

EMI Test Receivers ESHS 10 and ESVS 10

ESHS 10: 9 kHz to 30 MHz

ESVS 10: 20 MHz to 1000 MHz

Test receivers for commercial

EMI measurements

ESHS 10 (photo 42407)



Brief description

The receivers ESHS 10 and ESVS 10 are suitable for measuring electromagnetic interference in line with commercial standards:

- CISPR 16, VDE0876 and ANSI C63.2
- EN 55011 to 55022, ETS, FCC, VCCI and VDE 0871 to 0879 and ANSI C63.4

Applications

The instruments are ideal for routine tasks in industry such as development and approval tests in line with commercial standards. Featuring mains-independent battery powering, they are also suitable for mobile applications at EMC service providers, test houses and safety standard authorities.

Main features

Superior circuit design

- High measurement accuracy, typical error 0.5 dB
- Wide dynamic range, typical noise figure 7 dB with preamplifier, third-order intercept point 20 dBm (without preamplifier)

- Calibrated attenuator with high pulse loading capacity, switchable in 10-dB steps from 0 to 120 dB
- Comprehensive preselection filters
- Switchable preamplifier with wide dynamic range
- Crystal-stabilized, fast synthesizer with high resolution and sweep mode for fast frequency scanning
- High-level mixer with high oscillator rejection
- Delay-equalized IF filters

Demodulation

- Parallel detectors for average, peak and quasi-peak indication
- 60 dB operating range also for quasi-peak and average value indication
- Highly linear envelope detector with more than 70 dB dynamic range
- AM and A0 demodulators (ESVS also FM)
- Logarithmic amplifier with more than 70 dB dynamic range
- Peak indication with automatic consideration of IF bandwidth correction values for broadband interference measurements

- Automatic overload detection in mixer stages and in test channel by permanently activated peak detectors

Powerful processor system

- Manual operation or internal or external processor control
- Flash EPROMs for convenient and fast firmware update through PC
- Macros for automatic and semi-automatic test runs
- Automatic level calibration
- Automatic consideration of frequency-dependent transducer factors
- All built-in functions fully programmable via IEC/IEE bus
- Fast measurement in external trigger mode; output of up to 5000 values/s via IEC/IEEE bus, up to 400 values/s including frequency change within certain frequency bands
- 12-bit A/D converter with short conversion time, measurement time selectable between 1 ms and 100 s
- High measurement accuracy thanks to automatic total calibration
- Automatic monitoring of all synthesizer loops and supply voltages during operation

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Optimum result display and printout

- Measurement of voltage, field strength, current and pulse spectral density with display of relevant units
- Indication of result on analog meter or digital display with 0.1 dB resolution
- Output of results as lists and diagrams on printer including limit lines

Further features

- Digital level indication on LCD and analog level indication on moving-coil meter taking into account transducer factors and their units
- Numerous interfaces for driving or feeding additional devices
- AC supply as well as battery powering for mobile applications

Operation

RFI field-strength and RFI power measurements

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 receivers fea-

ture conventional test receiver operation with tuning knob, indication of results on a meter and built-in loudspeaker.

Nonvolatile storage of 22 limit lines and transducer factors with up to 50 values is possible. By combining the transducer factors, all test configurations occurring in practice can be covered.

Macros for semi-automatic test runs (ANALYSIS OPTIONS) match the test receivers to the specific configuration, device under test and test specification. Being thus prepared, the test receivers 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 the measurement time
- Final measurement at critical frequencies using average and/or peak detector
- Output of results on printer

The test receivers offer a choice between automatic, semi-automatic and user-controlled test runs. Scan options are available for prescan measurements, data reduction and final measurements.

Data reduction is the main criterion for optimizing the test run. It is the link between prescan interference measurement and correct weighting with test parameter variation (final measurement) to reduce measurement time. There are also scan options taking account of the test configuration, for instance measuring RFI voltage with LISNs, RFI power with an absorbing clamp and RFI field strength with antennas.

Design

The modular design of the test receivers provides excellent RF shielding and great convenience for servicing. An extremely low-noise, temperature-controlled fan ensures low self-heating. The comprehensive selftest functions allow easy identification of a faulty module which can be replaced with a minimum of effort and without affecting the other modules.

Specifications in brief: ESHS

Frequency range	9 kHz to 30 MHz
Frequency setting	in 10 Hz, 10 kHz steps or user-selectable step size for RF analysis
Automatic scan	7-digit LCD
Display	10 Hz
Resolution	3×10^{-6} +30 Hz
Frequency drift	
RF input	N connector, 50 Ω
VSWR	<1.2 with 10 dB RF attenuation, <2 with 0 dB RF attenuation
Preamplifier	10 dB, can be connected between preselector and 1st mixer
Preselector	5 fixed-tuned filters
Maximum input level (with and without preamplifier, RF attenuation ≥ 10 dB)	
DC voltage	7 V (corresp. to 1 W)

Sinewave AC voltage	137 dB μ V
Max. pulse voltage (10 μ s)	700 V
Max. pulse energy (10 μ s)	100 mWs

Interference rejection, nonlinearities

Image-frequency rejection	
1st IF	>90, typ. 100 dB
2nd IF	>75 dB
IF rejection	>90, typ. 100 dB

Intercept point d3 with $|f_1 - f_2| > 100$ kHz

and 0 dB RF attenuation	preamplifier off	preamplifier on
Level (f_1, f_2) at receiver	2x -10 dBm	2x -20 dBm
$f_m < 2$ MHz	typ. 15 dBm	typ. 0 dBm
$f_m \geq 2$ MHz	>15 dBm,	>0 dBm,
	typ. +20 dBm	typ. +5 dBm

Intercept point k2

>40 dBm	>20 dBm
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RF shielding

Voltage indication at field strength of 10 V/m with 0 dB RF attenuation ($f \neq f_m$)
Additional error in CISPR indication range at 10 V/m

<-10 dB μ V

<1 dB

IF bandwidth

200 Hz/10 kHz

Displayed noise floor

Average value, BW=200 Hz
 $f_m=9$ to 50 kHz

preamplifier off preamplifier on

<-24 to <-30 dB μ V
typ. -35 dB μ V

<-30 to <-36 dB μ V
typ. -41 dB μ V

$f_m > 50$ kHz
Average value, BW=10 kHz
 $f_m > 50$ kHz

typ. -17 dB μ V typ. -25 dB μ V

Peak value (typ.increase relative to average value)

+11 dB +11 dB

Quasi-peak

Band A 9 kHz to 50 kHz

typ. -24 to -30 dB μ V
typ. -32 dB μ V

typ. -30 to -36 dB μ V
typ. -38 dB μ V

50 kHz to 150 kHz
Band B (≥ 150 kHz)

typ. -13 dB μ V
typ. 34 dB (μ V/MHz)

typ. -19 dB μ V
typ. 28 dB (μ V/MHz)

PK/MHz (BW_{IF}=10 kHz)**Voltage measurement range** ($f_m > 50$ kHz)**Lower limit:**

(additional error caused by inherent noise <1 dB)

preamplifier off preamplifier on

Average indication (AV)BW_{IF}=200 Hztyp. -31 dB μ V typ. -37 dB μ VBW_{IF}=100 kHztyp. -13 dB μ V typ. -20 dB μ V**Peak indication (PK)**BW_{IF}=200 Hz

+11 dB +11 dB

BW_{IF}=100 kHztyp. -8 dB μ V typ. -14 dB μ Vtyp. -10 dB μ V typ. +4 dB μ V**Quasi-peak indication (QP) to CISPR**

Band A (25 Hz pulse frequency)

typ. -30 dB μ V typ. -36 dB μ V

Band B (100 Hz pulse frequency)

typ. -11 dB μ V typ. -17 dB μ V**Upper limit:**

AV, PK, QP

137 dB μ V (RF attenuation ≥ 10 dB)

Inherent spurious responses

<-10 dBV (equiv. input voltage)

Level display**Digital**

3½ digits, resolution 0.1 dB in dB μ V, dB μ A, dBm, dB(μ V/m) or dB(μ A/m) on moving-coil meter in operating range of IF detector with additional digital display of lower range limit

30 dB, 60 dB

Analog**Operating ranges****Display modes** (detectors)

average (AV), peak (PK), spectral density measurement (PK/MHz), quasi-peak (QP)

Averaging, hold and meas. times

1 ms to 100 s (1/2/5 steps)

Measurement accuracy (AV for S/N >16 dB)**Digital display**

<1 dB

IF

A0 (zero beat)
A3 (for A3E emissions)**Date, time of day**

internal clock

Remote control

to IEC 625-2 (IEEE 488-2)

Plotter language

HP-GL

Front-panel outputs

Supply and coding connector for antennas, etc
AF output

12-contact Tuchel connector
jack JK34, 10 Ω **Rear-panel outputs**

IF 74.7 MHz (ESHS 10 only)
Bandwidth (-3 dB)
IF 80 kHz
Video output (envelope demod.)

BNC connector, 50 Ω
2 MHz or bandwidth of preselector
BNC connector, 50 Ω
BNC connector

Interfaces

25-contact Cannon connector, includes 6 control lines for an external device (eg LISN), display voltage with and without meter simulation, input for external triggering, RS-232-C interface for firmware update
Printer connection
Keyboard connection

parallel interface
5-contact connector for MF2 keyboard

Rear-panel inputs

Ext. reference frequency
Frequency
Ext. battery
Required voltage

BNC connector
5/10 MHz
3-contact connector
11 V to 33 V

General data**AC supply**100/120/220/240 V $\pm 10\%$,
47 Hz to 440 Hz**Power consumption**

50 VA

Internal battery

12 V, 10 Ah

Operating hours

approx. 4 h

External battery

11 V to 33 V

Current drain 24 V/12 V

1.2 A/2.3 A

Dimensions (W x H x D)

435 mm x 236 mm x 363 mm

Weight

18 kg (21 kg with battery)

Specifications in brief: ESVS

Data specified below differ from that of ESHS.

Frequency range

20 MHz to 1000 MHz

Frequency setting
with tuning knob

in 100 Hz, 100 kHz steps or user-selectable step size

numerical
in steps

by keyboard entry

automatic scan

any size selectable

Display

for RF analysis

Resolution

8-digit LCD

Frequency drift

100 Hz

<3 x 10⁻⁶**RF input**N connector, 50 Ω **VSWR**<1.2 with ≥ 10 dB RF attenuation,

<2 with 0 dB RF attenuation

Preamplifier

can be switched between preselector

Gain

and 1st mixer

10 dB

Preselector

1 fixed-tuned and 5 tracking filters

Maximum input level (with and without preamplifier)**RF attenuation** ≥ 10 dB**DC voltage**

50 V

Sinewave AC voltage137 dB μ V (corresp. to 1 W)**Max. pulse voltage**

150 V

Max. pulse energy (20 μ s)

10 mWs

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RF attenuation ≥ 10 dB (option ESVS-B1)			
DC voltage	7 V		
Sinewave AC voltage	137 dB μ V (corresp. to 1 W)		
Max. pulse voltage	1500 V		
Max. pulse energy (10 μ s)	100 mWs		
Interference rejection, nonlinearities			
Image frequency rejection	typ. 100 dB		
IF rejection	>90, typ. 100 dB		
Intercept point d3			
$ f_1 - f_2 \geq 5$ MHz	preamplifier off $P_{in} = 2x (-10$ dBm)	preamplifier on $P_{in} = 2x (-20$ dBm)	
	typ. +20 dBm	typ. +10 dBm	
Intercept point k2			
	>35 dBm	>25 dBm	
RF shielding			
Intermediate frequencies			
1st/2nd/3rd IF	1354.7/74.7/10.7 MHz		
IF bandwidths	10/120 kHz		
Displayed noise floor			
Average value, BW=10 kHz	preamplifier off typ. -15 dB μ V	preamplifier on typ. -21 dB μ V	
BW=120 kHz	typ. -4 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	typ. +2 dB μ V	typ. -4 dB μ V	
PK/MHz (spectral density measurement, BW _{IF} =120 kHz)	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):			
Average indication (AV)	values 4 dB higher than displayed noise (AV)		
Peak indication (PK)	values 27 dB higher than displayed noise (PK)		
Quasi-peak indication(QP)			
CISPR band C/D			
(100 Hz pulse frequency)			
Preamplifier off	<10, typ. 6 dB μ V		
on	<4, typ. 0 dB μ V		
Upper limit:			
AV, PK, QP	137 dB μ V (RF attenuation ≥ 10 dB)		
Inherent spurious responses	<0 dB μ V (equivalent input voltage)		
Level display			
Digital	3½ digits, resolution 0.1 dB in dB μ V, dB μ A, dBm, dB(μ V/m), dB(μ A/m) or dBpW		
Analog	on moving-coil meter in operating range of IF detector with additional display of lower range limit		
Display modes (detectors)			
		average (AV), peak (PK), spectral density measurement (PK/MHz), quasi-peak (QP)	
Measurement accuracy (AV for S/N >16 dB)			
Digital display (0 to 55 °C)		≤ 1 dB	
Demodulation modes			
		A0, A3, F3	
Date, time of day			
		internal clock	
Remote control			
		to IEC 625-2 (IEEE 488-2)	
Front-panel outputs			
Supply and coding connector for antennas, etc		12-contact Tuchel connector	
AF output		jack JK34, 10 Ω	
Rear-panel outputs			
IF 74.7 MHz (ESVS 10 only)		BNC connector, 50 Ω	
IF 10.7 MHz		BNC connector, 50 Ω	
IF 80 kHz		BNC connector	
Video output		BNC connector	
Interfaces			
25-contact Cannon connector, includes 6 control lines for an external device (eg LISN), display voltage with and without meter simulation, input for external triggering, RS-232-C interface for firmware update			
Printer connection		parallel interface	
Keyboard connection		5-contact connector for MF2 keyboard	
Rear-panel inputs			
Ext. reference frequency		BNC connector	
Frequency		5/10 MHz	
Ext. battery		3-contact connector	
Required voltage		11 V to 33 V	
General data			
AC supply		100/120/220/240 V $\pm 10\%$, 47 Hz to 440 Hz	
Power consumption		60 VA	
Internal battery		12 V, 10 Ah	
Operating hours		approx. 2.5 h	
External battery		11 V to 33 V	
Current drain 24 V/12V		1.9 A/3.3 A	
Dimensions (W x H x D)		435 mm x 236 mm x 363 mm	
Ordering information			
EMI Test Receiver			
ESHS 10			1004.0401.10
ESVS 10			1011.2006.10