Test Receiver ESVB

Coverage measurements in digital audio and video broadcast networks

- Precision field-strength measurements using test antennas
- Bandwidths suitable for DAB and DVB-T in a single unit
- Frequency range
  20 MHz to 1000 MHz, with option up to 2050 MHz
- RMS and average detector for all test bandwidths
- Manual operation or control by internal processor or external computer
- RFI measurements in line with commercial EMI standards such as CISPR, EN, ETS, FCC, VCCI and VDE
- Automatic overload detection
- Powering from AC supply or internal/external battery

For planning and operation of sound and TV broadcast networks it is essential to know the propagation conditions in the area to be covered. Test Receiver ESVB features in a single unit IF bandwidths and signal weighting facilities both for digital video (DVB-T) and digital audio broadcasting (DAB). Due to these factors and the high measurement rate, ESVB is ideal for use in mobile and stationary coverage measurements.

Test Receiver ESVB is also highly suitable for measuring interference field strengths to various standards.

For measurements in digital mobile radio networks (GSM/PCN) the ESVB can optionally be equipped with a frequency-range extension up to 2050 MHz and a narrowband I/Q test demodulator.

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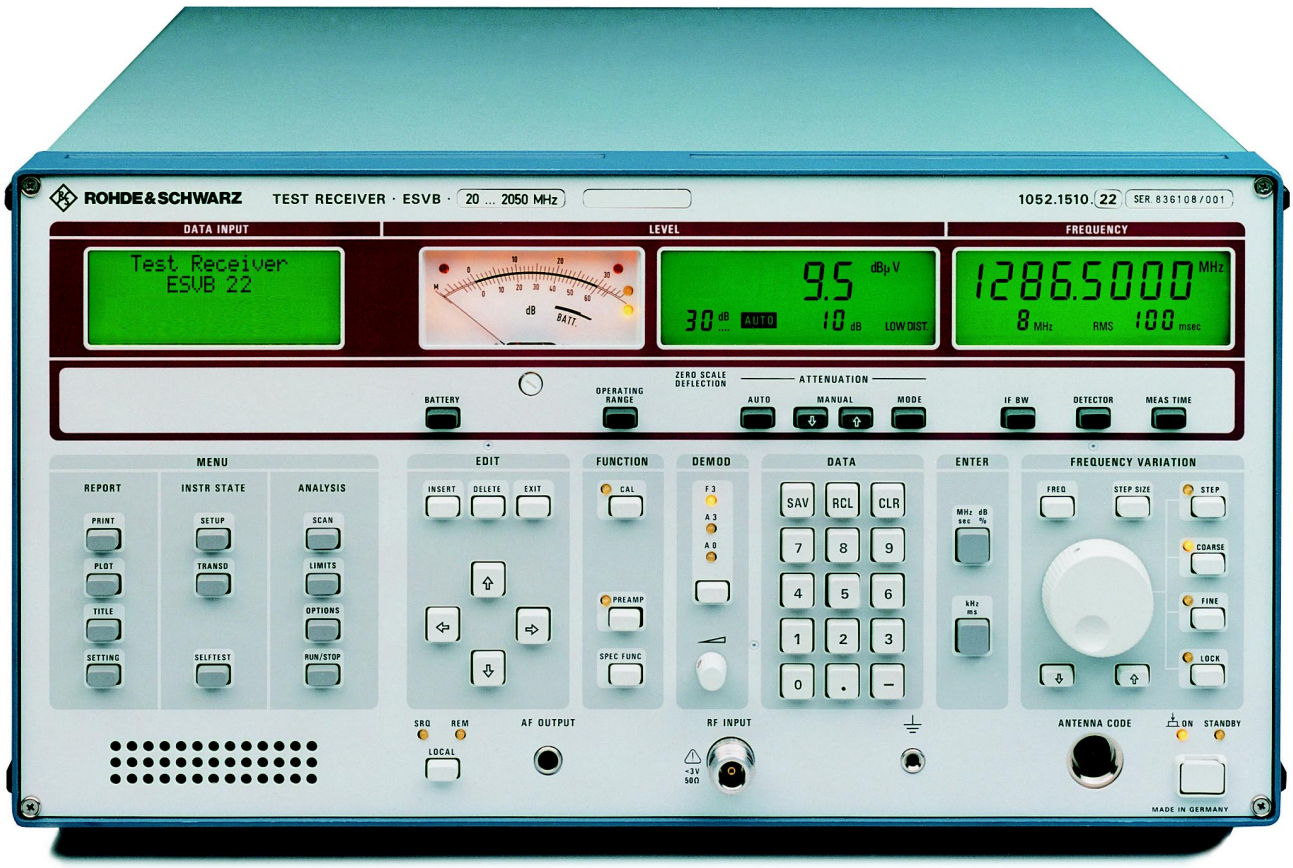


Characteristics

The ESVB combines three types of instruments in one:

- a **system-compatible test receiver** for DAB and DVB-T field-strength measurements
- a portable, manually tunable and **battery-powered receiver**
- an **automatic test receiver that automatically performs EMI measurements** and reports the results

The ESVB is equipped as standard with a steep-sided 1.5 MHz channel filter (SAW type) for use in DAB networks. For DVB-T applications it is fitted with an 8 MHz IF filter (SAW) of high selectivity for adjacent-channel operation. An I/Q test demodulator with a bandwidth of 0.75 MHz (DAB) and 4 MHz (DVB-T) is also provided as standard. The frequency range can be extended up to 2050 MHz with option UHF frontend ESN-B1.

Features

Special features of the ESVB:

Advanced circuit design

– High measurement accuracy, error typ. 0.5 dB
– Fast synthesizer, frequency resolution 100 Hz, sweep mode for fast frequency scanning
– Wide dynamic range, noise figure typ. 7 dB with preamplifier, third-order intercept point 20 dBm (without preamplifier)
– Average, RMS, peak and quasi-peak detectors operating in parallel
– Large display range, 60 dB even for quasi-peak and average indication; 70 dB for DAB/DVB-T signal measurements without changing input attenuation

Powerful processor system

– Macros for automatic and semi-automatic test runs
– Automatic level calibration
– Automatic consideration of frequency-dependent transducer factors
– Full programmability of all internal functions via IEC/IEEE bus
– High-speed measurement with external triggering; output of up to 5000 measured values/s via IEC/IEEE bus, up to 400 measured values/s including frequency changes within defined frequency bands
– Nonvolatile storage of ten complete device settings and 22 limit lines and transducer factors with up to 50 values each

Optimal result display and printout

- Measurement of voltage, field strength, current and spectral pulse density with full indication of units
- Indication of result on analog meter and digital display (0.1 dB resolution)
- Output of results as lists and diagrams on printer or plotter including limit lines and user-defined labelling

Applications

Field-strength measurements in digital audio and video broadcast networks

With bandwidths of 1.5 MHz and 8 MHz matching the DAB and DVB-T channels, the ESVB is able to cover the entire COFDM spectrum. The power of the total spectrum at the receiver input is a measure of DAB/DVB-T coverage. Due to the addition of very many carriers with pseudo-random phases, the DAB/DVB-T signal behaves like white noise within the transmission bandwidth, so that only the RMS measurement method is suitable for determining the power. A thermal power meter is inadequate for mobile measurements because of the speed involved. Therefore, the ESVB features an RMS detector allowing the power at the receiver input to be determined very quickly and over a wide range.

For further evaluation of the signals received, the ESVB is fitted with a broadband I/Q demodulator with bandwidths of ±750 kHz and ±4 MHz (depending on the selected IF filter 1.5 or 8 MHz). Option ESN-B1 offers an additional narrowband I/Q demodulator for the IF bandwidths of 10, 120 and 300 kHz, eg for measurements in digital mobile radio networks (GSM/PCN). This most general type of demodulation allows further processing of any kind of modulated signals.

Measurement of RFI field strength and RFI power

In addition to field-strength measurements in broadcast networks, the ESVB offers a whole range of facilities for detecting and identifying EMI signals. For manual operation it features the conventional way of operating a test receiver with tuning knob, parallel readout of results on LC display and pointer meter as well as built-in loudspeaker.

Macros for semi-automatic test runs match the ESVB to the test setup, device under test and test specification. Based on such macros, the ESVB is able to perform the following routines:

- Fast prescan measurement using peak or average detector
- Determination of critical frequencies by means of limit lines with data reduction to shorten measurement time
- Final measurement at critical frequencies using average and/or quasi-peak detector
- Output of results on plotter or printer

Documentation

The results of a frequency scan can be output on a printer with parallel interface or on a plotter with IEC/IEEE-bus interface, a wide range of hardcopy equipment being supported.

Any relevant information can be added to the test report, either by entering it via a line editor or via an MF2 keyboard. Parameters known to the ESVB, such as date, time and receiver settings, are automatically added.

Remote control

The IEC/IEEE-bus interface complies with the IEEE 488 standard, part 2. The results are output with a resolution of 0.01 dB.

With external triggering of the ESVB, up to 5000 measured values per second can be output via the IEC/IEEE bus.

Interfaces

For further signal evaluation and for driving or feeding additional devices, the ESVB features the following interfaces:

- Coding and supply socket (ANTENNA CODE) for active antennas and for coding of transducer factor
- 74.7 MHz IF output for connecting a spectrum analyzer
- 10.7 MHz IF output for evaluating the IF signal eg with an oscilloscope
- Controlled inphase and quadrature signal output for evaluating signals of any modulation (for IF bandwidths 1.5 and 8 MHz as standard; for IF bandwidths 10 kHz, 120 kHz and 300 kHz with option ESN-B1)
- Envelope detector output (VIDEO OUTPUT) for evaluating the rectified IF signal eg with an oscilloscope
- USER INTERFACE with
  - 6 TTL ports for controlling external devices
  - input for external trigger signals
  - outputs for analog display voltage with and without meter simulation
  - RS-232 interface for firmware updates by reprogramming the built-in flash EPROMs by means of an IBM-compatible PC
- Parallel interface (PRINTER INTERFACE) for connecting a printer
- IEC/IEEE-bus interface
- Connector for MF2-compatible keyboard for text entry
- Output for internal oven-controlled crystal reference frequency (10 MHz)
- Battery input (11 to 33 V) for independent powering, eg in a vehicle

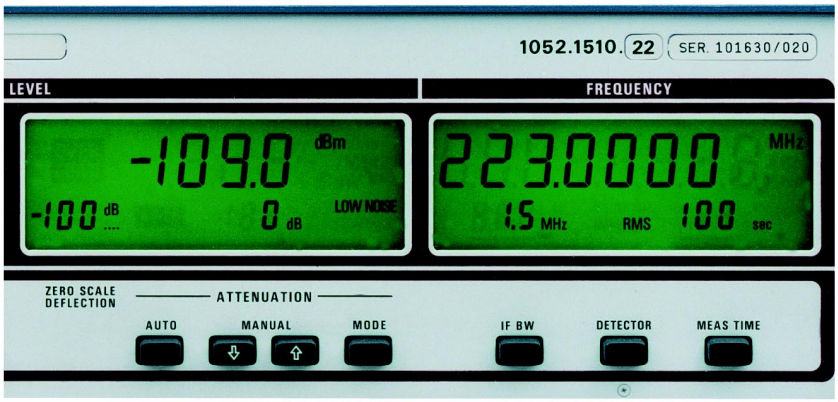
Technical features

Test Receiver ESVB for digital audio and video broadcast networks is a triple-conversion heterodyne receiver covering the frequency range from 20 MHz to 2050 MHz. Its main features and facilities include:

- **RF attenuator**, switchable in 10 dB steps in the range 0 dB to 120 dB
- One preselector with one fixed tuned and five **tracking preselection filters**, option ESN-B1 with four additional filters with fixed tuning
- **Preamplifier** with wide dynamic range, can be switched between preselector and 1st mixer
- **Crystal-stabilized synthesizer (OXCO)** as 1st local oscillator, variable in 100 Hz steps, sweep mode for fast frequency scanning
- **High-level mixer** ensuring high isolation of the 1st LO for converting the input frequency to the first IF (1354.7 MHz or 394.7 MHz)
- **High-level mixer** for conversion to the second (74.7 MHz) and third (10.7 MHz) IF
- **IF filters** (10 kHz, 120 kHz, 300 kHz) with **optimized group delay** in the third IF stage; additional steep-sided 1.5 MHz and 8 MHz IF filters for DAB/DVB-T applications
- **I/Q demodulator** (bandwidth per demodulated channel: ½ IF filter bandwidth; for IF bandwidths of 10, 120 and 300 kHz only in conjunction with option ESN-B1)
- Highly linear **envelope detector** with more than 70 dB dynamic range
- **Peak indication** (PK/MHz) with IF bandwidth correction factors for measurement of broadband interference automatically taken into account; not for IF bandwidths of 1.5 MHz and 8 MHz
- Monitoring of measurement by **automatic overload detection** in the relevant ESVB stages
- **Logarithmic amplifier** with more than 70 dB dynamic range
- **12-bit A/D converter** with short conversion time
- **Measurement time selectable** between 1 ms and 100 s
- **Digital level indication** on LC display and **analog level indication** on moving-coil meter taking into account transducer factors and their units
- **Automatic calibration** with the aid of a high-precision built-in generator at the push of a button
- **Demodulator circuits** for FM, AM and A0; built-in loudspeaker and headphones connector
- **Automatic monitoring** of all synthesizer loops and supply voltages during operation
- **Detection of faulty modules** by built-in selftest facilities

Design

The modular ESVB features excellent RF shielding and is service-friendly. A very quiet, temperature-controlled fan minimizes heat-up of the ESVB. Comprehensive selftest functions allow faulty modules to be easily identified and replaced independently of the other modules without the use of additional test aids.



ESVB display

Specifications

Frequency range	20 to 1000 MHz
with option	20 to 2050 MHz
Frequency setting	
with tuning knob	in 100 Hz, 100 kHz steps or in any selectable step size
numerical	via keyboard
in steps	of any selectable size
automatic scan	for RF analysis
Frequency indication	8-digit LCD
Resolution	100 Hz
Frequency error	
after 30 min warmup	$<1 \times 10^{-7}$
Temperature effect	$<1 \times 10^{-9}$/°C
Aging	$<1 \times 10^{-9}$/day

RF input	Z_{in} = 50 Ω, N female	
VSWR		
with RF attenuation of	0 dB	≥10 dB
20 MHz to 1000 MHz	<2	<1.2
1000 MH z to 2050 MHz	<2	<1.35

Preamplifier	between input filter and 1st mixer
Gain	10 dB

Maximum input level		
with RF attenuation of	0 dB	≥10 dB
DC voltage	7 V	7 V
Sinewave AC voltage	130 dBµV	137 dBµV (= 1 W)
Spectral pulse density	97 dBµV/MHz (100 V x 0.5 ns)	–
Max. pulse voltage	–	150 V
Max. pulse energy (10 µs)	–	1 mWs

Oscillator reradiation at RF input		
(0 dB RF attenuation)		
Preamplifier:	off	on
20 MHz to 1000 MHz	<20 dBµV	<10 dBµV
1000 MHz to 1900 MHz	<50 dBµV	<40 dBµV
1900 MHz to 2050 MHz	<60 dBµV	<50 dBµV

Interference rejection, nonlinearities	20 to 1000 MHz	1000 to 1900 MHz	1900 to 2050 MHz
Image-frequency rejection			
1st IF	>90, typ. 100 dB	>80, typ. 100 dB	>70, typ. 90 dB
2nd IF	>90, typ. 100 dB	>80, typ. 100 dB	>80, typ. 100 dB
IF rejection	>90, typ. 100 dB	>90, typ. 100 dB	>80, typ. 100 dB
Intercept point d3 (|f1 -f2| ≥10 MHz)			
Preamplifier:	off		on
$P_{f1, f2}$ =	–10 dBm		–20 dBm
20 MHz to 50 MHz	typ. +15 dBm		typ. +5 dBm
50 MHz to 1000 MHz	>15 dBm, typ. +20 dBm		>5 dBm, typ. +10 dBm
1000 MHz to 2050 MHz	>13 dBm, typ. +18 dBm		>3 dBm, typ. +8 dBm
Intercept point k2			
20 MHz to 1000 MHz	>35 dBm		>25 dBm
1000 MHz to 2050 MHz	>50 dBm		>40 dBm

Preselectors	
20 MHz to 1000 MHz	
1 fixed-tuned filter	20 MHz to <51.3 MHz
5 tracking filters	51.3 MHz to <125.3 MHz
	125.3 MHz to <273.3 MHz
	273.3 MHz to <495.3 MHz
	495.3 MHz to <717.3 MHz
	717.3 MHz to 1000 MHz
1000 MHz to 2050 MHz	
4 fixed-tuned filters	1000 MHz to <1250 MHz
	1250 MHz to <1522 MHz
	1522 MHz to <1795 MHz
	1795 MHz to 2050 MHz

RF shielding	
Voltage indication at field strength of 10 V/m with 0 dB RF attenuation ($f \neq f_{in}$)	<0 dBµV
Additional error in quasi-peak indication range (10 V/m)	<1 dB

Intermediate frequencies	
1st IF 20 MHz to 1000 MHz	1354.7 MHz
1000 MHz to 2050 MHz	394.7 MHz
2nd IF	74.7 MHz
3rd IF	10.7 MHz

IF bandwidths			
Nominal bandwidth	–3 dB ±20%	–6 dB ±10%	Shape factor BW_{6dB} : BW_{60dB}
10 kHz	7 kHz	9.5 kHz	1:4
120 kHz	90 kHz	120 kHz	1:5
300 kHz	300 kHz	400 kHz	1:6
DAB channel filter (1.5 MHz)			
–6 dB	1.5 MHz ±10%		
–40 dB	1.9 MHz		
DVB channel filter (8 MHz)			
–3 dB	7.9 MHz ±10%		
–40 dB	9.4 MHz		

Noise indication		
Preamplifier:	off	on
20 MHz to 1000 MHz		
Average indication (AV)		
BW = 10 kHz	<–10 dBµV, typ. –15 dBµV	<–14 dBµV typ. –21 dBµV
BW = 120 kHz	typ. –5 dBµV	typ. –9 dBµV
BW = 300 kHz	typ. 0 dBµV	typ. –4 dBµV
BW = 1.5 MHz	typ. 12 dBµV	typ. 5 dBµV
BW = 8 MHz	typ. 18 dBµV	typ. 11 dBµV
RMS indication (RMS)	1 dB above the values shown for average indication	
1000 MHz to 2050 MHz		
Average indication (AV)		
BW = 10 kHz	<–10 dBµV, typ. –15 dBµV	<–16 dBµV, typ. –21 dBµV
BW = 120 kHz	typ. –3 dBµV	typ. –9 dBµV
BW = 300 kHz	typ. 2 dBµV	typ. –4 dBµV
BW = 1.5 MHz	typ. 12 dBµV	typ. 5 dBµV
BW = 8 MHz	typ. 18 dBµV	typ. 11 dBµV
RMS indication (RMS)	1 dB above values shown for average indication	

Voltage measurement range		
Lower limit:		
Additional error (inherent noise)	<1 dB	
Preamplifier:	off	on
20 MHz to 1000 MHz		
Average indication (AV)		
BW = 10 kHz	<–6 dBµV, typ. –12 dBµV	<–10 dBµV, typ. –16 dBµV
BW = 120 kHz	typ. –1 dBµV	typ. –5 dBµV
BW = 300 kHz	typ. 4 dBµV	typ. 0 dBµV
BW = 1.5 MHz	typ. 16 dBµV	typ. 9 dBµV
BW = 8 MHz	typ. 22 dBµV	typ. 15 dBµV
Peak indication (PK)		
BW = 10 kHz	typ. 14 dBµV	typ. 10 dBµV
BW = 120 kHz	typ. 25 dBµV	typ. 21 dBµV
BW = 300 kHz	typ. 30 dBµV	typ. 26 dBµV
RMS indication (RMS)	3 dB above values shown for average indication	
Quasi-peak indication (QP), CISPR band C/D		
(30 MHz to 1000 MHz)	<10 dBµV, typ. 4 dBµV	<4 dBµV, typ. 0 dBµV
1000 MHz to 2050 MHz	2 dB above values for 20 to 1000 MHz	same values as for 20 to 1000 MHz
Upper limit:		
AV, PK, QP, RMS as above	137 dBµV (RF attenuation ≥10 dB)	

Inherent spurious responses	<0 dBµV (equivalent input voltage)

Level indication

Digital display in dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBpW	3½ digits
Resolution	0.1 dB
Analog display	on moving-coil meter in operating range of IF detector with additional digital display of lower range limit
Operating ranges	30 dB (for IF bandwidth ≤300 kHz), 60 dB
Display modes	average value (AV), RMS value (RMS), peak value (PK) (not for 1.5 and 8 MHz IF bandwidth), spectral density measurement (PK/MHz) (not for 1.5 and 8 MHz IF bandwidth), quasi-peak (QP) (for 120 kHz IF bandwidth)
Measurement times	1 ms to 100 s
Steps	1/2/5

Measurement error

(average value for S/N >16 dB, RMS value for S/N >20 dB)

IF bandwidth ≤1.5 MHz	
20 MHz to 1000 MHz	
0 °C to +55°C	≤1 dB (digital display)
–10 °C to 0°C	≤1.5 dB (digital display)
–10 °C to +55°C	typ. <2 dB (analog display)
1000 MHz to 2050 MHz	≤2 dB (digital display), typ. <3 dB (analog display)
IF bandwidth 8 MHz	
20 MHz to 2050 MHz	≤2 dB (digital display)
Level calibration	sinewave and harmonics generator

Demodulation modes	A0 (zero beat) A3 (for A3E emissions) F3 (for F3E emissions)
Date, time of day	internal clock, permanently operated from internal battery
Remote control	interface to IEC 625-2/IEEE 488
Connector	24-contact Amphenol
Interface functions	AH1, L4, SH1, T6, SR1, PP1, RL1, DC1, DT1, C1, C2, C3, C11
Plotter connection	via IEC/IEEE-bus interface
Plotter language	HP-GL
Printer connection	parallel interface (15-contact Cannon connector)

Front-panel outputs

Supply and coding connector for antennas, etc	12-contact Tuchel-type connector
AF output	Z_{out}=10 Ω, jack JK34
EMF	adjustable up to 1.5 V

Rear-panel outputs

IF 74.7 MHz	Z_{out}=50 Ω, BNC connector
Gain ref. to RF input (RF attenuation 0 dB)	8 dB without preamplifier, 18 dB with preamplifier
Bandwidth (-3 dB)	>8 MHz
IF 10.7 MHz	Z_{out}=50 Ω, BNC connector
EMF in range of analog level display for unmodulated sinewave signal, operating range 30 dB	1 mV to 30 mV
60 dB	1 mV to 1 V
Bandwidth	IF bandwidth, max. 1.5 MHz
Envelope demodulator output	BNC connector
EMF in range of analog level display, operating range 30 dB	4 to 126 mV
60 dB	4 mV to 4 V
Inphase and quadrature signal demodulator outputs with option ESN-B1	
(IF bandwidth ≤300 kHz)	1 BNC connector each
Input impedance	50 Ω, loadable with >200 Ω
EMF (peak value, regulated)	3 V
Bandwidth	0.5 x IF bandwidth
Static phase error between I and Q signal for S/N >40 dB, output frequency	
10 Hz to 100 kHz	typ. <1°
>100 kHz	typ. <3°
for signals in line with GSM Rec. 5.04, BW_{IF}=300 kHz	
RMS value	typ. <3°
Peak value	typ. <7°
Inphase and quadrature signal demodulator outputs (IF bandwidth 1.5 and 8 MHz)	1 BNC connector each
Output impedance	50 Ω
Level (controlled)	0 dBm
Coupling	DC
Offset	typ. 1 mV
Bandwidth	4 MHz
Amplitude error between I and Q signal (0 to 4 MHz)	typ. 0.5 dB
Static phase error between I and Q signal (0 to 4 MHz)	typ. 1°
Reference output	BNC connector
Frequency	10 MHz
EMF	>1 V
Frequency drift	see frequency error
User port	25-contact Cannon connector
including	6 control lines for an external device, analog display voltage with and without simulation of meter response, input for external triggering, RS-232-C interface for firmware update
Keyboard connector	5-contact DIN connector

Rear-panel input

External battery	3-contact connector

General data

Rated temperature range	–10 to +55°C (no condensation allowed)
Storage temperature range	–25 to +70°C
Mechanical load	shock-tested to MIL-STD-810D (shock spectrum 40 g), vibration-tested to MIL-T-28800D, class 5; in line with IEC Publ. 68-2-6
RFI suppression	in line with VDE0876, part 1a, Reg. 527/1979 and MIL-STD-461B (CE03 and RE02)
Power supply	
AC supply	100/120/240 V ±10%, 230 V +6/–10%, 47 to 420 Hz (70 VA), safety class I to VDE0411 (IEC348)
Battery	
Internal	12 V, 10 Ah
Operating time	approx. 2 h
External	11 to 33 V (switch-on voltage >12 V), 2.1 A at 24 V, 3.9 A at 12 V
Dimensions (W x H x D)	435 mm x 236 mm x 460 mm
Weight	26 kg with /23 kg without internal battery

Ordering information

Order designation

Test Receiver (20 MHz to 1000 MHz) for DAB and DBV-T applications	ESVB	1052.1510.22

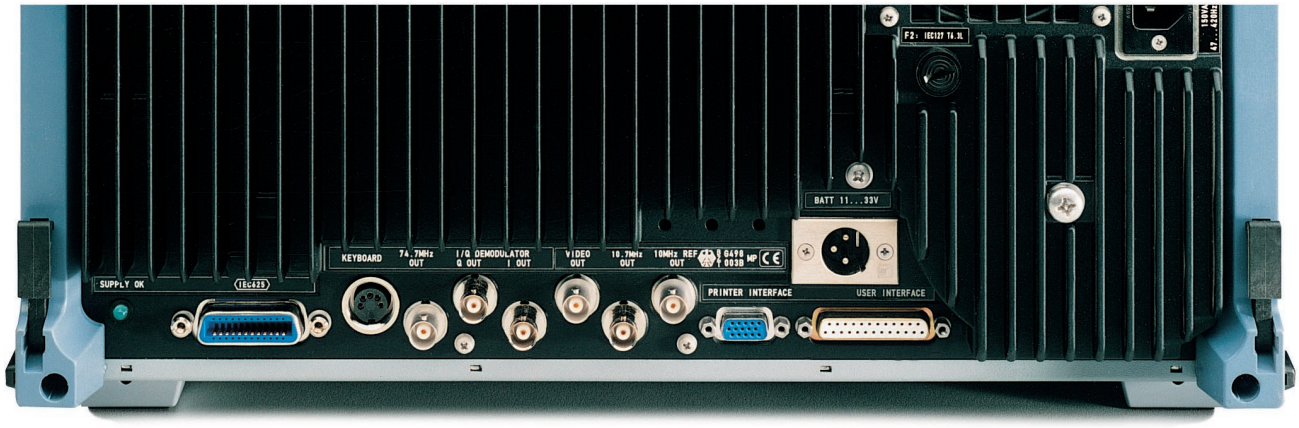
Accessories supplied power cable, connector for external battery, operating manual

Options

UHF Frontend 1000 MHz to 2050 MHz (with I/Q demodulator for IF bandwidths 10, 120 and 300 kHz)	ESN-B1	1052.0508.02

Recommended extras

Broadband Dipole 20 to 80 MHz	HUF-Z1	0358.0512.52
Log-Periodic Broadband Antenna 80 to 1300 MHz	HL023A1	0577.8017.02
Tripod	HFU-Z	0100.1114.02
Mast (for tripod)	HFU-Z	0100.1120.02
Biconical Antenna 20 to 300 MHz	HK116	4000.7752.02
Log-Periodic Antenna		
200 to 1300 MHz	HL223	4001.5501.02
400 to 3000 MHz	HL040	4035.8755.02
Conical Log Spiral Antenna 200 to 1000 MHz	HUF-Z4	0837.2210.52
Wooden Tripod	HZ-1	0837.2310.02
RF Connecting Cable (7 m)	HFU2-Z5	0252.0055.56
Preamplifier 10 dB, 20 to 1000 MHz	ESV-Z3	0397.7014.52
6 V Lead Storage Battery 10 Ah (2 required)		0338.4012.00
Keyboard German	PSA-Z1	1009.5001.31
English	PSA-Z1	1009.5001.32
Headphones		0110.2959.00
Service Manual		1026.5793.24
Service Kit	EZ-8	0816.1067.02
19" Rack Adapter (with front handles)	ZZA-95	0396.4911.00
Set of Side Handles		0396.9588.00
Transit Case	ZZK-954	1013.9395.00
Trolley	ZZK-0011	1014.0510.00
Printer Cable	EZ-11	0816.1767.02
IEC-Bus Cable, 1 m	PCK	0292.2013.10
2 m	PCK	0292.2013.20



Fax Reply (Test Receiver ESVB)

❑ **Please send me an offer**

❑ **I would like a demo**

❑ **Please call me**

❑ **I would like to receive your free-of-charge CD-ROM catalog**
(including Test&Measurement Products +
Sound and TV Broadcasting)

Others: _____

_____

_____

Name: _____

Company/Department: _____

Position: _____

Address: _____

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