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Miniport Receiver EB200

Portable monitoring from 10 kHz to 3 GHz

- Ergonomic design for on-body operation
- Continuous frequency range 10 kHz to 3 GHz
- Detection of unlicensed transmitters
- Location of close-range to medium-range targets with the aid of Handheld Directional Antenna HE200
- Digital IF section with 12 bandwidths (150 Hz to 150 kHz)
- Fast, accurate level indication across 110 dB dynamic range
- Scanning modes
  - Frequency scanning
  - Memory scanning
- Frequency spectrum (option)
- IF panorama display (option)
- Remote-controllable via RS232 C PPP or LAN (Ethernet 10Base-T)

ROHDE&SCHWARZ

Brief description

Miniport Receiver EB200 with Active Directional Antenna HE200 is a portable unit for radiomonitoring in the wide frequency range from 10 kHz to 3 GHz. Whether used for monitoring emissions, detecting interference or locating mini-transmitters irrespective of their position, EB200 offers features unrivalled in its class. The favourably priced and compact receiver with LAN interface may also be used in computer-based stationary systems.

The 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 as well as a sturdy, pickup-proof die-cast aluminium housing with well-protected integrated operating elements make the EB200 ideal for use in places which cannot be reached with a vehicle. Its low power consumption permits battery operation typically of four hours. The EB200 battery pack is easily accessible and can be exchanged quickly.

In case of power supply interruption, all the data is stored. Operation can thus be resumed immediately after the power supply is restored.

EB200 fulfils the following tasks:

- Monitoring of given frequencies, eg storage of 1 to 1000 frequencies, squelch setting, constant monitoring of one frequency or cyclical scanning of several frequencies
- Searching in a frequency range with freely selectable start and stop frequency and step widths of 1 kHz to 9.999 MHz
- Location of close-range to medium-range targets with the aid of Handheld Directional Antenna HE200
- 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 transmissions
- Remote-controlled operation via modem and PC in coverage measurement and monitoring systems

EB200 and HE200: ergonomic design for on-body operation

Digital IF section

The 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. This problem cannot be solved by means of analog filters as space is limited. The solution is a digital IF section in which a wide variety of different filters can be implemented in a relatively small space with the aid of DSP. The EB200 has 12 IF bandwidths between 150 Hz and 150 kHz. The following digital demodulators are available: AM, FM, LSB, USB and CW. If the receiver is fitted with the IF panorama option, the number of bandwidths is increased to 15 up to 1 MHz. Bandwidths over 150 kHz are for level and deviation measurement as demodulation is not possible.

Scanning modes

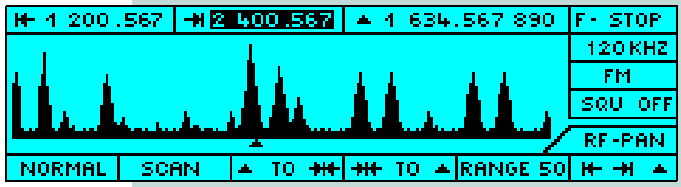
Frequency scanning
It is possible to define a frequency range to which a complete data set can be allocated. In addition to receiver settings, the following scan parameters may be included in the data set:

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

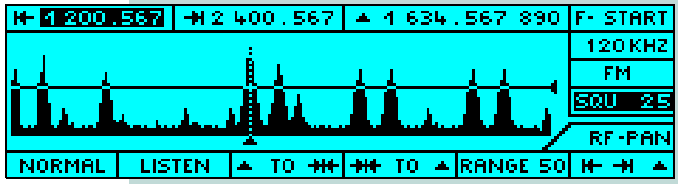
Memory scanning
The EB200 uses 1000 definable memory locations. A complete data set, such as frequency, mode of demodulation, bandwidth, squelch level, etc, can be assigned to each memory location. The memory content can be edited or overwritten with the results of a scanning run. The content of any memory location can be transferred to the receiver manually using the RCL key, by turning the setting knob or automatically by activating the memory scanning process.

Frequency spectrum
Fitted with the frequency spectrum (DIGI-Scan) option, EB200 scans the frequency range of interest with digital control and displays the associated spectrum. Emissions detected can be seen at a glance. Aural monitoring of the information is possible by simply pressing a softkey. EB200 then goes to the DIGI-Scan listen mode. The stored spectrum is displayed in the background, and the emission of interest can be selected and monitored by marking it with the frequency cursor.

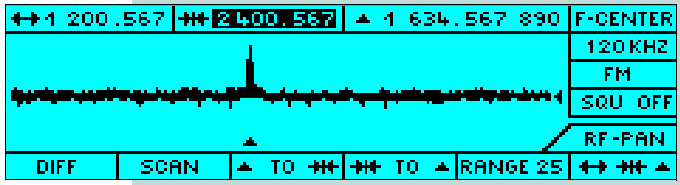
Location of miniature transmitters at close range is possible in the differential mode of the DIGI-Scan option. In this mode, the displayed spectrum is stored as a reference. Current spectra are superimposed on the reference spectrum, and any new signals or variations in signal strength are clearly discernible as peaks. 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. This differential display ensures fast and reliable location of miniature transmitters even in case of spread-spectrum transmission.



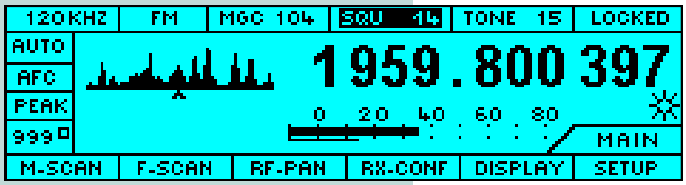
DIGI-Scan: Scan mode ...



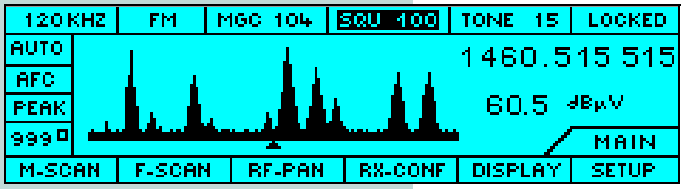
... listen mode ...



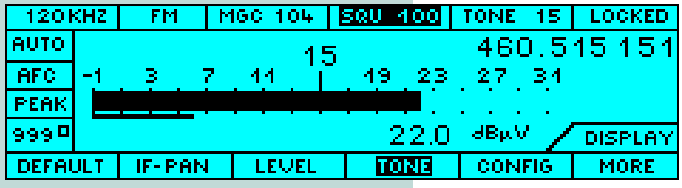
... differential mode



Overview



IF panorama



Level (zoomed)

For every task
the optimized view ...

State-of-the-art design

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

BITE

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

Serviceability

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

Remote control

All the receiver functions can be remote-controlled via the serial RS232C interface of a controller. For measurement tasks, the LAN option provides a hundred times faster speed as well as easy connection and control of multiple receivers from a PC. With these different versions the user can select the type of remote control to suit his tasks.

Function

The EB200 is a superhet 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 high-pass/lowpass combination 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. A modern 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 operational concept of the EB200 meets all the requirements of a modern radiomonitoring receiver, ie all the essential functions, such as modes of demodulation, bandwidths, etc, can be set via labelled keys directly.

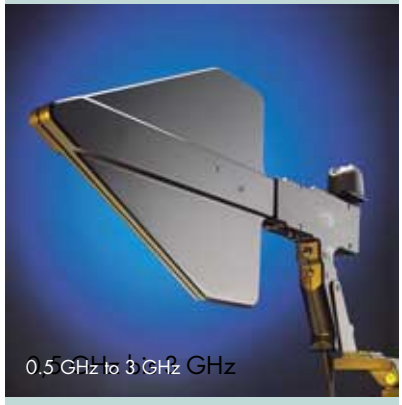
Settings that are not used during current operation are available in submenus. The hierarchy of menu control is implemented according to priorities for ease of use.

Certified Quality System
ISO 9001
DQS REG. NO 1954-04

Handheld Directional Antennas

HE200HF

HE200



Uses

The handy and highly broadband Active Directional Antenna HE200 in conjunction with portable receivers (eg EB200) is ideal for locating transmitting and interfering sources. The direction is found by pointing the antenna towards the direction of maximum signal voltage. The overall frequency range from 0.01 MHz to 3000 MHz is covered by 4 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

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 loaded loop antenna in two different sizes. A log-periodic dipole antenna covers the range 500 MHz to 3000 MHz with a directional pattern. A loop antenna is available as an option for the lower frequency range of 0.01 MHz to 20 MHz.

The four RF modules can be exchanged by means of a quick-release catch provided at the supply and display unit. The supply and display unit comprises the following modules:

- Unambiguous direction finding*), ie 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 material used and 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

*) For the unambiguous determination of the angle of incidence of a signal, at least two different sites are required. The transmitter is to be located at the intersection point of the DF beams.

- Antenna electronics made up of low-noise amplifier as well as active/passive switchover circuit
- Active/passive switchover by means of relay

The low-noise amplifier is bypassed in passive mode and has no supply voltage. 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 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 from battery or external source has fallen below the permissible range.

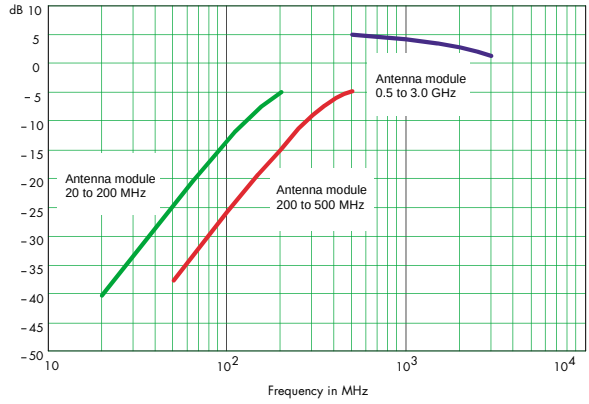
Specifications

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
Frequency accuracy	≤±1.5x10^{-6} (–10°C to + 55°C)
Aging	≤±0.5x10^{-6}/year
Synthesizer setting time	≤3 ms
Oscillator phase noise	≤–100 dBc/Hz at 10 kHz offset
Antenna input	N socket, 50 Ω , VSWR ≤3; SMA connector for rackmounting at rear panel
Oscillator reradiation	≤–107 dBm
RF attenuation	30 dB, man. or autom., switchable
Input selection	
100 kHz to 20 MHz	highpass/lowpass
20 MHz to 1.5 GHz	tracking preselection
1.5 GHz to 3 GHz	highpass/lowpass
Interference rejection, nonlinearities	
Image frequency rejection	≥70 dB, typ. 80 dB
IF rejection	≥70 dB, typ. 80 dB
2nd order intercept point	typ. 40 dBm
3rd order intercept point	typ. 2 dBm
Internal spurious signals	≤–107 dBm
Sensitivity	
Overall noise figure (including AF section)	
20 MHz to 650 MHz	≤14 dB, typ. 12 dB
650 MHz to 1500 MHz	≤15.5 dB
1500 MHz to 2700 MHz	≤14 dB, typ. 12 dB
2700 MHz to 3000 MHz	≤15 dB, typ. 13 dB
Signal-to-noise ratio	measurement with telephone filter to CCITT
AM, bandwidth 6 kHz, f_{mod} = 1 kHz, m = 0.5	
20 MHz to 2700 MHz, V = 1 µV	≥10 dB
2.7 GHz to 3 GHz, V = 1.3 µV	≥10 dB
FM, bandwidth 15 kHz, f_{mod} = 1 kHz, deviation = 5 kHz	
20 MHz to 2700 MHz, V = 1 µV	≥25 dB
2.7 GHz to 3 GHz, V = 1.3 µV	≥25 dB
Demodulation	AM, FM, USB, LSB, CW
IF bandwidths	12 (150/300/600 Hz/1.5/2.4/6/9/15/30/50/120/150 kHz)
IF bandwidths for level and deviation indication	15 (150 Hz to 1 MHz) only with IF Panoramic Unit EB200SU
Squelch	signal-controlled, can be set from –10 dBµV to +100 dBµV
Gain control	AGC, MGC
IF control	80 dB
RF + IF control	110 dB
AFC	digital retuning for signals unstable in frequency
Deviation indication	graphical with tuning label
Signal level indication	graphical as level line or numerical from –10 dBµV to +100 dBµV, acoustic indication by level tone
IF panorama display (option SU)	internal module, ranges 25, 50, 100, 200, 500, 1000 kHz
Scan characteristics	
Automatic memory scan	1000 definable memory locations to each of which a complete data set can be allocated
Frequency scan	START/STOP/STEP definition with receiving data set
Inputs/outputs	
Digital IF output	serial data (clock, data, frame) up to 256 ksps: 2 x 16 bit
Bidirectional reference frequency connectors	10 MHz, BNC
in	0.1 V to 1 V; R_i = 500 Ω
out	0 dBm, R_o = 50 Ω
I/Q output (digital)	AF signal, 2 x 16 bit
IF 10.7 MHz, wideband	±5 MHz uncontrolled for external panoramic display
AF output, balanced	600 Ω , 0 dBm
Loudspeaker output	8 Ω , 500 mW
Headphones output	via volume control
Output log. signal level	0 V to +4.5 V
BITE	monitoring of test signals by means of loop test
Data interface	RS232 C PPP
Option	LAN (Ethernet 10Base-T)
General data	
Operating temperature range	–10°C to +55°C
Rated temperature range	0°C to +50°C
Storage temperature range	–40°C to +70°C
Humidity	max. 95%, cyclic test 25/55°C
Shock	to DIN IEC 68-2-27 (MIL-STD-810D, MIL-T-28800D), 40 g, shock spectrum 45 Hz to 2 kHz
Vibration (sinewave)	to DIN IEC 68-2-6 (MIL-T-28800D), 5 Hz to 55 Hz, 0.15 mm amplitude
Vibration (noise)	to DIN IEC 68-2-36, 10 Hz to 500 Hz, 1.9 g (rms)
Electromagnetic compatibility (EMC)	EN50081/82-1,82-2, MIL-STD-461, CE03; RE02 and RS03
Power supply	battery pack (typ. 6 h operation) or DC 10 V to 30 V (max. 22 W)
Dimensions (W x H x D)	210 mm x 88 mm x 270 mm ½19" x 2 HU
Weight (without battery pack)	4 kg
Battery pack	1.5 kg

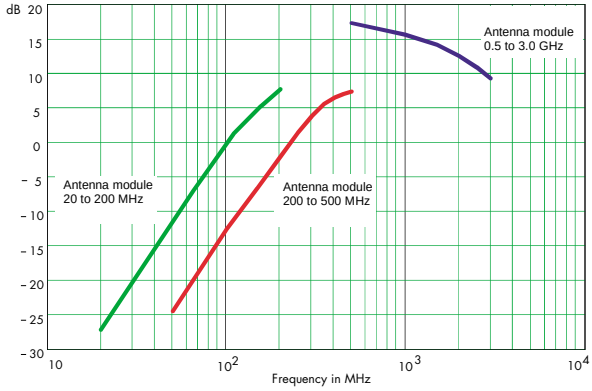
Directional antennas HE200/HE200HF

Frequency range	0.01 MHz to 3000 MHz
Antenna modules	20 MHz to 3000 MHz, with 3 plug-in antennas
20 MHz to 200 MHz	loaded loop antenna
200 MHz to 500 MHz	loaded loop antenna
500 MHz to 3000 MHz	log-periodic antenna
Option	
0.01 MHz to 20 MHz	loop antenna
Polarization	vertical for all antenna modules, horizontal polarization by turning the longitudinal antenna axis by 90°
Loop antenna	
0.01 MHz to 20 MHz	direction finding for horizontally polarized signals not possible because of circular vertical pattern of system
Nominal impedance	50 Ω
SWR	<2.5 typ.
RF output	1 m cable with N connector
Gain	for typical values see page 7
Antenna factor	for typical values see page 7
Field-strength sensitivity	for typical values see page 7
Linearity of amplifier	IP3, typ. 19 dBm (battery voltage 6 V, 25°C)
Current drain	55 mA in active mode 0 mA in passive mode
Power supply	in handle, 4 x 1.5 V mignon cell R6
Dimensions (W x H x D)	470 mm x 360 mm x 180 mm (in transport case)
General data	
Operating temperature range	–30°C to +60°C active/passive mode
Rated temperature range	–10°C to +50°C active mode –30°C to +60°C passive mode
Storage temperature range	–30°C to +60°C
Vibration resistance	random 10 Hz to 300 Hz: 0.01 g^2/Hz, 300 Hz to 500 Hz: 0.003 g^2/Hz, every 30 minutes in 3 orthogonal axes; acceleration approx. 1.9 g rms
Shock resistance	max. 40 g, crossover frequency 45 Hz in 3 orthogonal axes
Weights:	
Supply and display unit	0.5 kg
with adapters and compass	0.65 kg
RF modules	
20 MHz to 200 MHz	0.55 kg
200 MHz to 500 MHz	0.3 kg
500 MHz to 3000 MHz	0.45 kg
0.01 MHz to 20 MHz	0.4 kg

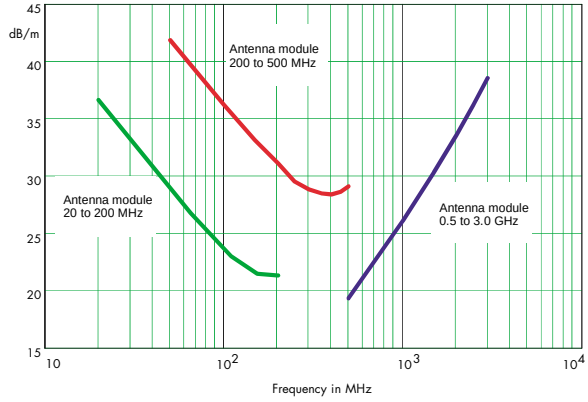
Gain, passive mode



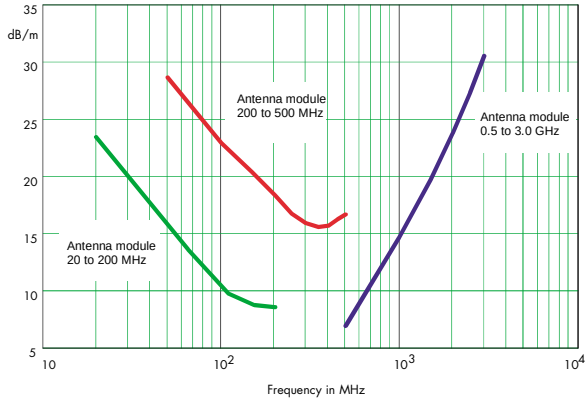
Gain. active mode



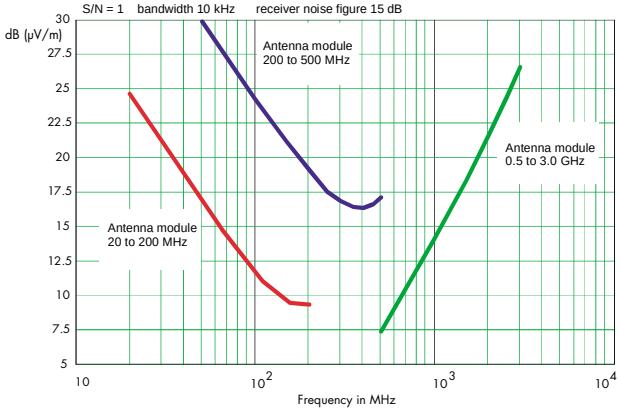
Antenna factor, passive mode



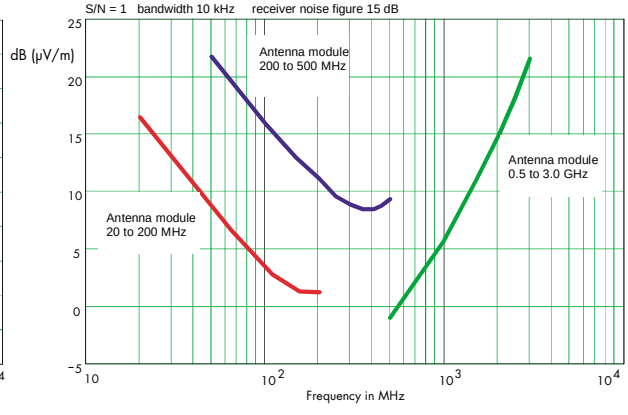
Antenna factor, active mode



Field-strength sensitivity, passive mode



Field-strength sensitivity, active mode



Ordering information

EB200

Miniport Receiver	EB200	4052.2000.02
Accessory supplied: power supply 110/230 V, 50/60 Hz		
Recommended extras		
Carrying Case (telescopic antenna, headset, belt and space for EB200, battery pack)	EB200SC	4052.9304.02
Battery Pack	EB200BP	4052.4102.02
Internal IF Panoramic Unit	EB200SU	4052.3206.02
RF Spectrum DIGI-Scan	EB200DS	4052.9604.02
LAN Interface	EB200R4	4052.9156.02
Rack Adapter	EB200ZZ	4052.8250.02

Handheld directional antennas

HE200	20 MHz to 3 GHz	4050.3509.02
HE200 comprises		
Loaded loop antenna	20 MHz to 200 MHz	0701.5702.00
Loaded loop antenna	200 MHz to 500 MHz	0701.5354.00
Log-periodic antenna	500 MHz to 3 GHz	4050.3609.02
Accessory supplied: carrying case		
Option HE200HF		
Loop antenna	0.01 MHz to 20 MHz	4051.4009.02

Adapter and compass fitted to the supply and display unit when delivered.