2

Contents Overview

Type Index

Main Menu

Searching/intercepting even the weakest of signals
Whatever kind of receiver you need, we can offer it:

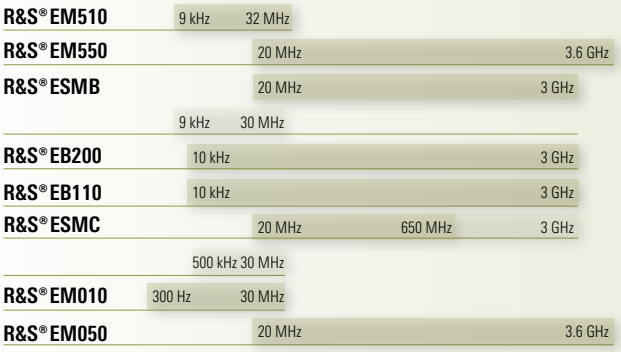
- Stationary, mobile, and portable
- For HF and VHF/UHF
- Extremely sensitive even in a congested signal environment
- Incorporating state-of-the-art DSP technology
- Featuring intelligent search routines
- With networking and remote control capability via software
- Providing all features for measuring field strength, type of modulation, etc, as required by ITU

Our receivers search at extremely high speeds of several GHz/s. This makes them ideal for intercepting frequency-agile emissions and LPI signals.

Contents of Chapter 2

Type	Designation	Page
R&S®EM510 New	HF Digital Wideband Receiver	22
R&S®EM550 New	VHF/UHF Digital Wideband Receiver	26
R&S®ESMB	Monitoring Receiver	30
R&S®EB200	Miniport Receiver	34
R&S®EB110	Receiver Module	40
R&S®ESMC	Compact Receiver	44
R&S®EM010	VXI HF Receiver	50
R&S®EM050	VXI VHF/UHF Digital Wideband Receiver	54

Receivers



New

R&S®EM510
HF Digital Wideband Receiver

Efficient and versatile solution for radiomonitoring applications

Main features

- Wideband operation
  - I/Q data up to 10 MHz bandwidth
  - Demodulation up to 10 MHz bandwidth
- 30 IF filters, 100 Hz to 10 MHz
- Panorama scan up to 34 GHz/s or 600 000 channels/s
- Frequency/memory scan up to 1500 channels/s
- IF panorama up to 9.6 MHz span
- Video panorama, AM, FM, AM^2, FM^2, I/Q
- Audio filter: notch, noise reduction, bandpass
- Two-channel analog video output (AM, FM)
- ITU measurements
- LAN interface (SCPI)

Brief description

The R&S®EM510 is a fully digitized HF receiver of advanced design based on state-of-the-art technology. It covers the frequency range 9 kHz to 32 MHz.

Excellent RF characteristics and dynamic performance paired with powerful digital signal processing are the basis for optimum system solutions.

Chapter Overview
Type Index
Main Menu

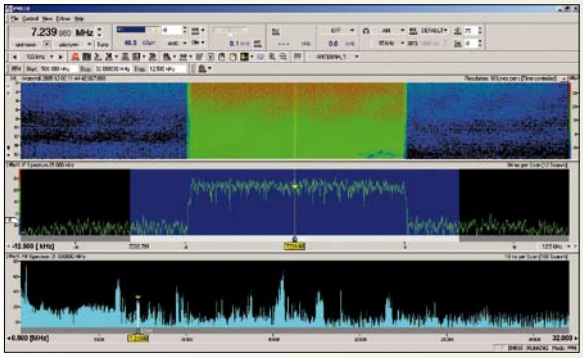
Characteristics

The R&S®EM510 HF digital wideband receiver is ideally suited for military/paramilitary monitoring tasks and spectrum monitoring in line with ITU recommendations as well as for radio investigation services.

The R&S®EM510 is prepared to meet any future demands in the field of receiver and analyzer technology for the purpose of frequency spectrum and signal analysis. The receiver is software compatible with the R&S®EM550/EB200/ESMB family, thus providing an easy way to upgrade existing radiomonitoring systems.

The R&S®EM510 features a modern direct reception concept. After passing the preselection with suboctave filters, the antenna signal is fed directly to the A/D converter. The tremendous advantages of this concept are the following:

- No synthesizer settling time – extremely high scan speed
- No image and IF frequencies (no mixers and local oscillators)
- No local oscillator phase noise
- Ideal for wideband applications
- No spurious signals from local oscillators and mixers
- High linearity in spite of low power consumption
- Increased MTBF due to use of less critical components



IF spectrum zoomed for measurements

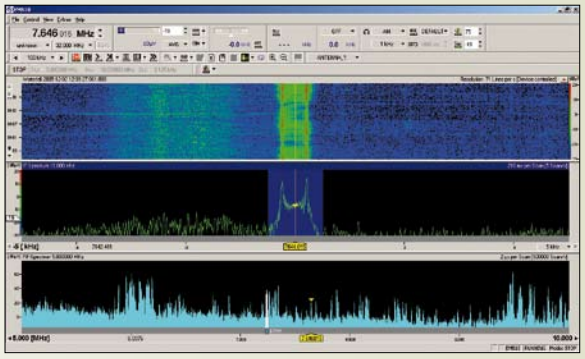
Operating modes

In the **Fixed Frequency** mode, a fixed frequency channel is set at which the signal is received, filtered and demodulated.

In the **Memory Scan** mode, the receiver settings can be programmed for the monitoring of up to 10 000 channels. These channels can be scanned with the Memory Scan command. A single channel can be set with the Recall command.

In the **Frequency Scan** mode, start frequency, stop frequency, and frequency step are defined for monitoring a specific frequency range. This frequency range can be scanned with the Frequency Scan command.

In the **Memory Scan** or **Frequency Scan** mode, a selectable number of different measurements (e.g. level offset, AM modulation index, FM deviation, bandwidth) are performed in parallel.



FSK transmission

In the **Panorama Scan** mode, the receiver is tuned from the start to the stop frequency in steps of nearly 10 MHz, performing a high resolution FFT at each step. The resolution bandwidth covers the range from 125 Hz up to 100 kHz, resulting in an outstanding scan speed of up to 34 GHz/s or 600 000 channels/s.

Applications

Due to its high scan speed, the receiver is ideally suited for fast and reliable detection of all types of signals in the wide field of civil and military monitoring, paramilitary monitoring, homeland security, secret services, signal investigation services, etc. No matter whether fixed frequency emissions, frequency-agile signals such as hoppers, pulsed periodic or non-periodic emissions are to be detected, nothing is lost in the scenario.

This includes the following:

- Detection of signals in the RF spectrum
- Memory scan of up to 10 000 memory channels
- Frequency scan in predefined frequency ranges
- Visualization of the signal and the signal vicinity
- Identification of the signal type (analog or digital)
- Recording of baseband and audio data
- Demodulation of the signal
- Audio monitoring of AM, FM, CW and SSB transmissions
- Signal analysis
- Demodulation of analog hoppers
- Pulse detection and pulse measurements

The outstanding video panorama with AM, FM, AM^2, FM^2 and I/Q functions enables the user to visualize the demodulated spectrum. In the AM^2 and FM^2 modes, digitally modulated signals can be identified and further measurements can be performed such as the following:

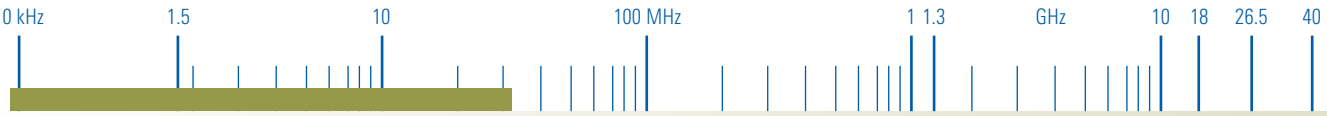
- Symbol rate
- Chip rate of DSSS transmissions

Specifications

Frequency	
Frequency range	9 kHz to 32 MHz
Frequency resolution	1 Hz
Frequency accuracy	≤1 × 10^{-7}
Input for external reference	10 MHz
Phase noise	≤–130 dBc (1 Hz) at 1 kHz offset
BFO	adjustable, 0 Hz to ±8 kHz
Antenna input	BNC, 50 Ω
VSWR	≤2.5
Input level	–137 dBm to +10 dBm, f = 400 kHz to 32 MHz
	–137 dBm to +6 dBm, f < 400 kHz
Input selection	
9 kHz to 400 kHz	lowpass
400 kHz to 32 MHz	highpass/lowpass filters
Interference rejection	
Aliasing suppression	≥90 dB, typ. 120 dB
Internal spurious signals	≤–110 dBm (normal mode)
Linearity	
2nd order intercept point	>70 dBm, typ. 80 dBm (low distortion mode), f = 1 MHz to 30 MHz
3rd order intercept point[1)]	≥32 dBm, typ. 38 dBm (low distortion mode), f = 1 MHz to 30 MHz
Noise figure	≤15 dB, typ. 12 dB (normal mode), f = 400 kHz to 30 MHz

Sensitivity	measurement with telephone filter in line with ITU-T, normal mode, f = 400 kHz to 30 MHz
AM, bandwidth = 6 kHz, SINAD = 10 dB	
f_{mod} = 1 kHz, m = 0.5	≤1 µV (≤–107 dBm)
FM, bandwidth = 15 kHz, SINAD = 20 dB	
f_{mod} = 1 kHz, deviation = 5 kHz	≤1 µV (≤–107 dBm)
SSB, bandwidth = 2.4 kHz, SINAD = 10 dB	≤0.5 µV (≤–113 dBm)
CW, bandwidth = 600 Hz, SINAD = 10 dB	≤0.22 µV (≤–120 dBm)
Demodulation modes	AM, FM, PM, PULSE, I/Q (all IF bandwidths)
	USB, LSB, CW, ISB (IF bandwidth ≥1 kHz) (IF bandwidth ≤9 kHz)
IF bandwidths	
For demodulation, level and offset measurement	
(3 dB bandwidth)	30 filters (100/150/300/600 Hz/1/1.5/2.1/2.4/2.7/3.1/4/4.8/6/9/12/15/30/50/120/150/250/300/500/800 kHz/1/1.25/1.5/2/5/10 MHz)
Shape factor	
3 dB:60 dB	≤1:1.6, for 100 Hz to 5 MHz filter
1 dB:60 dB	≤1:1.5, for 10 MHz filter

[1)] Frequency spacing between intermodulating signals ≥100 kHz.



Level and offset measurement	
Signal level	–30 dBµV to +130 dBµV, resolution 0.1 dB
Gain control	AGC, MGC, –30 dBµV to +130 dBµV
	MGC selectable in 1 dB steps
	AGC gain selectable: FAST/DEFAULT/SLOW
Squelch (level squelch)	–30 dBµV to +130 dBµV,
	selectable in 1 dB steps
Automatic frequency	
control (AFC)	digital retuning for frequency-instable
	signals ± ½ IF bandwidth
	(100 Hz to 10 MHz)
IF panorama (with	
R&S®EM510SU option)	internal FFT (2048 points),
	typ. 20 pictures/s
Span range	10 kHz to 9.6 MHz (10/25/50/100/150/256/
	300/400/600/800 kHz/1.2/2.4/4.8/9.6 MHz)
Modulation measurement	
(with R&S®EM510IM option)	
AM (modulation index)	AM, AM+, AM–, m = 0 % to 999.9 %,
	resolution 0.1 %, f_{max} = 4 MHz
FM (FM deviation)	FM, FM+, FM–, Δf = 0 Hz to 4 MHz,
	resolution 0.001 kHz
	f_{max} = 4 MHz (f_{mod} + deviation)
PM	Δφ = 0 rad to 12.5 rad,
	resolution 0.01 rad
	f_{max} = 4 MHz (f_{mod} + deviation)
Bandwidth measurement	up to 9.6 MHz automatically, >9.6 MHz
	with external software xx dB and ß %
	method

Scan characteristics	
Memory scan	10 000 definable memory locations
	scan speed up to 1500 channels/s
Frequency scan	f_{start}, f_{stop}, f_{step}, user-selectable,
	100 suppress frequencies
	scan speed up to 1500 channels/s
Panorama scan (with	
R&S®EM510PS option)	RF spectrum with user-selectable f_{start}, f_{stop}
	selectable steps: 125/250/500/625 Hz/
	1.25/2.5/3.125/6.25/12.5/25/50/100 kHz,
	scan speed up to 34 GHz/s or
	600 000 channels/s
Data interface	LAN (Ethernet 10/100BaseT)
General data	in line with DIN EN 60068-2-1, 60068-2-2
Operating	
temperature range	0 °C to +50 °C
Permissible	
temperature range	–10 °C to +55 °C
Storage	
temperature range	–40 °C to +70 °C
Power	
AC	90 V to 260 V, 47 Hz to 63 Hz, typ. 45 VA
DC	12 V/24 V, typ. 33 W
Dimensions (W × H × D)	426.7 mm × 87.6 mm × 450 mm
	(16.80 in × 3.45 in × 17.72 in)
	(without feet and handles)
	19", 2 height units
Weight	8.5 kg (18.74 lb)

Ordering information

HF Digital Wideband		
Receiver	R&S®EM510	4065.7728.02

Options		
Panorama Scan		
(RF Spectrum)	R&S®EM510PS	4065.8430.02
IF Panorama		
(IF Spectrum)	R&S®EM510SU	4065.8499.02
ITU Measurement		
Software[1)]	R&S®EM510IM	4065.8401.02

[1)] The R&S®EM510SU IF panorama is already included in the R&S®EM510IM option.

New

R&S®EM550 VHF/UHF Digital Wideband Receiver

Efficient and versatile solution for radiomonitoring applications

Main features

- Wideband operation
  - I/Q data up to 10 MHz bandwidth
  - Demodulation up to 10 MHz bandwidth
  - IF analog output up to 50 MHz bandwidth
  - Analog TV, radar
- 23 IF filters, 150 Hz to 10 MHz
- Panorama scan up to 34 GHz/s or 600 000 channels/s
- Frequency/memory scan up to 850 channels/s
- IF panorama up to 9.6 MHz span
- Video panorama, AM, FM, AM^2, FM^2, I/Q
- Audio filter: notch, noise reduction, bandpass
- Two-channel analog video output: AM, FM or I/Q
- ITU measurements
- Selective call decoding
- LAN interface (SCPI)

Brief description

The R&S®EM550 is a fully digitized VHF/UHF receiver of advanced design based on state-of-the-art technology. It covers the frequency range 20 MHz to 3.6 GHz.

Excellent RF characteristics and dynamic performance paired with powerful digital signal processing are the basis for optimum system solutions.

Chapter Overview
Type Index
Main Menu

Characteristics

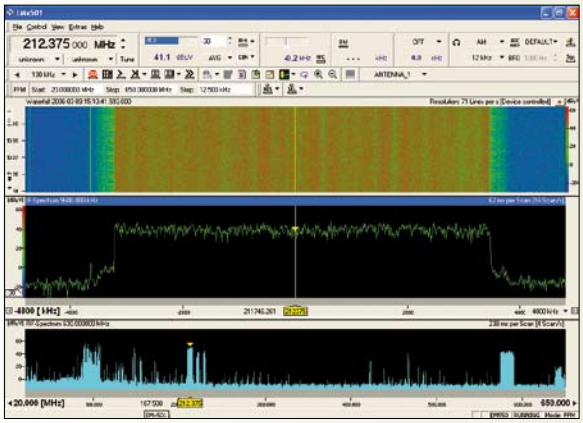
The R&S®EM550 VHF/UHF digital wideband receiver is ideally suited for military/paramilitary monitoring tasks and spectrum monitoring in line with ITU recommendations as well as for radio investigation services.

The R&S®EM550 is prepared to meet any future demands in the field of receiver and analyzer technology for the purpose of frequency spectrum and signal analysis.

High level mixers and amplifiers make sure that even in critical scenarios the intermodulation products are extremely low. Additionally the receiver features comprehensive preselection to reduce the signal sum load on the input. Local oscillators with low phase noise are the basis for optimum detection of weak signals in the close vicinity of strong emitters.

Operating modes

In the **Fixed Frequency** mode, a fixed frequency channel is set at which the signal is received, filtered and demodulated.



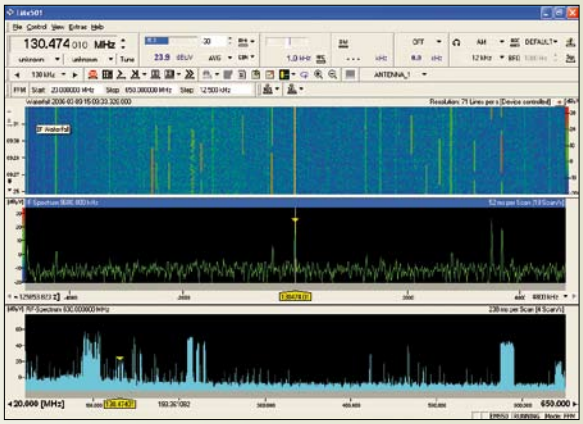
Detection of a DVB transmission

In the **Memory Scan** mode, the receiver settings can be programmed for the monitoring of up to 10000 channels. These channels can be scanned with the Memory Scan command. A single channel can be set with the Recall command.

In the **Frequency Scan** mode, start frequency, stop frequency, and frequency step are defined for monitoring a specific frequency range. This frequency range can be scanned with the Frequency Scan command.

In the **Memory Scan** or **Frequency Scan** mode, a selectable number of different measurements (e.g. level offset, AM modulation index, FM deviation, bandwidth) are performed in parallel.

In the **Panorama Scan** mode, the receiver is tuned from the start to the stop frequency in steps of nearly 10 MHz, performing a high resolution FFT at each step. The resolution bandwidth covers the range from 125 Hz up to 100 kHz, resulting in an outstanding scan speed of up to 34 GHz/s or 600000 channels/s.



R&S®EM550 control software

In the **Wideband** mode, the receiver offers an analog IF output with 50 MHz bandwidth and a center frequency of 405.4 MHz. In this mode, the IF section is not active, and demodulation is not possible.

Applications

Due to its high scan speed, the receiver is ideally suited for fast and reliable detection of all types of signals in the wide field of civil and military monitoring, paramilitary monitoring, homeland security, secret services, signal investigation services, etc.

No matter whether fixed frequency emissions, frequency-agile signals such as hoppers, pulsed periodic or non-periodic emissions are to be detected, nothing is lost in the scenario.

This includes the following:

- Detection of signals in the RF spectrum
- Memory scan of up to 10 000 memory channels
- Frequency scan in predefined frequency ranges
- Visualization of the signal and the signal vicinity
- Identification of the signal type (analog or digital)
- Recording of baseband and audio data
- Demodulation of the signal
- Audio monitoring of AM, FM, CW and SSB transmissions
- Signal analysis
- Demodulation of analog hoppers
- Pulse detection and pulse measurements
- Radio data system (RDS) analysis
- TV picture on AM video output and as a bitmap

Civil monitoring in line with ITU recommendations
With the R&S®EM510IM option installed, the following measurements can be performed:

- Frequency and frequency offset in line with ITU-R SM377
- Field strength in line with ITU-R SM378 (with R&S®ARGUS software)
- Modulation in line with ITU-R SM328
- Spectrum occupancy on control PC in line with ITU-R SM182/SM328
- Bandwidth in line with ITU-R SM443
- Detection of mono or stereo transmissions

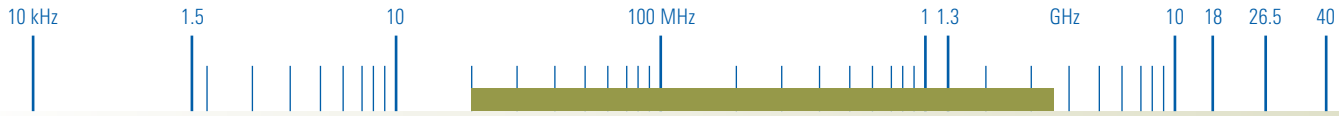
Specifications

Frequency	
Frequency range	20 MHz to 3.6 GHz
Frequency resolution	1 Hz
BFO	–8 kHz to +8 kHz
Frequency accuracy	≤1 × 10^{-7}
Input for external reference	10 MHz
Synthesizer setting time	typ. 1 ms, ≤5 ms (any step width)
Oscillator phase noise	≤–120 dBc (1 Hz) at 10 kHz offset, f = 640 MHz
Antenna input	N female, 50 Ω
VSWR	≤2.5, f ≤ 1 GHz
	≤3, f > 1 GHz
Input level	–137 dBm to +3 dBm
	(–30 dBµV to +120 dBµV)
Input selection	
0 Hz to 215 MHz	bypass for broadband applications
20 MHz to 1500 MHz	tracking preselection
1500 MHz to 2300 MHz	highpass/lowpass filters
1500 MHz to 3000 MHz	highpass/lowpass filters
Interference rejection	
Image frequency rejection	≥90 dB, typ. 100 dB
IF rejection	≥90 dB, typ. 100 dB
Internal spurious signals	≤–103 dBm

Linearity	
2nd order intercept point	typ. 55 dBm (low distortion mode)
	typ. 50 dBm (normal mode)
3rd order intercept point	
Inband[1)]	≥17 dBm, f ≤ 300 MHz
	≥20 dBm, f > 300 MHz
	(low distortion mode), typ. 23 dBm
	≥8 dBm, f ≤ 1500 MHz
	≥10 dBm, f > 1500 MHz (normal mode), typ. 12 dBm
Out-of-band	typ. 32 dBm
Noise figure	≤12 dB, typ. 10 dB, f ≤ 2 GHz
	≤15 dB, typ. 12 dB, f = 2 GHz to 3 GHz
	≤17 dB, typ. 15 dB, f > 3 GHz
	(low noise mode)
	≤16 dB, typ. 13 dB, f ≤ 2 GHz
	≤18 dB, typ. 15 dB, f = 2 GHz to 3 GHz
	≤20 dB, typ. 17 dB, f > 3 GHz
	(normal mode)

[1)] Frequency spacing between intermodulating signals ≥1 MHz.

Chapter Overview
Type Index
Main Menu



Sensitivity	measurement with telephone filter in line with ITU-T, low noise mode
AM, bandwidth = 6 kHz,	
SINAD = 10 dB, f_{mod} = 1 kHz,	
m = 0.5	≤1 µV, f ≤ 2 GHz
	≤1.4 µV (≤–104 dBm), f = 2 GHz to 3 GHz
	≤1.8 µV (≤–102 dBm), f > 3 GHz
FM, bandwidth = 15 kHz, SINAD = 20 dB, f_{mod} = 1 kHz,	
deviation = 5 kHz	≤1 µV (≤–107 dBm), f ≤ 2 GHz
	≤1.4 µV (≤–104 dBm), f = 2 GHz to 3 GHz
	≤1.8 µV (≤–102 dBm), f = 2 GHz to 3 GHz
SSB, bandwidth = 2.4 kHz,	
SINAD = 10 dB	≤0.5 µV (≤–113 dBm)
CW, bandwidth = 600 Hz,	
SINAD = 10 dB	≤0.22 µV (≤–120 dBm)
Demodulation modes	AM, FM, PM, PULSE, I/Q (all IF bandwidths)
	USB, LSB, CW ISB (IF bandwidth ≥1 kHz)
	(IF bandwidth ≤9 kHz)
	TV (analog)
IF bandwidths	
For demodulation, level and offset measurement	
(3 dB bandwidth)	23 filters (150/300/600 Hz/1.5/2.4/6/9/12/15/30/50/120/150/250/300/500/800 kHz/1/1.25/1.5/2/5/10 MHz)
Shape factor	
(3 dB:60 dB)	≤1:1.7, for 150 Hz to 2 MHz filter
	≤1:1.6, for 5 MHz filter (3 dB:50 dB)
	≤1:2, for 10 MHz filter (3 dB:50 dB)
Level and offset measurement	
Signal level	–30 dB to +120 dBµV, resolution 0.1 dB
IF panorama (with	
R&S®EM550SU option)	internal FFT (2048 points), 20 pictures/s
Span range	10 kHz to 9.6 MHz (10/25/50/100/150/256/300/400/600/800 kHz/1.2/2.4/4.8/9.6 MHz)

Modulation measurement	
(with R&S®EM550IM option)	
AM (modulation index)	m = 0 % to 999.9 %, resolution 0.1 %, f_{max} = 4 MHz
FM (FM deviation)	Δf = 0 Hz to 4 MHz, resolution 0.001 kHz
	f_{max} = 4 MHz (f_{mod} + deviation)
PM	Δφ = 0 rad to 12.5 rad, resolution 0.01 rad
	f_{max} = 4 MHz (f_{mod} + deviation)
Bandwidth measurement	up to 10 MHz automatically,
	>10 MHz with external software
	xx dB and ß % method
Scan characteristics	
Memory scan	10 000 definable memory locations
	scan speed up to 850 channels/s
Frequency scan	f_{start}, f_{stop}, f_{step}, user-selectable,
	100 suppress frequencies
	scan speed up to 850 channels/s
Panorama scan (with	
R&S®EM550PS option)	RF spectrum with user-selectable f_{start}, f_{stop}
	selectable steps: 125/250/500/625 Hz/1.25/2.5/3.125/6.25/12.5/25/50/100 kHz,
	scan speed up to 34 GHz/s or
	600 000 channels/s
Data and control	
interface	LAN (Ethernet 10/100BaseT)
Optical data interface	serial FPDP; 1 Gbit/s
General data	
Operating	
temperature range	0 °C to +50 °C
Storage	
temperature range	–40 °C to +70 °C
Power	
AC	90 V to 260 V, 47 Hz to 63 Hz, ≤110 VA
DC	12 V/24 V, ≤95 VA
Dimensions (W × H × D)	426.7 mm × 87.6 mm × 450 mm
	(16.80 in × 3.45 in × 17.72 in)
	19", 2 height units (w/o feet and handles)
Weight	11 kg (24.45 lb)

Ordering information

VHF/UHF Digital Wideband		
Receiver	R&S®EM550	4065.5083.02

Options		
Panorama Scan		
(RF Spectrum)	R&S®EM550PS	4065.5348.02
IF Panorama		
(IF Spectrum)	R&S®EM550SU	4065.5331.02
ITU Measurement		
Software[1)]	R&S®EM550IM	4065.5325.02
SEL CALL Analysis	R&S®EM550SL	4065.5354.02

[1)] The R&S®EM550SU IF panorama is included in the R&S®EM550IM option.

Receivers

R&S®ESMB
Monitoring Receiver

2

ITU-compliant measurements from 9 kHz to 3 GHz

Main features

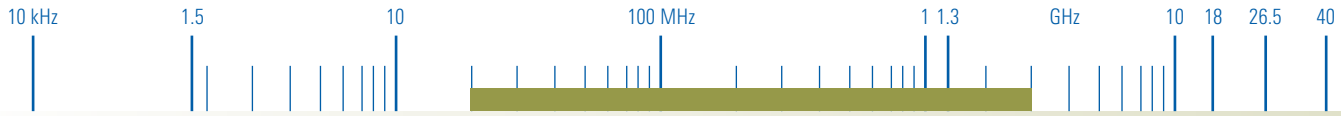
- Frequency and frequency offset measurements in line with ITU-R SM377
- Field strength measurement in line with ITU-R SM378
- Modulation measurement in line with ITU-R SM328
- Spectrum occupancy and identification with external PC in line with ITU-R SM182
- Bandwidth measurement in line with ITU-R SM433
- Search modes
  - Frequency scan
  - Memory scan
  - Frequency spectrum (DIGI-Scan)

Brief description

The R&S®ESMB monitoring receiver is ideally suited for military monitoring tasks and spectrum monitoring in line with ITU recommendations as well as for use in radio investigation services. The compact and sturdy design plus its low weight make the R&S®ESMB a versatile and universal instrument for stationary and mobile use.

The R&S®ESMB covers the wide frequency range from 9 kHz to 3 GHz. Processing the various signals available with optimum signal-to-noise ratio requires a large number of IF bandwidths. The R&S®ESMB is equipped with a digital IF section (DSP) that provides 18 IF filters with a bandwidth between 150 Hz and 300 kHz and additional filters up to 1 MHz in the IF panorama mode. Bandwidths above 300 kHz are for level and bandwidth measurement.

Chapter Overview
Type Index
Main Menu



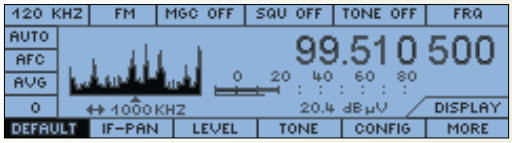
For radio investigation services, the following tasks can be performed:

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

The R&S®ESMB monitoring receiver as a ½ 19" unit can be integrated in racks. The basic elements of the R&S®ESMB are the following:

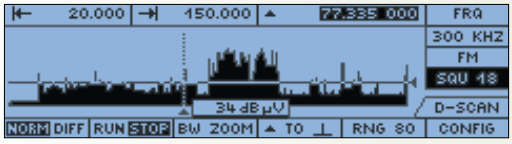
- Band and tracking preselection
- RF frontends for converting the antenna signal into an IF of 10.7 MHz
- Fast synthesizer
- A/D and DSP module with digital IF filters, digital demodulators for CW, AM, LSB, USB, PULSE, FM, PM, I/Q and ISB, parameter measurements and FFT processing of IF panoramic display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

Optimized view for current task

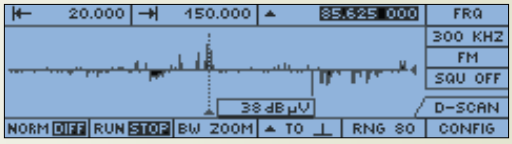


Overview

IF panorama



DIGI-Scan: listen mode



DIGI-Scan: differential mode

Use in computer-controlled systems

For use in computer-controlled systems, Rohde&Schwarz offers the R&S®ARGUS and R&S®RAMON monitoring software packages. For these applications, the R&S®ESMB is also available without front panel.

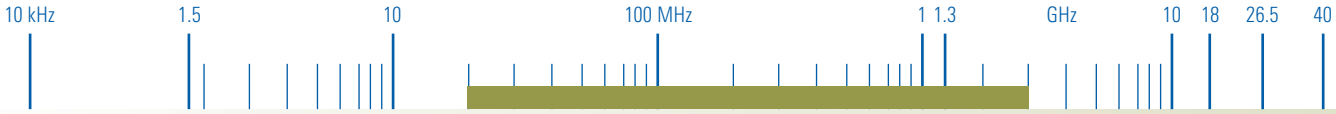
R&S®RAMON (see page 164), which is primarily used in military and security applications, enables fast frequency detection and transfer to support monitoring receivers (concentration on interactive operation and signal identification).

R&S®ARGUS (see page 141) is intended for applications focusing on measurements, and is therefore particularly suitable for frequency management tasks.

For basic tasks, the R&S®ARGUS software is available for remote control of the R&S®ESMB. The functionality of this software, which features a favorable price/performance ratio, is optimally tailored to the capabilities of the R&S®ESMB. It allows remote control of all settings, measurement and scan functions as well as saving of measured data such as frequency, level, offset, date and time. The basic R&S®ARGUS software can be extended with many options for use in more complex systems. The R&S®ESMB together with R&S®ARGUS is a cost-efficient basic system that fulfills all the ITU recommendations.

Specifications

Frequency range	
Base unit	20 MHz to 3 GHz
Base unit with	
R&S®ESMBHF	9 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 accuracy	≤0.5 × 10^{-6} (0 °C to +45 °C)
Input for external reference	10 MHz
Synthesizer setting time	≤3 ms, typ. 1 ms
Oscillator phase noise	
HF range	≤–120 dBc (1 Hz) at 10 kHz offset
VHF/UHF range	≤–100 dBc (1 Hz) at 10 kHz offset
Antenna inputs	N female, 50 Ω
VSWR	≤3, typ. 2
Oscillator reradiation	≤–107 dBm
Input selection	
9 kHz to 30 MHz	5 bandpass filters
20 (30) MHz to 1500 MHz	tracking preselection
1500 MHz to 3000 MHz	highpass, lowpass
Interference rejection, nonlinearities – HF range (only with R&S®EB200HF)	
Image frequency rejection	≥90 dB, typ. 100 dB
IF rejection	≥90 dB, typ. 100 dB
2nd order intercept point	≥50 dBm, typ. 60 dBm (ATT off)
3rd order intercept point	≥20 dBm, typ. 25 dBm (ATT off)
Internal spurious signals	≤–107 dBm
Interference rejection, nonlinearities – VHF/UHF range	
Image frequency rejection	≥80 dB, typ. 95 dB
IF rejection	≥90 dB, typ. 100 dB
2nd order intercept point	≥40 dBm, typ. 55 dBm (low distortion mode)
3rd order intercept point	≥12 dBm, typ. 18 dBm (low distortion mode)
Internal spurious signals	≤–107 dBm
Noise figure, sensitivity – HF range (only with R&S®ESMBHF)	
Noise figure (including AF section)	≤14 dB, typ. 10 dB f ≥ 0.1 MHz (ATT off)
Sensitivity	measurement with telephone filter (ATT off)
CW, bandwidth = 300 Hz, S/N = 10 dB	≤0.6 µV
SSB, bandwidth = 2.4 kHz, S/N = 10 dB	≤1 µV
AM, bandwidth = 9 kHz, S/N = 10 dB	≤1 µV
Noise figure, sensitivity – VHF/UHF range	
Noise figure (including AF section)	≤12 dB, typ. 9 dB 20 (30) MHz to 2.7 GHz (low noise mode)
Sensitivity	measurement with telephone filter (low noise mode)
AM, bandwidth = 9 kHz, S/N = 10 dB, f_{mod} = 1 kHz, m = 0.5	
20(30) MHz to 2.7 GHz	≤1 µV, typ. 0.5 µV
>2.7 GHz	≤1.3 µV, typ. 0.7 µV
FM, bandwidth = 15 kHz, S/N = 25 dB, f_{mod} = 1 kHz, deviation = 5 kHz	
20(30) MHz to 2.7 GHz	≤1 µV, typ. 0.6 µV
>2.7 GHz	≤1.3 µV, typ. 0.8 µV
Detection modes	AM, FM, PM, USB, LSB, CW, ISB, PULSE, I/Q
IF bandwidths for level detection and offset measurement	23 filters (150 Hz to 1 MHz)
IF bandwidths with standard demodulation (–6 dB bandwidth)	0.15/0.3/0.6/1/1.5/2.4/3/4/6/8/9/15/30/100/120/150/250/300 kHz (reduced IF bandwidth in HF range: ±5 kHz)
Squelch, signal-controlled	–30 dBµV to +110 dBµV
Gain control	AGC, MGC (120 dB)
AFC	digital retuning for unstable signals
Modulation measurement	
AM (f_{max} = 100 kHz)	m = 1 % to 99 % (resolution 0.1 %)
Indication error	<5 % for m = 50 %, S/N >40 dB, AF = 1 kHz
FM (f_{max} = 100 kHz)	deviation max. 125 kHz less modulation frequency (resolution 0.001 kHz)
Indication error	
Narrow bandwidth (≤15 kHz)	100 Hz + 3 % of reading
Broad bandwidth (≤250 kHz)	2 kHz + 3 % of reading for S/N >40 dB, AF = 1 kHz
PM (f = 0.3 kHz to 5 kHz)	Δφ = 0 to 4 π Δφ = 0 rad to 12.5 rad (resolution 0.01 rad)
Indication error	<0.1 rad + 5 % of reading for S/N >40 dB, AF = 1 kHz
Level and offset measurement	
Offset indication	graphically with tuning markers or numerically
Signal level	–30 dBµV to +110 dBµV
Error	≤±1.5 dB, typ. ±0.8 dB (HF range), typ. ±1.0 dB (VHF/UHF range) for V = 20 dBµV to 100 dBµV, AVG, 0 °C to +45 °C
Display	numeric, 3 digits, resolution 0.1 dB or graphical as level line, acoustic indication by level tone
Level indication mode	AVG, PEAK, FAST, RMS
Field strength (dBµV/m)	level range depending on antenna used



Scan characteristics	
Automatic memory scan	1000 definable memory locations
	typ. 250 channels/s (IF filter ≥100 kHz)
Frequency scan	start/stop/step and 100 suppress ranges
	typ. 300 channels/s (IF filter ≥100 kHz)
DIGI-Scan (option)	RF spectrum with user-selectable start/stop
	frequency, typ. 3 GHz/s (IF filter ≥100 kHz)
Inputs/outputs	
Reference frequency	10 MHz, bidirectional, SMA
IF wideband output	10.7 MHz, ±2.5 MHz (VHF/UHF range),
	±5 kHz (HF range), uncontrolled, SMA
AF output (digital)	via LAN and
	AF signal, 2 × 16 bit, AES/EBU interface
	AES3-1985 (ANSI 4.40)
AF output, symmetrical	600 Ω, 0 dBm
Loudspeaker output	4 Ω, 500 mW
Headphones output	via volume control

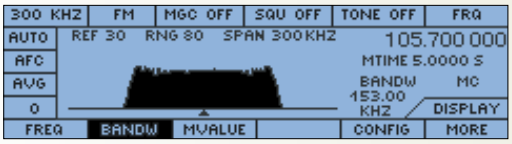
BITE	monitoring of test signals by means of
	loop test
Data interface	LAN (Ethernet 10BaseT) or
	9-pin RS-232-C (standard or PPP)
General data	
Operating	
temperature range	0 °C to +50 °C
Permissible	
temperature range	–10 °C to +55 °C
Power supply	10 V to 32 V DC (max. 40 W) or
	via external AC/DC supply
Dimensions (W × H × D)	227 mm × 153 mm × 474 mm
	(8.94 in × 6.02 in × 18.66 in)
Rack model	210 mm × 132 mm x 460 mm
	(8.27 in × 5.20 in × 18.11 in)
	½ 19" × 3 height units
Weight	8 kg (17.64 lb)

Ordering information

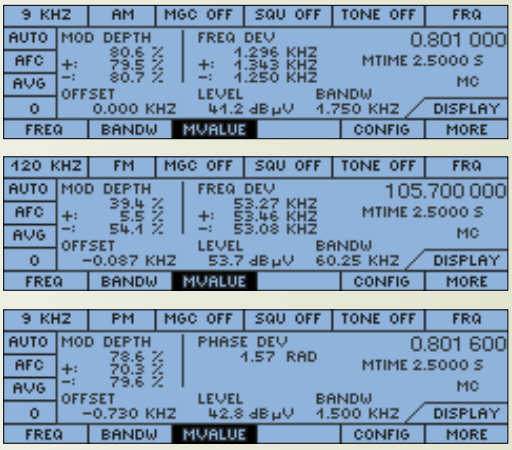
Monitoring Receiver	**R&S®ESMB**	
With LAN interface and		
external power supply		4056.6000.02
Without front panel		4056.6000.10

Options		
Tuner for 9 kHz to 30 MHz	R&S®ESMBHF	4056.6100.02
RF Spectrum DIGI-Scan	R&S®ESMBDS	4056.6200.02
Serial Interface	R&S®ESMBR2	4052.9065.02
Coverage Measurement	R&S®EB200CM	4052.9804.02

R&S®ESMB in measurement mode



Bandwidth measurement



Modulation measurement

Receivers

R&S®EB200
Miniport Receiver

Portable monitoring from 10 kHz to 3 GHz with R&S®HE200 handheld directional antenna

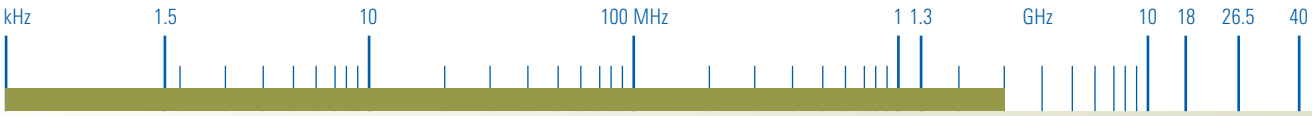
Main features

- Ergonomic design for on-body operation
- Continuous frequency range 10 kHz to 3 GHz
- Digital IF section with 12 bandwidths (150 Hz to 150 kHz)
- Fast, accurate level indication across 120 dB dynamic range
- Scanning modes
  - Frequency scan
  - Memory scan
  - Frequency spectrum (DIGI-Scan)
- Remote control via LAN (Ethernet 10BaseT) or RS-232-C

Brief description

The R&S®EB200 miniport receiver is a miniaturized portable professional receiver for the HF/VHF/UHF range. 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 – ½ 19", two height units – and low weight as well as its sturdy design 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 typically six hours. The R&S®EB200 battery pack is easily accessible and can be exchanged quickly. In case of power supply interruption, all data is stored. Operation can thus be resumed immediately after the power supply is restored.

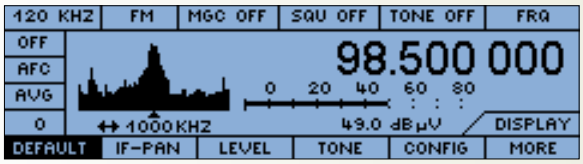


Function

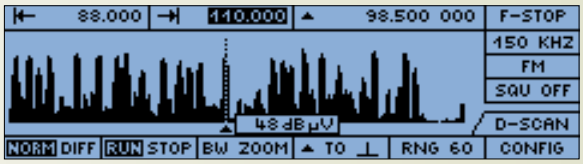
The R&S®EB200 is a superhet receiver with a third intermediate frequency of 10.7 MHz. The receiver input is equipped with a highpass/lowpass combination or tracking preselection, as required, to reduce the signal sum load. Intermodulation suppression equals that of many receivers used in stationary applications. 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. The digital IF section provides a wide variety of different filters which are implemented in a minimum of space with the aid of DSP. The R&S®EB200 has 12 IF bandwidths between 150 Hz and 150 kHz. The following digital demodulators are available: AM, FM, LSB, USB, CW, PULSE and I/Q. If the receiver is fitted with the IF panorama option, the number of bandwidths is increased to 17 up to 1 MHz. Bandwidths over 150 kHz are for level and deviation measurement as demodulation is not possible.

Applications

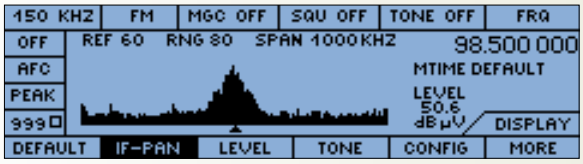
- Monitoring of specific frequencies, e.g. storage of 1 to 1000 frequencies, squelch setting, constant monitoring of one frequency or cyclical scanning of several frequencies
- Searching in a frequency range with user-selectable start and stop frequency and step widths of 0.1 kHz to 10 MHz
- Search at maximum speed in the frequency range with user-selectable start and stop frequency (DIGI-Scan option)
- 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 transmissions
- Remote-controlled operation via modem and PC in coverage measurement and monitoring systems



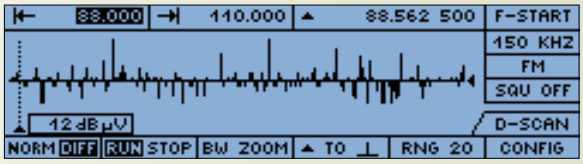
Overview



DIGI-Scan: scan mode



IF panorama display



DIGI-Scan: differential mode

Use in computer-controlled systems

For use in computer-controlled systems, Rohde & Schwarz offers the R&S®ARGUS and R&S®RAMON monitoring software. R&S®RAMON, which is used in the military field, allows fast frequency detection and transfer to support monitoring receivers, while R&S®ARGUS is intended for civil applications, e.g. for authorities with frequency management tasks such as long-term monitoring of specific frequency bands.

Handheld directional antenna

The handy and highly broadband R&S®HE200 directional antenna in conjunction with portable receivers such as 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 overall frequency range from 0.01 MHz to 3000 MHz 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.

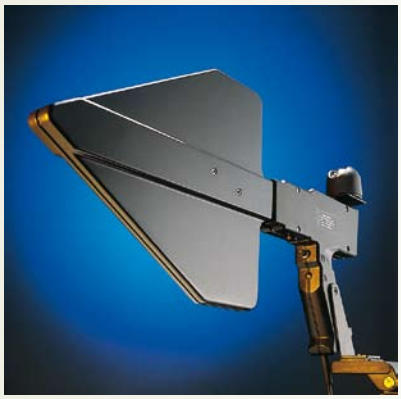
R&S®HE200HF

10 kHz to 20 MHz

R&S®HE200

20 MHz to 200 MHz

200 MHz to 500 MHz

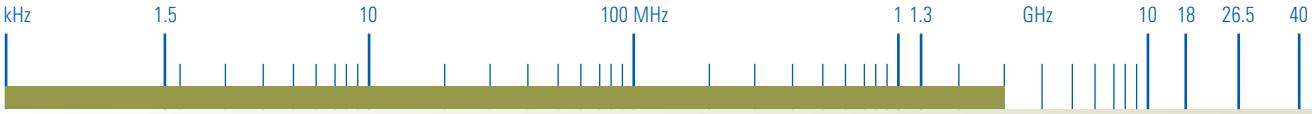


0.5 GHz to 3 GHz

Chapter Overview

Type Index

Main Menu



Specifications

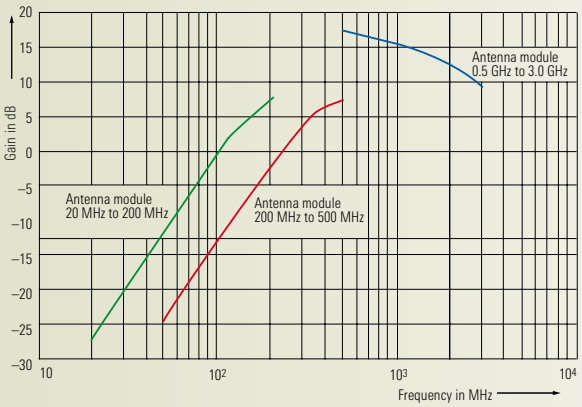
Frequency range	10 kHz to 3 GHz
Frequency setting via	
keypad or rollkey	1 kHz, 100 Hz, 10 Hz, 1 Hz or in selectable increments
Frequency accuracy	≤0.5 × 10^{-6} (–10 °C to +55 °C)
Aging	≤1 × 10^{-6}/year
Synthesizer setting time	≤3 ms
Oscillator phase noise	≤–100 dBc (1 Hz) at 10 kHz offset
Antenna input	N female, 50 Ω, VSWR ≤3, SMA connector on rear panel for rackmounting
Oscillator reradiation	≤–107 dBm
Input attenuation	manual or automatic
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
Noise figure (overall noise figure including AF section)	
20 MHz to 650 MHz	≤14 dB, typ. 12 dB
650 MHz to 1500 MHz	≤15.5 dB, typ. 13 dB
1500 MHz to 2.7 GHz	≤14 dB, typ. 12 dB
>2.7 GHz	≤15 dB, typ. 13 dB
Sensitivity	measurement with telephone filter
AM, bandwidth = 6 kHz, S/N = 10 dB	
f_{mod} = 1 kHz, m = 0.5	
0.1 MHz	typ. 6 µV
1 MHz	typ. 4.5 µV
10 MHz	typ. 1.3 µV
20 MHz to 2.7 GHz	≤1 µV, typ. 0.5 µV
>2.7 GHz	≤1.3 µV, typ. 0.7 µV
FM, bandwidth = 15 kHz, S/N = 25 dB	
f_{mod} = 1 kHz, deviation = 5 kHz	
0.1 MHz	typ. 6 µV
1 MHz	typ. 3.5 µV
10 MHz	typ. 1.2 µV
20 MHz to 2.7 GHz	≤1 µV, typ. 0.5 µV
>2.7 GHz	≤1.3 µV, typ. 0.7 µV

Demodulation	AM, FM, LSB, USB, CW, PULSE, I/Q
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 R&S®EB200SU
Squelch	signal-controlled, –30 dBµV to +110 dBµV
Gain control	AGC, MGC (120 dB)
AFC	digital retuning for frequency-unstable signals
Level and offset measurement	
Offset indication	numeric
Signal level	–30 dBµV to +110 dBµV
Error	typ. ±1.5 dB (+15 °C to +35 °C)
Signal level indication	numeric, 3 digits, resolution 0.1 dB or graphical as level line, acoustic indication by level tone
Level indication mode	AVG, PEAK, FAST
Field strength (dBµV/m)	level range depending on antenna used
Display	numeric
IF panorama (R&S®EB200SU option)	internal module, ranges 25/50/100/200/500/1000 kHz, and coupled to IF bandwidths
Scan characteristics	
Automatic memory scan	1000 definable memory locations typ. 250 channels/s (IF filter ≥100 kHz)
Frequency scan	start/stop/step and 100 suppress ranges typ. 300 channels/s (IF filter ≥100 kHz)
DIGI-Scan (option)	RF spectrum with user-selectable start/stop frequency, typ. 1.5 GHz/s (IF filter ≥100 kHz)
Inputs/outputs	
Reference frequency	10 MHz, bidirectional, SMA
IF wideband output	10.7 MHz, ±2.5 MHz, uncontrolled, SMA
AF output (digital)	via LAN and AF signal, 2 × 16 bit, AES/EBU interface, AES3-1985 (ANSI 4.40)
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	LAN (Ethernet 10BaseT) or RS-232-C

Specifications in brief of the R&S®HE200

General data	
Operating	
temperature range	0 °C to +50 °C
Permissible	
temperature range	–10 °C to +55 °C
Storage	
temperature range	–40 °C to +70 °C
Power supply	110/230 V AC, 50/60 Hz
	battery pack (typ. 6 h operation) or
	10 V to 30 V DC (max. 22 W)
R&S®HE200	in handle, 4 × 1.5 V mignon cell R6
Dimensions (W × H × D)	210 mm × 88 mm × 270 mm
	(8.27 in × 3.46 in × 10.63 in)
	½ 19" × 2 height units
R&S®HE200	470 mm × 360 mm × 180 mm
	(18.50 in × 14.17 in × 7.09 in)
	(in transit case)
Weight	
Without battery pack	4 kg (8.82 lb)
Battery pack	1.5 kg (3.31 lb)
R&S®HE200	
(without battery)	0.8 kg to 1.1 kg (1.76 lb to 2.43 lb)
	depending on antenna modules used

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	typ. <2.5
RF output	1 m cable with N connector

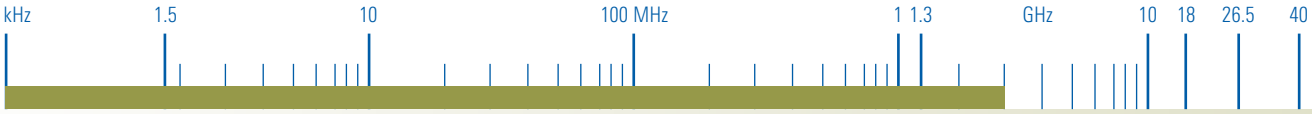


Gain, active mode

Chapter Overview

Type Index

Main Menu



Ordering information

Miniport Receiver		
Without interface, with external AC power supply	R&S®EB200	4052.2000.02
Options		
IF Panorama	R&S®EB200SU	4052.3206.02
RF Spectrum DIGI-Scan	R&S®EB200DS	4052.9604.02
LAN (Ethernet 10BaseT) Interface	R&S®EB200R4	4052.9156.02
RS-232-C Serial Interface	R&S®ESMBR2	4052.9156.02
Recommended extras		
Transit Case (telescopic antenna, headset, belt and space for R&S®EB200 and battery pack)	R&S®EB200SC	4052.9304.02
Battery Pack	R&S®EB200BP	4052.4102.03
Carrying Bag	R&S®EB200CB	4052.8708.02
Car Converter (10/30 V to 24 V)	R&S®EB200CC	4052.6005.02
Field-Strength Measurement Software	R&S®EB200FS	4052.9704.02
Coverage Measurement Software	R&S®EB200CM	4052.9804.02
Rack Adapter	R&S®EB200ZZ	4052.8250.02
Handheld Directional Antenna (including transit case)	R&S®HE200	4050.3509.02
HF Module 10 kHz to 20 MHz	R&S®HE200HF	4051.4009.02

R&S®EB110
Receiver Module

Computer-controlled monitoring from 10 kHz to 3 GHz

Main features

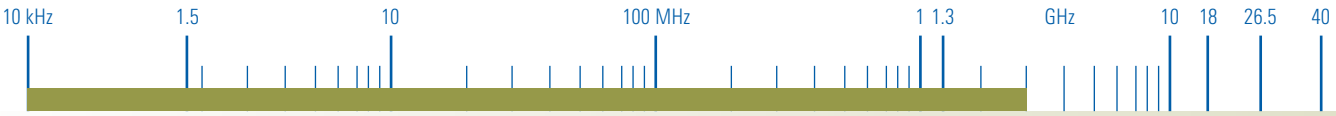
- Remote control via LAN or RS-232-C
- Continuous frequency range 10 kHz to 3 GHz
- Digital IF section with 12 bandwidths (150 Hz to 150 kHz)
- Fast, accurate level indication across 120 dB dynamic range
- Scan modes
  - Frequency scan
  - Memory scan
  - Frequency spectrum (option) (DIGI-Scan)
- IF panorama (option)
- Field-strength measurement and coverage measurement (options)
- Standard ½ 19" design for rackmount application

Brief description

The R&S®EB110 receiver module is a remote-controlled unit for monitoring in the wide frequency range from 10 kHz to 3 GHz. Whether used for measurements of signals or for detecting interference, the R&S®EB110 offers features unrivaled in its class. The favorably priced and compact receiver with LAN (or RS-232-C) interface is ideally suited for computer-controlled mobile and 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 as well as its sturdy, pickup-proof aluminum housing make the R&S®EB110 ideal for use in applications where space is critical. In case of power supply interruption, all data is stored. Operation can thus be resumed immediately after the power supply is restored.

Chapter Overview
Type Index
Main Menu



Function

The signal at the antenna input is converted to a third intermediate frequency of 10.7 MHz. In spite of its compact size, the receiver features an advanced concept. The receiver input is equipped with a highpass/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.

Digital IF section

The R&S®EB110 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 R&S®EB110 has 12 IF bandwidths between 150 Hz and 150 kHz. The following digital demodulators are available: AM, FM, CW, LSB, USB, PULSE and I/Q.

If the receiver is fitted with the R&S®EB200SU IF panorama option, the IF spectrum with a maximum span of ±500 kHz is available via a remote interface on the external PC.

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 of individual frequencies

Memory scanning
The R&S®EB110 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.

Frequency spectrum (option)
With the frequency spectrum option (DIGI-Scan), the R&S®EB110 scans the frequency range of interest with digital control and displays the associated spectrum on the external PC. Emissions detected can be seen at a glance. Aural remote monitoring of the information is possible from the external control station.

Remote control

The receiver can be remote-controlled via the LAN or serial RS-232-C interface. For measurement tasks, the LAN interface provides a speed hundred times faster as well as easy connection and control of multiple receivers from a PC. It is also used for transferring the digital audio signals and the high data rate of DIGI-Scan.

Applications

- Monitoring of specific frequencies, e.g. 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 user-selectable start and stop frequency and step widths of 1 kHz to 10 MHz
- Search at maximum speed in the frequency range with user-selectable start and stop frequency (DIGI-Scan option)
- Field-strength measurement with consideration of transducer factors (with R&S®EB200FS option)
- Coverage measurements for network planning, e.g. GSM networks (with R&S®EB200CM option)
- Detection of undesired emissions including pulsed emissions
- Detection of unlicensed transmitters communicating illegally or interfering with licensed transmission
- Monitoring of selected transmissions
- Remote-controlled operation via modem and PC in coverage measurement and monitoring systems

Rear view

Chapter Overview

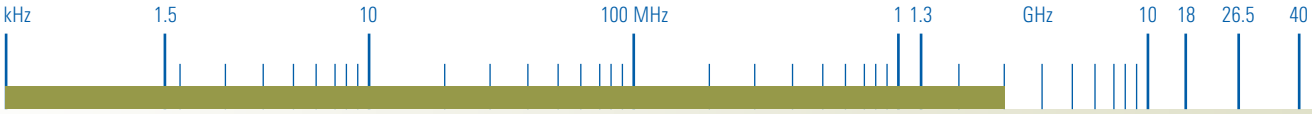
Type Index

Main Menu

Specifications

Frequency range	10 kHz to 3 GHz
Frequency accuracy	≤0.5 × 10^{-6} (–10 °C to +55 °C)
Aging	≤1 × 10^{-6}/year
Synthesizer setting time	≤3 ms
Oscillator phase noise	≤–100 dBc (1 Hz) at 10 kHz offset
Antenna input	SMA connector on rear panel for rackmounting
Oscillator reradiation	≤–107 dBm
Input attenuation	30 dB, manual or automatic
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	measurement with telephone filter
AM, bandwidth = 6 kHz, S/N = 10 dB	
f_{mod} = 1 kHz, m = 0.5	
0.1 MHz	typ. 6 µV
1 MHz	typ. 4.5 µV
10 MHz	typ. 1.3 µV
20 MHz to 2.7 GHz	≤1 µV, typ. 0.5 µV
>2.7 GHz	≤1.3 µV, typ. 0.7 µV
FM, bandwidth = 15 kHz, S/N = 25 dB	
f_{mod} = 1 kHz, deviation = 5 kHz	
0.1 MHz	typ. 6 µV
1 MHz	typ. 3.5 µV
10 MHz	typ. 1.2 µV
20 MHz to 2.7 GHz	≤1 µV, typ. 0.5 µV
>2.7 GHz	≤1.3 µV, typ. 0.7 µV

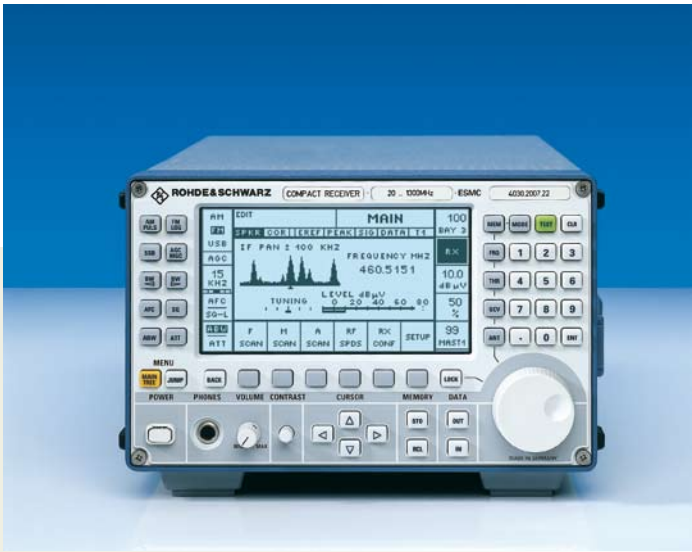


Demodulation	AM, FM, LSB, USB, CW, PULSE, I/Q
IF bandwidths	12 (150/300/600 Hz/1.5/2.4/6/9/15/30/50/120/150 kHz)
IF bandwidths for level and deviation indication	15 (150 Hz to 1 MHz) only with R&S®EB200SU
Squelch	signal-controlled, –30 dBµV to +110 dBµV
Gain control	AGC, MGC (120 dB)
AFC	digital retuning for frequency-unstable signals
Level and offset measurement	
Signal level	–30 dBµV to +110 dBµV
Error	typ. ±1.5 dB (+15 °C to +35 °C)
Signal level indication	0.1 dB resolution from –30 dBµV to +110 dBµV, acoustic indication by level tone
Accuracy	typ. ±1.5 dB
Scan characteristics	
Automatic memory scan	1000 definable memory locations typ. 250 channels/s (IF filter ≥100 kHz)
Frequency scan	start/stop/step and 100 suppress ranges typ. 300 channels/s (IF filter ≥100 kHz)
DIGI-Scan (option)	RF spectrum with user-selectable start/stop frequency, typ. 1.5 GHz/s (up to 18 000 channels/s) (IF filter ≥100 kHz)
Inputs/outputs	
Digital I/Q baseband output	serial data (clock, data, frame) up to 256 ksps, 2 × 16 bit
Bidirectional reference frequency connectors	10 MHz, BNC
In	0.1 V to 1 V, R_i = 500 Ω
Out	0 dBm, R_0 = 50 Ω
Digital audio output (for DAT recorders)	in line with AES/EBU, ANSI 4.40
IF wideband output	10.7 MHz, ±2.5 MHz, uncontrolled for external panorama display
LINE output	0.5 V ±0.3 V for m = 0.5, R_i = 100 Ω f = 10 Hz to 12.5 kHz f = 10/300 Hz to 12.5 kHz (AM, depending on bandwidth)
BITE	monitoring of test signals by means of loop test
Data interface	LAN (Ethernet 10BaseT) or RS-232-C
General data	
Operating temperature range	0 °C to +50 °C
Permissible temperature range	–10 °C to +55 °C
Storage temperature range	–40 °C to +70 °C
Power supply	
DC	10 V to 30 V (max. 22 W)
AC	with external power supply
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	4 kg (8.82 lb)
Battery pack	1.5 kg (3.31 lb)

Ordering information

Receiver Module		
Without interface	R&S®EB110	4062.0000.02
Options		
LAN (Ethernet 10BaseT) Interface	R&S®EB200R4	4052.9156.02
RS-232-C Serial Interface	R&S®ESMBR2	4052.9156.02
Recommended extras		
Internal IF Panorama (span range up to ±500 kHz)	R&S®EB200SU	4052.3206.02
RF Spectrum DIGI-Scan	R&S®EB200DS	4052.9604.02
Car Converter (10/30 V to 24 V)	R&S®EB200CC	4052.6005.02
Field-Strength Measurement Software	R&S®EB200FS	4052.9704.02
Coverage Measurement Software	R&S®EB200CM	4052.9804.02
Rack Adapter	R&S®EB200ZZ	4052.8250.02

R&S®ESMC
Compact Receiver



Lightweight – compact – user-friendly: optimized radiomonitoring from 0.5 MHz to 3000 MHz

Main features

- Custom-specific frequency extension from HF to UHF
- Detection of frequency-agile emissions with analog sweep
- Compact design and low weight
- Simple operation via LC display
- Wide dynamic range and high overload capacity
- 1 Hz frequency resolution
- RF and IF spectrum display
- Low phase noise
- Master/slave operation without a PC
- Accurate measurement of signal level
- Offset display for channel frequency
- Remote control unit for mobile use
- AC/DC supply without changing the power supply unit

Brief description

The R&S®ESMC compact receiver is a universal and multipurpose receiver for radiomonitoring applications. Its compact size is absolutely unrivaled.

The receiver is only half the size of customary 19" multipurpose receivers of three height units, but its specifications are even superior to those of such instruments.

Applications

- Signal reception
  - Aural monitoring
  - Radiomonitoring
  - Recording
- Searching and scanning
  - Continuous manual tuning
  - At any channel spacing
  - 5 start/stop frequency ranges
  - Spectrum display with a speed of up to 13 GHz/s
  - Within 1000 memory locations
- Measurement of
  - Frequency occupancy
  - Level and frequency
  - Coverage

Operation

The operating concept meets all the demands made on a state-of-the-art radiomonitoring receiver, i.e. all main functions such as type of demodulation, bandwidth, etc, can be set directly via labeled keys. A hotkey enables the user to return to the main menu from any submenu. Menu control is organized in priority levels so that signal processing is not interrupted by menu changes and the user never loses sight of what is going on.

Search facilities

The R&S®ESMC uses highly advanced search routines. Fast synthesizer settling and short level measurement times ensure highly effective search operations.

Frequency scan

Five start/stop frequency ranges (five jobs) may be defined and a complete data set allocated to each range. In addition to receiver settings, the following scan parameters may be included in the data set:

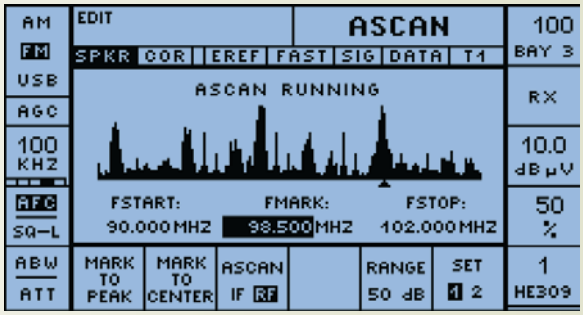
- Step width
- Signal threshold (dBµV)
- Dwell time (s)
- Hold time (ms) plus the time required for external devices, if any
- Number of scan repetitions
- Signal-controlled continuation (on/off)
- Suppression (individual frequencies or ranges)

Memory scan

The R&S®ESMC uses 1000 memory locations, each holding a complete receiver setting such as frequency, type of modulation, bandwidth, etc. The content of the memory can be modified manually or overwritten by scan results. User-definable code names, group ID and scan enable flags may also be defined for each location. The whole memory can be sorted according to increasing frequency values. The content of any memory location can be transferred to the receiver manually, by using the RCL key, by turning the tuning knob or automatically by activating the memory scan.

Analog scan – full-speed detection of bursts and hoppers

The advantage of analog scan is the extremely high speed. This allows detection of burst signals and frequency-agile transmissions. With the R&S®ESMC-AS option and an external PC, a program under Windows is provided, which enables panorama and waterfall displays. Start and stop frequencies are user-selectable within any tuner range. Depending on the performance of the controlling PC, a scanning speed of up to 13 GHz/s can be achieved. With the aid of a printer, measurement results may be documented as a frequency-versus-time plot.



Fast hopping frequencies can be detected by means of the R&S®ESMC-AS option

Click & listen

For fixed frequency monitoring, a spectrum line can be selected by mouse click or by frequency marker.

Use in computer-controlled systems

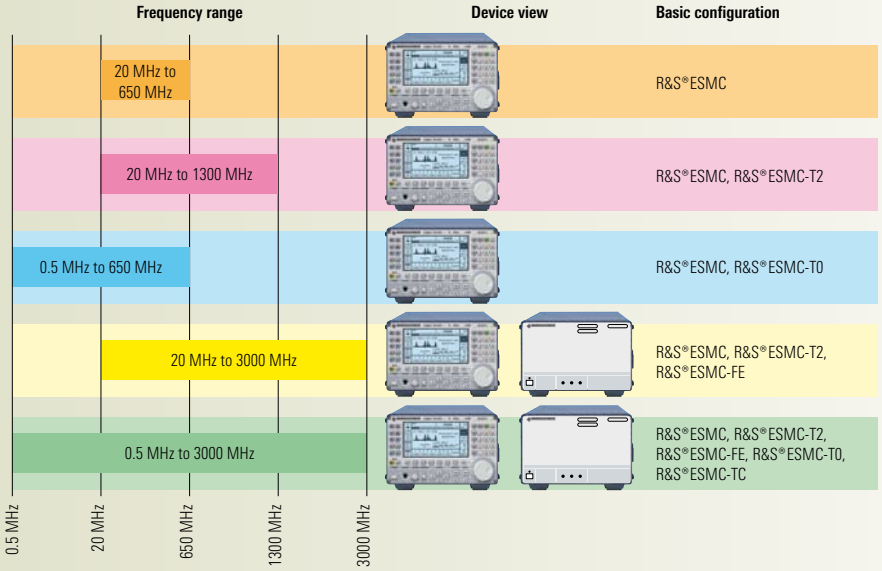
For use in computer-controlled systems, Rohde & Schwarz offers the R&S®ARGUS and R&S®RAMON monitoring software. R&S®RAMON, which is used in the military field, allows fast frequency detection and transfer to support monitoring receivers, while R&S®ARGUS is intended for civil applications, e.g. for authorities with frequency management tasks such as long-term monitoring of specific frequency bands.

Option overview

Several options allow the R&S®ESMC to be customized. All these options can be added to the basic version of the R&S®ESMC without any software reconfiguration; whenever a module is changed or added, a recalibration process is started automatically after power-up.

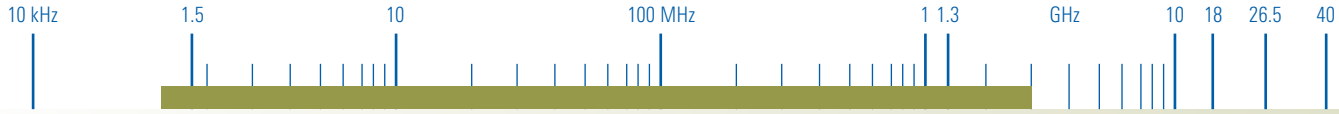
Description	Type	Order No.
Frequency extension from 0.5 MHz to 30 MHz instead of R&S®ESMC-T2[1]	R&S®ESMC-T0	4039.9004.03
Frequency extension up to 1.3 GHz[1]	R&S®ESMC-T2	4037.5201.02
Separate ½ 19" unit for frequency extension from 1.3 GHz to 3 GHz or 0.5 MHz to 3 GHz	R&S®ESMC-FE	4042.6002.02
Antenna splitter for one antenna input, 20 MHz to 3 GHz (only with R&S®ESMC-FE)	R&S®ESMC-AN	4042.6702.02
10 MHz OCXO reference (error ≤0.1×10^{-6})[2]	R&S®ESMC-OR	4042.6902.02
Reception of LSB/USB and A1	R&S®ESMC-S3	4037.5501.02
Cost-effective panoramic adapter using the receiver's LCD	R&S®ESMC-SU	4037.5553.02
Analog scan function and software	R&S®ESMC-AS	4042.0404.02
Remote control via IEC 625-2/IEEE 488 (instead of R&S®ESMC-R2)[1]	R&S®ESMC-R1	4037.5401.02
Remote control via RS-232-C, RS-422, RS-485 (instead of R&S®ESMC-R1)[1]	R&S®ESMC-R2	4037.5453.02
Remote control unit (operator front panel) for controlling the R&S®ESMC model .02 or .03 via a serial link especially for mobile applications	R&S®ESMC-GB	4039.8508.02
IF section with special bandwidth (see ordering information)	R&S®ESMC-Z1	4037.5253.xx

[1] Only one of these options to be fitted.
[2] Slot in R&S®ESMC-FE option available, otherwise in R&S®ESMC base unit instead of R&S®ESMC-SU option.



Custom-specific frequency extension from HF to UHF

Chapter Overview
Type Index
Main Menu



Option for model .23/.03

IF Section (special bandwidths) R&S®ESMC-Z1 4037.5253.xx

500 Hz	2.5 kHz	8 kHz	15 kHz	30 kHz	50 kHz	100 kHz	200 kHz	500 kHz	1 MHz	2 MHz	4 MHz	8 MHz	Model
•	•	•		•		•							.08
•	•		•			•				•			.03
•	•		•				•				•		.34
•	•					•					•	•	.20
	•	•	•	•		•							.10
	•	•	•	•			•						.32
	•	•	•			•	•						.06
	•	•	•			•				•			.02
	•	•	• (16 kHz)	• (38 kHz)		•							.13
	•	•				•				•		•	.16
	•	•		•							•	•	.36
	•	•				•					•	•	.22
	•		•	•		•	•						.04
	•				•			•	•		•		.15
		•	•	•	•	•							.05
		•	•	•		•				•			.09
		•	•	•		•					•		.39
		•	•	•		•						•	.18
		•	•	•			•					•	.12
		•	•	•				•		•			.19
		•	•			•				•		•	.11
		•		•	•			•		•			.29
		•		•		•		•	•				.21
		•		•		•			•	•			.25
		•		•				•	•		•		.26
		•		•				•		•	•		.40
		•		•				•		•		•	.41
		•			•		•	•		•			.24
		•				•				•	•	•	.35
		•				•		•			•	•	.38
			•		•	•	•			•			.07
			•			•	•	•				•	.17
			•			•		•	•			•	.27
						•	•	•	•	•			.23
						•	•	•	•			•	.33
						•	•		•	•		•	.31
						•	•		•		•	•	.30
						•	•			•	•	•	.37

Specifications

Frequency range		
Base unit (with tuner 1)	20 MHz to 650 MHz	
Tuner 2	650 MHz to 1300 MHz (optional)	
Tuner 0	0.5 MHz to 30 MHz (optional)	
Frequency setting	1 kHz, 100 Hz, 10 Hz, 1 Hz	
Frequency error	≤±1.5 × 10^{-6} (–10 °C to +55 °C)	
Frequency aging	≤±0.5 × 10^{-6}/year	
Oscillator phase noise	≤–110 dBc (10 kHz)	
For tuner 0	≤–138 dBc (10 kHz)	
Synthesizer settling time	≤1 ms	
Antenna input	N connector, 50 Ω, VSWR ≤2.5, overload-protected	
Oscillator reradiation	≤–107 dBm	
Tuner 0	≤–127 dBm	
Input selectivity	tuned filters	
Tuner 0	4 switched bandpass filters	
Immunity to interference, nonlinearities		
Image frequency rejection	typ. 110 dB, ≥90 dB	
IF rejection	typ. 110 dB, ≥90 dB	
IP2	typ. 50 dBm, ≥40 dBm	
Tuner 0	typ. 70 dBm, ≥55 dBm	
IP3	typ. 11 dBm, ≥ 8 dBm	
Tuner 2	typ. 9 dBm, ≥6 dBm	
Tuner 0	typ. 35 dBm, ≥28 dBm	
Spurious	≤–107 dBm	
Tuner 0	≤–113 dBm	
Sensitivity		
Total noise figure (incl. AF section)	≤13.5 dB, typ. 10 dB (20 MHz to 650 MHz) ≤14.5 dB, typ. 11 dB (650 MHz to 1300 MHz)	
(S+N)/N ratio (measurement using telephone filter in line with ITU-T)	Tuner 1 20 to 650 MHz	Tuner 2 650 to 1300 MHz
AM, IF bandwidth = 8 kHz, f_{mod} =1 kHz, m = 0.5	V_{in} = –107 dBm (1 µV) ≥10 dB	V_{in} = –103.5 dBm (1.5 µV) ≥10 dB V_{in} = –47 dBm (1 mV) ≥47 dB
FM, IF bandwidth = 15 kHz, f_{mod} = 1 kHz, deviation = 5 kHz	V_{in} = –107 dBm (1.5 µV) ≥25 dB	V_{in} = –103.5 dBm (1 mV) V_{in} = –47 dBm (1 mV) ≥70 dB
USB/LSB, IF bandwidth = 2.5 kHz, Δf = 1 kHz	V_{in} = –117 dBm (0.3 µV) ≥10 dB	V_{in} = –47 dBm (1 mV) ≥50 dB
(S+N)/N ratio (meas. using tel. filter in line with ITU-T)	Tuner 0 0.5 to 20 MHz	Tuner 0 20 to 30 MHz
USB/LSB, IF bandwidth 500 Hz, Δf = 500 Hz	V_{in} = 0.4 µV ≥10 dB	V_{in} = 0.5 µV ≥10 dB
USB/LSB, IF bandwidth 2.5 kHz, Δf = 1 kHz	V_{in} = 0.6 µV ≥10 dB	V_{in} = 0.7 µV ≥10 dB V_{in} = 100 mV ≥46 dB
AM, IF bandwidth 2.5 kHz, f_{mod} = 1 kHz, m = 0.5	V_{in} = 1 µV ≥10 dB	V_{in} = 1.2 µV ≥10 dB
Other receiving characteristics		
Demodulation	AM, FM , LOG, PULSE; SSB and CW optional	
Squelch	signal-controlled, adjustable –10 dBµV to +80 dBµV (max. 110 dBµV, 120 dBµV with tuner 0)	
AGC range	90 dB; 1 µV to 10 mV makes ≤4 dB difference in AF level	
RF attenuator	30 dB (40 dB with tuner 0) selectable or signal-controlled	
AGC speed for 90 dB range	Attack	Decay
AM, BW = 15 kHz	<15 ms	15 ms
Pulse, BW = 100 kHz	<0.1 ms	⌈3 s, corr. to
SSB, BW = 2.5 kHz	<1 ms	⌊3 dB/100 ms
Range of MGC (manual gain control)	90 dB	
EGC (external gain control) by analog voltage	90 dB	
COR		
Decay	adjustable, 1 s to 10 s	
Attack	≤25 ms	
AFC	digital tuning for signals of unstable frequency	
Offset indication	graphical using tuning markers, numeric in 50 Hz steps (BW ≤100 kHz)	
Signal-level indication	graphical as level line or numeric from –10 dBµV to +80 dBµV (110 dBµV), with tuner 0 120 dBµV	
Resolution	graphical 1 dB, numeric 0.1 dB	
Error	≤±3 dB, ≤±2 dB for level ≥0 dBµV	
Automatic memory scan	1000 definable memory locations, each location may be allocated a complete set of receive data	
Frequency scan	five definable start/stop frequency spans with separate receive data sets (5 jobs)	
Analog scan (option)	full receive range (max. 650 MHz) or any expanded section	
Frequency marker	added for receiver tuning	
Sweep time	approx. 47 ms	
Resolution filter	IF filters of receiver	
Built-in test (BIT)		
Continuous test	module monitoring, test points of modules can be shown on display, fault signaling with error code + text	
Loop test	key-triggered, automatic test of complete receive section incl. AF section	

Inputs and outputs	
IF 21.4 MHz, controlled output	500 Hz to 8 MHz[1], BNC, 50 Ω, –10 dBm
IF 21.4 MHz, uncontrolled output	500 Hz to 8 MHz[1], BNC, 50 Ω, V_{in} +12 dB
21.4 MHz, wideband output	±4 MHz uncontrolled, BNC, 50 Ω, V_{in} +9 dB, for external spectrum display
Video output, AM/FM/LOG	1/2 IF bandwidth, DC-coupled, BNC, 50 Ω, 2 V (V_{pp}); for log 1 V
AF output, balanced	600 Ω, 0 dBm
AF output, filtered, unbalanced	0.3 kHz to 3.4 kHz, fixed, 1 V RMS
AF output, unbalanced	1 V RMS
AF loudspeaker output (AF filter 0.3 kHz to 3.4 kHz may be switched to any AF output)	4 Ω, 500 mW
Output, log signal level	0 V to +5 V, Z_{out} = 1 kΩ
Output, channel offset	–5 V to +5 V, Z_{out} = 1 kΩ
Input, ext. MGC voltage	0 V to 2 V, Z_{in} = 10 kΩ
Output, 1st LO	50 Ω, SMA, –10 dBm
Output, 2nd LO	50 Ω, SMA, –15 dBm

[1] Depending on selected bandwidth.

Bidirectional reference-frequency connector	10 MHz, BNC
In	0.1 V to 2 V, Z_{in} = 500 Ω
Out	3 dBm, Z_{out} = 50 Ω
Special function ports	configurable for muting, ext. scan stop, etc
Output for controlling antenna selectors	BCD, TTL level (for frequency information)
Data interfaces	IEC 625-2 (IEEE 488) (standard) or RS-232-C/RS-422/RS-485 (option)
General data	
Operating temperature range	0 °C to +50 °C
Storage temperature range	–10 °C to +55 °C
Power supply	
AC	100/120/230/240 V, –12 %/+10 %, 47 Hz to 440 Hz, overvoltage protection in line with VDE 160
DC	10 V to 32 V, reversed polarity protection
Power consumption	
AC	≤100 VA
DC	≤75 W
Dimensions (W × H × D)	219 mm × 147 mm × 460 mm (8.62 in × 5.79 in × 18.11 in) ½ 19", 3 height units
Weight	
Model .02/.03	11.5 kg (25.35 lb)
Model .22/.23	12 kg (26.46 lb)

Ordering information

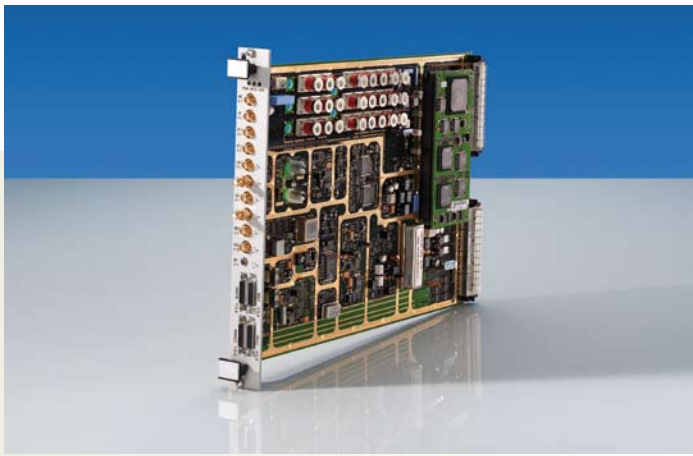
VHF/UHF Compact Receiver		
Base units including IEC 625 (IEEE 488) interface and IF section (filters 2.5 kHz/ 8 kHz/15 kHz/100 kHz/2 MHz)		
With front-panel control	R&S®ESMC	4030.2007.22
Without front-panel control	R&S®ESMC	4030.2007.02
Base units without IEC 625 (IEEE 488) interface and IF section		
With front-panel control	R&S®ESMC	4030.2007.23
Without front-panel control	R&S®ESMC	4030.2007.03
Options	**see table on page 47**	
Tuner 0 for 0.5 MHz to 30 MHz	R&S®ESMC-T0[1]	4039.9004.03
Tuner 2 for 650 MHz to 1300 MHz	R&S®ESMC-T2[1]	4037.5201.02
(Tuner 0 and tuner 2 cannot be combined in one R&S®ESMC)		

[1] Only one of these options to be fitted.

SSB Unit	R&S®ESMC-S3	4037.5501.02
IF Spectrum Unit	R&S®ESMC-SU	4037.5553.02
Analog Scan (software) IEC 625 (IEEE 488) Interface	R&S®ESMC-AS R&S®ESMC-R1[1]	4042.0404.02 4037.5401.02
Serial Interface (RS-232-C/ RS-422/RS-485)	R&S®ESMC-R2[1]	4037.5453.02
Remote Control Unit for model .02/.03	R&S®ESMC-GB	4039.8508.02
Frequency Extension 1.3 GHz to 3 GHz (separate ½ 19" unit)	R&S®ESMC-FE	4042.6002.02
10 MHz OCXO Reference	R&S®ESMC-OR[2]	4042.6902.02
Antenna Splitter	R&S®ESMC-AN[3]	4042.6702.02
Recommended extras		
Spectrum Display	R&S®EPZ513	4011.9500.04
19" Adapter	R&S®ZZA-98	0827.4533.00

[2] Slot in R&S®ESMC-FE option available, otherwise in R&S®ESMC base unit instead of R&S®ESMC-SU option.
[3] Only with R&S®ESMC-FE.

R&S®EM010
VXI HF Receiver



Efficient and versatile solution for radiomonitoring systems

Main features

- System compatibility on a variety of platforms
- Only one single C-size module for covering the total frequency range
- Suitable for all common monitoring methods
- Frequency and memory scan
- Excellent price/performance ratio

Brief description

The R&S®EM010 is a VXI receiver of advanced design based on DSPs and covers the frequency range 10 kHz to 30 MHz (300 Hz to 30 MHz with the R&S®EM010LF option). Excellent RF characteristics plus powerful signal processors create the prerequisites for optimum system solutions. Shielding covers ensure excellent electromagnetic compatibility even in critical environments.

Chapter Overview
Type Index
Main Menu

Characteristics

The R&S®EM010 VXI HF receiver is based on the long-standing experience of Rohde&Schwarz in the design of high-grade shortwave receivers. The VXI interface provides the prerequisites for powerful, compact and versatile system solutions. The use of modern signal processors allows filtering, demodulation as well as a variety of data formats to be tailored to the signal scenario.

The receiver is controlled via the VXI interface as standard and is configured for binary control based on the OSI Common Management Information Service Element (CMISE) Standard.

The baseband data can be output via VXI or SHARC link port.

The receiver operates in the following modes:

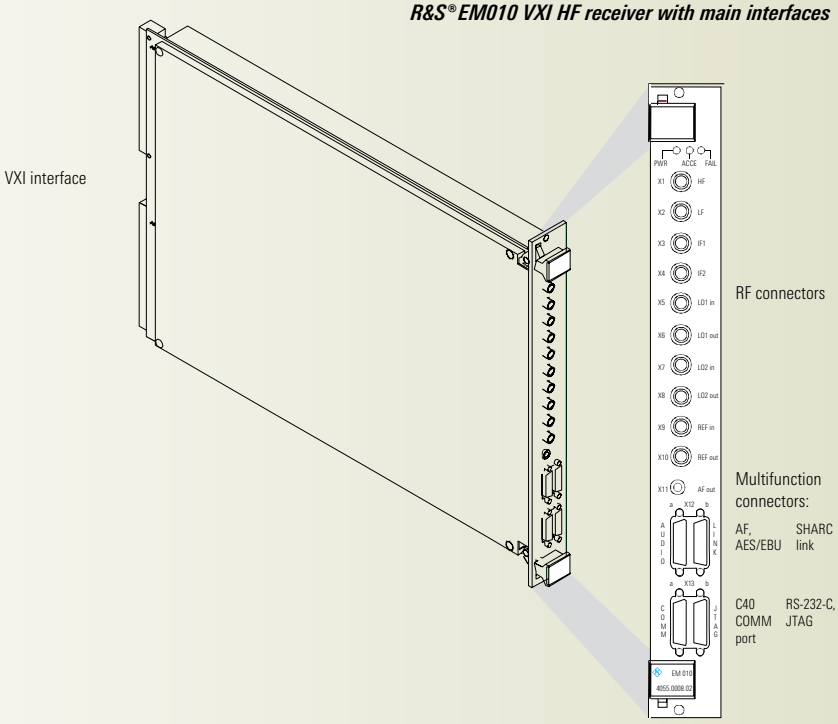
- Fixed frequency mode (FFM)
- Memory scan mode
- Frequency scan mode
- Replay (IF/AF)
- Selftest

Data output is possible in the following formats:

- Baseband signal (I and Q) in digital form, bandwidth 20 kHz
- IF 1: wideband, analog, 40.048 MHz ±2 MHz[1)]
- IF 2: analog, 455 kHz or 0 Hz to 40 kHz, selectable
- AES/EBU for recording and replay of IF data
- AF digital
- AF analog (600 Ω line and headphones)

[1)] If the IF 1 wideband output is activated, demodulation is not possible and the complete digital IF section is inactive.

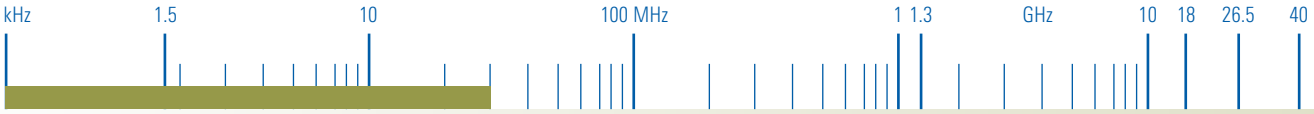
R&S®EM010 VXI HF receiver with main interfaces



Specifications

Frequency	
Frequency range	10 kHz to 30 MHz
	300 Hz to 60 kHz
	(via separate input with R&S®EM010LF option)
Frequency spacing	1 Hz
Frequency stability	
(internal reference)	≤1×10^{-7}
Phase noise	≤–110 dBc (1 Hz) (1 kHz offset)
External freq. locking	10 MHz
Tuning	
Tuning time	<10 ms (bandwidth 20 kHz)
	<25 ms (delay of AF at 3 kHz IF bandwidth)
Synthesizer setting time	≤5 ms
	≤1 ms, ≤100 kHz step
Antenna input	
Nominal impedance	50 Ω
VSWR	≤2 (peaks up to max. 3.0)
Overvoltage protection	≤50 V EMF (Z_{in} = 50 Ω)
Preselection	10 kHz to 1.5 MHz, bandpass filter
	1.5 MHz to 30 MHz, eight suboctave filters or 10 kHz to 30 MHz, broadband filter for wideband applications
Noise figure	
(preamplifier on)	≤10 dB, typ. 8 dB (1 MHz to 20 MHz)
	≤11 dB, typ. 9 dB (20 MHz to 30 MHz)
Linearity	
2nd order intercept point	
(preamplifier off)	≥75 dBm, typ. 90 dBm (with suboctave filters)
	≥50 dBm, typ. 70 dBm (with broadband filter)
3rd order intercept point	
(preamplifier off)	≥35 dBm, typ. 40 dBm (1.5 MHz to 30 MHz)
Crossmodulation	30 % AM-modulated signal of 6 dBm produces less than 10 % crossmodulation for an unmodulated signal of –60 dBm (frequency offset 100 kHz)
Blocking	a useful signal of –52 dBm is attenuated by less than 3 dB by an unmodulated signal of 23 dBm (frequency offset 59 kHz)
Dynamic range of A/D converter	16 bit resolution
Interference rejection	
Image frequency rejection	≥90 dB, typ. 100 dB
IF rejection	≥100 dB, typ. 110 dB
Oscillator reradiation at antenna input	≤–107 dBm, typ. –115 dBm
Spurious responses	≤–110 dBm

Gain control	AGC or MGC
RF control	
AGC range	≥30 dB, typ. 40 dB
AGC time constants	
Attack time	≤2 ms (20 dB step)
MGC range	≥30 dB in 1 dB steps
Overall control	
(RF and analog narrowband IF)	
AGC range	110 dB
AGC time constants	
Attack time	≤2 ms (60 dB step)
Hold time (incl. decay)	10/20/50/100/500 ms/1/5/9 s for 60 dB rolloff
MGC range	110 dB in 1 dB steps
Squelch	syllabic or level squelch selectable above 120 dB in 1 dB steps
Filters	
Analog IF filter	20 kHz (3 dB bandwidth)
Inband ripple	≤2 dB (bandwidth = 8 kHz)
Digital IF filter	
3 dB bandwidths	52 Hz to 20 kHz in 70 steps
Stopband attenuation	≥90 dB
Shape factor	
(60 dB:6 dB)	≤1.5 (with bandwidths above 300 Hz
Inband ripple	typ. 0.5 dB (without ripple of baseband filter)
Notch filter	max. 2, selectable in baseband, separately adjustable in 1 Hz steps
Stopband	28 steps in range 50 Hz to 500 Hz
Stopband attenuation	≥40 dB at bandwidth = 80 Hz
Demodulation	
Demodulation modes	AM, FM, USB, LSB, CW
	ISB (bandwidth 2.8 kHz)
Level measurement	
Measurement accuracy	±3 dB
Resolution	0.01 dB
Sensitivity	
AM (m = 50 %, f_{mod} = 1000 Hz, bandwidth 6 kHz)	–111 dBm for (S+N)/N = 10 dB
FM (5 kHz deviation, f_{mod} = 400 Hz, bandwidth 15 kHz)	–106 dBm for (S+N)/N = 25 dB
CW (bandwidth 313 Hz)	–126 dBm for (S+N)/N = 10 dB
SSB (bandwidth 2.75 kHz)	–120 dBm for (S+N)/N = 10 dB
BFO	±10 kHz, adjustable in 1 Hz steps
Scan functions	
Memory scan	1000 programmable channels
Frequency scan (sweep)	start frequency – stop frequency, step size



Power supply (DC)	+24 V/20 mA, +12 V/1500 mA
	–12 V/240 mA, +5 V/2500 mA
Total power consumption	typ. 34 W
Inputs	
RF	10 kHz to 30 MHz, 50 Ω
LF	300 Hz to 60 kHz, 600 Ω
1st LO	40.058 MHz to 70.048 MHz
2nd LO	40 MHz
Reference	10 MHz
Outputs	
IF0	
(software-configurable)	baseband digital I and Q,
	32 ksamples/s (VXI)
	AF digital, 16 ksamples/s (VXI)
IF1 wideband analog	center frequency 40.048 MHz,
	bandwidth ≥4 MHz
IF2 analog	
(software-configurable)	gain controlled, 455 kHz,
	bandwidth = 15 kHz or frequency
	0 Hz to 40 kHz, selectable
1st LO	40.058 MHz to 70.048 MHz
2nd LO	40 MHz
Reference	10 MHz
AF line	600 Ω balanced
	(AMPLIMITE .050 series 26-pin)
AF phone	3.5 mm jack, 8 Ω
Control data interfaces	VXI (96-pin VG connector)
	AUDIO/COMM//LINK/JTAG
	(each 26-pin AMPLIMITE .050 series)

General data	
Permissible	
temperature range	–10 °C to +50 °C
Storage	
temperature range	–40 °C to +75 °C
Dimensions (W × H × L)	302 mm × 233 mm × 343 mm
	(11.89 in × 9.17 in × 13.50 in)
With front panel	302 mm × 262 mm × 343 mm
	(11.89 in × 10.31 in × 13.50 in)
Weight	1.75 kg (3.86 lb)

Ordering information

VXI HF Receiver	R&S®EM010	4055.0008.03
Option		
LF Receiver	R&S®EM010LF	4055.0014.02

R&S®EM050 VXI VHF/UHF Digital Wideband Receiver

Top performance for VHF/UHF single- and multichannel monitoring systems

Main features

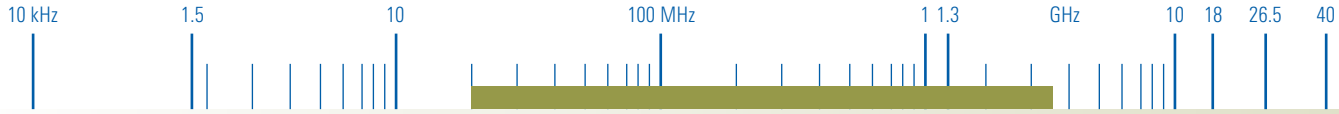
- System compatibility on a variety of platforms
- Preselection
- Wideband operation
- I/Q data up to 10 MHz bandwidth
- IF analog output up to 50 MHz bandwidth
- Suitable for all common monitoring methods
- Frequency and memory scan
- Excellent price/performance ratio

Brief description

The R&S®EM050 is a VXI receiver of advanced design based on DSPs and ASICs of state-of-the-art technology. It covers the frequency range from 20 MHz to 3600 MHz.

Excellent RF characteristics and dynamic performance paired with powerful signal processors are the basis for optimum system solutions.

Chapter Overview
Type Index
Main Menu



Characteristics

The R&S®EM050 VXI VHF/UHF digital wideband receiver is based on the long-standing experience Rohde&Schwarz has gained in designing highly sophisticated VHF/UHF receivers. The VXI interface provides the basis for powerful, compact and versatile system solutions.

The receiver is controlled via the VXI interface as a standard for binary control based on the OSI Common Management Information Service Element (CMISE) Standard. The R&S®EM050 features all the interfaces of the R&S®AMMOS family and is thus prepared to meet any future demands in the field of receiver and analyzer technology for the purpose of frequency spectrum analysis.

The receiver operates in the following modes:

- Fixed frequency mode (FFM)
- Memory scan
- Frequency scan
- DIGI-Scan (option)
- Replay (IF)
- Wideband
- Test

Data output is possible in the following formats:

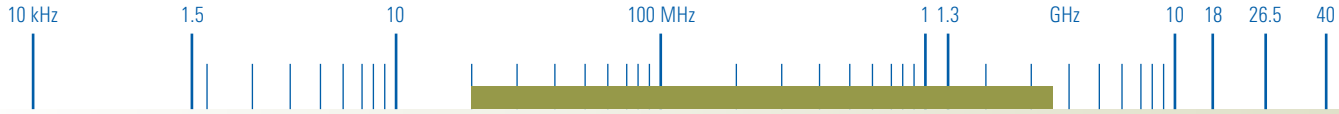
- Baseband signal (I and Q) in digital form at
  - VXI
  - LAN (max. bandwidth = 500 kHz)
  - FPDP (max. bandwidth = 10 MHz)
- IF2[1)] wideband analog, f = 405.4 MHz, bandwidth ≥50 MHz or IF3 analog, f = 21.4 MHz, bandwidth = 10 MHz
- AES3 for recording AF data
- AF digital
- AF analog (600 Ω line and headphones)

[1)] If the IF2 wideband output is activated, demodulation is not possible and the complete digital IF section is inactive.

Specifications

Frequency	
Frequency range	20 MHz to 3600 MHz
Frequency accuracy	≤±1 × 10^{-7}
Frequency resolution	1 Hz
Oscillator phase noise	≤–120 dBc (1 Hz) (10 kHz offset)
Tuning	
Tuning time	typ. 5 ms (15 kHz filter)
Synthesizer setting time	typ. 1 m
Antenna input	
Nominal impedance	50 Ω
VSWR	<3
Input selection	
0 Hz to 215 MHz	bypass for wideband application
20 MHz to 1500 MHz	tracking preselection
1500 MHz to 2300 MHz	highpass/lowpass
2300 MHz to 3600 MHz	highpass/lowpass
Linearity	
2nd order intercept point	
(with preselection)	typ. 55 dBm
3rd order intercept point	
20 MHz to 300 MHz	≥17 dBm
300 MHz to 3600 MHz	≥20 dBm
Interference rejection	
Image freq. rejection	≥90 dB
IF rejection	≥90 dB
Oscillator reradiation	
at antenna input	≤–107 dBm
Spurious responses	≤–110 dBm
Noise figure	
f < 2 GHz	≤12 dB
f = 2 GHz to 3 GHz	≤15 dB
Sensitivity	measurement with telephone filter in line with ITU-T, low noise mode
AM, bandwidth = 6 kHz,	
SINAD = 10 dB, f_{mod} = 1 kHz,	
m = 0.5	≤1 µV, f ≤ 2000 MHz
	≤1.4 µV (≤–104 dBm), f = 2000 MHz to 3000 MHz
	≤1.8 µV (≤–102 dBm), f > 3000 MHz
FM, bandwidth = 15 kHz,	
SINAD = 20 dB, f_{mod} = 1 kHz,	
deviation = 5 kHz	≤1 µV, (≤–107 dBm), f ≤ 2000 MHz
	≤1.4 µV, (≤–104 dBm), f = 2000 MHz to 3000 MHz
	≤1.8 µV, (≤–102 dBm), f = 2000 MHz to 3000 MHz
SSB, bandwidth = 2.4 kHz,	
SINAD = 10 dB	≤0.5 µV (≤–113 dBm)
CW, bandwidth = 300 Hz,	
SINAD = 10 dB	≤0.22 µV (≤–120 dBm)

ADC resolution	14 bit
Filter	
Roofing filter	120 kHz, 800 kHz, 3 MHz, 10 MHz
IF filter	digital, 150 Hz to 10 MHz (21 filters)
Demodulation	AM, FM, PM, PULSE, CW, LSB, USB, ISB, I/Q, TV
Inputs/outputs	
LO1 output	f = 4649.4 MHz to 8229.4 MHz
IF output, analog	
(405.4 MHz output	
switched off)	f = 21.4 MHz (bandwidth = 10 MHz)
IF output, analog wideband	
(21.4 MHz output	
switched off)	f = 405.4 MHz (bandwidth ≥50 MHz)
I/Q output, digital	VXI
	LAN (max. bandwidth = 500 kHz)
	FPDP (max. bandwidth = 10 MHz)
Video output, digital	VXI, LAN, FPDP
Video output, analog	DC to bandwidth = ½ IF bandwidth
IF output, analog GC	
(alternatively to video)	0 Hz to 10.7 MHz
	(max. bandwidth = 2 MHz)
Audio output, digital	VXI, LAN
Audio output, analog	
(max. bandwidth	
= 12 kHz)	line, phone, 600 Ω symmetrical
Ext. reference input	f = 1 MHz to 20 MHz
Int. reference output	f = 10 MHz (or f = ext. reference)
General data	
Operating	
temperature range	0 °C to +50 °C
Storage	
temperature range	–40 °C to +70 °C
Power supply (DC)	+24 V, 1200 mA
	+12 V, 1150 (1500) mA
	–12 V, 220 mA
	+5 V, 6900 mA
Power consumption	80 W
MTBF	≥50 000 h (in line with IEC 1709)
Dimensions (W × H × D)	shielded C-size module double wide
	61 mm × 233 mm × 355 mm
	(2.40 in × 9.17 in × 13.98 in)
	height of front panel: 262 mm (10.31 in)
Weight	4.8 kg (10.58 lb)



Ordering information

VXI VHF/UHF Digital Wideband Receiver	R&S®EM050	4060.3501.02
Options		
Panorama Scan (RF Spectrum)	R&S®EM050PS	4060.4620.02
IF Panorama (IF Spectrum)	R&S®EM050SU	4060.4614.02
ITU Measurement Software[1)]	R&S®EM050IM	4060.4608.02
SEL CALL Analysis	R&S®EM050SL	4060.4466.02

[1)] The R&S®EM050SU IF panorama is included in the R&S®EM050IM option.