

EMI Receiver ESPC

EMC-compatible development and production

- Correct interference weighting to CISPR 16-1 down to 10-Hz pulse repetition frequency
- Integrated preselection
- For all commercial EMI standards such as CISPR, EN, ETS, FCC and ANSI C63.4, VCCI as well as VDE
- Automatic overload detection
- Power sourcing from internal or external battery
- Easy to use thanks to built-in macro functions
- EMI software under Windows™ supplied as standard



ROHDE & SCHWARZ



EMI Precertification Test Receiver ESPC has been derived from various Rohde & Schwarz full-compliance receiver models and thus opens up versatile applications in the field of EMI precompliance. It is a budget-priced solution for emission tests at all stages of development and production of electrical products. With a view to obtaining the CE conformity mark, this test receiver will be used wherever EMI tests become necessary prior to acceptance testing in order to minimize the risks involved and the time taken for full-compliance tests.

Featuring built-in preselection, ESPC is able to perform accurate interference measurements with pulse repetition frequencies (PRF) to as low as 10 Hz in line with CISPR 16-1. An overload detection system for the

complete receiver signal path from the input through to the IF stages warns the user in case of erroneous measurements.

Preselection and overload protection ensure reliable and reproducible measurements which is a particularly important aspect in automatic test runs. Incorrect EMI diagnostics at an early production stage cause high costs, delay the product launch and hence put at risk the return on high investment. If a product does not pass the compliance test for whatever reason, it is all the more important that the test receiver used for post-qualification is absolutely reliable so that rework can be performed within the shortest possible time and the compliance test repeated as soon as possible.

Special features of ESPC

- Large frequency range from 150 kHz to 1000 MHz
- Options for frequency extension to 9 kHz and 2500 MHz
- Parallel detectors for average, peak and quasi-peak reading
- Fast synthesizer: frequency resolution 10 and 100 Hz

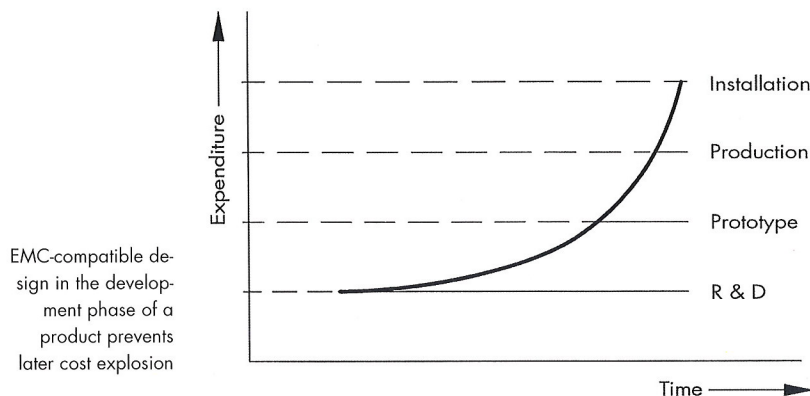
Powerful processor system

- Macros for automatic and semi-automatic test routines
- Automatic level calibration
- Measurement of voltage, field strength, current and pulse spectral density with display of relevant units
- Automatic consideration of frequency-dependent transducer factors

Since the ESPC has been designed for use in electrical and electronic industries to cover all stages of development and production, it offers a compact and economical solution in particular for

- development-accompanying EMI diagnostic measurements,
- pre- and post-qualification tests,
- production tests.

With the aid of fast prescan measurements and subsequent evaluation the ESPC checks the equipment under test



for EMC compatibility. The ESPC provides settings of scan, bandwidth, limit lines and correction factors of frequency-dependent accessories in line with the relevant standards and thus satisfies the main requirements in development for improving the product quality while saving time and money. The comparison with standard or user-defined limit values allows immediate differentiation between critical and non-critical emissions of the EUT. With the aid of a variable acceptance value, uncertainties in the test setup or production tolerances can be taken into account.

Due to the increasing number and higher frequencies of mobile radio services, useful and interfering emissions up to 2.5 GHz have often to be investigated although weighting of emissions in line with EN standards is

specified up to a frequency limit of 1 GHz only. The ESPC provides an optional frequency range extension up to 2.5 GHz which can also be retrofitted.

Complete tests at a keystroke

Using the FAST PRESCAN function and peak and/or average detectors, the critical ranges of the spectrum can be determined and, to minimize the measurement time, the final measurement then correctly be carried out at the critical frequencies with the aid of

data reduction routines and quasi-peak and average detectors. With this concept valuable measurement time can be saved which otherwise would be spent on ranges of no interest with low emission levels.

The test receiver automatically selects the correct CISPR bandwidths for the relevant test frequency. In conjunction with firmware macros for automatic test routines, comparisons with limit lines, for instance to EN standards, can conveniently be made.

Up to 22 different

- limit lines and
- transducer factors

can be stored in a built-in nonvolatile memory, ensuring high accuracy for every frequency step.

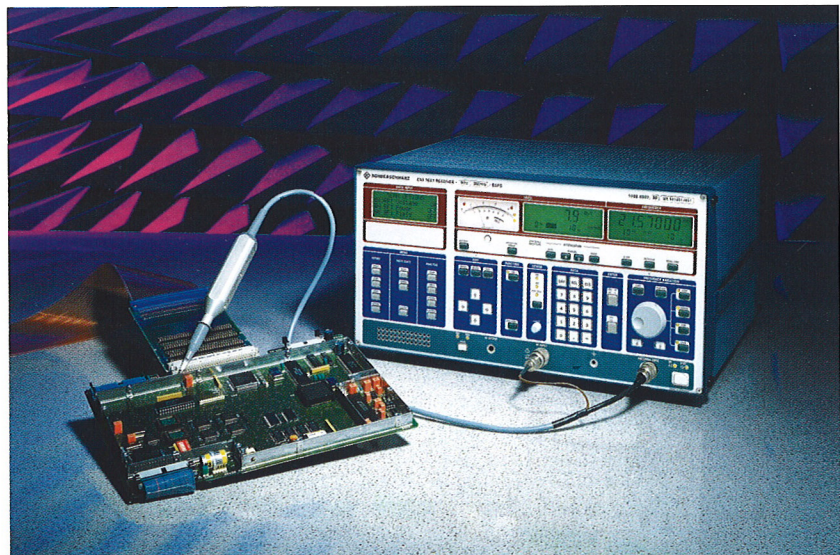
Users not specialized in EMI can also easily handle and carry out these reproducible test runs. The ESPC shows its true strength at the press of a single button and starts as a stand-alone unit measurement of

- RFI voltage,
- RFI power,
- RFI field strength.

Moreover, the following test routines are available:

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

ESPC allows simple and time-saving performance of development-accompanying diagnostic measurements



A comprehensive test report can be output on a printer or plotter. This makes the ESPC an extremely useful tool in development.

The report contains all the information required for reproducible measurements such as comments and description, test receiver settings, graphs and final results.

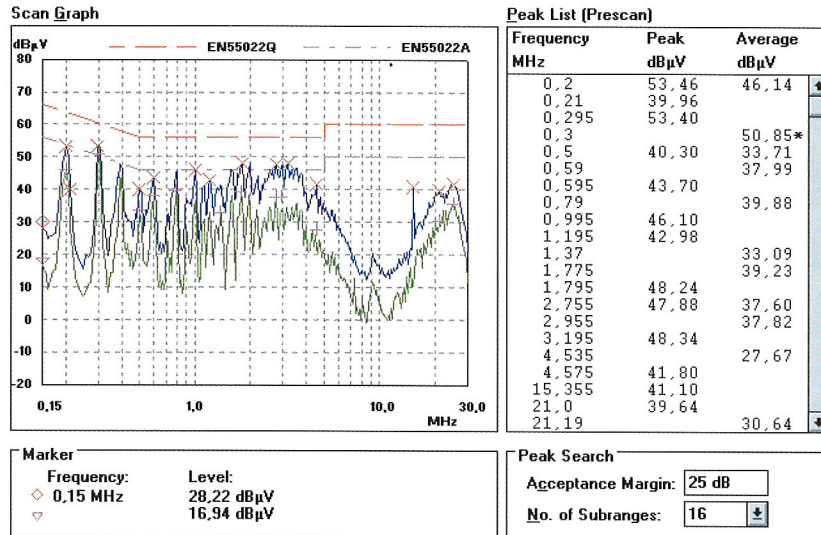
The final results of RFI voltage measurements are listed with frequency and level for QP and AV values. Levels exceeding the limit line are marked by an asterisk, with phase and grounding being specified.

Software-supported EMI measurements

The Windows™ Software ESPC-K1 supplied with the ESPC supports EMI measurements in line with commercial standards. After setting of the measurement configuration and test parameters via pulldown menus, the results are displayed as graphs and lists on the screen of a PC. Following a prescan measurement, investigation and final measurement at the critical frequencies are made in automatic, semiautomatic interactive or manual mode. Marker and zoom functions facilitate analysis of spurious emissions. The ESPC is controlled via the IEC/IEEE bus.

The test results can be output as graphs or lists on printers supported by Windows™ or as files. A complete RFI voltage test in line with EN55022 is shown in the illustration.

RFI voltage test to EN55022



Note: In conjunction with line-impedance stabilization networks the ESPC should always be used with the Pulse Limiter ESH3-Z2 for safety reasons (see also recommended extras).

Specifications

Frequency range

Lower limit 150 kHz (optionally 9 kHz with ESPC-B2)
Upper limit 1000 MHz (optionally 2500 MHz with ESPC-B3)

Frequency setting with tuning knob in 10-Hz, 100-Hz and 100-kHz steps or user-selectable

numerical via keyboard
automatic scan for RF analysis

Display 8-digit LCD with backlighting, can be switched off

Resolution up to 1000 MHz: 10 Hz,
from 1000 MHz: 100 Hz

Frequency error $< 3 \times 10^{-6}$, after 30 min warmup

RF input

VSWR, $f_{in} < 1$ GHz
 $Z_{in} = 50 \Omega$, N female
1.5 with ≥ 10 dB RF attenuation
 < 2 with 0 dB RF attenuation

RF attenuator

0 to 70 dB, 10-dB steps

Maximum input level

RF attenuation 0 dB
Sinewave AC voltage 130 dBµV (0.1 W)
Pulse spectral density 97 dBµV/MHz (100 V x 0.5 ns)

RF attenuation ≥ 10 dB
Sinewave AC voltage 137 dBµV (1 W)
Max. pulse voltage 150 V
Max. pulse energy (10 µs) 10 mWs

Interference rejection, $f < 1000$ MHz

Image-frequency rejection, 70 dB
1st and 2nd IF 70 dB
IF rejection 70 dB

Preselection

9 kHz to 1000 MHz 2 fixed-tuned, 6 tracking filters
1000 to 2500 MHz 2 tracking filters

RF shielding

Voltage indication at a field strength of 3 V/m with 0 dB RF attenuation ($f \neq f_{in}$) < 0 dBµV
Additional error in quasi-peak indication range (3 V/m) < 1 dB

IF bandwidths

Nominal bandwidth	-3 dB	-6 dB
200 Hz ¹⁾ (with option ESPC-B2)	180 Hz	200 Hz
10 kHz ¹⁾	7 kHz	9.5 kHz
120 kHz ¹⁾	90 kHz	120 kHz

Noise indication, average

9 kHz to 2 MHz, BW = 200 Hz	+25 to -22 dBµV
$f > 2$ MHz	
BW = 200 Hz	-22 dBµV
BW = 10 kHz	-10 dBµV
BW = 120 kHz	0 dBµV

Voltage measurement range

Lower limit (additional error due to inherent noise < 1 dB)
Average indication (AV), $f > 2$ MHz
BW=200 Hz -18 dBµV
BW=10 kHz -6 dBµV
BW=120 kHz +4 dBµV
Upper limit AV, PK, QP 130 dBµV (RF attenuation ≥ 10 dB)

1) Tolerances to CISPR 16-1.

Level display	
Digital	in dB μ V, dB μ A, dBm, dB μ V/m, dB μ A/m, dBpW, 3-digit LCD with backlighting (can be switched off), resolution 0.1 dB
Analog	on moving-coil meter in operating range of IF detector with digital display of lower range limit
Operating ranges	30, 60 dB
Overload indication	by level detectors in RF and IF signal path
Detectors	average (AV), peak (PK), quasi-peak (QP); 2 detectors can be switched on simultaneously
Measurement times	1 ms to 100 s (1/2/5 steps)
Measurement error	
Average indication	≤ 1.5 dB
9 kHz to 1000 MHz	typ. 1.5 dB
1000 to 2500 MHz (optional)	to CISPR 16, ≥ 10 Hz pulse repetition frequency
Quasi-peak indication	harmonics generator; calibrates the receiver for settings, correction values stored in nonvolatile memory, duration approx. 2 min
Level calibration	
Demodulation modes	
Volum	AM, FM, A0 (zero beat), internal loudspeaker, headphones connector adjustable with rotary knob
Date, time of day	internal clock, permanently operated from internal battery
Internal memory	
Transducer	22 transducer factors with up to 50 reference values, nonvolatile, can be combined
Limit lines	22 limit lines with up to 50 reference values, nonvolatile
Instrument settings	9 complete setups, nonvolatile
Automatic modes	
Frequency scan	definable start and stop frequency and step size, max. 5 ranges with individual settings
Frequency lists	automatic measurement at max. 400 frequencies
RFI voltage measurements	automatic control of line-impedance stabilization networks, determination of maximum values in up to 400 subranges, checking for out-of-tolerance values
RFI power measurement	interactive mode with MDS absorbing clamps, determination of maximum values in up to 400 subranges, checking for out-of-tolerance values
RFI field-strength measurement	interactive mode with automatic antenna switchover, determination of maximum values in up to 400 subranges, checking for out-of-tolerance values
Documentation	
Plotter (IEC/IEEE bus) or printer (Centronics)	graphs with limit lines, settings and comments, frequency and level lists
Scaling of graphs	linear or logarithmic frequency axis
Connectors and interfaces	
Remote control	
Remote-control connector	interface to IEC625-2/IEEE488.2
Plotter	24-contact Amphenol connector via IEC/IEEE-bus interface
Printer	parallel interface (15-contact Cannon connector)
Front-panel outputs	
Supply and coding connector for antennas, etc	12-contact Tuchel connector
AF output	jack JK34, adjustable level
Rear-panel outputs	
IF 10.7 MHz	$Z_{out} = 50 \Omega$, BNC connector, bandwidth = IF bandwidth
User port	25-contact Cannon connector for control of LISNs (phase switching) and antennas
Keyboard connector	5-contact DIN connector for MF2 keyboard

Rear-panel inputs

Reference input	BNC connector
Frequency	10 MHz
EMF	> 1 V
Frequency drift	see frequency error
External battery	3-contact connector
Required voltage	11 to 33 V (switch-on voltage > 12 V)

General data

Rated temperature range	+5 to +45 °C
Operating temperature range	-10 to +55 °C (no condensation allowed)
Storage temperature range	-25 to +70 °C
Mechanical resistance	shock-tested to MIL-STD-810D (shock spectrum 40 g), vibration-tested to MIL-T-28800D, Class 5; corresponds to IEC Publ. 68-2-6
EMC	satisfies EMC directives of EU (89/336/EEC) and German EMC law
Calibration interval	1 year
Selftest	at a keystroke, detects faults down to module level
Power supply	
AC supply	100/120/240 V $\pm 10\%$, 230 V +6/-10%, 80 VA, 47 to 420 Hz, safety class I to VDE 0411 (IEC 348)
Battery (external)	11 to 33 V
Dimensions (W x H x D), weight	435 mm x 236 mm x 350 mm, 17 kg



Ordering information

EMI Test Receiver	ESPC	1082.8007.10
Accessories supplied	Windows™ Software ESPC-K1, power cable, connector for external battery, operating manual	
PC configuration required for Software ESPC-K1	IBM AT-compatible, 386 or higher	
Options		
Internal Battery with Automatic Charging	ESPC-B1	1082.9503.02
Frequency Extension 9 kHz to 150 kHz and IF bandwidth 200 Hz	ESPC-B2	1082.9555.02
Frequency Extension 1000 to 2500 MHz	ESPC-B3	1082.9603.02
Recommended extras		
Pulse Limiter (9 kHz to 30 MHz)	ESH3-Z2	0357.8810.52
10-dB Preamplifier (9 kHz to 30 MHz)	ESH3-Z3	0827.8016.52
10-dB Preamplifier (20 to 1000 MHz)	ESV-Z3	0397.7014.52
IEC/IEEE-Bus Interface for operation of ESPC-K1	PS-B4	1006.6207.04
IEC/IEEE-Bus Connecting Cable 1 m	PCK	0292.2013.10
IEC/IEEE-Bus Connecting Cable 2 m	PCK	0292.2013.20
Printer Cable	EZ-11	0816.1767.02
Control Cable for Artificial Mains Networks		
for ESH3-Z5 (2 m)	EZ-14	1026.5341.02
for ESH2-Z5 (2 m)	EZ-13	1026.5293.02
Service Kit	EZ-8	0816.1067.02
Headphones		0100.2959.00
Front Handles	ZZG-95	0396.5176.00
Transit Case	ZZK-953	1013.0510.00
Trolley	ZZK-1	1014.0510.00

Further accessories for EMI measurements (antennas, artificial mains networks, etc) see ESS data sheet (PD 756.9768)