EMI Test Receiver ESCS30

Compact EMI test receiver up to 2.75 GHz compliant to all standards

- Fully compliant to CISPR 16-1 and VDE 0876
- Integrated preselector
- Level measurement range –38 dBµV to +137 dBµV
- For all commercial EMI standards such as CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE
- Automatic overload detection
- Built-in 6.5" VGA colour display in TFT technology
- Ease of use through internal macro-functions
- Internal and external battery operation

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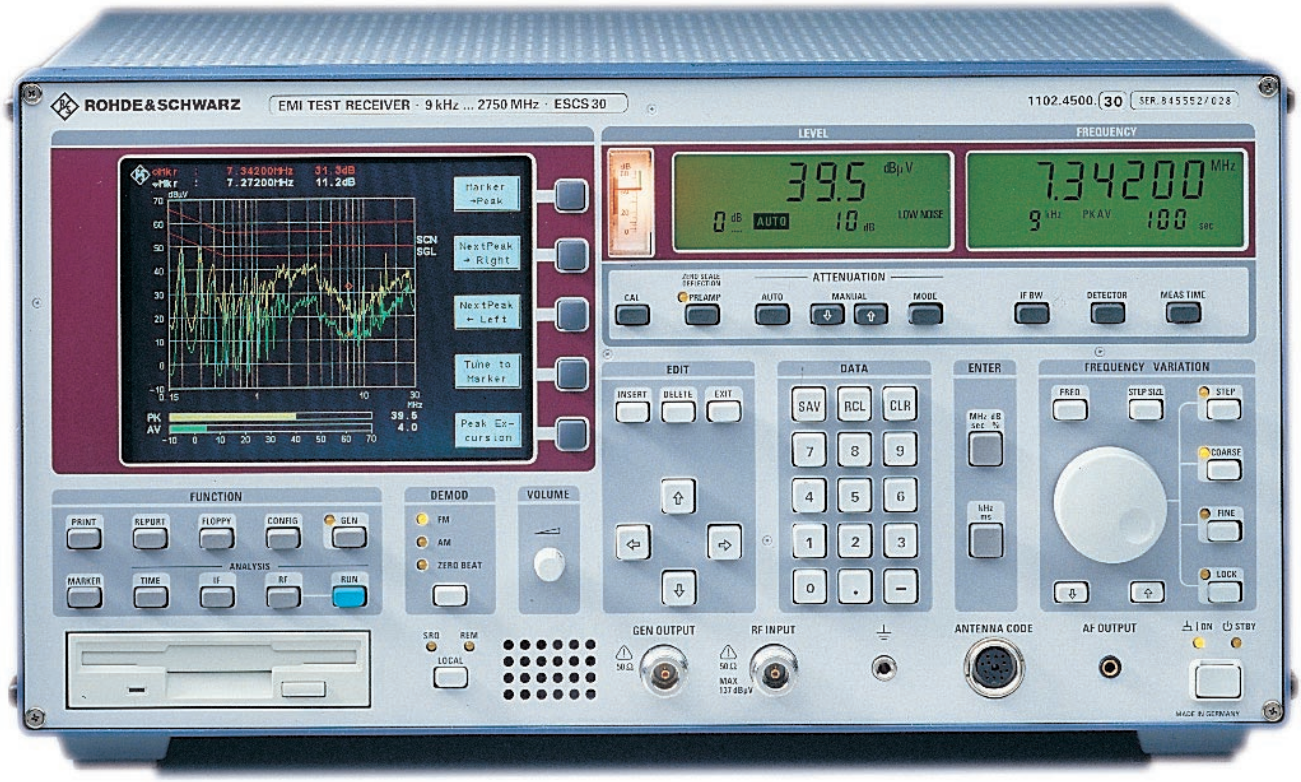


Applications

The EMI Test Receiver ESCS30 – fully complying with CISPR16-1 standard and having a 6.5" colour LCD – is an addition to the well-proven EMI test receiver family as a top model covering the frequency range from 9 kHz to 2.75 GHz.

Test Receiver ESCS30 is used for measuring electromagnetic emissions in line with all commercial standards and combines three types of instruments in one:

- a portable, manually tunable test receiver with built-in battery,
- an automatic test receiver which as a stand-alone unit performs measurements and reports the results,
- a system-compatible test receiver with IEC/IEEE-bus interface and EMI software packages running under Windows™.

General

The number of measurements required to ensure electromagnetic compatibility is continuously increasing and is governed by laws in many countries.

Thanks to the built-in intelligence of EMI Test Receiver ESCS30, the time required for such measurements is reduced considerably. This specialist for EMI measurements supplies the results fast and highly accurately in line with the standards from CISPR, CENELEC, ETSI, FCC, ANSI, VCCI and VDE.

Characteristics

The ESCS30 basic model is a full-featured EMI test receiver.
It is:

– a test receiver,
– an RF analyzer and
– a timing analyzer.

An IF spectrum analyzer function is optionally available (ESCS-B4).

Due to the built-in Ni-MH battery and an advanced power-saving circuit the ESCS30 satisfies all requirements for portable mobile use (options ESCS-B1, ESCS-B2).

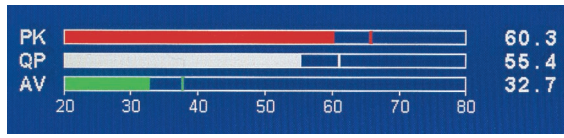
High-grade RF circuit design

- High measurement accuracy: error <1 dB; typ. <0.5 dB
- Fast synthesizer: any frequency step in <1 ms; frequency resolution down to 10/100 Hz (internal <1 Hz)
- Wide dynamic range: noise figure with built-in preamplifier below 30 MHz typ. 5 dB, above 30 MHz typ. 9 dB, third-order intercept point typ. 10 dBm without preamplifier
- CISPR filters 200 Hz, 9 kHz, 120 kHz and 1 MHz with low group-delay distortion
- Parallel detectors for peak, quasi-peak and average indication – three detectors can be switched on simultaneously; optionally RMS detector (ESCS-B9)
- Tracking generator for attenuation and gain measurements; eg for checking test cables (option ESCS-B5)

Powerful firmware functions

- Macros for automatic and interactive test routines
- Frequency scan over up to 400 user-selectable channels
- Automatic level calibration
- Automatic consideration of frequency-dependent transducer factors
- Nonvolatile storage of 9 complete instrument settings, 22 different antenna factors and limit lines with up to 50 values

Level display in form of bargraphs with PEAK HOLD function



Optimum result display for every application

- 16.5 cm (6.5") TFT colour LCD for display of interference spectra including limit lines
- Clear digital level indication with 0.1 dB resolution on separate level display
- Quasi-analog display of results in form of bargraphs to allow comparison of results supplied by the detectors at a glance
- Time domain analysis (oscilloscope mode) for measurement of pulse widths and amplitudes with a display range from 5 ms to 10,000 s, zooming up to maximum resolution
- IF spectrum analysis with 10 MHz display range for visual monitoring of spectrum (option ESCS-B4)

Full storage and logging of results

- Built-in 3.5" disk drive for storing test results and instrument settings; PC-compatible
- Storage of test results and test reports as HP-GL file for simple post-processing with word processing programs
- Output of results as lists and diagrams including limit lines and user-definable labelling; the complete and conclusive test report with user comments can be output on a (impact, inkjet or laser) printer, also in colour

Operation

The logical operating concept of the ESCS30 combines great measurement convenience and fast and reliable setting of the test receiver.

The clear arrangement of the controls – all keys being assigned one function only – and the indication of the selected parameters such as attenuation, bandwidth and detector(s) on separate, large-size LC displays ensure great ease of operation.

Manual operation

For solving complex EMI problems, manual measurement often is the most efficient way, since the operator can make full use of his experience in identifying interference sources.

The ESCS30 features the proven test receiver operation with tuning knob, indication of results on an LC display, bargraph and meter as well as acoustic monitoring via the built-in loudspeaker. The IF analysis function allows the spectrum of the interference signal to be analyzed in a range of up to 10 MHz about the receive frequency. For in-depth examination of interference spectra the marker and zoom functions are extremely useful both in the IF analysis and after a frequency scan in the RF spectrum.

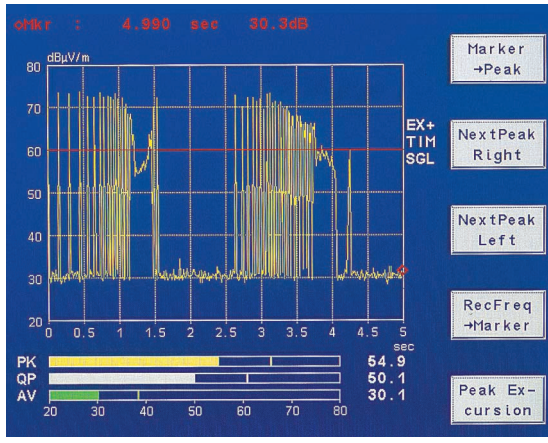
The ESCS30 saves frequency scan results in its own memory. Up to 30,000 measured values can be stored. Upon completion of the measurement all values can be viewed on the screen by expanding the frequency axis. Also data sets stored on floppy disk can thus be evaluated later.

Time domain analysis

The time domain analysis allows the timing of interference to be investigated and assessed. For correct setting of the receiver's measurement time when performing RF analysis it is useful to check the signal in the time domain: the user can determine whether and how much a narrowband interference is fluctuating, whether it is amplitude-modulated or pulsed and he can measure the pulse rate of broadband interference. The measurement time can then be set to a value that is greater than or equal to the reciprocal value of the pulse rate.

Devices with thermostatic or microprocessor control generate discontinuous interference. CISPR 14 and EN 55014 therefore specify limit values for the RFI voltage with click rate weighting in the range 0.15 MHz to 30 MHz. Usually, interference of this kind is measured with the aid of click rate analyzers. Successive pulses, whose amplitude cannot be exactly allocated due to the time constants in quasi-peak weighting and therefore may cause the limits to be exceeded, represent a problem area in click rate measurements.

With the time domain analysis of the ESCS30 the pulse amplitude and duration can be determined and can thus prove to be very useful for the measurement of such pulses. With a resolution of 100 µs, the time domain analysis satisfies the requirements of CISPR 16-1 regarding pulse duration measurements. Triggering can be made internally by level setting using the display line or externally with TTL levels. Also in time domain up to 30,000 measured values can be stored and zoomed with the aid of the marker function for detailed investigation.



Measurement of a breaking spark in the time domain

Automatic operation

Fully automatic test routines permit even complex measurements to be carried out quickly and the results be logged. Compared to manual measurements, test time may be reduced considerably. Softkeys are provided for the entry of frequency scans, limit lines, transducer factors, configuration data and macros for test routines.

In a frequency scan with linear or log steps 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 first displayed in graphical form on the screen. Evaluation tools such as marker and zoom functions allow detailed investigations of the measured interference spectra.

RFI measurement

No matter whether conducted or radiated interference is to be measured, macros for fully automatic or semiautomatic test routines optimally match the ESCS30 to the specific test configuration, equipment under test and measurement specification. Being thus set up, the test receiver automatically performs the following routines eg for measuring the RFI voltage:

- Fast prescan measurement using the average and/or peak detector; two test curves can simultaneously be displayed on the screen and the display modes selected independently of each other
- Max. Hold: to detect impulsive or short-time signals

With these display modes ambient and EUT emissions can be quickly identified in a spectrum and measured. Numerous marker functions allow fast evaluation and measurement of the identified signals in the receive channel:

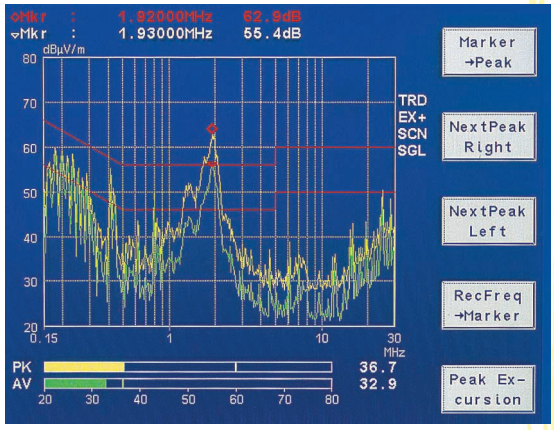
- Shortened measurement time through data reduction: determination of level values and associated frequencies that are critical with respect to limit lines (acceptance analysis)
- Final measurement at critical frequencies on all phases of the line impedance stabilization network (LISN) using the average and/or quasi-peak detector
- Output of results on printer

The same principle is adopted for the semi-automatic RFI power measurement using an absorbing clamp. The interference maximum at the usually few critical frequencies is determined interactively by sliding the clamp along the line.

Measurement of the magnetic RFI field strength to EN55011 for instance is based on the same test concept. In the search for the interference maximum the loop antenna is turned at a distance of 3 m from the equipment under test, and the latter is also turned, eg using a turntable, so that measurements can be carried out at different positions at the critical frequencies.

For measurements in line with EN standards the following basic configuration is required:

RFI voltage measurement
EMI Test Receiver ESCS30 + LISN (2-line or 4-line V network) + printer



Interference spectrum with active markers and bargraph display

RFI power measurement
EMI Test Receiver ESCS30 + absorbing clamp (if required, slideway for automatic guidance of clamp) + printer

RFI field-strength measurement
EMI Test Receiver ESCS30 + antennas (magnetic/electric/electromagnetic) + tripod/antenna mast + printer (if required, automatically controlled mast and turntable systems)

Complete tests at a keystroke

Using the SPECTRUM OVERVIEW function and the peak detector, the critical ranges of the spectrum can be determined. With the aid of data reduction routines the final measurement is then made accurately at the critical frequencies using quasi-peak and average detectors. This concept saves valuable measurement time which would otherwise be wasted for ranges with low emission levels.

At a single keystroke the ESCS30 as a stand-alone unit measures

- RFI voltage
- RFI power
- RFI field strength

Further test routines offered include:

- automatic frequency scan and
- frequency list measurements at up to 400 frequencies

The test receiver automatically selects the correct CISPR bandwidths for the specific test frequency. In conjunction with firmware macros for automatic test routines, comparisons to limit lines eg to EN standards are made.

Test example

A typical radiated emissions test on an open area test site (OATS) will consist of the following:

- Spectrum overview with the peak detector to get the spectrum contents. One scan from 30 to 1000 MHz with approx. 15,000 values takes approx. 10 s. If antenna height, polarization and turntable azimuth are changed, a repetitive spectrum overview will be used.
- Marker and zoom functions to find critical parts of the spectrum.
- Tune-to-marker function to tune the receiver to critical frequencies and listen to the demodulated signal.
- IF analysis to monitor the spectrum in the vicinity of the critical frequency and identify the origin of the signal (EUT or ambience).
- Time domain analysis to define the measurement time.
- Quasi-peak detector to measure the level of the radiated emission at the antenna height and turntable azimuth of maximum field strength for both horizontal and vertical polarization and the result stored on the display.
- Report function to get a hardcopy or save the result on micro floppy disk.

Report/documentation

A comprehensive test report can be generated on a (colour) printer. The report includes all relevant information required for the reproducibility of the measurements, such as comments and description, test receiver settings, graphs and final results.

The text is entered via the line editor or more conveniently via an external keyboard. Known parameters such as date, time and receiver settings are automatically added by the ESCS30.

The final results of RFI voltage measurements are listed as to QP and AV value for frequency and level. Levels exceeding the limit line are marked accordingly.

Mechanical design

The service-friendly modular design in conjunction with a consequent layout to current EMC rules ensures excellent results regarding RFI emissions and immunity.

Comprehensive selftests allow faults to be located down to functional block level and the malfunctions to be displayed on the screen. The faulty module can thus easily be identified and replaced with a minimum of effort.

Specifications

Frequency range	9 kHz to 2750 MHz
Frequency setting	
with tuning knob	in 10 Hz, 100 Hz, 100 kHz steps or user-defined step size(switch-selected)
numerical	by keyboard entry
in steps	any size selectable
automatic scanning	for RF spectrum analysis
Display	8 digit LCD with backlighting
Resolution up to 1000 MHz	10 Hz
from 1000 MHz	100 Hz
Frequency accuracy	
after 30 min warmup with optional OCXO Reference Oscillator ESCS-B6	$<1 \times 10^{-6}$ $<5 \times 10^{-7}$

RF input	50 Ω, N female
VSWR	
f <1000 MHz	<1.2 with ≥10 dB RF attenuation <2.0 with 0 dB RF attenuation
f >1000 MHz	typ. 1.5 with ≥10 dB RF attenuation typ. 2.0 with 0 dB RF attenuation
RF attenuator	0 to 60 dB, 5 dB steps

Preamplifier	can be connected between preselector and 1st mixer
Gain	10 dB nominal

Maximum input level	
RF attenuation 0 dB	
DC voltage	50 V
Sinewave AC voltage	130 dBµV
Pulse spectral density	97 dBµV/MHz (100 V x 0.5 ns)
RF attenuation ≥10 dB	
DC voltage	50 V
Sinewave AC voltage	137 dBµV (1 W)
Max. pulse voltage (10 µs)	150 V
Max. pulse energy (20 µs)	10 mWs

Oscillator reradiation at RF input	
(0 dB RF attenuation)	
9 kHz to 1000 MHz	<20 dBµV

Interference rejection, nonlinearities	
Image frequency 1st and 2nd IF	
9 kHz to 30 MHz	>90 dB
30 to 1000 MHz	>80 dB
IF rejection	
9 kHz to 30 MHz	>90 dB
30 MHz to 1000 MHz	>70 dB
1000 MHz to 2750 MHz	>80 dB
Intercept point d3, (|f1-f2| > 2 MHz), preamplifier off	>5 dBm, typ. 10 dBm
Intercept point k2	
9 kHz to 1960 MHz	>30 dBm
Preselector	
Filter ranges:	
9 kHz to 150 kHz	fixed
150 kHz to 2 MHz	fixed
2 MHz to 8 MHz	tracking
8 MHz to 25 MHz	tracking
25 MHz to 80 MHz	tracking
80 MHz to 200 MHz	tracking
200 MHz to 500 MHz	tracking
500 MHz to 1000 MHz	fixed
1000 MHz to 1900 MHz	fixed
1900 MHz to 2750 MHz	fixed

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

Intermediate frequencies

	9 kHz to 30 MHz	30 to 1000 MHz	1000 to 2750 MHz
1st IF	74.7 MHz	1354.7 MHz	394.7 MHz
2nd IF	10.7 MHz	74.7 MHz	74.7 MHz
3rd IF	—	10.7 MHz	10.7 MHz

IF bandwidths

Nominal bandwidth	–3 dB	–6 dB	Shape factor $BW_{6\,dB}/BW_{60\,dB}$
200 Hz[1])	180 Hz	200 Hz	1:8
9 kHz[1])	7 kHz	9 kHz	1:4
120 kHz[1])	90 kHz	120 kHz	1:5
1 MHz	700 kHz	1 MHz	1:5

[1]) Complies with tolerance to CISPR 16.

Displayed noise level (average)

Range		Preamplifier off	Preamplifier on
9 kHz to 30 MHz	BW = 200 Hz	<–25 dBµV typ. –28 dBµV	<–34 dBµV typ. –38 dBµV
50 kHz to 30 MHz	BW = 9 kHz	<–12 dBµV	<–18 dBµV
30 to 1000 MHz	BW = 120 kHz	<+1 dBµV typ. –1 dBµV	<–4 dBµV typ. –7 dBµV
1000 to 2750 MHz	BW = 120 kHz	<+5 dBµV	<0 dBµV

Inherent spurious responses	
(equivalent input voltage)	
9 kHz to 30 MHz	<–10 dBµV
30 to 2750 MHz	<0 dBµV

Level display	
Digital in dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBpW, dBpT	3½-digit LCD, resolution 0.1 dB
Analog	on analog meter in operating range of IF detector with digital display of lower range limit
Bargraph display	horizontal bar on the screen
Resolution	0.1 dB
Operating range	60 dB
Overload indication	by level detectors in the RF and IF signal path
Detectors	average (AV), peak (PK), quasi-peak (QP), RMS (option ESCS-B9), 3 detectors can be switched on simultaneously
Measuring times	1 ms to 100 s (1/2/5 steps)
Measuring times in overview mode	50 µs to 1 s (1/2/5 steps)

Measurement accuracy	
Average indication for S/N > 16 dB	
9 kHz to 1000 MHz	<1 dB
1000 to 2750 MHz	<1.5 dB
Quasi-peak indication	to CISPR 16-1
Level calibration	harmonics generator, calibrates the receiver for all settings, correction values saved in nonvolatile memory, duration approx. 1 min

Screen	6.5" TFT colour LCD
Resolution	640 x 480 pixels (VGA)
Viewing angle	90° vertical, 90° horizontal
Contrast ratio	100:1

RF spectrum analysis

Display range	
X axis (frequency)	user-selectable, linear or logarithmic
Y axis (level)	10 dB to 200 dB, adjustable in 10 dB steps
Traces	max. 2
Display modes	Clr/Write, Max Hold, View
Frequency scan modes	
Spectrum Overview	scan with fixed attenuation and step size with maximum speed
Scan	scan with automatic attenuation setting and selectable step size
Channel	scan on up to 400 preset frequencies

Marker

	2 markers with digital display of frequency and level
Marker functions	Normal Marker, Delta Marker, Marker to Peak, Next Peak Right, Next Peak Left, Marker Track, Receiver to Marker, Marker Zoom; display of a user-selectable section of the trace; zoom depth down to single value display from max. 30,000 scan values

Time domain analysis

Display range (sweep time)	5 ms to 10,000 s
Minimum resolution (x axis)	100 µs
Level display range (y axis)	10 to 200 dB, adjustable in 10 dB steps, autoscale function
Triggering	
Internal	RF-level-controlled, threshold adjustable via display line, digital on-screen display of threshold
External	TTL levels, positive or negative edge
Manual	manual trigger of sweep
Sweep	one-shot or free-running
Number of traces	max. 2
Display modes	Clr/Write, Max Hold, View
Markers	2 markers with digital display of time and level
Marker functions	Normal Marker, Delta Marker, Marker to Peak, Next Peak Right, Next Peak Left, Marker Zoom; display of a user-selectable section of the trace; zoom depth down to single value display from max. 30,000 values measured in time domain

IF spectrum analysis (option ESCS-B4)

Display range	10 kHz to 10 MHz, 1/2/5 steps
IF input attenuation	0/20 dB (selectable)
Resolution	1/3/10 kHz
Sweep time	50 ms to 10 s, 1/2/5 steps
Level display range	80 dB
Number of traces	max. 2
Display modes	Clr/Write, Max Hold, Min Hold, Average, View
Markers	2 markers with digital display of frequency and level
Marker functions	Normal Marker, Delta Marker, Marker to Peak, Tune to Marker

Demodulation modes

	AM, FM, A0 (zero beat)
Loudspeaker	built-in loudspeaker, headphones connection
Volume	adjustable with knob
Squelch	digitally adjustable, displayed on screen, coupled to threshold level for triggering measurements

Date, time of day

	built-in clock module, continuously active, fed from internal battery

Internal memory

Transducer	22 transducer factors with up to 50 values, nonvolatile, combinable
Limit lines	22 limit lines with up to 50 values, nonvolatile
Instrument settings	9 complete setups, nonvolatile
Automatic scan	
Frequency scan	can be defined with start and stop frequency and step size, max. 5 ranges with individual settings
Frequency lists	automatic measurement on max. 400 frequencies
RFI voltage measurement	automatic control of LISNs, peak value determination in up to 400 subranges, limit check
RFI power measurement	interactive scan with absorbing clamp, peak value determination in up to 400 subranges, limit check
RFI field-strength measurement	interactive scan with automatic antenna switching, peak value determination in up to 400 subranges, limit check

Documentation

Plotter (IEC/IEEE bus) or printer (Centronics)	graphs with limit lines, settings and comments, complete test reports, lists with frequency and level
Scaling of graphs	lin or log frequency axis

Connectors and interfaces

Remote control	interface to IEC625.2 (IEEE488.2)
Remote-control connector	24-pin Amphenol
Plotter	via IEC/IEEE-bus interface
Printer connector	parallel interface (25-pin Centronics)
Suitable printers	24-pin impact, inkjet (monochrome and colour), laser printer
Floppy disk drive	$3^1/_2$", 1.44 Mbyte (formatted) for saving instrument settings, measurement results, transducer factors and limit lines
Formatting	MS-DOS-compatible
Data format	binary or HP-GL
Front-panel outputs	
Supply and coding connector for antennas, etc.	12-pin Tuchel
AF output	stereo jack 3.5 mm, adjustable level
Tracking generator (option ESCS-B5)	
Generator output	50 Ω, N female
Frequency range	9 kHz to 2750 MHz
Output level	90 dBµV, can be electronically reduced by max. 10 dB
Frequency response	<2 dB
Rear-panel outputs	
IF 10.7 MHz	50 Ω, BNC female
EMF in range of analog level display for unmodulated sinewave signal	1 mV to 1 V
Bandwidth = IF bandwidth	
Reference input/output	BNC female
Frequency	10 MHz
Output level	7 dBm
Frequency drift	see frequency accuracy
Input level (if switched as reference input)	>–7 dBm (0.1 V)
User port	25-pin Cannon connector for control of LISNs (phase switching) and antennas
Keyboard connector	5-pin DIN for connection of MF2 keyboard
VGA connector	15-pin Cannon for connection of colour monitor
Rear-panel inputs	
Reference input/output	BNC female
External battery	3-pin male
Required voltage	11 to 33 V (switch-on voltage >12 V)

General data

Rated temperature range	0 to +50°C
Storage temperature range	–20 to +60°C
Mechanical resistance	shock-tested to MIL-STD-810 D (shock spectrum 40 g), vibration-tested to MIL-T-28800 D, class 5; complies with IEC Publ. 68-2-6
EMC	to EEA-EMC directive (89/336/EEC), German EMC legislation and CISPR 16-1, A-1
Calibration interval	1 year
Selftest	on keystroke, fault detection down to module level
Power supply	
AC supply	100/120/230/240 V ± 10%, 47 to 420 Hz (60 VA), safety class I to VDE 0411 (IEC 348)
Battery, external internal (options[1]))	11 to 33 V/2.5 A at 24 V, 4.7 A at 12 V 13.2 V, Ni-MH
Operating time with Battery Controller ESCS-B1 and 3 Battery Packs ESCS-B2	3 h (basic unit only)
Indication of operating time	in hours and minutes with automatic warning if remaining operating time is less than 20 min
Dimensions (W x H x D)	435 mm x 236 mm x 350 mm
Weight	18.4 kg
with option ESCS-B1 and 3 Battery Packs ESCS-B2	22.9 kg

[1]) ESCS-B1 and ESCS-B2

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

Ordering information

EMI Test Receiver (9 kHz to 2750 MHz)	ESCS30	1102.4500.30

Options

Battery Controller Ni-MH and battery support (without battery packs)	ESCS-B1	1102.6490.02
Ni-MH Battery Pack (max. 3 packs can be inserted, option ESCS-B1 required)	ESCS-B2	1102.6690.02
IF Spectrum Analysis	ESCS-B4	1102.6890.02
Tracking Generator 9 kHz to 2750 MHz	ESCS-B5	1102.7097.02
OCXO Reference Oscillator	ESCS-B6	1102.9397.02
RMS Detector	ESCS-B9	1102.7897.02

Recommended extras

Current Probe 20 Hz to 100 MHz	EZ-17	0816.2063.02
20 Hz to 100 MHz for EMS measurements	EZ-17	0816.2063.03
RF Current Probe 100 kHz to 30 MHz	ESH2-Z1	0338.3516.52
VHF Current Probe 20 to 300 MHz	ESV-Z1	0353.7019.02
Absorbing Clamp 30 to 1000 MHz	MDS-21	0194.0100.50
Adapter (BNC female to N male)		0118.2812.00
Active Probe 9 kHz to 30 MHz, high-impedance	ESH2-Z2	0299.7210.52
Passive Probe 9 kHz to 30 MHz, VDE 0876	ESH2-Z3	0299.7810.52
Four-Line V-Network 9 kHz to 150 kHz/30 MHz, VDE 0876	ESH2-Z5	0338.5219.53
Four-Line V-Network	ENV4200	1107.2387.02
2x2 Wire ISN to CISPR22 on unshielded telecommunication ports	ENY22	1109.9508.02
4 Wire ISN to CISPR22 on unshielded telecommunication ports	ENY41	1110.0175.02
Option for ENY41: 3 additional RJ45 adapters	ENY4-B1	1109.9950.02
Two-Line V-Network	ESH3-Z5	0831.5518.52
V-Network 5 µH ||50 Ω	ESH3-Z6	0836.5016.52
Attenuator 20 dB, 10 W	ESH2-Z11	0349.7518.52
Antenna Impedance Converter	EZ-12	1026.4800.02

Antennas and accessories

Rod Antenna	HFH2-Z1	0335.3215.52
Loop Antenna 9 kHz to 30 MHz	HFH2-Z2	0335.4711.52
Roof-Mounting Kit	HFH2-Z5	0335.5718.02
Inductive Probe	HFH2-Z4	0338.3016.52
Broadband Dipole 20 to 80 MHz	HUF-Z1	0358.0512.52
Log-Periodic Broadband Antenna 80 MHz to 1300 MHz	HL023A1	0577.8017.02
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
Probe	HFV-Z	0204.1010.02
Adapter for Probe (BNC female to N male)		0118.2812.00
Preamplifier 10 dB, 20 to 1000 MHz	ESV-Z3	0397.7014.52
Tripod	HFU-Z	0100.1114.02
Mast	HFU-Z	0100.1120.02
Wooden Tripod	HZ-1	0837.2310.02
RF Connecting Cable, 7 m	HFU2-Z5	0252.0055.56
12 m	HFU2-Z4	0252.0090.56

Other accessories

Keyboard, German	PSA-Z1	1009.5001.31
English	PSA-Z1	1009.5001.32
Headphones		0708.9010.00
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	ZZK-953	1013.9389.00

Cables

IEC/IEEE-Bus Connecting Cable, 1 m	PCK	0292.2013.10
2 m	PCK	0292.2013.20
Control Cables for LISNs		
From ESCS30 to ESH3-Z5, 2 m	EZ-14	1026.5341.02
to ESH2-Z5, 2 m	EZ-13	1026.5293.02
to ENV4200, 3 m	EZ-21	1107.2087.03
to ENV4200, 10 m	EZ-21	1107.2087.10
Control Cables for LISNs in shielded cabins		
From ESCS30 to ESH3-Z5		
(both cables required), 2 m	EZ-14	1026.5341.02
10 m	EZ-6	0816.0683.03
to ESH2-Z5		
(both cables required), 2 m	EZ-14	1026.5341.02
10 m	EZ-5	0816.0625.03
to ENV4200		
(both cables required), 3 m	EZ-21	1107.2087.03
10 m	EZ-21	1107.2087.10
Feeder Cable for active antennas in shielded cabins (two required)		
Feedthrough Cable, 3 m	HZ-3	0837.3469.02
10 m	HZ-4	0816.0519.02
Printer Cable	EZ-23	1106.3638.02

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