

EMI Test Receivers ESVS

20 MHz to 1000 MHz

- Comply with CISPR 16-1, VDE0876 and ANSIC63.2
- Level measurement range -14 dB μ V to +137 dB μ V
- For measurements to European Standards 55011 to 55022, ETS, FCC, VCCI and VDE0871 to 0879
- Frequency resolution 100 Hz
- Manual operation or automatic test
- Field-strength measurements using test antennas
- Battery (int./ext.) or AC supply



Functions

The EMI Test Receivers ESVS 10 and 30 are triple-conversion heterodyne receivers covering the frequency range from 20 MHz to 1000 MHz. They can be manually operated, featuring high frequency resolution and accurate level indication, equally so in average and quasi-peak detection.

Thanks to the built-in intelligence of EMI Test Receivers ESVS, the time required for such measurements is reduced considerably. Being specialists for EMI measurements to CISPR, CENELEC, ETSI, FCC, VCCI and VDE standards, these test receivers furnish results at a speed and accuracy not possible previously.

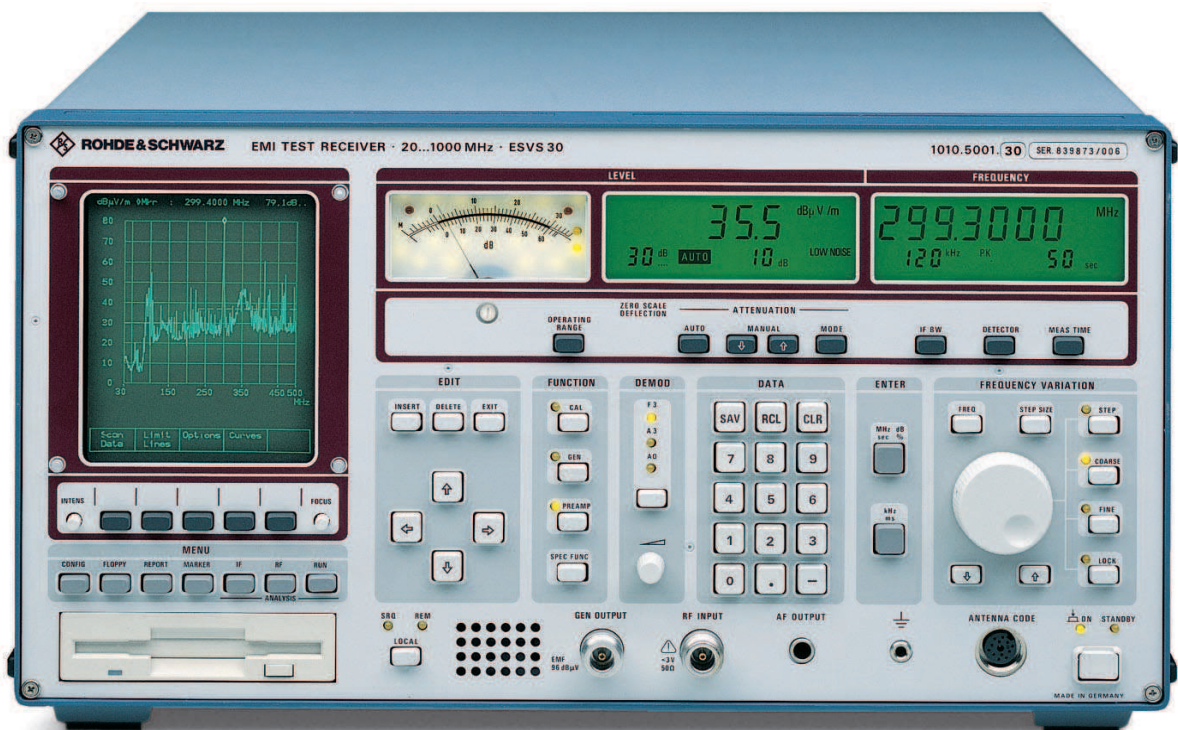
Their real strength, however, is the semi-automatic measurement of RFI power and field strength. After a fast prescan measurement, they compare the results with the permissible limits, display the interference spectrum on the screen and furnish a comprehensive test report with all the necessary information.

Both receiver models combine three classes of instruments in one:

- a compact, manually tunable and battery-operated test receiver
- an automatic test receiver which automatically performs measurements and reports the results
- a system-compatible test receiver

Features

- RF attenuator switchable in 10-dB steps in range 0 dB to 120 dB; optional pulse-resistant 10-dB attenuator (ESVS-B1)
- One preselection filter with fixed tuning and five tracking preselection filters
- Logarithmic amplifier with more than 70 dB dynamic range
- Preamplifier with wide dynamic range, can be switched between preselection filter and 1st mixer
- Crystal-controlled synthesizer as 1st LO, variable in 100-Hz steps, sweep mode for fast frequency scans
- High-level mixer for converting input frequency into first IF (1354.7 MHz)
- High-level mixers for conversion into second (74.7 MHz) and third (10.7 MHz) IF
- Peak, average and quasi-peak detectors operating in parallel
- Peak indication with automatic consideration of IF bandwidth correction factors for measuring broadband interference (PK/MHz)
- IF filters (10kHz and 120kHz) with low delay distortion in third IF stage
- Digital level indication on LC display and analog level indication on moving-coil meter taking into account transducer factors and their units
- 12-bit A/D converter with short conversion time
- Highly linear envelope detector with more than 70 dB dynamic range
- Automatic overload detection in mixer stages and in test channel by permanently activated peak detectors



- Flash EPROMs allowing convenient and fast firmware updating
- Automatic calibration with the aid of a high-precision built-in generator
- Measurement time selectable between 1 ms and 100 s
- Demodulator circuits for FM, AM and AO; headphones connector and built-in loudspeaker
- Automatic monitoring of all synthesizer loops and supply voltages during operation
- Detection of faulty modules by built-in selftest facilities

Superior RF circuit design

- Parallel detectors for average, peak and quasi-peak indication
- Fast synthesizer: frequency resolution 100 Hz, any frequency step in ≤ 30 ms, sweep mode for fast frequency scanning
- High pulse loading capacity of input attenuator when using option ESVS-B1
- High measuring accuracy: error ≤ 1 dB; typ. < 0.5 dB
- Wide dynamic range: noise figure typ. 7 dB with preamplifier, 12 dB without preamplifier, third-order intercept point typ. 20 dBm (without preamplifier)
- 60-dB operating range also for quasi-peak and average indication

Powerful processor system

- Macros for automatic and semi-automatic test runs



- Automatic level calibration
- Automatic consideration of frequency-dependent transducer factors
- Nonvolatile storage of 9 complete instrument settings and 22 different transducer factors and limit lines

Optimal result display for every application

- Measurement of voltage, field strength, current and pulse spectral density with full indication of units
- Indication of level on analog meter and digital display with 0.1-dB resolution

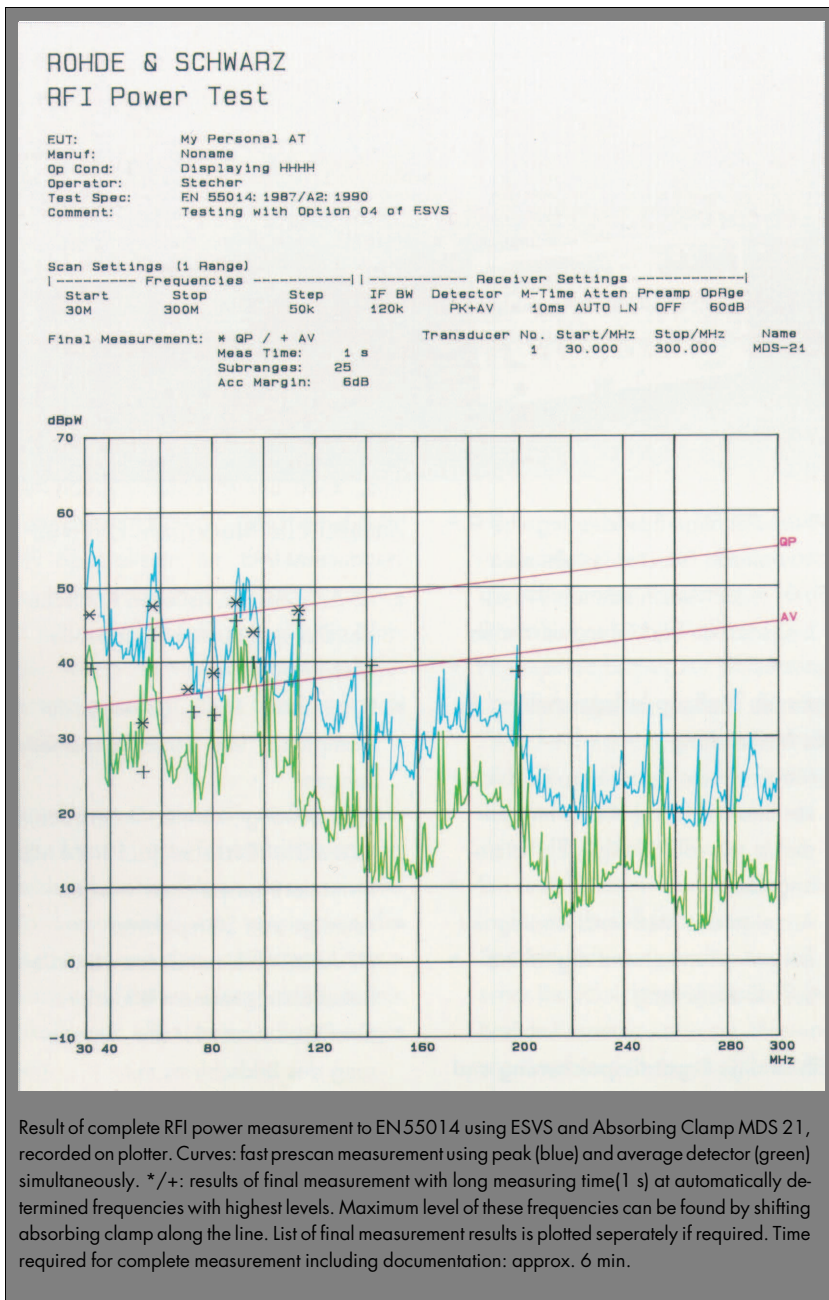
Full storage and listing of results

- Output of results as lists and diagrams on printer or plotter including limit lines and user-definable labelling
- Time-consuming quasi-peak measurement only carried out in cases where peak values are close to the relevant limits

Additional features of ESVS30

- IF analysis for visual check of interference spectrum in manual measurement mode
- Built-in tracking generator for attenuation and gain measurements
- If required, test results can be stored on 3½" floppy disks with 1.44-Mbyte storage capacity (formatted) by means of built-in disk drive
- Display of interference spectra (RF ANALYSIS) including limit lines on low-emission screen
- Graphics processor for driving the screen with a resolution of 1024 × 1024 pixels
- IF analysis module with resolution bandwidth of 1.3 kHz and 10 kHz; IF analysis executed automatically during level measurement





In a frequency scan (lin or log), up to five subscans are covered; each subscan can be assigned a specific test receiver setting. Nonvolatile storage of 22 limit lines and transducer factors with up to 50 values is possible. By combining the transducer factors, all configurations occurring in practice can be covered.

The results of a frequency scan are usually output on a printer as a list and/or on a plotter as a graph. Additionally, on the ESVS30 the results are displayed in graphical form on the screen.

Time can be saved by simultaneous printing of the lists and plotting of the graphs. Plotting is also possible during the frequency scan so that the desired document is already obtained during the measurement. Any relevant information can be added to the test report, either by entering it via a line editor or, more conveniently, via an MF2 keyboard that can be connected. Information can be automatically added to the parameters known to the ESVS such as date, time and receiver settings.

Macros for automatic test runs (ANALYSIS OPTIONS) match the ESVS to the specific configuration, device under test and measurement specification. Being thus prepared, the test receivers perform the following routines:

- Fast prescan measurement using the peak and/or average detector, multiple scans for spectrum observation possible
- Final measurement at critical frequencies using the average and/or quasi-peak detector
- Determination of critical frequencies by means of limit lines with data reduction to shorten the measuring time

Manual operation

For solving complex EMC problems, manual measurement often is the most efficient way, since the operator can make full use of his experience in identifying interference sources. The ESVS receivers feature conventional test receiver operation with tuning knob, indication of results on a meter and built-in loudspeaker.

Automatic operation

The input keys for automatic measurements are arranged on the left of the front panel. Three groups of menu keys on the ESVS 10 and a row of menu keys and a row of softkeys on the ESVS30 are provided below the screen to enter frequency scans, limits, transducer factors, configuration data and macros for test routines.

- Report of results on printer or plotter
- Storage of results on floppy disk of ESVS30

The minimum configuration consisting of ESVS 10 or 30, absorbing clamp and plotter is already an extremely powerful test set for RFI measurements.

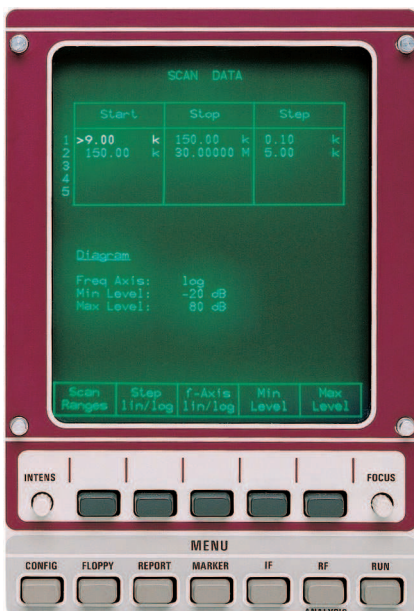
Remote control

The IEC/IEEE-bus interface complies with the latest IEEE Standard 488 Part 2. The measured values are output with a resolution of 0.01 dB.

Interfaces

For further signal evaluation and for driving or feeding add-on units, ESVS 10 and 30 have the following interfaces:

- Parallel interface (PRINTER INTERFACE) for connecting a printer
- Coding and supply socket (ANTENNA CODE) for antennas and other accessories

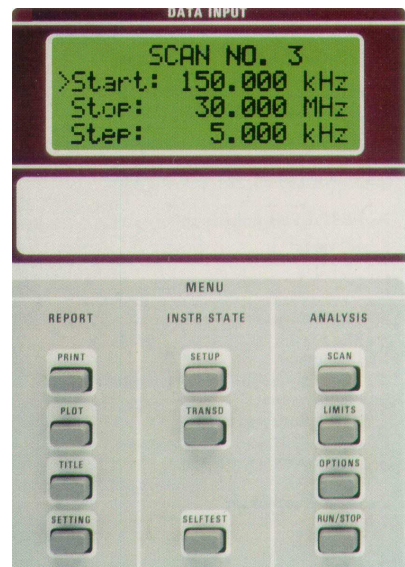


- IF output 74.7 MHz (ESVS 10 only)
- IEC/IEEE-bus interface
- IF output 10.7 MHz for evaluating the IF signal eg with an oscilloscope
- Envelope detector output (VIDEO OUTPUT) for evaluating the detected IF signal eg with an oscilloscope
- USER INTERFACE with
 - 6 TTL ports for driving external devices
 - input for external triggering of measurements
 - outputs for the analog display voltage with and without meter simulation for connecting a discontinuous interference analyzer
 - RS-232-C interface for firmware updating by reprogramming the built-in flash EPROMs via an AT-compatible computer
- Connector for an MF2-compatible keyboard for text entry
- Input for an external reference frequency (5 MHz or 10 MHz, automatic detection)
- Connector (11 V to 33 V) for battery-powered operation, eg in a vehicle

Design

The service-friendly modular design of the ESVS 10 and 30 in conjunction with a consequent design to EMC rules including the low-emission screen ensures excellent results regarding RFI emission and immunity.

A faulty module can easily be found by the built-in selftest and replaced with a minimum of effort and without affecting the other modules.



Specifications

Frequency range	20 MHz to 1000 MHz
Frequency setting with tuning knob	in 100-Hz, 100-kHz steps or any step size selectable by keyboard entry
numerical in steps	any size selectable
automatic scanning	for RF analysis
Display	8-digit LCD
Resolution	100 Hz
Setting error	$<3 \times 10^{-6}$

RF input	N connector, female, 50 Ω
VSWR	<1.2 with ≥ 10 dB RF attenuation, <2 with 0 dB RF attenuation

Oscillator reradiation at RF input (0 dB RF attenuation)	
without preamplifier	<20 dB μ V
with preamplifier	<10 dB μ V
Preamplifier	switchable between preselector and 1st mixer
Gain	10 dB

Preselector	
1 filter with fixed tuning	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

Maximum input level (with and without preamplifier)	
RF attenuation 0 dB (AC-coupled)	
DC voltage	50 V
Sinewave AC voltage	130 dB μ V
Pulse spectral density	96 dB μ V/MHz (100 V for 0.5 ns)
RF attenuation ≥ 10 dB (AC-coupled)	
DC voltage	50 V
Sinewave AC voltage	137 dB μ V = 1 W
Max. pulse voltage	150 V
Max. pulse energy (10 μ s)	10 mWs
RF attenuation ≥ 10 dB with option	
ESVS-B1 (DC-coupled)	
DC voltage	7 V
Sinewave AC voltage	137 dB μ V = 1 W
Max. pulse voltage	150 V
Max. pulse energy (10 μ s)	100 mWs

Interference rejection, non-linearities			
Image-frequency rejection	1st IF	>90 dB, typ. 100 dB	
	2nd IF	>90 dB, typ. 100 dB	
IF rejection		>90 dB, typ. 100 dB	
Intercept point d3, with $f_1 - f_2 \geq 5$ MHz			
		off	Preamplifier on
Level (f_1, f_2) at receiver input		-10 dBm	-20 dBm
$f_{in} < 50$ MHz		typ. 15 dBm	typ. 5 dBm
$f_{in} \geq 50$ MHz		>15 dBm, typ. $+20$ dBm	>5 dBm, typ. $+10$ dBm
Intercept point k2		>35 dBm	>25 dBm

RF shielding	
Voltage indication at a field strength of 10 V/m with 0 dB RF attenuation ($f \neq f_{in}$)	<0 dB μ V
Additional error in CISPR indication range at 10 V/m	<1 dB
Interference/interference immunity	to EN50081-1/EN50082-1

Intermediate frequencies (IF)	
1st IF	1354.7 MHz
2nd IF	74.7 MHz
3rd IF	10.7 MHz

IF bandwidths			
Nominal bandwidth	-3 dB ($\pm 20\%$)	-6 dB	Shape factor $BW_{6\text{ dB}} : BW_{60\text{ dB}}$
10 kHz	7 kHz	$9.5 \text{ kHz} \pm 0.5 \text{ kHz}$	1 : 4.0 (typ.)
120 kHz	90 kHz	$120 \text{ kHz} \pm 10\%$	1 : 5.5 (typ.)

Noise indication		Preamplifier	
		off	on
Average value, BW = 10 kHz		<-10 dB μ V typ. -1.5 dB μ V	<-16 dB μ V typ. -21 dB μ V
BW = 120 kHz		<1 dB μ V typ. -4 dB μ V	<-5 dB μ V typ. -10 dB μ V
Peak value, BW = 10 kHz		typ. -4 dB μ V	typ. -9 dB μ V
BW = 120 kHz		typ. $+7$ dB μ V	typ. $+1$ dB μ V
Quasi-peak band C/D PK/MHz (spectral density measurement, BW = 120 kHz)		typ. $+2$ dB μ V	typ. -4 dB μ V
		typ. 25 dB μ V/MHz	typ. 21 dB μ V/MHz

Voltage measurement range	
Lower limit (additional error caused by inherent noise <1 dB)	
	Preamplifier
	off
	on

Average indication (AV)		
BW = 10 kHz	<-6 dB μ V typ. -11 dB μ V	<-12 dB μ V typ. -17 dB μ V
BW = 120 kHz	$<+5$ dB μ V typ. 0 dB μ V	<-1 dB μ V typ. -6 dB μ V
Peak indication (PK)		
BW = 10 kHz	typ. 12 dB μ V	typ. 7 dB μ V
BW = 120 kHz	typ. 23 dB μ V	typ. 17 dB μ V
Quasi-peak indication (QP)		
CISPR band C/D (100 Hz pulse frequency)	<10 dB μ V typ. 6 dB μ V	<4 dB μ V typ. 0 dB μ V
Upper limit AV, PK, QP	137 dB μ V (RF attenuation ≥ 10 dB)	
Inherent spurious response	<0 dB μ V (equivalent input voltage)	

Level display	
digital	$3\frac{1}{2}$ digits in dB μ V, dB μ A, dBm, dB μ V/m, dB μ A/m or dB μ V, resolution 0.1 dB
analog	on moving-coil meter in operating range of IF detector with additional digital display of lower range limit 30 dB, 60 dB
Operating ranges	5" CRT with digital display memory
Screen ESVS30 (RF analysis)	1024 x 1024 pixels
Resolution	freely selectable (20 MHz to 1000 MHz), linear or logarithmic
Display range X axis (frequency)	10 dB to 200 dB, adjustable
Y axis (level)	average (AV), peak (PK), spectral density measurement (PK/MHz), quasi-peak (QP)
Display modes	1 ms to 100 s (1/2/5 steps)
Averaging, hold and measuring times	
Measuring error (AV for S/N >16 dB)	
Digital display, 0 $^{\circ}$ C to 55 $^{\circ}$ C	<1 dB
-10 $^{\circ}$ C to 0 $^{\circ}$ C	<1.5 dB
Analog display	typ. <2 dB
Level calibration	sinewave and harmonics generator

Demodulation modes	A0 (zero beat)
	A3 (for A3E emissions)
	F3 (for F3E emissions)

IF analysis (ESVS30 only)	
Display range	10 kHz to 2 MHz in 1, 2, 5 steps
Resolution	-3 dB Shape factor ($\pm 20\%$) $BW_{3\text{ dB}} : BW_{60\text{ dB}}$

Nominal bandwidth	10 kHz	10 kHz	1 : 4
	3 kHz	3 kHz	1 : 6
	1 kHz	1 kHz	1 : 9
Sweep time	50 ms to 10 s (adjustable)		
Level display range	80 dB		
Input attenuation	0/20 dB, selectable		

Date, time of day	internal clock, permanently operated from internal battery
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$3\frac{1}{2}$" floppy disk drive (ESVS30 only)	1.44 Mbyte formatted
Formatting	MS-DOS-compatible
Data format	binary or HP-GL

Connectors and interfaces

Remote control

Remote-control connector
Plotter

to IEC 625-2 (IEEE 488)

24-contact Amphenol connector
via IEC/IEEE-bus interface

Front-panel outputs

Supply and coding connector
for antennas etc
AF output
EMF
Generator output (ESVS30 only)
EMF

12-contact Tuchel connector
jack JK34, 10 Ω
adjustable up to 2 V
N connector, female, 10 kΩ
96 dBµV ±1 dB

Rear-panel outputs

IF 74.7 MHz (ESVS 10 only)
Gain ref. to RF input
(RF attenuation 0 dB)

$Z_{out} = 50 \Omega$, BNC connector, female

10 dB without preamplifier,
20 dB with amplifier
2 MHz
BNC connector, female, 50 Ω

Bandwidth (-3 dB)
IF 10.7 MHz
EMF in range of analog level
display for unmodulated
sinewave signal:
Operating range 30 dB
60 dB

1 mV to 30 mV
1 mV to 1 V

Bandwidth=IF bandwidth
Video output
(envelope detector)
EMF in range of
analog level display:
Operating range 30 dB
60 dB

BNC connector, female

4 mV to 126 mV
4 mV to 4 V
25-contact Cannon connector;
includes 6 control lines for an external
device (eg artificial mains network),
display voltage (analog) with and with-
out meter simulation, input for external
triggering, RS-232-C interface for
firmware updating
parallel interface
(15-contact Cannon connector)
5-contact DIN connector for MF2 key-
board

User interface

Printer connection

Keyboard connection

Rear-panel inputs

Ext. reference frequency
Required level
Frequency
Ext. battery
Required voltage

BNC connector, female
EMF ≥1 V from 50 Ω
5/10 MHz
3-contact connector
11 to 33 V

General data

Rated temperature range

-10 °C to +55 °C
(without condensation)

Temperature range for
floppy disk drive (ESVS30 only)
Storage temperature range
Mechanical resistance

+5 °C to +50 °C
-25 °C to +70 °C
shock-tested to MIL-STD-810D (shock
spectrum 40 g), vibration-tested to
MIL-T-28800D, class 5; complies with
IEC Publ. 68-2-6
complies with VDE0876, Part 1a,
Regulation 527/1979 and
MIL-STD-461B (CE03 and RE02)

EMC

Power supply

AC supply

100/120/240 V ±10%,
230 V +6/-10%
47 Hz to 420 Hz
90 VA,
safety class I to VDE 0411 (IEC 348)

Battery

ESVS 10: internal
external

12 V, 10 Ah
(operating time approx. 2.5 h)
11 V to 33 V
(switch-on voltage >12 V)
1.9 A at 24 V
3.3 A at 12 V
11 V to 33 V
2.6 A at 24 V,
4.8 A at 12 V

ESVS30: external

Dimensions (W×H×D)

ESVS30
ESVS10

435 mm × 236 mm × 460 mm
435 mm × 236 mm × 363 mm

Weight

ESVS30
ESVS10

26.4 kg
23.7 kg with batteries
20.4 kg without batteries

Ordering information

Order designation

EMI Test Receiver ESVS 30
EMI Test Receiver ESVS 10
Accessories supplied

1010.5001.30
1011.2006.10

power cable, connector for exter-
nal battery, operating manual

Option

Pulse Power Attenuator

ESVS-B1

0816.1815.02

Recommended extras

For interference measurements:

Current Probe 20 Hz to 100 MHz
Current Probe 20 Hz to 100 MHz for
EMS measurements
VHF Current Probe 20 MHz to 300 MHz
Absorbing Clamp 30 MHz to 1000 MHz

EZ-17

0816.2063.02

EZ-17

0816.2063.03

ESV-Z1

0353.7019.02

MDS-21

0194.0100.50

Antennas and accessories

Broadband Dipole 20 MHz to 80 MHz
Log-periodic Broadband Antenna
80 MHz to 1300 MHz
Biconical Antenna 20 MHz to 300 MHz
Log-periodic Antenna 200 MHz to
1300 MHz
Conical Log Spiral Antenna
200 MHz to 1000 MHz
Probe (BNC connector)
Adapter (BNC female to N male)
Preamplifier 10 dB
Tripod
Mast (for tripod)
Wooden Tripod
RF Connecting Cable 7 m
RF Connecting Cable 12 m

HUF-Z1

0358.0512.52

HL023 A1

0577.8017.02

HK116

4000.7752.02

HL223

4001.5501.02

HUF-Z4

0837.2210.52

HFV-Z

0204.1010.02

0118.2812.00

ESV-Z3

0397.7014.52

HFU-Z

0100.1114.02

HFU-Z

0100.1120.02

HZ-1

0837.2310.02

HFU2-Z5

0252.0055.55

HFU2-Z4

0252.0090.56

Other accessories

Keyboard

PSA-Z1

1009.5001.32

Headphones

0110.2959.00

Service Manual

ESVS30

1010.5147.24

ESVS10

1011.2441.24

Service Kit

EZ-8

0816.1067.02

19" Rack Adapter

with front handles

ZZA-95

0396.4911.00

without front handles

ZZA-951

0396.9488.00

Set of Front Handles

ZZG-95

0396.5176.00

Transit Case

ESVS30

ZZK-954

1013.9395.00

ESVS10

ZZK-953

1013.9389.00

Trolley

ZZK-1

1014.0510.00

Printer Cable

EZ-11

0816.1767.02

IEC-bus Connecting Cable 1 m

PCK

0292.2013.10

IEC-bus Connecting Cable 2 m

PCK

0292.2013.20

ESVS 10 only:
6-V Lead Acid Storage Battery,
maintenance-free, 10 Ah
(2 required)

0338.4012.00



Fax Reply (EMI Test Receivers ESVS)

- Please send me an offer
- I would like a demo
- Please call me
- I would like to receive your free-of-charge CD-ROM catalogs

Others: _____

Name: _____

Company/Department: _____

Position: _____

Address: _____

Country: _____

Telephone: _____

Fax: _____

E-mail: _____



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