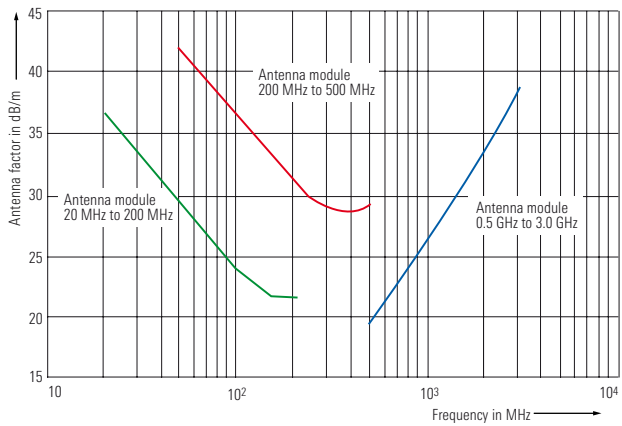
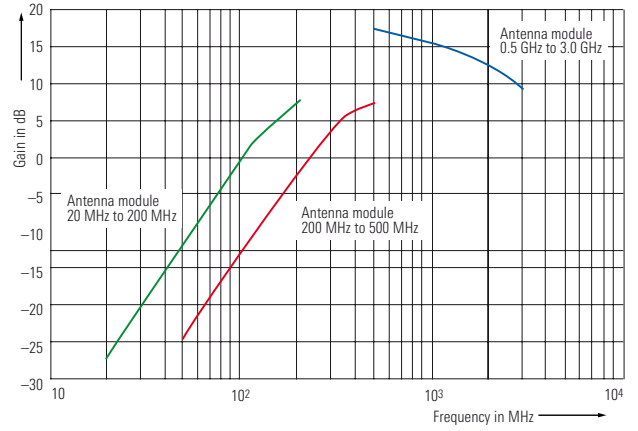
#### R&S®HE200/R&S®HE200HF directional antennas

Frequency range	10 kHz to 3 GHz
Antenna modules	20 MHz to 3 GHz, with 3 plug-in antennas
Polarization	vertical for all antenna modules, horizontal polarization by turning the longitudinal antenna axis by 90°
Loop antenna 10 kHz to 20 MHz	direction finding for horizontally polarized signals not possible because of circular vertical pattern of system
Nominal impedance	50 $\Omega$
VSWR	typ. <2.5
RF connector	1 m cable with N connector
Gain	for typical values, see figures on page 10
Antenna factor	
Field-strength sensitivity	
Linearity of amplifier	IP3, typ. 19 dBm (battery voltage 6 V, +25 °C)
Current drain	55 mA in active mode, 0 A in passive mode (6 V, +25 °C)
Power supply	in handle, 4 × 1.5 V, mignon cell R6
Dimensions (W × H × D) (in transit case with accessories)	470 mm × 360 mm × 180 mm (18.50 in × 14.17 in × 7.09 in)
General data	
Permissible temperature range (active/passive mode)	−10 °C to +60 °C
Operating temperature range Active mode Passive mode	−10 °C to +50 °C −30 °C to +60 °C
Storage temperature range	−30 °C to +60 °C
Vibration	random 10 Hz to 300 Hz: 0.01 g <sup>2</sup> /Hz, 300 Hz to 500 Hz: 0.003 g <sup>2</sup> /Hz, every 30 min in 3 orthogonal axes; acceleration approx. 1.9 g rms
Shock	max. 40 g, crossover frequency 45 Hz, in 3 orthogonal axes
Weight (handle with compass and antenna module)	800 g to 1100 g (1.76 lb to 2.42 lb), depending on connected antenna module

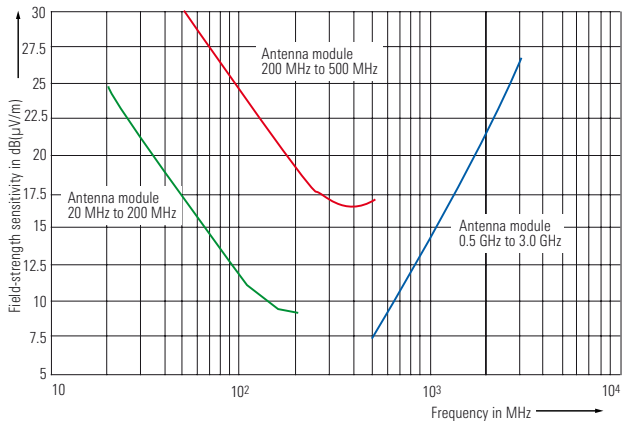
Passive mode



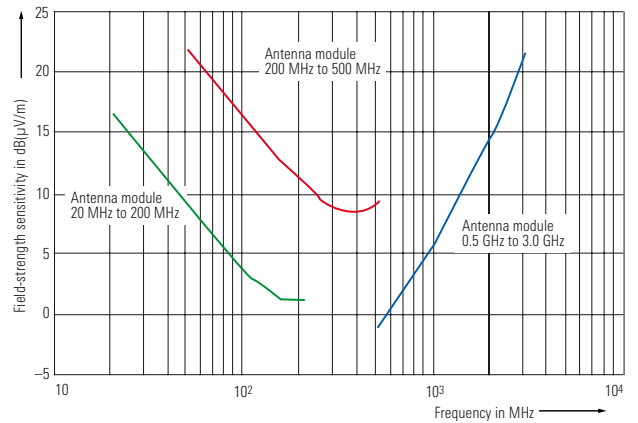
Active mode



S/N = 1, bandwidth 10 kHz, receiver noise figure 15 dB



S/N = 1, bandwidth 10 kHz, receiver noise figure 15 dB



## Ordering information

### R&S®EB200

Designation	Type	Order number
Miniport Receiver (accessories supplied: power supply 95 V to 265 V, 50/60 Hz)	R&S®EB200	4052.2000.02
<b>Options</b>		
Battery Pack	R&S®EB200BP	4052.4102.02
IF Panorama	R&S®EB200SU	4052.3206.02
RF Spectrum DIGI-Scan	R&S®EB200DS	4052.9604.02
Field-Strength Measurement Software	R&S®EB200FS	4052.9704.02
Coverage Measurement Software	R&S®EB200CM	4052.9804.02
LAN Interface	R&S®EB200R4	4052.9156.02
Serial Interface (RS-232-C)	R&S®ESMBR2	4052.9056.02
<b>Recommended extras</b>		
Transit case with accessories (telescopic antenna, headset, space for R&S®EB200, battery pack and power supply)	R&S®EB200SC	4052.9304.02
Carrying Bag	R&S®EB200CB	4052.8708.02
Car Converter	R&S®EB200CC	4052.6005.02
Rack Adapter	R&S®EB200ZZ	4052.8250.02
Power Supply (extra or as spare part)		4052.3064.02

### R&S®HE200

Designation	Type	Order number
Handheld Directional Antenna (20 MHz to 3 GHz) (accessory supplied: transit case)	R&S®HE200	4050.3509.02
R&S®HE200 includes:		
Loop antenna (20 MHz to 200 MHz)		0701.5702.00
Loop antenna (200 MHz to 500 MHz)		0701.5354.00
Log-periodic antenna (500 MHz to 3 GHz)		4050.3609.02
<b>Option</b>		
Loop Antenna (10 kHz to 20 MHz)	R&S®HE200HF	4051.4009.02
Adapter and compass fitted to handle when delivered		



More information at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
(search term: EB200)



**ROHDE & SCHWARZ**

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