

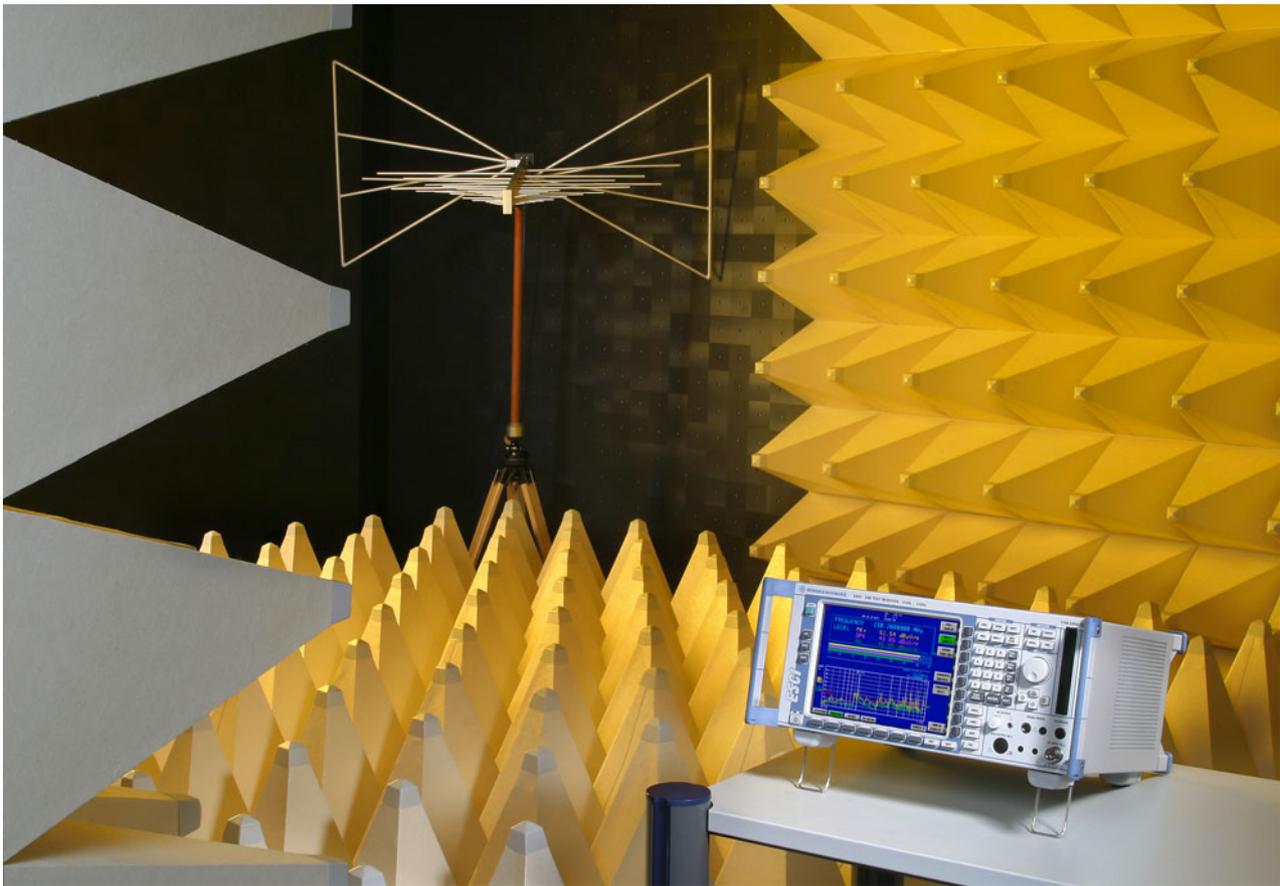


Contents Overview

Chapter Overview

Type Index

R&S Addresses



*R&S® ESCI, which is a compact EMI test receiver for conformity measurements to all civil standards from 9 kHz to 3 GHz*



Contents Overview

Chapter Overview

Type Index

R&S Addresses



◀	Contents Overview	Chapter Overview	Type Index	R&S Addresses	▶
---	-------------------	------------------	------------	---------------	---

## Contents of Chapter 2

Designation	Type	Description	Page
<b>Introduction</b>			56
<b>Equipment for EMI measurements to specific standards</b>			60
<b>EMI Test Receivers</b>			
9 kHz to 3 GHz 9 kHz to 7 GHz	R&S®ESPI3 R&S®ESPI7	Specially designed for precompliance measurements in development	62
9 kHz to 3 GHz	R&S®ESCI	Compact EMI test receiver for Conformity measurements to all civil standards	66
20 Hz to 7/26.5/40 GHz	R&S®ESIB7/26/40	EMI test receiver and spectrum analyzer all in one. Commercial/military EMI measurements, spectrum/network analyses in different frequency ranges	70
	R&S®ESIB-B2		Internal Preamplifier 74
<b>Signal Test Receivers</b>			
10 kHz to 3 GHz	R&S®EB200	Portable monitoring with Handheld Directional Antenna R&S®HE200	75
<b>Coverage Test Receivers</b>			
9 kHz to 3 GHz 9 kHz to 7 GHz	R&S®ESPI3 + R&S®ESPI-K50 R&S®ESPI7 + R&S®ESPI-K50	Field-strength measurements in mobile communications networks and terrestrial broadcast networks	62
<b>EMI Test Software</b>			
	R&S®ES-K1	Fully automatic measurement of conducted and radiated emissions to international commercial and military standards	78
	R&S®EMC32	For use in development, for compliance and batch testing	80
	R&S®EMC32-E+	EMI Measurement Software	82
	R&S®ESxS-K1	Low-cost remote-control display	84
<b>EMC Test Accessories</b>			
Absorbing Clamps, Ferrite Clamp	R&S®MDS-21, R&S®MDS-22, R&S®EZ-24		85
Triple-Loop Antenna	R&S®HM020		87
Active Antennas	R&S®AM524, R&S®HM525		88
Shielded, Calibrated Magnetic Field Pickup Coil	R&S®HZ-10		89
Probe SEN (E and H Field)	R&S®HZ-11, R&S®HZ-14		90
Precision Halfwave Dipole SEN	R&S®HZ-12, R&S®HZ-13		92
Active Dipole Antennas	R&S®HE202, R&S®HE302		93
HF Antennas; Power Supply (for remote feeding)	R&S®HFH2-Z2/-Z4/-Z6, R&S®HZ-9		94
VHF, UHF and SHF Antennas, RF Probe	R&S®HK116, R&S®HL223, R&S®HL023A1, R&S®HL040/050, R&S®HL562, R&S®HF906		98
Broadband Dipole, Tripods, Mast (manual)	R&S®HUF-Z1, R&S®HFU-Z, R&S®HZ-1		99
V-Networks	R&S®ESH2-Z5, R&S®ESH3-Z6, R&S®ENV216, R&S®ENV4200		102
Coupling Networks	R&S®ENY22, R&S®ENY41		104
Antenna Impedance Converter	R&S®EZ-12, R&S®EZ-17		105
150 kHz Highpass	R&S®EZ-25		106
Current Probes, Pulse Limiter, Attenuator	R&S®ESV-Z1, R&S®ESH3-Z2		106
Probes, Attenuators and RF Cables	R&S®ESH-Z2/-Z3, R&S®ESH2Z31, R&S®HFU, R&S®HZ3, R&S®HZ4		107
<b>Test Systems and Supplementary Equipment in other Chapters</b>			
EMC, EMI, EMS Test System Families	R&S®TS997..., R&S®TS998...		355
Field-Strength Measurement Systems	R&S®TS995...		336
Signal Generators	R&S®SM...		225

◀	Contents Overview	Chapter Overview	Type Index	R&S Addresses	▶
---	-------------------	------------------	------------	---------------	---



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Introduction

### EMC = EMI + EMS

Electromagnetic compatibility (EMC) is the capability of an electrical device or system to operate in its electromagnetic environment without disturbing or being disturbed by it. EMC is an important criterion of product quality. To ensure EMC of a product in the most economical way, appropriate measures should be taken as early as in the design phase.

According to the definition, EMC is subdivided into electromagnetic interference (EMI) and electromagnetic immunity or susceptibility (EMS). Legislation prescribes compliance with maximum values for EMI and minimum values for EMS. The relevant limit values, the measurement methods and instruments to be employed are specified in the relevant standards.

#### Conformity mark

To show their conformity to the EMC requirements prescribed by law, all electrical devices have to be marked accordingly.



*European CE conformity mark*

Since beginning of 1996 uniform marking is prescribed for the European Economic Area (EEA). From that date on electrical and electronic equipment not bearing the CE conformity mark may not be marketed any more in the whole European economic area.

### EMI measurements

For measuring the electromagnetic interference, the interference sink, which in the commercial sector is always the listener or viewer, is replaced by the measuring instrument. As a result, all test receivers for commercial EMI measurements should have man-like response built-in: they must have a quasi-peak-weighting detector to show the human perception of interference as a measured value.

In the military sector the interference sink is assumed to be a technical device which responds to the maximum interference level. Therefore, the peak level of interference is measured.

Interference is emitted by the equipment under test in completely undefined ways. Therefore, the EMC standards contain regulations for coupling the test receiver to the equipment under test, for the environment of the EUT and its operation.

### EMS measurements

For measuring the electromagnetic susceptibility, the different interference sources occurring in practice are replaced by appropriate generators, the interfering signals of which are applied to the EUT via suitable coupling/decoupling networks.

For monitoring the proper functioning of the EUT, suitable monitoring equipment can be provided, which so far has not been defined in the relevant EMC standards. In many cases, highly shielded video cameras with a monitor are used for this purpose.

### EMC measurement software

Reproducible EMC measurements are only possible upon strict compliance with a number of rules and standards for the measuring instruments used and for the measurement methods adopted.

EMI test equipment from Rohde&Schwarz complies with the relevant standards for measuring instruments. Compliance with the prescribed measurement methods, however, is the user's own problem. Support is rendered in the form of special measurement software allowing time-saving and correct measurements.

A number of measurement software packages is available (R&S®ES-K1, R&S®EMC32-E and R&S®ESxS-K1 for EMI measurements and R&S®EMC32-S for EMS measurements). They relieve the user of routine settings and offer every convenience from automatic consideration of frequency-dependent transducer factors of the coupling/decoupling networks, automatic selection of the applicable limit lines, display of the results in graphical or tabular form through to the generation of test reports. Similar convenience is provided by the automatic EMI test routines implemented in the Test Receivers of the R&S®ESCI, R&S®ESIB and R&S®ESPI series. They allow fully automatic time-saving measurements without an external controller, so that extremely compact test procedures can be implemented.



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Introduction

### EMC measuring instruments

Rohde&Schwarz not only offers suitable test receivers covering a frequency range from 20 Hz to 40 GHz for EMI measurements, but also the necessary accessories. In the range from 9 kHz to 3 GHz, different types of test receivers of the R&S®ESCI and R&S®ESPI families are available. The frequency range of the R&S®ESIB receivers starts at 20 Hz and extends to 7 GHz, 26.5 GHz or 40 GHz. There is the right instrument for every application and measurement problem, from the precertification test receiver R&S®ESPI for development-accompanying diagnostic measurements through to the high-end R&S®ESIB.

Line impedance stabilization networks (LISN) are required as coupling/decoupling networks for conducted emission measurements on power lines in the frequency range from 9 kHz to 30 MHz. These are available for a current drain of up to 16 A for two-phase feeding and up to 200 A for three-phase feeding of the EUTs. Symmetrical LISNs are available for RFI voltage measurements on data lines which are becoming ever more important.

Radiated emission is measured above 30 MHz, with calibrated antennas being required. The Rohde&Schwarz range of products comprises various high-precision antennas, as well as absorbing clamps, which are required for RFI power measurements e.g. on household appliances. For EMS measurements, the Rohde&Schwarz range of products includes signal generators whose modulation and level control characteristics are tailored to the specific requirements of these measurements. Suitable antennas and power meters are also available.

### EMC test systems

Planning and implementation of practice-oriented EMC test systems requires a great deal of specialized knowledge and experience. This is what Rohde&Schwarz specialists have. All their expertise goes into turnkey EMC test systems which provide the fastest way of yielding correct EMC measurements. These systems are always tailored to the specific needs of the customer to provide the optimum solution to the tasks on hand. We can offer everything from small systems through to complete equipment of test houses with shielded anechoic chamber and the complete infrastructure required. Naturally, the main emphasis is on fully automatic measurements with comprehensive documentation of the test results and, if desired, statistical evaluation. One of the important factors of automatic EMC test systems is calibration and continuous monitoring of the measurement accuracy to make sure that all test results will pass a verification compliance test.

### EMC seminars

Successful work in the field of EMC requires an accurate knowledge of all the relevant regulations, laws, standards and techniques required. It is not easy to be familiar with all of them and – in view of the frequent modifications – to remain up to date. Support is given in the form of seminars, in which experts both from Rohde&Schwarz and from outside will impart the necessary knowledge to the participants. These seminars are held at the training center in Munich, but are also offered at various Rohde&Schwarz branch offices; or also directly at the customer's if there is such a demand.

### EMC legislation and standards

For the European Economic Area (EEA) EMC is regulated in the "Council Directive of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility (89/336/EEC)", which was published in the Official Journal of the EU on 23 May 1989.

In the meantime this directive has been updated and transformed into national laws in all EEA member states, e.g. in Germany into the "Law on Electromagnetic Compatibility" (EMVG) of 25 September 1998.

The directive prescribes "protection goals" for all equipment containing electric or electronic components. These protection goals apply to EMI as well as to EMS. The directive does not contain any EMC limits, but refers to the appropriate standards. It is assumed that compliance with these standards entails compliance with the protection goals.

In order to be recognized by the directive and the EMVG, the numbers ("sources") of EMC standards must be published in the Official Journal of the European Communities or the Official Journal of Posts and Telecommunications.



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Introduction

### EMC standards

The number of standards published in the Official Journals is steadily increasing. The different types of standards include "generic standards", which are to be applied in all cases which are not covered by specific product or product family standards. The product (family) standards are divided into standards limiting low-frequency and high-frequency emission (radio disturbance suppression) and standards defining the requirements of immunity to electromagnetic emission. Besides, there is a series of specific product standards defining EMC requirements.

#### Individual EMC standards (extract of Official Journal 12/2002):

##### Generic standards – emission

- ◆ **EN 61000-6-3:** Residential, commercial and light industry environment
- ◆ **EN 61000-6-4:** Industrial environment

##### Generic standards – immunity

- ◆ **EN 61000-6-1:** Residential, commercial and light industry environment
- ◆ **EN 61000-6-2:** Industrial environment

##### Product family standards and product standards for low-frequency emission

- ◆ **EN 61 000-3-2:** EMC Part 3-2: Limits for harmonics up to 16 A
- ◆ **EN 61 000-3-3:** EMC Part 3-3: Limits for voltage fluctuations and flicker up to 16 A
- ◆ **EN 61000-3-11:** EMC Part 3-11: Limits for upper oscillation currents and voltage variations up to 75 A

##### Product family standards for high-frequency emission

- ◆ **EN 55011:** ISM equipment
- ◆ **EN 55012:** Vehicles, internal combustion engines
- ◆ **EN 55013:** Sound and TV broadcast receivers
- ◆ **EN 55014-1:** Household appliances and electric tools
- ◆ **EN 55015:** lighting equipment
- ◆ **EN 55022:** Information technology equipment
- ◆ **EN 55103-1:** Audio and video equipment

##### Product standards for immunity

- ◆ **EN 55014-2:** Household appliances, tools and similar apparatus
- ◆ **EN 61547:** Lighting equipment
- ◆ **EN 55020:** Sound and TV broadcast receivers
- ◆ **EN 55024:** Informatics equipment
- ◆ **EN 55103-2:** Audio and video equipment

##### Special standard for signal transmission in low voltage installations

- ◆ **EN 50065-1:** Signalling on low-voltage electrical installations, Part 1: General requirements, frequency bands and electromagnetic disturbances

##### Product standards containing EMC requirements

- ◆ **EN 50083-2:** Cable distribution systems for TV and sound signals
- ◆ **EN 50090-2-2:** Electrical system technique for home and buildings
- ◆ **EN 50091-2:** Uninterruptible power systems (UPS);
- ◆ **EN 50 130-4:** Alarm systems
- ◆ **EN 50 148:** Electronic taximeters

- ◆ **EN 50199:** Light arch welding equipment
- ◆ **EN 50227:** Nearing sensors
- ◆ **EN 50263:** Measuring relays
- ◆ **EN 50270:** Gas sensors
- ◆ **EN 50293:** Traffic signals
- ◆ **EN 60204-31:** Sewing machines
- ◆ **EN 60439-1, EN 60947-x-x, EN 50295:** Low voltage switchgear and control gear
- ◆ **EN 60521, EN 60687, EN 61036, EN 61268:** Several AC watt-hour meters
- ◆ **EN 60601-1-2:** Medical electrical apparatus, General safety requirements – EMC requirements and tests
- ◆ **EN 60669-2-x:** Electronic switches for household and similar
- ◆ **EN 60730-x-x:** Automatic electric controls for household and similar use
- ◆ **EN 60870-2-1:** Telecontrol equipment and systems
- ◆ **EN 60945:** Maritime navigational equipment
- ◆ **EN 61008-1, EN 61009-1, EN 61543:** Residual current circuit breakers
- ◆ **EN 61037:** Electronic ripple control receivers for tariff and load control
- ◆ **EN 61038:** Time switches for tariff and load control
- ◆ **EN 61 131-2:** Programmable controllers
- ◆ **EN 61326:** Electrical equipment for measurement and test, control and laboratory use
- ◆ **EN 61 800-3:** Adjustable speed electrical power drive systems
- ◆ **EN 12015, EN 12016:** Elevators and escalators
- ◆ **EN ISO 14982:** Agricultural and forestry machines
- ◆ **EN 300386:** Telecommunications network equipment



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



[Contents Overview](#)[Chapter Overview](#)[Type Index](#)[R&S Addresses](#)

## Introduction

### EMC standards for radio and telecommunication equipment

According to the European R&TTE Directive that took effect on 7 April 1999, standards for radio equipment and telecommunications terminal equipment are listed in the Official Journal. The R&TTE Directive was incorporated into the German Law on Radio Equipment and Telecommunications Terminal Equipment (FTEG). These include the ETSI standards EN30x xxx, e.g. EN301489 radio sets. So far, 52 of these standards have been published in the Official Journal. EMC test methods.

As already described above, since January 1996 all electrical products offered on the EEA market must be identified with the CE mark, the prerequisite for this conformity mark being compliance with the relevant EMC standards.

The EMC directive prescribes different test methods, depending on whether the equipment tested is "normal" equipment; it is also of importance whether complete standards, i.e. relating to both EMI and EMS, exist for that equipment.

In the simplest possible case, i.e. if a complete standard is available, the manufacturer or importer in the EEA is authorized to carry out the required tests himself and to label the product with the CE mark without supervision. Incomplete standards, however, require the involvement of a competent body.

All in all, the EMC and R&TTE directives give the manufacturer or importer more possibilities than previously to pursue independently the certification of the electromagnetic compatibility of his products, which is then recognized on the entire European market.

### Field-strength measurements

Wide measurement ranges (30 nV to 7 V) in conjunction with high selectivity and large dynamic range permit the Rohde&Schwarz test receivers to be used as high-accuracy selective voltmeters in labs and test departments. With built-in tracking generators, the test receivers can also perform twoport measurements. Antennas make them suitable for field-strength measurements.

Radiocommunication services (regulation authorities, broadcasting corporations, military, traffic and security authorities as well as civil providers) use field-strength meters for radio control and propagation measurements in the planning stage and for coverage measurements during operation of communication networks.

Field-strength measurements – in particular propagation and coverage measurements – are usually made in mobile mode (vehicle or helicopter). Portability and battery operation are important criteria in the choice of the test receiver.

### Hardware from Rohde&Schwarz

Rohde&Schwarz offers the complete range of measuring equipment from a single source: from automatic test receivers through to turnkey systems with power amplifiers and remote-controlled antennas. The Rohde&Schwarz products feature future-oriented design and advanced circuit technology; they comply with the highest international standards both electrically and mechanically.

### Software from Rohde&Schwarz

For years Rohde&Schwarz has been creating programs which are extremely user-friendly and can be used without any in-depth programming knowledge. Using modern software development tools and in close cooperation with the customers, program packages are tailored to the specific needs.

[Contents Overview](#)[Chapter Overview](#)[Type Index](#)[R&S Addresses](#)

# Equipment required for EMI measurements to specific standards

◀

▶

Contents Overview

Chapter Overview

Type Index

## Group of equipment

Standards		Industrial, scientific and medical equipment	Vehicles with combustion engines, remote/built-in RF suppression	Sound and TV broadcast receivers	Electrical devices, household appliances and tools	Fluorescent lamps and luminaires	Information technology equipment (ITE)	Military equipment and systems	Generic emission standards	Mains signalling equipment	Cable distribution systems, TV/sound	Uninterruptible power systems (UPS)	Professional audio/video equipm.	Electric railways	Medical electrical apparatus	Maritime navigation equipment
Frequency range	Test Receivers	Accessories and extras														
from 20 Hz	ESIB	Current Probe EZ-17 H-Field Coil HZ-10						●					●			
from 9 kHz	ESIB	Current Probe EZ-17 H-Field Coil HZ-10 Tripod HFU-Z Loop Antenna HFH2-Z2 Tripod HZ-1 Rod Antenna HFH2-Z6	○	○	○	○	●	●	○	○			●			
	ESCI	V-Network ESH2-Z5 V-Network ENV216			●	●	●	● <sup>b)</sup>	●	● <sup>c)</sup>	●	●	●	●	●	●
	ESPI <sup>1)</sup>	V-Network ENV 4200			●	●	●	● <sup>b)</sup>	●	● <sup>c)</sup>	●	●	●	●	●	●
	ESIB	V-Network ESH3-Z6 Coupling Network ENY22 Coupling Network ENY41 Probe ESH2-Z2 Probe ESH2-Z3 Ant. Imp. Converter EZ-12 Probe Set EZ-11 Probe Set EZ-14 Triple-Loop Ant. HM 020 RF Cable HZ-3/HZ-4	●		●	●	●	● <sup>b)</sup>	●	● <sup>c)</sup>	●	●	●	●	●	●
from 30 MHz	ESIB	Current Probe EZ-17 Current Probe ESV-Z1 Absorb. Clamp MDS-21/22 Probe Set HZ-11 Probe Set HZ-14 Tripod, Mast HFU-Z Broadband Dipole HUF-Z1 Log Periodic Ant. HL023A1 Biconical Antenna HK 116 Log Periodic Ant. HL223 Con. Log Spir. Ant. HUF-Z4 Tripod HZ-1 RF Cable HFU2-Z4/-Z5 Shielded TEM-Line S-LINE	○	○	○	○	○	●	○	○	○	○	○	○	○	○
	ESCI	Probe Set HZ-11 Probe Set HZ-14	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	ESPI <sup>1)</sup>	Tripod, Mast HFU-Z Broadband Dipole HUF-Z1 Log Periodic Ant. HL023A1	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	ESIB	Biconical Antenna HK 116 Log Periodic Ant. HL223 Con. Log Spir. Ant. HUF-Z4 Tripod HZ-1 RF Cable HFU2-Z4/-Z5 Shielded TEM-Line S-LINE	●	●	●	●	●	● <sup>f)</sup>	●	●	●	●	●	●	●	●
from 1 GHz	ESPI ESCI ESIB	Antennas HL050, AC008 on request	●		●		● <sup>2)</sup>	●			●					
from 2 GHz	ESIB	Antennas HL050, AC008 on request	●		●		● <sup>3)</sup>	●			●					
from 5 GHz	ESIB 26 ESIB 40	Antennas HL050, AC008 on request	●				●	●			●					
from 10 GHz	ESIB 26 ESIB 40	Antennas HL050, AC008 on request	●				●	●			●					
from 18 GHz to 40 GHz	ESIB 40	Accessories on request						● <sup>**</sup> ● <sup>***</sup>			●					

1) ESPC has limited compliance with CISPR 16-1.

2) FCC: clock frequency <200 MHz.

3) FCC: clock frequency <500 MHz.

4) VG up to 200 kHz.

5) VG.

6) VG, MIL.

# Equipment required for EMI measurements to specific standards

◀
▶

**Contents Overview**

**Chapter Overview**

**Type Index**

EN 60 947-x-x	EN 300 127	EN 300 220, 330, 440 EN 301489-3	EN 301489-5 EN 301489-6	EN 300339 EN 301489-1	EN 300340	EN 301489-7 EN 302018-2	EN 300385 EN 301489-4	ETSI 300386-1 EN 300 386-2	EN 301489-9	EN 301489-10	EN 301489-11 ETSI 300384/447	EN 301489-12	EN 301489-13	EN 300 741 EN 301489-2	EN 301489-15	EN 301783-2	EN 301489-16	EN 301489-17	EN 301489-18	EN 301843-2	EN 300 829	EN 301489-19	EN 300 831 EN 301489-20	EN 300 832 EN 301721	Description	
Low-voltage switchgear and control gear	Telecom Systems of large dimensions	Short range devices (SRD) 9 kHz to 40 GHz	PMR equipment DECT equipment	Generic EMC standard for radio equipment	ERMES paging receivers	GSM 900 MHz GSM 1800 MHz	Fixed radio links	Equipment of tele-communication networks	Wireless microphones and similar equipment	Second generation cordless telephones (CT2)	VHF FM broadcasting transmitters	VSAI, SNG and TES equipment	CB radio and ancillary equipment	On-site and wide-area paging equipment	Commercially available amateur radio equipment	Analog cellular radio comm. equipment	2.6 GHz wideband trans- mission and HIPERLAN	TETRA and ancillary equipment	VHF maritime mobile radio telephone	1.5 GHz maritime MES with LBRDC for GMDSS	1.5 GHz receive-only MES for data comm.	1.5/2/2.5 GHz MES for satellite GSM	<1 GHz MES with LBRDC using LEDs			
		●																							Current probe 5 Hz to 2 MHz/20 Hz to 100 MHz	
																									Shielded, calibrated field coil 5 Hz to 10 MHz	
		●																							Current probe 20 Hz to 100 MHz	
																									Shielded, calibrated field coil 5 Hz to 10 MHz	
		●																							Tripod for Loop Antenna HFH2-Z2	
																									Active loop antenna 9 kHz to 30 MHz	
																									Tripod for Rod Antenna HFH2-Z6	
																									Active rod antenna 9 kHz to 30 MHz	
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	V-network up to 25 A (70 A), 4-line LISN
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	V-network up to 16 A, 2-line LISN
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	V-network up to 200 A, 4-line LISN
			●	●		●	●		●		●	●		●	●	●									●	V-network up to 150 A (500 A), single-phase LISN
								○																		2-wire Coupling Network
								○																		4-wire Coupling Network)
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Active probe for RFI voltage measurement
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Passive probe for RFI voltage measurement
																										Antenna impedance converter 9 kHz to 30 MHz
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Near-field probe set 100 kHz to 2 GHz
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Near-field probe set 9 kHz to 1 GHz
		○																								Triple-loop antenna 9 kHz to 30 MHz
																										Low-loss coaxial cables 3 m/10 m
																										Current probe 20 Hz to 100 MHz
																										Current probe 20 to 300 MHz (cal. up to 600 MHz)
																										Absorbing clamp 30 to 1000 MHz
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Near-field probe set 100 kHz to 2 GHz
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Near-field probe set 9 kHz to 1 GHz
																										Absorbing Clamp Slideway HCA f. autom. meas.
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Broadband dipoles 20 to 80 MHz
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Log-periodic antenna 80 to 1300 MHz
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Biconical antenna 30 to 300 MHz
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Log-periodic antenna 200 to 1300 MHz
																										Conical log spiral antenna 200 to 1000 MHz
																										Tripod for HK116, HL223 and HUF-Z4
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	RF connecting cable 12 m/7 m, common-mode suppr.
		○	○	○	○	○		○	○					○	○	○										Shielded TEM-Line, 0.15 to 1000 MHz (2 models)
		●													●											Log-periodic antenna/directional ant. 1 to 18 GHz e.g. double-ridged waveguide horn antennas
			●													●										Log-periodic antenna/directional ant. 1 to 18 GHz e.g. double-ridged waveguide horn ant.
				●												●										Log-periodic antenna/directional ant. 1 to 18 GHz e.g. double-ridged waveguide horn antennas
					●											●										Log-periodic antenna/directional ant. 1 to 18 GHz e.g. double-ridged waveguide horn ant.
						●											●									Double-ridged waveguide horn antenna

### Legend

- necessary accessory
- recommended extra
- 10 GHz = upper freq. limit to GAM-EG 13
- \*\* 18 GHz = upper freq. limit to CISPR 11, VG standards and DEF-STAN 59-41
- \*\*\* 40 GHz = upper frequency limit to ANSI C63.2, C63.4 and MIL-STD-461
- Further European standards see page 58

## Test Receiver R&S® ESPI

**R&S® ESPI 3: 9 kHz to 3 GHz**

**R&S® ESPI 7: 9 kHz to 7 GHz**

**The precompliance standard**



### Brief description

The **R&S® ESPI3** and **R&S® ESPI7**, which are suitable for all commercial EMI standards to CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE, have been specially designed for precompliance measurements in development.

Both models are based on the modern Spectrum Analyzer Family R&S® FSP. They combine the complete repertoire of a high-end analyzer with that of a conventional test receiver in a manner that sets new standards with respect to versatility and performance in precompliance testing. This makes the final compliance test purely a formality. This combination makes the R&S® ESPI equally well-suited for general tasks in spectrum analysis as well as for special EMI diagnostics, providing an ideal instrument for any development laboratory or other facility that does not need to perform measurements in absolute conformity with the strict CISPR requirements. The objective is to perform and document EMC diagnostic measurements on the equipment under test as quickly as possible and as accurately as necessary.

### Main features

#### Excellent test receiver features

- ◆ Peak, Quasi-Peak, RMS and AV (max. 3 detectors simultaneously)
- ◆ EMI measurement bandwidths 200 Hz, 9 kHz, 120 kHz, 1 MHz
- ◆ Correct pulse weighting to CISPR 16-1 from PRF of **10 Hz**
- ◆ For all commercial EMI standards such as CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE

#### Extremely high measurement speed

- ◆ Fast detection of critical frequencies through overview measurements:
  - Measurement time 100  $\mu$ s to 100 s in receiver mode
  - up to 16000 s in analyzer mode
- ◆ Fast measurements in the time domain: minimum sweep time 1  $\mu$ s

#### Spectrum analyzer

- ◆ Resolution bandwidths from 10 Hz to 10 MHz (in 1/3/10 sequence)
- ◆ RMS detector for measurements on digitally modulated signals
- ◆ Test routines for TOI, ACPR, OBW, amplitude statistics
- ◆ Gated sweep for measurements on TDMA signals

### Outstanding performance features

- ◆ Total measurement uncertainty
  - Spectrum analyzer mode: 0.5 dB (without preselection)
  - Receiver mode: <1.5 dB
- ◆ Displayed average noise level (DANL): **-155 dBm** (1 Hz),  $f < 1$  GHz
- ◆ Phase noise of -145 dBc (1 Hz) typ. at an offset of 10 MHz provides optimum conditions for ACPR measurements on WCDMA systems
- ◆ NF = 21.5 dB (12 dB with preamplifier option R&S® ESPI-B2)
- ◆ User-programmable scan tables
- ◆ Display of results and comparison with standard-conformal limit lines
- ◆ Correction values for cable loss, coupling networks and antennas included as transducer factor
- ◆ Data reduction and modification of a frequency list for weighted final measurement
- ◆ Bargraph display for different types of detectors
- ◆ Automatic overload monitoring
- ◆ Built-in AF demodulation
- ◆ EMI bandwidths to CISPR
- ◆ Brilliant 21 cm TFT colour display
- ◆ Split-screen display with independent settings and up to 3 traces per screen
- ◆ Interfaces: GPIB, Centronics, RS-232-C, LAN (option)



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Test Receiver R&S®ESPI

### Characteristics

The precompliance measuring instruments from Rohde&Schwarz provide the functions that are required for in-house test sequences:

- ◆ Manual measurement of EMI spectra thanks to the receiver-oriented operating concept
- ◆ Semi-automatic measurements with predefined scan and sweep tables allowing interactive interruption
- ◆ Individual evaluation of critical frequencies using markers and additional detectors assigned to the markers which are simultaneously displayed
- ◆ Fully automatic interference measurements in conjunction with external EMI software packages from Rohde&Schwarz, including, for instance, determination of the worst case by automatic switchover of the phase and protective ground settings via the USER port for remote-controlled line impedance stabilization networks

Accuracy and reproducibility are also key parameters for all applications of the R&S®ESPI test receiver family.

The combination of test receiver and spectrum analyzer provides an optimum concept for precompliance measurements in development environments.

### EMI measurements to standard

Fitted with the optional preselector/preamplifier (R&S®ESPI-B2), all R&S®ESPI models feature an excellent dynamic range compared with other precompliance solutions and are, therefore, able to perform precise interference measurements with pulse repetition frequencies (PRF) from **10 Hz** to CISPR 16-1.

Measurements to commercial EMI standards such as CISPR, EN 550xx, ETS, FCC, ANSI C63.4, VCCI or VDE can be carried out directly by comparing the EMI spectrum with the associated limit lines and switching on the appropriate detectors (PK, QP, AV, RMS).

### Options

#### Preamplifier and preselection filters up to 3 GHz

The preselector/preamplifier option (R&S®ESPI-B2) is available as a protection against overloading by pulsed, high-power signals and for ensuring the validity of signal evaluation in the linear operating range of the measuring instrument. In the spectrum analyzer mode and in the test receiver mode, both modes offer the choice of switching the preamplifier on or off. In the receiver mode, the preselection filter setting is fixed, whereas in the analyzer mode it can be selected.

#### Tracking generator 9 kHz to 3 GHz

The optional Internal Tracking Generator R&S®FSP-B9 up to 3 GHz and External Generator Control R&S®FSP-B10 enhance the two R&S®ESPI test receiver models to give scalar network analyzer functionality. A frequency offset of  $\pm 150$  MHz can be set for measurements on frequency-converting modules. The tracking generator can be broadband-modulated by an external I/Q baseband signal.

#### LAN interface

With the aid of the optional LAN Interface R&S®FSP-B16, the R&S®ESPI models can be connected to common networks such as 100Base-T so that functions like file logging on network drives or documentation of measurement results via network

printer are available. The R&S®ESPI can also be remote-controlled via the LAN interface. Control is via a softpanel that behaves exactly as if it were part of a real instrument.

#### Trigger for coverage measurements

The Firmware Option R&S®ESPI-K50 enhances the application range of the Test Receivers R&S®ESPI3 and R&S®ESPI7 by adding field-strength profile measurements controlled by a displacement sensor. For these measurements, the option provides additional channel filters with bandwidths from 5.6 MHz to 8 MHz for DVB-T signals.

The option allows continuous level measurements to be performed with sufficiently high measurement rate and the results to be transferred to an evaluation unit. The measured levels are usually processed by the controller that remotely controls the Test Receiver R&S®ESPI via IEC/IEEE bus or LAN interface.

When a displacement sensor/GPS system is used, the external trigger input of the R&S®ESPI can be used to start single measurements. The level values can thus be accurately assigned to the measurement site.

The coverage measurement function of the R&S®ESPI is only available in the receiver mode plus remote control. There is a choice of two different measurement modes:

- ◆ All measurements are performed at a discrete frequency (>100 000 measurements/s including transfer via IEC/IEEE bus or LAN)
- ◆ A channel list is cyclically processed, i.e. a new frequency is set for each measurement (max. 10 000 channels)



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Test Receiver R&amp;S®ESPI

## Specifications in brief

You will find detailed and binding data on the enclosed CD (./DATASHEET/ESPI.pdf), or, for the latest updates, visit [www.rohde-schwarz.com](http://www.rohde-schwarz.com), search term: ESPI

Frequency	R&S®ESPI3	R&S®ESPI7
Frequency range	9 kHz to 3 GHz	9 kHz to 7 GHz
Frequency resolution	0.01 Hz	
Frequency display (receiver mode)		
Display	numerical display	
Resolution	0.1 Hz	
Frequency display (analyzer mode)		
Display	with marker or frequency counter	
Resolution	span/500	
Frequency counter		
Resolution	0.1 Hz to 10 kHz (selectable)	
<b>Spectral purity (dBc (1 Hz))</b> SSB phase noise, f = 500 MHz, carrier offset 10 MHz	-145 dBc (1 Hz) typ.	
Residual FM, f = 500 MHz, RBW 1 kHz, sweep time 100 ms	3 Hz typ.	
<b>Frequency scan (receiver mode)</b>		
Scan	scan with max. 10 subranges with different settings	
Measurement time per frequency	100 µs to 100 s, selectable	
<b>Sweep (analyzer mode)</b>		
Span 0 Hz (zero span)	1 µs to 16000 s	
Span ≥10 Hz	2.5 ms to 16000 s	
<b>IF bandwidths (receiver and analyzer mode)</b>		
Bandwidths (-3 dB)	10 Hz to 10 MHz; in 1, 3, 10 sequence	
EMI bandwidths (CISPR)	200 Hz, 9 kHz, 120 kHz (-6 dB) 1 MHz (pulse bandwidth)	
Video bandwidths (only analyzer mode)	1 Hz to 10 MHz; in 1, 3, 10 sequence	
<b>FFT filter</b>		
Bandwidths (-3 dB)	1 Hz to 30 kHz (-3 dB); in 1, 3, 10 sequence	
<b>Level</b>		
Maximum input level		
DC voltage	50 V	
RF attenuation 0 dB		
CW RF power	127 dBµV (= 0.3 W)	
Pulse spectral density	97 dB(µV/MHz)	
RF attenuation ≥10 dB		
CW RF power	137 dBµV (= 1 W)	
Max. pulse voltage	150 V	
Max. pulse energy (10 µs)	1 mWs	
<b>1 dB compression of input mixer</b> (0 dB RF attenuation, f >200 MHz, without preselector)	0 dBm nominal	
<b>Intermodulation</b>		
3rd-order intermodulation (TOI)		
Intermodulation-free dynamic range, level 2 x -30 dBm, Δf >5 × RBW or 10 kHz, whichever the greater value		
20 MHz to 200 MHz	>70 dBc, TOI >5 dBm	
200 MHz to 3 GHz	>74 dBc, TOI >7 dBm (10 dBm typ.)	
3 GHz to 7 GHz	- >80 dBc, TOI >10 dBm (15 dBm typ.)	

Frequency	R&S®ESPI3	R&S®ESPI7
<b>Second harmonic intercept point (SHI)</b>		
<100 MHz	typ. 25 dBm	
100 MHz to 3 GHz	typ. 35 dBm	
3 GHz to 7 GHz	-	typ. 45 dBm
<b>Displayed average noise level</b>		
0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, 20 averages, trace average, zero span, 50 Ω termination		
10 MHz to 1 GHz	<-142 dBm, typ. -145 dBm	<-140 dBm, typ. -145 dBm
<b>Immunity to interference</b>		
Image rejection	>70 dB	
Intermediate frequency (f <3 GHz)	>70 dB	
Spurious responses (f >1 MHz, without input signal, 0 dB attenuation)	<-103 dBm	
<b>Level display (receiver mode)</b>		
Digital	numerical; 0.01 dB resolution	
Analog	bargraph display, separately for each detector	
Spectrum	level axis 10 dB to 200 dB in 10 dB steps, frequency axis user- selectable, linear or logarithmic	
Detectors	average (AV), RMS, MaxPeak, MinPeak and Quasi-Peak (QP), 3 detectors can be switched on simultaneously	
Measurement time	100 µs to 100 s, selectable	
<b>Level display (analyzer mode)</b>		
Result display	501 × 400 pixels (one diagram), max. 2 diagrams with independent settings	
Log level scale	10 dB to 200 dB in 10 dB steps	
Linear level scale	10% of reference level per level division (10 divisions)	
Traces	max. 3 per diagram	
Trace detectors	MaxPeak, MinPeak, AutoPeak, Sample, RMS, Average, Quasi-Peak	
Trace functions	Clear/Write, MaxHold, MinHold, Average	
<b>Setting range of reference level</b>		
Logarithmic level display	-130 dBm to +30 dBm, in 0.1 dB steps	
<b>Level measurement accuracy</b>		
Level accuracy at 128 MHz (level = -30 dBm, RF attenuation 10 dB, ref. level -20 dBm, RBW 10 kHz)	<0.2 dB (σ = 0.07 dB)	
Quasi-peak display	in line with CISPR 16-1, ≥10 Hz pulse repetition frequency (with option R&S®ESPI-B2)	
<b>Frequency response</b>		
50 kHz to 3 GHz	<0.5 dB (σ = 0.17 dB)	
Attenuator	<0.2 dB (σ = 0.07 dB)	
Reference level switching	<0.2 dB (σ = 0.07 dB)	
<b>Total measurement uncertainty (0 Hz to 3 GHz)</b>		
Spectrum analyzer mode without preselection	0.5 dB	
Receiver mode with preselection	<1.5 dB	
<b>Audio demodulation</b>	AM and FM	
Audio output	loudspeaker and headphones output	



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Test Receiver R&amp;S®ESPI

Frequency	R&S®ESPI3	R&S®ESPI7
<b>Trigger functions</b>		
Trigger source	free run, video, external, IF level	
Trigger offset	125 ns to 100 s, resolution	
<b>Gated sweep</b>		
Trigger source	external, IF level, video	
Gate delay	1 µs to 100 s	
Gate length	125 ns to 100 s	
<b>Interfaces</b>		
IEEE-bus remote control	IEEE488.2 (IEC625)	
Serial interface	RS-232-C, 9-pin SUB-D connector	
Printer interface	parallel interface (Centronics)	

## General data

Display	21 cm TFT colour display (8.4") (VGA)	
Rated temperature range	+5°C to +40°C	
AC power supply	100 V AC to 240 V AC, 50 Hz to 400 Hz	
Power consumption	70 VA	120 VA
Dimension (W × H × D)	412 mm × 197 mm × 417 mm	
Weight	10.5 kg	11.3 kg

## Ordering information

<b>Test Receiver</b>		
9 kHz to 3 GHz	R&S®ESPI 3	1142.8007.03
9 kHz to 7 GHz	R&S®ESPI 7	1142.8007.07
<b>Accessories supplied</b>	Power cable, operating manual, service manual, adaptor cable for probe power	
<b>Options</b>		
Preselector/Preamplifier (factory-fitted)	R&S®ESPI-B2	1129.7498.02
Extended environment spec (1.9 g rms, 0 to 55 deg. G) for R&S®ESPI	R&S®ESPI-B20	1155.1606.03
Rugged case, carrying handle (factory-fitted)	R&S®FSP-B1	1129.7998.02
OCXO Reference Frequency	R&S®FSP-B4	1129.6740.02
TV Trigger and Adjustable RF Power Trigger (40 dB) for R&S®FSP and R&S®ESPI	R&S®FSP-B6	1129.8594.02
Internal Tracking Generator		
9 kHz to 3 GHz, I/Q modulator	R&S®FSP-B9	1129.6991.02
External Generator Control	R&S®FSP-B10	1129.7246.02
LAN Interface 100BT	R&S®FSP-B16	1129.8042.02
DC Supply 12 V to 28 V	R&S®FSP-B30	1155.1158.02

Battery Pack + Charge Unit <sup>1)</sup>	R&S®FSP-B31	1155.1258.02
Replace Battery Pack	R&S®FSP-B32	1155.1506.02
<b>Software</b>		
Firmware Coverage Measurements	R&S®ESPIK50	
Noise Measurement Software	R&S®FS-K3	1057.3028.02
<b>Extras</b>		
Pulse Limiter 0 Hz to 30 MHz	R&S®ESH3-Z2	0357.8810.54
Control Cable V-Network R&S®ESH2-Z5	R&S®EZ-13	1026.5293.02
Control Cable V-Network R&S®ESH3-Z5 (2 m)	R&S®EZ-14	1026.5341.02
Control Cable V-Network R&S®ENV216 (3 m)	R&S®EZ-1	1107.2087.03
Headphones	–	0708.9010.00
US Keyboard with trackball	R&S®PSP-Z2	1091.4100.02
PS/2 Mouse	R&S®FSE-Z2	1084.7043.02
IEC/IEEE-Bus Cable, 1 m or 2 m	R&S®PCK	0292.2013.x0
19" Rack Adapter (not for R&S®FSP-B1)	R&S®ZZA478	1096.3248.00
Bag for Instruments	R&S®ZT-473	1109.5048.00
Matching Pad, 75 Ω, L Section Series Resistor, 25 Ω <sup>2)</sup>		
SWR Bridge, 5 MHz to 3000 MHz	R&S®RAM R&S®RAZ R&S®ZRB2	0358.5414.02 0358.5714.02 0373.9017.52
High-Power Attenuators, 100 W 3/6/10/20/30 dB	R&S®RBU 100 (XX = 03/06/10/20/30)	1073.8820.XX
High-Power Attenuators, 50 W 3/6/10/20/30 dB	R&S®RBU 50 (XX = 03/06/10/20/30)	1073.8695.XX

1) Requires R&S®ESPI with option R&S®FSP-B1.

2) Taken into account in device function RF INPUT 75 Ω.

## See also data sheets

Accessories for Test Receivers and Spectrum Analyzers: PD 0756.4320  
EMC Test Antennas: PD 0757.5743



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

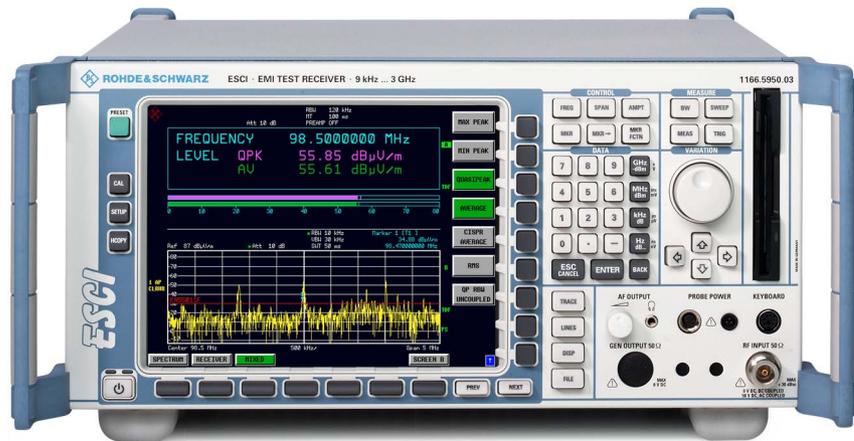
R&amp;S Addresses



## EMI Test Receiver R&amp;S® ESCI

New

**Compact EMI test receiver for compliance tests to all civil standards from 9 kHz to 3 GHz**



## Brief description

With the EMI Test Receiver R&S®ESCI, a top-class instrument is added to the family of EMI test receivers with spectrum analyzer platform. The R&S®ESCI provides measurements in full compliance with CISPR 16-1-1. The instrument operates in the frequency range from 9 kHz to 3 GHz and is equipped with a 21 cm TFT colour display. The EMI Test Receiver R&S®ESCI measures electromagnetic emissions in line with all civil standards and combines several types of instrument in one:

- ◆ Portable, tunable EMI test receiver that can be operated independently of the AC supply with the R&S®FSP-B30 and R&S®FSP-B31 battery options fitted and, with a weight of only 10.5 kg, is ideal for mobile use
- ◆ Spectrum analyzer with excellent RF characteristics and ample measurement functions for laboratory measurements, as well as measurements in compliance with mobile radio standards, featuring an RMS detector, selectable ACP standard and channel bandwidths up to 5 MHz

- ◆ Automatic, standard-conforming test receiver that independently performs measurements for certifications
- ◆ System-compatible test receiver capable of remote control via IEC/IEEE-bus interface, or LAN interface in conjunction with EMI software packages, e.g. R&S®EMC32
- ◆ Time-domain analyzer for measuring click interference, capable of recording interference versus time for a period of over two hours

## Main features

## Excellent test receiver characteristics

- ◆ For all commercial EMI requirements such as CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE
- ◆ Peak (max, min), quasi-peak, RMS, CISPR average, average detectors (max. three detectors can be switched on simultaneously)
- ◆ Bargraph display for various detectors, with peak-hold indication
- ◆ Pulse weighting conforming to CISPR 16-1-1 with quasi-peak detector
- ◆ Time-domain analysis, e.g. for measuring click interference
- ◆ CISPR-conformant EMI measurement bandwidths:  
200 Hz, 9 kHz, 120 kHz, 1 MHz

- ◆ 11 preselection filters and built-in 20 dB preamplifier
- ◆ Pulse-protected RF input
- ◆ Power supply for accessories such as sensors, probes and antennas
- ◆ Overload indication
- ◆ Built-in AF demodulator
- ◆ Bright 21 cm TFT colour display

## Powerful firmware functions

- ◆ Scan table with independently programmable parameters for up to ten subranges for automatic and interactive test routines
- ◆ Prescan measurement, data reduction and final measurement separately for each trace memory
- ◆ Correction values for cable loss, coupling networks and antennas taken into account in the form of transducer factors
- ◆ Data reduction and modification of frequency list for weighted final measurement
- ◆ Limit lines in accordance with civil standards
- ◆ Automatic level calibration
- ◆ Storage of complete instrument setups on disk or internal hard disk



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## EMI Test Receiver R&amp;S®ESCI

**High measurement speed**

- ◆ Receiver mode
  - Measurement times from 100 s (SCAN mode)
- ◆ Spectrum mode
  - Sweep times from 2.5 ms to 16000 s (span >10 Hz)
  - Zero span (time domain) from 1 s to 16000 s, resolution 125 ns

**Spectrum analyzer**

- ◆ Overview measurements in spectrum analyzer mode
- ◆ Resolution bandwidths from 10 Hz to 10 MHz (in steps of 1/3/10)
- ◆ RMS detector for measurements on digitally modulated signals
- ◆ Digital filters from 1 Hz to 30 kHz
- ◆ Channel filter bandwidths from 100 Hz to 5 MHz
- ◆ Test routines for IP3, ACPR, OBW
- ◆ Fast ACP measurements in time domain

**Performance**

- ◆ 1 dB compression >+5 dBm (without preselection)
- ◆ Total measurement uncertainty
  - Receiver mode <1 dB
  - Spectrum analyzer mode <0.5 dB (without preselection)
- ◆ Displayed average noise level (DANL) typ. -155 dBm (RBW = 10 Hz, preamplifier switched on)
- ◆ Phase noise (f = 500 MHz) <-113 dBc (1 Hz) (at 10 kHz from carrier)

**Other features****A new dimension in measurement speed and accuracy**

The R&S®ESCI sets new standards in terms of scope of functions, measurement speed and measurement accuracy in the instrument class up to 3 GHz.

The use of innovative techniques such as an LSI frontend and largely digital signal processing, in conjunction with Rohde & Schwarz-developed ASICs, result in excellent specifications and high reliability.

The measurements required for verifying compliance with electromagnetic compatibility requirements are laid down in international and national legislation and standards. The measurements stipulated for conducted and radiated EMI until approval and CE certification are extremely time-consuming. The R&S®ESCI's built-in intelligence substantially reduces the measurement effort and thus significantly cuts down on measurement time.

This specialist for EMI measurements furnishes results at maximum speed and accuracy in accordance with the requirements published by CISPR, CENELEC, ETSI, FCC, VCCI and VDE.

EMI full-compliance test receivers are needed when certification in accordance with relevant standards is to be obtained. Featuring a pulse-resistant attenuator, preselection with a 20 dB preamplifier and a frontend withstanding high loads, the EMI Test Receiver R&S®ESCI fully satisfies the requirements for measurements in line with the CISPR, VDE, ANSI, FCC, EN and VCCI standards.

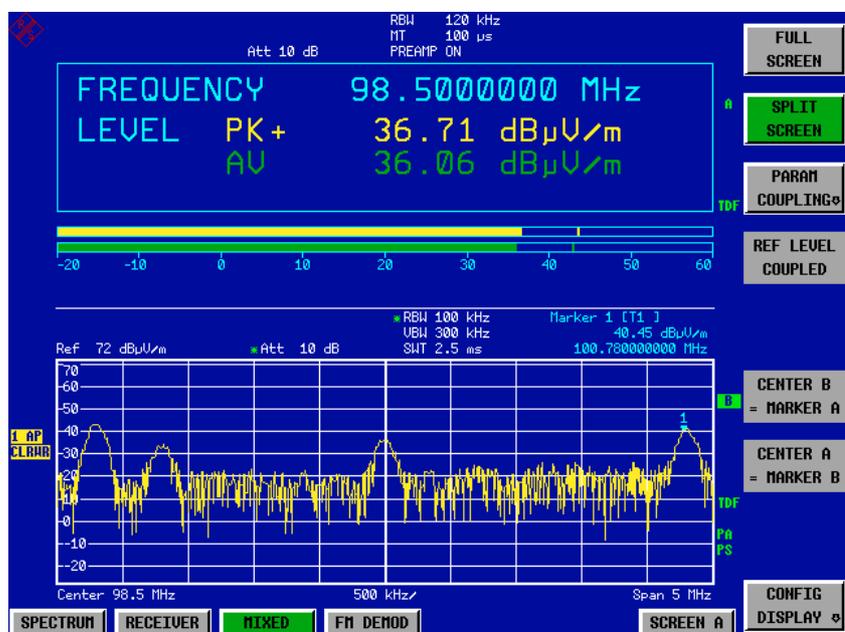
**Fast EMI measurements and MIXED mode display**

The typical EMC parameters such as

- RFI voltage,
- RFI power and
- RFI field strength

can be measured both with the analyzer and the test receiver.

The analyzer comes into its own where fast prescan sweeps have to be performed and evaluated with marker functions. The test receiver, on the other hand, offers the more elaborate tech-



*MIXED mode bargraph measurement and spectrum. The standard-conforming bargraph measurement and the fast sweep are displayed simultaneously*



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&S Addresses



## EMI Test Receiver R&S® ESCI

niques with respect to data reduction and standard-conforming final measurements including storage of all measured values and exact frequency measurement.

A large number of operating parameters can be coupled or decoupled both for the test receiver and the spectrum analyzer mode.

### Ready for the PC world ...

- ◆ PC-compatible screenshots without any need for conversion software
- ◆ Windows printer support
- ◆ USB interface (keyboard, mouse)
- ◆ Drivers: LabView, LabWindows/CVI, VXI plug & play instrument driver for VEE, Visual Basic, Visual C++, Borland C++, etc
- ◆ SCPI-compatible

### Options

#### Sturdy construction – for use under any conditions

For outdoor applications, the R&S® ESCI is available with an enclosure (option R&S® FSP B1) with shock-absorbing corners and carrying handles. In vehicles, the test receiver can be operated from an

optional 12 V to 28 V DC power supply (R&S® FSP-B30). On open-area test sites, the R&S® ESCI can perform measurements for several hours if equipped with the optional R&S® FSP-B31 battery pack. In extreme cases, an additional battery pack can be used. In the R&S® ESCI standard unit, data is stored on a hard disk. For use in vehicles, a flash disk can be used instead of the hard disk to accommodate for major temperature fluctuations (0°C to 55°C) and aggravated shock and vibration. The flash disk option (R&S® ESCI B20) has been specially designed for use under adverse conditions.

#### FM Measurement Demodulator R&S® FS K7

The R&S® FS K7 adds universal digital FM demodulation capability to the R&S® ESCI.

#### LAN Interface R&S® FSP-B16

Using the optional LAN Interface R&S® FSP B16, the R&S® ESCI can be configured as a network workstation. The Windows XP Remote Desktop function makes it particularly easy to log files on network drives or to document results via a network printer. This yields a clear speed advantage over the IEC/IEEE bus,

especially for the transmission of large data blocks. This makes the R&S® ESCI ideal for networking.

#### Internal Tracking Generator R&S® FSP-B9

The Internal Tracking Generator R&S® FSP-B9 covers the frequency range from 9 kHz to 3 GHz. A frequency offset of ±150 MHz can be set for measurements on frequency-converting modules. The tracking generator can be broadband-modulated using an external I/Q base-band signal.

#### External Generator Control R&S® FSP-B10

The R&S® FSP-B10 option uses a commercial RF signal generator as its external tracking source that can be controlled via the GPIB or a TTL bus. This option provides the functionality of the internal tracking generator.

#### TV Trigger and RF Power Trigger R&S® FSP-B6

The R&S® FSP-B6 option makes the test receiver suitable for analog TV measurements. It provides a settable RF level trigger for measurements on pulsed RF signals that are used in TDMA transmission systems.

## Specifications in brief

You will find detailed and binding data on our homepage [www.rohde-schwarz.com](http://www.rohde-schwarz.com), search term: ESCI

### Frequency

Frequency range	9 kHz to 3 GHz
Frequency resolution	0.01 Hz
Frequency display (receiver mode)	numeric display
Frequency display (analyzer mode)	with marker or frequency counter
Spectral purity, SSB phase noise f = 500 MHz, carrier offset = 10 MHz	typ. -145 dBc (1 Hz)

Scan	max. 10 partial ranges with different settings
Measurement time per frequency	100 µs to 100 s
<b>Sweep (analyzer mode)</b>	
In time range, span = 0 Hz	1 µs to 16000 s, resolution 125 ns
In frequency range, span ≥ 10 Hz	2.5 ms to 16000 s
<b>Resolution bandwidth</b>	
Sweep filter	
3-dB bandwidths	10 Hz to 3 MHz in 1/3 sequences
EMI filters (-6 dB, pulse bandwidth)	200 Hz, 9 kHz, 120 kHz, 1 MHz
Video bandwidths (analyzer mode)	1 Hz to 10 MHz in 1/3 sequences
FFT filters (-3 dB, analyzer mode)	1 Hz to 30 kHz in 1/3 sequences



Contents Overview

Chapter Overview

Type Index

R&S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## EMI Test Receiver R&amp;S® ESCI

Channel filters (bandwidths) 100/200/300/500 Hz, 1/1.5/2/2.4/2.7/3/3.4/4/4.5/5/6/8.5/9/10/12.5/14/15/16/18 (RRC)/20/21/ 24.3 (RRC)/25/30/50/100/150/192/200/300/500 kHz, 1/1.228/1.28 (RRC)/1.5/2/3/3.84 (RRC)/4.096 (RRC)/5 MHz (RRC = Root Raised Cosine)	
Preselection (can be switched off in analyzer mode)	11 preselection filters
Preamplifier (switchable between preselection and 1st mixer)	20 dB

## Level

<b>Display range</b>	displayed noise floor to 30 dBm
<b>Max. input level</b>	
RF attenuation $\geq 10$ dB	
DC voltage	0 V (DC coupling); 50 V (AC coupling)
CW RF power	30 dBm
Max. pulse volt age (10 $\mu$ s)	150 V
Max. pulse energy (20 $\mu$ s)	10 mWs
RF attenuation $\geq 10$ dB	
Pulse spectral density	97 dB $\mu$ V/MHz
<b>Intermodulation</b>	
1 dB compression of input mixer (f > 200 MHz, 0 dB RF attenuation, pre- selection and preamplifier OFF)	5 dBm (nominal)
3rd-order intercept point (T.O.I., 200 MHz to 3 GHz, level 2 $\times$ -30 dBm, $\Delta f > 5 \times$ IF bandwidth or resolution bandwidth, or $> 10$ kHz)	
Without preselection	$> 7$ dBm, typ. 10 dBm
With preselection, without preamp.	$> 2$ dBm, typ. 5 dBm
With preselection and preamplifier	$> 18$ dBm, typ. -15 dBm
Intercept point k2 (100 MHz to 3 GHz)	
Without preselection	typ. 35 dBm
With preselection, without preamp.	$> 50$ dBm
With preselection and preamplifier	$> 35$ dBm
<b>Displayed noise floor (analyzer mode)</b>	
0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, span = 0 Hz, 20 averages, trace average, 50 $\Omega$ termination, 10 MHz to 1 GHz	
Without preselection (AC/DC coupl.)	$< -142$ dBm, typ. -145 dBm
With preselection, without preamp.	$< -142$ dBm, typ. -145 dBm
With preselection and preamplifier	$< -152$ dBm, typ. -155 dBm
<b>Displayed noise floor (receiver mode)</b>	
AV display, 30 MHz to 1 GHz, BW = 120 kHz	
Without preamplifier	$< 6$ dB $\mu$ V, typ. 3 dB $\mu$ V
With preamplifier	$< -16$ dB $\mu$ V, typ. -19 dB $\mu$ V
<b>Immunity to interference</b>	
Image frequency, IF	$> 70$ dB
Spurious response (f > 1 MHz, without input signal, 0 dB RF attenuation)	$< -103$ dBm
Other spurious	$< -70$ dBc
<b>RF leakage</b>	
Level display, field strength 3 V/m, 0 dB RF attenuation, 50 $\Omega$ term., f $\neq$ f <sub>IF</sub>	$< 10$ dB $\mu$ V (nominal)
Level display (receiver mode)	
Level display, digital	numeric, 0.01 dB resolution
Level display, analog	bargraph display, separate for each detector
Spectrum, level axis	level axis 10 dB to 200 dB in 10 dB steps
Spectrum, frequency axis	user-selectable, linear or logarithmic

<b>Level display (analyzer mode)</b>	
Result display	501 x 400 pixels (per diagram), max. 2 diagrams with independent settings
Logarithmic level display range	1 dB, 10 dB to 200 dB in 10 dB steps
Linear level display range	10% of reference level per division (10 divisions)
Traces, 1 diagram	3
Traces, 2 diagrams	6
<b>Level measurement accuracy</b>	
Total error	
Without preselection and preampl.	0.5 dB
With preselection and preamplifier	1 dB
Quasi peak display	according to CISPR 16-1

## Trigger functions

Trigger source	free run, video external, IF level
Trigger offset, span $\geq 10$ Hz	125 ns to 100 s
Gate source	video external, IF level
Gate delay	1 $\mu$ s to 100 s

## Interfaces

External noise sources supply	BNC, female, 28 V DC
IEC/IEEE-bus remote control	IEC 625-2/IEEE 488.2
Serial interface	RS-232-C
Printer interface	Centronics parallel
USB interface	Version 1.1

## General data

Display	21-cm TFT color display, VGA
Operating temperature range	+5°C to +40°C 0°C to +50°C (with option R&S® ESCI-B20)
Power supply	100 V AC to 240 V AC, 50 Hz to 400 Hz, 3.1 to 1.3 A, 70 VA
Dimensions (W x H x D)	412 mm x 197 mm x 417 mm
Weight	10.5 kg

## Ordering information

<b>EMI Test Receiver</b>	R&S® ESCI	1166.5950.03
Accessories supplied	Power cord, operating manual, service manual	
<b>Options</b>		
Rugged Case with Variable Carrying Handle	R&S® FSP-B1	1129.7998.02
OCXO 10 MHz	R&S® FSP-B4	1129.6740.02
TV Trigger/RF Power Trigger	R&S® FSP-B6	1129.8594.02
Tracking Generator, I/Q Modulator	R&S® FSP-B9	1129.6991.02
External Generator Control	R&S® FSP-B10	1129.7246.02
LAN Interface 100 BT	R&S® FSP-B16	1129.8042.03
Extension of Environmental Specifications	R&S® ESCI-B20	1155.1606.09
DC Power Supply	R&S® FSP-B30	1155.1158.02
NIMH Battery Pack + Charger	R&S® FSP-B31	1155.1258.02
Spare Battery Pack (NIMH)	R&S® FSP-B32	1155.1506.02



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## EMI Test Receiver R&amp;S® ESIB

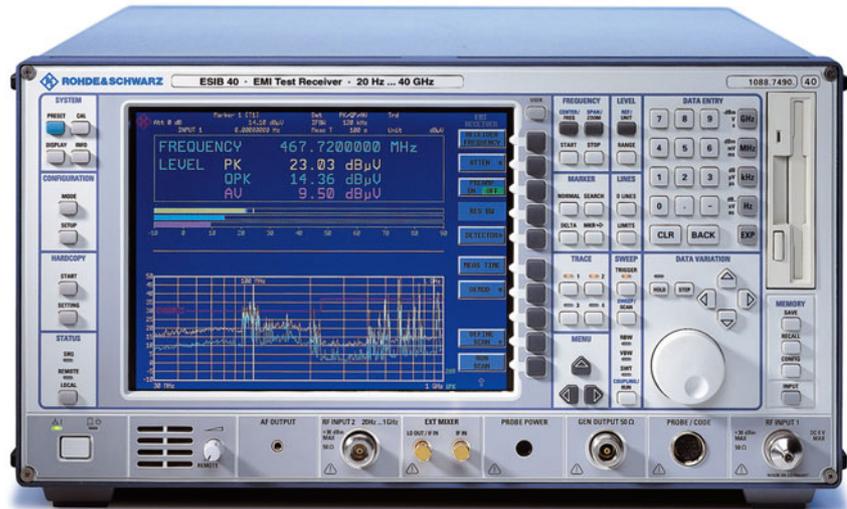
R&S® ESIB7: 20 Hz to 7 GHz

R&S® ESIB26: 20 Hz to 26.5 GHz

R&S® ESIB40: 20 Hz to 40 GHz

EMI measurements up to 40 GHz

conforming to standards



R&S® ESIB40

### Brief description

The EMI test receivers of the R&S® ESIB family combine the versatility and measurement speed of spectrum analyzers with the advantages of classic test receivers and fulfill the extremely high dynamic requirements for EMI measurements in conformance with standards.

The R&S® ESIB family comprises three models with different upper frequency limits. The upper frequency limit of the R&S® ESIB26 and R&S® ESIB40 can be extended up to 110 GHz by means of external mixers (option R&S® FSE-B21).

### Main features

#### State-of-the-art technology

- ◆ Low inherent noise
- ◆ Wide dynamic range
- ◆ Preselection + preamplifier
- ◆ Automatic overload control
- ◆ Pulse-protected 2nd RF input
- ◆ Fast overview measurements

#### Current standards

- ◆ Correct weighting of pulses to CISPR 16-1-1 and VDE0876

- ◆ All commercial and military standards such as CISPR, EN, ETS, FCC, VDE, ANSI, VCCI, MIL-STD, VG, DEF-STAN, and many others

#### Straightforward operation

- ◆ Active colour LCD
- ◆ Analog level display for each detector (parallel operation)
- ◆ Split-screen display for detailed analysis (i. e. combination of Analyzer and receiver settings)
- ◆ Receiver-oriented operating concept allowing manual operation
- ◆ EMI software package R&S® ES-K1 supplied

#### System integration

- ◆ Fast data processing for use in automatic test systems. The IEC/IEEE bus command set (IEC625-2) is SCPI-conformal (1994.0)
- ◆ Integrated computer function under Windows provided as standard
- ◆ Use as test system controller by adding a second IEC/IEEE bus card (option R&S® FSE-B17)
- ◆ Space- and cost-saving implementation of complete test systems without need for an additional controller

#### Documentation of results

- ◆ All printers for which Windows drivers are available can be used
- ◆ Storage of results also on floppy disk or built-in hard disk in standard formats such as EMF, WMF or BMP

### Description

#### Practice-oriented test routines

During the various development phases of a product, different measurements are performed as required for each stage. The R&S® ESIB family offers appropriate features and routines for the different development stages. Early in development, functional measurements play the predominant role. While EMI measurements are important right from the beginning to avoid redesigns, the R&S® ESIB at this stage primarily functions as a high-grade spectrum analyzer (see R&S® FSE, page 185).

As development progresses, EMI measurements become more and more important, for example on modules and their interfaces. Here, too, the R&S® ESIB family meets all relevant requirements in terms of performance, functionality and economy of operation:





Contents Overview

Chapter Overview

Type Index

R&S Addresses



## EMI Test Receiver R&S® ESIB

### Specifications in brief

You will find detailed and binding data on the enclosed CD (./DATASHEET/ESIB.pdf), or, for the latest updates, visit [www.rohde-schwarz.com](http://www.rohde-schwarz.com), search term: ESIB

	R&S® ESIB7	ESIB26	ESIB40
<b>Frequency</b>			
<b>Frequency range</b>			
Input 1	20 Hz to 7 GHz	20 Hz to 26.5 GHz	20 Hz to 40 GHz
Input 2	20 Hz to 1 GHz		
Frequency display (receiver mode)	numeric display		
Frequency display (analyzer mode)	with marker		
Frequency counter	measures the marker frequency		
<b>Spectral purity</b>			
SSB phase noise, f ≤ 500 MHz, span > 100 kHz, carrier offset 100 kHz	< -111 dBc (1 Hz)		
<b>Frequency scan (receiver mode)</b>	scan with max. 10 subranges with different settings		
Measurement time per frequency	100 μs to 1000 s, selectable		
<b>Sweep (analyzer mode)</b>			
Span 0 Hz (zero span)	1 μs to 16000 s selectable in steps of 5%		
Span ≥ 10 Hz	5 ms to 1000 s selectable in steps of ≤ 10%		
Picture refresh rate/s (span ≤ 7 GHz)	> 20 updates/s with 1 trace, > 15 traces/s with 2 traces at shortest sweep time		
Sampling rate	50 ns (20 MHz A/D converter)		
Number of pixels	500		
Time-domain measurement	with marker and cursor lines		
<b>IF bandwidths (receiver mode)</b>			
6 dB bandwidths	10/100/200 Hz, 1/9/10/100/120 kHz, 1 <sup>1</sup> /10 MHz		
<b>Resolution bandwidths (analyzer mode)</b>			
3 dB bandwidth	1 Hz to 10 MHz, in steps of 1/2/3/5		
Video bandwidths	1 Hz to 10 MHz, in steps of 1/2/3/5		
<b>FFT filter</b>			
3 dB bandwidths	1 Hz to 1 kHz, in steps of 1/2/3/5		
<b>Level</b>			
<b>Max. input level (input 1)</b>			
RF attenuation ≥ 10 dB			
DC voltage	0 V		
CW RF power	137 dBμV (= 1 W)		
Max. pulse volt age (10 μs)	150 V	50 V	
Max. pulse energy (10 μs)	1 mWs	0.5 mWs	
Input 2 (receiver mode)	20 Hz to 1 GHz		
DC voltage (DC/AC coupling)	0 V/50 V		
RF attenuation ≥ 10 dB			
CW RF power	137 dBμV (= 1 W)		
Max. pulse voltage (10 μs)	1500 V	250 V	
Max. pulse energy (10 μs)	30 mWs	15 mWs	
<b>1 dB compression of input mixer (0 dB RF attenuation)</b>			
Analyzer mode	+10 dBm nominal		
<b>Intermodulation</b>			
3rd-order intercept point (T.O.I.) in dBm			
Analyzer mode, Δf > 5 × IF bandwidth or resolution bandwidth, or > 10 kHz	≥ 12, typ. 15 for f > 150 MHz	≥ 12, 15 typ. for f > 150 MHz; ≥ 10 for f > 7 GHz	

	R&S® ESIB7	ESIB26	ESIB40
Receiver mode, preamplifier off	typ. ≥ 2, 5 for f > 150 MHz		
Receiver mode, preamplifier on	≥ -18, typ. -15 for f > 150 MHz		
Intercept point k2, analyzer mode	typ. > 25 for f < 150 MHz typ. > 40 for f > 150 MHz		
<b>Level display (receiver mode)</b>			
Digital	numeric, 0.1 dB resolution		
Analog	bargraph display, separate for each detector		
Spectrum	level axis 10 dB to 200 dB in 10 dB steps, frequency axis user-selectable, linear or logarithmic		
Detectors	average (AV), RMS, peak (PK) and quasi-peak (QP), 4 detectors simultaneously selectable		
Measurement time	100 μs to 100 s, selectable		
<b>Level display (analyzer mode)</b>			
Result display	500 × 400 pixels (per diagram), max. 2 diagrams with independent settings		
Logarithmic level display range	10 dB to 200 dB in 10 dB steps		
Linear level display range	10% of reference level per division (10 divisions) or logarithmic scaling		
Traces	max. 4 per diagram (max. 2 per diagram with display of 2 diagrams); quasi-analog display of all results		
Trace detectors	max peak, min peak, auto peak (normal), sample, rms, average		
Trace functions	clear/write, max hold, min hold, average		
<b>Setting range of reference level</b>			
Logarithmic level display	-130 dBm to 30 dBm in 0.1 dB steps		
<b>Displayed noise floor (receiver mode)</b>			
Linear average (AV) display (preamplifier off/on)			
1 GHz to 5 GHz, RBW=1 MHz	< 15/< 6 dB	< 18/< 9 dB	
RMS, typ. increase rel. to AV display	+1 dB		
PK, typ. increase rel. to AV display	+11 dB		
Quasi-peak (preamplifier off/on)	3 to -9/ -7 to -21	3 to -9/-7 to -21	
Band A			
Band B	9 to 0/ -2 to -12	9 to 0/-2 to -12	
Band C	17/1	20/4	
Band D	14/1	17/4	
<b>Displayed noise floor (analyzer mode)</b>			
Displayed average noise level in dBm, typical values in parentheses, 0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, 20 averages, trace average, zero span, 50 Ω termination			
Frequency 10 MHz to 6 GHz	< -142 (147)	< -138 (140)	
<b>Max. dynamic range</b>			
1 dB compression point/displayed noise floor (1 Hz bandwidth)	162 dB	160 dB	
<b>Max. harmonics suppression, f &gt; 50 MHz</b>			
	> 90 dB		
<b>Max. intermodulation-free range</b>			
150 MHz to 7/26.5 GHz (nominal)	115 dB	112 dB	
Intermodulation-free range at -40 dBm mixer input level	105 dB		
<b>Immunity to interference</b>			
Image frequency	> 80 dB, typ. > 90 dB	> 80 dB	
Intermediate frequency	> 75 dB	> 80 dB	
<b>Spurious response (f &gt; 1 MHz, without input signal, 0 dB RF attenuation)</b>			
Receiver mode or span < 30 MHz	< -3 dBμV		
Span ≥ 30 MHz	< 7 dBμV		



Contents Overview

Chapter Overview

Type Index

R&S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## EMI Test Receiver R&amp;S® ESIB

	R&S® ESIB 7	ESIB 26	ESIB 40
<b>Level measurement accuracy</b>			
Level error at 120 MHz (level = -40 dBm, RF attenuation 20 dB, reference level -15 dBm, RBW 5 kHz)		±0.3 dB	
Attenuator error		±0.3 dB	
<b>Bandwidth switching error</b>			
1 Hz to 30 kHz/100 to 300 kHz		±0.2 dB	
1 MHz to 10 MHz		±0.3 dB	
<b>Frequency response (analyzer mode, 10 dB RF attenuation)</b>			
≤1 GHz		±0.5 dB	
1 GHz to 7 GHz		±1 dB	
7 GHz to 18 GHz	–	±2 dB	
18 GHz to 26.5 GHz	–	±2.5 dB <sup>1)</sup>	
26.5 GHz to 40 GHz	–	–	±3 dB <sup>2)</sup>
<b>Total error</b>			
Receiver mode (AV display, display range =0 dB to -50 dB, S/N >15 dB, preamplifier off)			
≤9 kHz		±1.5 dB	
≤150 kHz		±1.2 dB	
≤1 GHz		±1 dB	
1 GHz to 4.5 GHz		±2 dB	
4.5 GHz to 7 GHz		±2.5 dB	
7 GHz to 18 GHz	–	±2.5 dB <sup>2)</sup>	
18 GHz to 26.5 GHz	–	±3 dB <sup>2)</sup>	
26.5 GHz to 40 GHz	–	–	±3.5 dB <sup>2)</sup>
Analyzer mode (display range = 0 dB to -50 dB, S/N >15 dB, span/RBW <100)			
<1 GHz		±1 dB	
1 GHz to 4.5 GHz		±1.5 dB	
4.5 GHz to 7 GHz		±2 dB	
7 GHz to 18 GHz	–	±2.5 dB <sup>2)</sup>	
18 GHz to 26.5 GHz	–	±3 dB <sup>2)</sup>	
26.5 GHz to 40 GHz	–	–	±3.5 dB <sup>2)</sup>

**General data**

Display	24 cm colour LC display (9.5") (VGA)		
Rated temperature range	+5 °C to +40 °C		
Power supply	200 V to 240 V/50 Hz to 60 Hz; 100 V to 120 V/50 Hz to 400 Hz,		
Power consumption	195 VA	230 VA	
Dimensions (W × H × D)	435 mm × 236 mm × 570 mm		
Weight	25.1 kg	26.4 kg	27.0 kg

1) According to CISPR 16 tolerance for impulse bandwidths and MIL-STD (-6 dB).

2) For RF frequencies >7 GHz: error after calling peaking function.  
For sweep time <10 ms/GHz: additional error ±1.5 dB.

## Ordering information

EMI Test Receiver		
20 Hz to 7 GHz	R&S® ESIB 7	1088.7490.07
20 Hz to 26.5 GHz	R&S® ESIB 26	1088.7490.26
20 Hz to 40 GHz	R&S® ESIB 40	1088.7490.40

**Accessories supplied**

Power cord, spare fuses, test port adaptor N (only R&S® ESIB 26+40), test port adaptor K (only R&S® ESIB 40), test port adaptor K (3.5 mm, only R&S® ESIB 26), PS/2 mouse, MF2 keyboard (US, DIN connector), EMI Test Software R&S® ESIB-K1 (pre-installed + CD)

**Options**

Preamplifier 20 dB, 7 GHz to 26.5 GHz	R&S® ESIB-B2	1137.4494.26
Preamplifier 20 dB, 7 GHz to 40 GHz	R&S® ESIB-B2	1137.4494.40
Vector Signal Analyzer	R&S® FSE-B7	1066.4317.02
Tracking Generator 7 GHz	R&S® FSE-B10	1066.4769.02
Switchable Attenuator for Tracking Generator	R&S® FSE-B12	1066.5065.02
Ethernet Card, RJ-45 connector	R&S® FSE-B16	1037.5973.04
Second IEC/IEEE-bus Card	R&S® FSE-B17	1066.4017.02
Removable Hard Disk for R&S® ESIB <sup>1)</sup>	R&S® FSE-B18	1088.6993.02
Second Hard Disk for R&S® ESIB, Windows NT	R&S® FSE-B19	1088.7248.10
External mixer output for R&S® ESIB 26/40	R&S® FSE-B21	1084.7243.02

**Software**

EMC Measurement Software (32 bit)	R&S® EMC 32-E	1119.4621.02
EMI Software for EMI Test Receiver (Windows)	R&S® ES-K1	1026.6790.02
Script Development Kit	R&S® ES-K2	1026.6890.02
Driver for R&S® ESIB 7/26/40	R&S® ES-K16	1108.0288.02
Driver for Mast (Schäfer) and Turntable (Schäfer)	R&S® ES-K30	1026.7196.02
Driver for MDS Absorbing Clamp Slideway (Schäfer)	R&S® ES-K31	1026.7921.02
Further driver software for R&S® ES-K1	on request	

**Extras**

Service Kit	R&S® FSE-Z1	1066.3862.02
DC Block, 5 MHz to 7000 MHz (type N)	R&S® FSE-Z3	4010.3895.00
DC Block, 10 kHz to 18 GHz (type N)	R&S® FSE-Z4	1084.7443.02
Microwave Measurement Cable and Adapter Set up to 26 GHz	R&S® FS-Z15	1046.2002.02
IEC/IEEE-Bus Cable, 1 m	R&S® PCK	0292.2013.10
IEC/IEEE-Bus Cable, 2 m	R&S® PCK	0292.2013.20
Control Cable 10 m, R&S® ES- IB-ESH2-Z5	R&S® EZ-5	0816.0625.03
Control Cable 10 m, R&S® ES- IB-ESH3-Z5	R&S® EZ-6	0816.0683.03
Control Cable 3 m, R&S® ES- IB-ENV 4200	R&S® EZ-21	1107.2087.03
Transit Case 19", 5 HU	R&S® ZZK-955	1013.9408.00
19" Rack Adapter, 5 HU	R&S® ZZA-95	0396.4911.00

**EMI accessories**

see data sheet PD 0756.4320

(Accessories for Test Receivers and Spectrum Analyzers)

For further extras for spectrum analyzer applications see data sheet PD 0757.1519 (Spectrum Analyzers R&amp;S® FSE).

1) Factory-fitted.



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Internal Preamplifier R&S® ESIB-B2

**Option for the EMI Test Receivers R&S® ESIB26/40 in the frequency range 7 GHz to 26.5/40 GHz**

### Brief description

The internal preamplifier (option R&S® ESIB-B2) is used to extend the frequency range of the preamplifier (9 kHz to 7 GHz) integrated as standard in the EMI Test Receivers R&S® ESIB26 and R&S® ESIB40 in the microwave range up to 26.5 GHz or 40 GHz. The preamplifier is used to improve the input sensitivity of the receivers by approximately 18 dB so that cable losses and antenna correction values can largely be compensated in the GHz range.

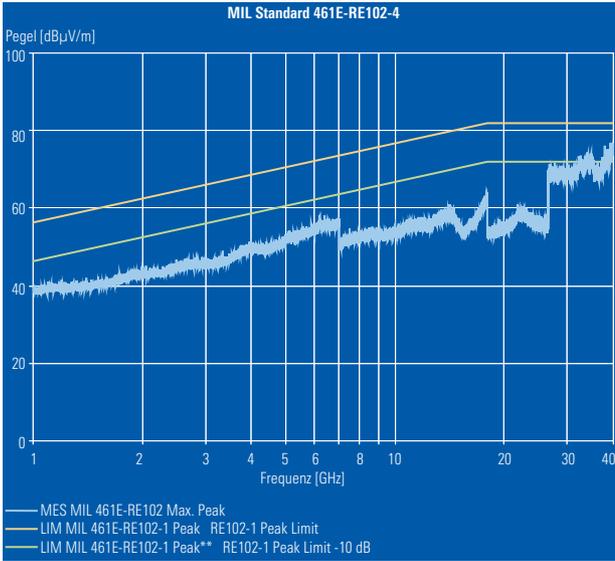
### Main features

- ◆ System noise figure improved by typ. 18 dB
- ◆ Nominal gain 20 dB
- ◆ Multistage configuration up to 26.5 GHz or 40 GHz
- ◆ Connection irrespective of operating mode: analyzer or receiver

### Specifications

The specifications below describe the additional data valid as of firmware version 4.01 or higher and are supplementary to the EMI Test Receivers R&S® ESIB data sheet (PD 0757.4576). Data designated "nominal" applies to design parameters and is not tested.

Displayed noise floor (receiver mode) (AV detector, 0 dB RF attenuation, RBW = 1 MHz, 50 Ω termination)		
	Model .26	Model .40
Preamplifier off		
7 GHz to 18 GHz	<22 dBμV	<26 dBμV
18 GHz to 26.5 GHz	<25 dBμV	<29 dBμV
26.5 GHz to 30 GHz	–	<40 dBμV
30 GHz to 40 GHz	–	<44 dBμV
Preamplifier on		
7 GHz to 18 GHz	<4 dBμV	<6 dBμV
18 GHz to 26.5 GHz	<6 dBμV	<9 dBμV
26.5 GHz to 30 GHz	–	<20 dBμV
30 GHz to 40 GHz	–	<26 dBμV



**Typical displayed average noise level of R&S® ESIB 40 with built-in Preamplifier R&S® ESIB-B2 (model .40), recorded with peak detector, measurement bandwidth (RBW) of 1 MHz and taking into account cable attenuation and correction factors of three horn antennas up to 18 GHz, 26 GHz and 40 GHz.**

Displayed noise floor (analyzer mode) (displayed average noise level, 0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, 20 averages, trace average, 50 Ω termination)		
Preamplifier off		
7 GHz to 18 GHz	<-135 dBm	<-131 dBm
18 GHz to 26.5 GHz	<-132 dBm	<-128 dBm
26.5 GHz to 30 GHz	–	<-117 dBm
30 GHz to 40 GHz	–	<-113 dBm
Preamplifier on		
7 GHz to 18 GHz	<-153 dBm	<-151 dBm
18 GHz to 26.5 GHz	<-151 dBm	<-148 dBm
26.5 GHz to 30 GHz	–	<-137 dBm
30 GHz to 40 GHz	–	<-131 dBm
Frequency response (10 dB RF attenuation)		
7 GHz to 18 GHz	±3 dB <sup>1)</sup>	±3 dB <sup>1)</sup>
18 GHz to 26.5 GHz	±3.5 dB <sup>1)</sup>	±3.5 dB <sup>1)</sup>
26.5 GHz to 40 GHz	–	±4 dB <sup>1)</sup>

<sup>1)</sup> Error after calling peak function. Additional error of ±1.5 dB for sweep time <10 ms/GHz.

### Ordering information

Internal Preamplifier		
7 GHz to 26.5 GHz	R&S® ESIB-B2	1137.4494.26
7 GHz to 40 GHz	R&S® ESIB-B2	1137.4494.40

## Miniport Receiver R&S® EB200

**Portable monitoring from**  
**10 kHz to 3 GHz with Handheld**  
**Directional Antenna R&S® HE200**



### Brief description

Miniport Receiver R&S®EB200 is a miniaturized portable professional receiver for the HF-VHF-UHF range. The R&S®EB200 is characterized by high input sensitivity and frequency setting accuracy throughout the frequency range from 10 kHz to 3 GHz.

Its small dimensions – ½ 19“, two height units – and low weight as well as a sturdy design make the R&S®EB200 ideal for use in places which cannot be reached with a vehicle. Its low power consumption permits battery operation typically of six hours. The R&S®EB200 battery pack is easily accessible and can be exchanged quickly. In case of power supply interruption, all the data are stored. Operation can thus be resumed immediately after the power supply is restored.

### Main features

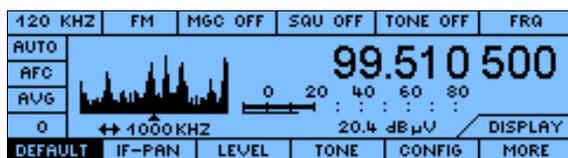
- ◆ Ergonomic design for on-body operation
- ◆ Continuous frequency range 10 kHz to 3 GHz
- ◆ Digital IF section with 12 bandwidths (150 Hz to 150 kHz)
- ◆ Fast, accurate level indication across 120 dB dynamic range
- ◆ Search modes
  - Frequency search
  - Memory search
  - Frequency spectrum
- ◆ Remote-controllable via LAN (Ethernet 10 Base-T) or RS-232-C

### Function

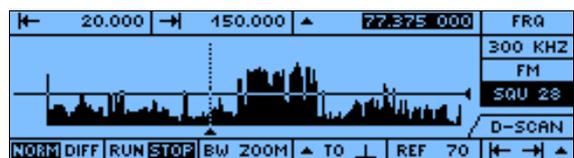
The R&S®EB200 is a superhet receiver with a third intermediate frequency of 10.7 MHz. The receiver input is equipped with a highpass/lowpass combination or tracking preselection, as required, to

reduce the signal sum load. Intermodulation suppression equals that of many receivers used in stationary applications. The low degree of oscillator reradiation is a result of large-scale filtering. A modern synthesizer concept featuring very low phase noise permits switching times of less than 3 ms. Effective frequency and memory scanning is thus possible.

The digital IF section has a wide variety of different filters which are implemented in a minimal space with the aid of DSP. The R&S®EB200 has 12 IF bandwidths between 150 Hz and 150 kHz. The following digital demodulators are available: AM, FM, LSB, USB, CW, PULSE and IQ. If the receiver is fitted with the IF panorama option, the number of bandwidths is increased to 17 up to 1 MHz. Bandwidths over 150 kHz are for level and deviation measurement as demodulation is not possible.



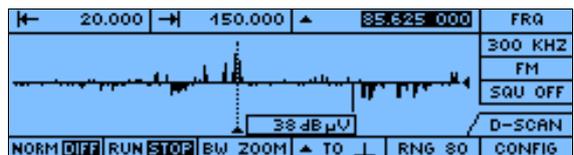
Overview



DIGI Scan listen mode



IF panoramic display



DIGI Scan differential mode



Contents Overview

Chapter Overview

Type Index

R&S Addresses



## Miniport Receiver R&S® EB200

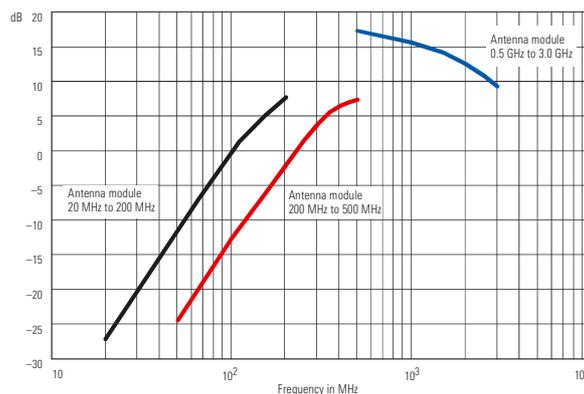
### Applications

- ◆ Monitoring of given frequencies, e.g. storage of 1 to 1000 frequencies, squelch setting, constant monitoring of one frequency or cyclical scanning of several frequencies
- ◆ Searching in a frequency range with freely selectable start and stop frequency and step widths of 0.1 kHz to 10 MHz
- ◆ Search with highest speed in the frequency range with free selectable start and stop frequency (option DIGI scan)
- ◆ Location of close-range to medium-range targets with the aid of Handheld Directional Antenna R&S® HE200
- ◆ Detection of undesired emissions including pulsed emissions
- ◆ Detection of unlicensed transmitters communicating illegally or interfering with licensed transmission
- ◆ Protection against tapping by detecting miniature spy transmitters (bugs)
- ◆ Monitoring of one's own radio exercises in a service band
- ◆ Monitoring of selected transmissions
- ◆ Remote-controlled operation via modem and PC in coverage measurement and monitoring systems

### Handheld Directional Antenna

The handy and highly broadband Active Directional Antenna R&S® HE200 in conjunction with portable receivers such as R&S® EB200 is ideal for locating transmitting and interfering sources. The direction is found by pointing the antenna towards the direction of maximum signal voltage. The overall frequency range from 0.01 MHz to 3000 MHz is covered by 4 exchangeable broadband antenna modules each with a distinct directional pattern.

A low-noise broadband amplifier may be added to increase sensitivity in the active mode. The amplifier is bypassed in the passive mode and in this case the antenna may also be used in the vicinity of strong transmitters.



Gain, active mode



Contents Overview

Chapter Overview

Type Index

R&S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Miniport Receiver R&S® EB200

### Specifications in brief R&S® EB200

You will find detailed and binding data on the enclosed CD (./DATASHEET/EB200.pdf), or, for the latest updates, visit [www.rohde-schwarz.com](http://www.rohde-schwarz.com), search term: EB200

<b>Frequency range</b>	10 kHz to 3 GHz
Frequency setting via keypad or rollkey	1 kHz, 100 Hz, 10 Hz, 1 Hz or in selectable increments
Frequency accuracy	$\leq 1 \times 10^{-6}$ (–10°C to +55°C)
Aging	$\leq 0.5 \times 10^{-6}$ /year
Synthesizer setting time	$\leq 3$ ms
Oscillator phase noise	$\leq -100$ dBc (1 Hz) at 10 kHz offset
<b>Antenna input</b>	N female, 50 $\Omega$ , VSWR $\leq 3$ , SMA connector on rear panel for rack mounting
Oscillator reradiation	$\leq -107$ dBm
Input attenuation	manual or automatic
Input selection	
100 kHz to 20 MHz	highpass/lowpass
20 MHz to 1.5 GHz	tracking preselection
1.5 GHz to 3 GHz	highpass/lowpass
<b>Interference rejection, nonlinearities</b>	
Image frequency rejection	$\geq 70$ dB, typ. 80 dB
IF rejection	$\geq 70$ dB, typ. 80 dB
2nd order intercept point	typ. 40 dBm
3rd order intercept point	typ. 2 dBm
Internal spurious signals	$\leq -107$ dBm
<b>Sensitivity</b>	
Overall noise figure	typ. 12 dB
Demodulation	AM, FM, LSB, CW, PULSE, IQ
IF bandwidths	12 (150/300/600 Hz/1.5/2.5/6/9/15/30/50/120/150 kHz)
IF bandwidths for level and deviation indication	15 (150 Hz to 1 MHz) only with IF Panoramic Unit R&S® EB200SU
Squelch	signal-controlled, can be set from –30 dB $\mu$ V to 110 dB $\mu$ V
Gain control	AGC, MGC
AFC	digital retuning for frequency-unstable signals
Deviation indication	graphical with tuning label or numerical
Signal level indication	graphical as level line or numerical from –10 to 110 dB $\mu$ V, acoustic indication by level tone
IF panorama (option SU)	internal module, ranges 25, 50, 100, 200, 500, 1000 kHz, all IF bandwidths additional 25 kHz to 1 MHz
<b>Scan characteristics</b>	
Automatic memory search	1000 definable memory locations to each of which a complete data set can be allocated
Frequency search	START/STOP/STEP definition with receiving data set
RF spectrum DIGI scan (option)	start/stop, up to 1.5 GHz/sec
<b>Inputs/outputs</b>	
Digital IF output	serial data (clock, data, frame) up to 256 kbps
I/Q output (digital)	AF signal, 16 bit
IF 10.7 MHz, wideband	typ. $\pm 5$ MHz uncontrolled for external panoramic display
AF output, balanced	600 $\Omega$ , 0 dBm
Loudspeaker output	8 $\Omega$ , 500 mW
Headphones output	via volume control
Output log. signal level	0 V to +4.5 V



Contents Overview

Chapter Overview

<b>BITE</b>	monitoring of test signals by means of loop test
<b>Data interface</b>	LAN (Ethernet 10 Base-T) or RS-232-C

### General data

Operating temperature range	–10°C to +55°C
Rated temperature range	0°C to +50°C
Storage temperature range	–40°C to +70°C
Power supply	110/230 V AC, 50/60 Hz battery pack (typ. 6 h operation) or 10 V to 30 V DC (max. 22 W)
Dimensions (W × H × D)	210 mm × 88 mm × 270 mm, ½ 19" × 2 HU
Weight (without battery pack)	4 kg
Battery pack	1.5 kg

### Specifications in brief R&S® HE200

Frequency range	0.01 MHz to 3000 MHz
Antenna modules	20 MHz to 3000 MHz, with 3 plug-in antennas
20 MHz to 200 MHz	loaded loop antenna
200 MHz to 500 MHz	loaded loop antenna
500 MHz to 3000 MHz	log-periodic antenna
Option	
0.01 MHz to 20 MHz	loop antenna
Polarization	vertical for all antenna modules, horizontal polarization by turning the longitudinal antenna axis by 90°
Loop antenna 0.01 MHz to 20 MHz	direction finding for horizontally polarized signals not possible because of circular vertical pattern of system
Nominal impedance	50 $\Omega$
SWR	typ. <2.5
RF output	1 m cable with N connector

### General data

Operating temperature range	–10°C to +55°C
Rated temperature range	0°C to +50°C
Power supply	in handle, 4 × 1.5 V mignon cell R6
Dimensions (W × H × D)	470 mm × 360 mm × 180 mm (in transport case)
Weight (without battery)	4.5 kg including transport case

### Ordering information

<b>Miniport Receiver</b>	R&S® EB200	4052.2000.02
<b>Options</b>		
Internal IF Panoramic Unit	R&S® EB200SU	4052.3206.02
RF Spectrum DIGI-Scan	R&S® EB200DS	4052.9604.02
LAN (Ethernet 10 Base-T) Interface	R&S® EB200R4	4052.9156.02
RS-232-C Interface	R&S® ESMBR2	4052.9156.02
<b>Extras</b>		
Carrying Case (telescopic antenna, headset, belt and space for R&S® EB200 and battery pack)	R&S® EB200SC	4052.9304.02
Battery Pack	R&S® EB200BP	4052.4102.02
Handheld Directional Antenna inclusive carrying case	R&S® HE200	4050.3509.02
HF Module 10 kHz to 20 MHz	R&S® HE200HF	4051.4009.02



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



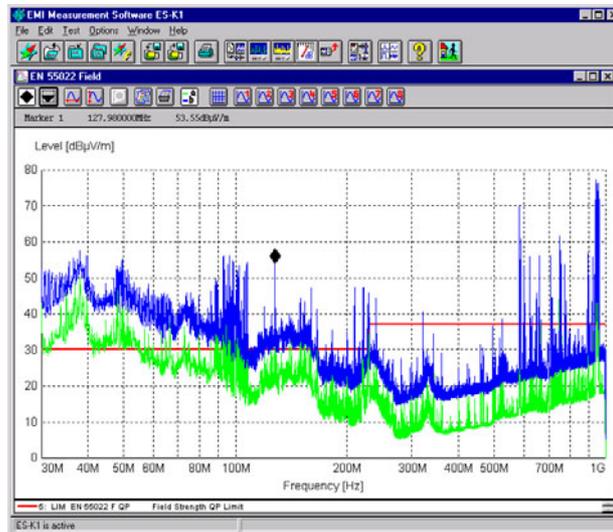
## EMI Software R&S® ES-K1

**Automation of EMI measurements with Rohde&Schwarz instruments:**

**Analyzer families**

**R&S® ESIB and R&S® ESPI**

**Further analyzers/test receivers on request**



*The frequency spectrums for two or more (depending on receiver type) different detectors measuring in parallel are shown simultaneously.*

## Brief description

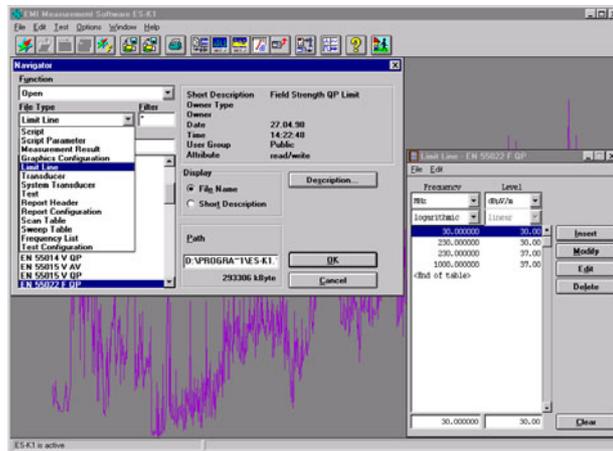
EMI Software R&S® ES-K1 is a versatile, efficient and user-friendly tool for fully automatic measurement of conducted and radiated emissions to international commercial and military standards such as CISPR, VDE, FCC, EACL, ANSI, EN; MIL, VG, DEF-STAN, GAM-EG13.

Offering various drivers, the software not only supports EMI test receivers and EMI spectrum analyzers from Rohde&Schwarz, but also a large variety of accessories:

- ◆ Mast and turntable system for measurement of RFI field strength
- ◆ Artificial mains networks and absorbing clamp slideways for measurement of conducted emissions
- ◆ Matrix for switching over antennas and transducers

## Main features

- ◆ User-friendly EMI test software under Windows
- ◆ EMI measurements to commercial and military standards
- ◆ Adaptation to other standards



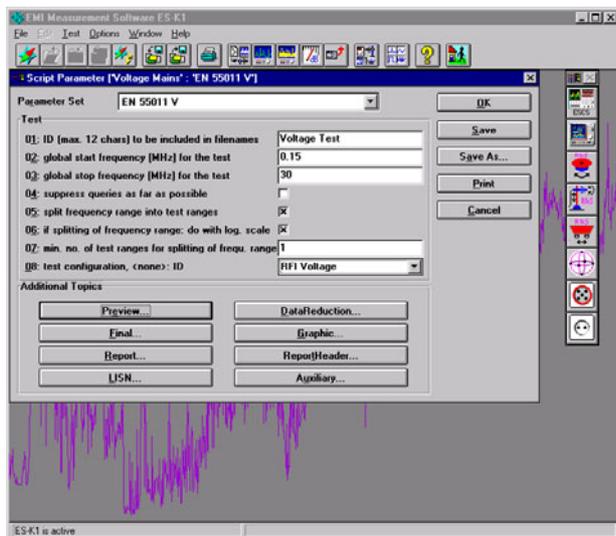
*The integrated data-base contains a large number of predefined limit lines, transducer factors and scan or sweep tables that can easily be selected via a navigator and edited.*

- ◆ Integrated database
- ◆ User-group-specific data allocation
- ◆ Fully automatic operation or interactive single measurement
- ◆ Automatic compensation of transducers (correction factors) and limit lines
- ◆ Large choice of data reduction methods
- ◆ Azimuth chart test
- ◆ Evaluation of narrowband/broadband interferers
- ◆ Test setup calibration
- ◆ Convenient and flexible result documentation and report generation
- ◆ Universal data storage
- ◆ Hardlock key (dongle) for authentication
- ◆ Network-compatible

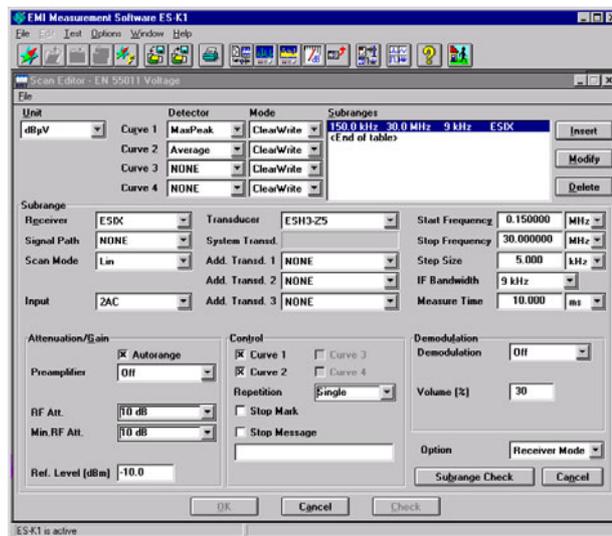
## Test runs

Depending on the application and use of the software, control of the test runs is either fully automatic or interactive. By loading automatic test routines defined in the form scripts, measurements can be started simply at the press of a button without any time-consuming entries. The scripts control the test run, evaluate the results and generate the necessary test reports. In addition to standard scripts, user-specific scripts can be generated and existing scripts modified (option R&S® ES-K2).

## EMI Software R&S® ES-K1



*Standard parameter configuration enables standard-compliant measurement with flexible scripts.*



*The measurement parameters for frequency subranges can additionally be optimized in standard preset scan tables.*

A database is integrated in R&S® ES-K1 for management of the measured data or of the result files derived with the aid of comprehensive test and evaluation routines. The convenient access to these files with informative short descriptions does away with tiresome file searching.

Versatile and flexible result display is possible in the form of tables or graphs. A maximum of eight test results, limit lines and transducer factors can be displayed simultaneously.

A zoom function allows enlargement of any parts of the result display.

### Report generation

By using the integrated report configuration file, users can customize their test reports to a large extent. In addition to a report header, all measurement-relevant data can be output. The measurement results, limit lines and transducer factors are output in tables or graphics.

During report generation, the protocol can be viewed prior to printing by using PRINT REVIEW. Moreover, graphics, tables as well as RTF files can be stored. Another asset is the flexible configuration of the test reports, allowing users to insert graphics, tables or measurement result lists where needed by means of a common text program (e.g. Word). Any Windows-supported printer can be used.

### Hardware requirements

IBM compatible PC minimum 486 with Windows 3.1/95/98/NT4.0/2000/ME; minimum 8-MByte RAM; minimum memory capacity on hard disk 8 Mbyte; IEC/IEEE bus interface with Windows driver (DLL), National Instruments IEC/IEEE bus interface.

### Ordering information

<b>EMI Software</b>	R&S® ES-K1	1026.6790.02
(Windows program with driver for Artificial Mains Networks R&S® ESH2-Z5, R&S® ESH3-Z5 and Relay Matrixes R&S® PSU, R&S® RSU and R&S® PSN)		
Script Development Kit	R&S® ES-K2	1026.6890.02

Drivers for Test Receivers and Spectrum Analyzers		
R&S® ESHS/ESVS/ESVD/ESCS/ESPC	R&S® ES-K10	1026.6948.02
R&S® ESAI/ESBI/ESMI	R&S® ES-K12	1026.7144.02
R&S® ESIB 7/26/40	R&S® ES-K16	1108.0288.02
R&S® ESPI3/7	R&S® ES-K18	1140.5298.02
Drivers for accessories		
Schäfer Mast and Turntable	R&S® ES-K30	1026.7196.02
Deisel Controller, Mast, Turntable, HD-MA2xx and HD-DT3xx	R&S® ES-K33	1035.1097.02
EMCO Controller, Mast, Turntable, 2090 and SUNOL SC9XV	R&S® ES-K40	1140.4591.02
User specific IEC/IEEE Bus Driver	R&S® ES-K50	1057.2496.02
Multi-User Licence	R&S® ES-K100	1057.0741.02
Further drivers on request.		

## EMC Measurement Software R&S® EMC32

**For use in development, for compliance and batch testing**

*R&S® EMC32 display for single EMI measurements; parameters such as current measurement frequency, detectors, bandwidth, measurement time, demodulation or RF attenuation can be varied during the measurement*

### Brief description

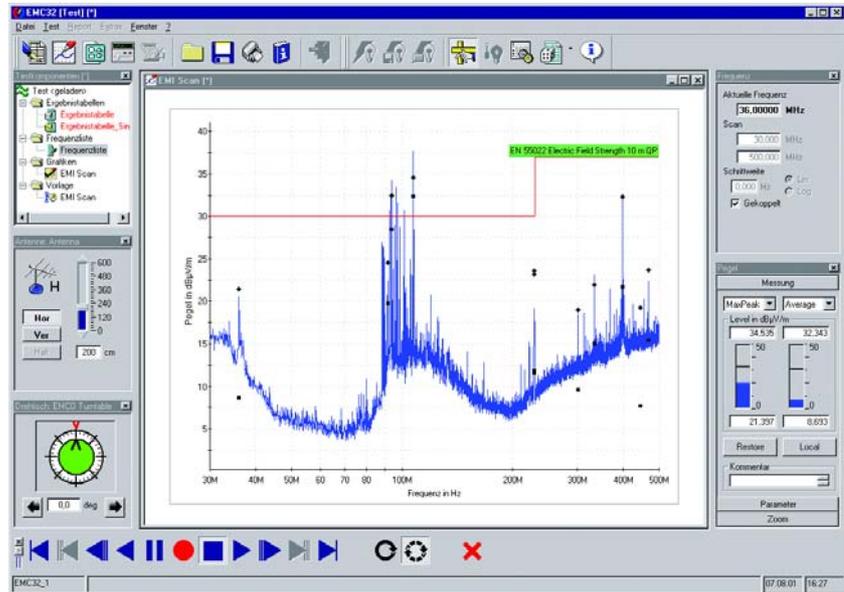
The EMC Measurement Software R&S® EMC32 runs on 32-bit operating systems from Microsoft and offers a common user interface for electromagnetic interference (EMI) and electromagnetic susceptibility (EMS) measurements. The software is a modern and powerful tool for controlling and monitoring Rohde&Schwarz EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation and documentation of measurement results.

Thanks to its comprehensive and extremely flexible configuration capabilities and its open software structure, R&S® EMC32 can be used for all EMI and EMS measurements in line with civil standards.

### Main features

#### Flexible

- ◆ Modules for measuring electromagnetic interference (EMI) and electromagnetic susceptibility (EMS)
- ◆ Support of measurements to civil standards such as CISPR, IEC, ISO, EN, ETSI, VDE, FCC and ANSI



- ◆ Manual and automatic EMI and EMS measurements
- ◆ Can be combined with EMC test systems and EMI test receivers/analyzers from Rohde&Schwarz

#### Efficient

- ◆ Graphical user interface for instrument and system configuration
- ◆ Menu-guided, intuitive user prompting for all test sequences (virtual instrument)
- ◆ Product-oriented test selection
- ◆ EUT-specific data management
- ◆ Modular calibration concept
  - Minimal recalibration effort required
  - Simplified test system certification
- ◆ Assisted installation and configuration
- ◆ Online help

#### Future-oriented

- ◆ Modular program structure
- ◆ Easily upgradeable
- ◆ Data storage in text format
- ◆ Reports generated as RTF, HTML or PDF file
- ◆ 32-bit software for Windows 2000 and XP

### Applications

An essential feature of the R&S® EMC32 software is that it can be optimally adapted to the requirements of the various EMC applications:

#### ◆ Tests during development

Switchover between manual and automatic measurements at any time

#### ◆ Compliance testing

Standard measurements can be performed easily and rapidly with the aid of predefined test routines and an integrated EUT monitoring function (EMS)

#### ◆ Batch tests

The capability to perform graphical batch measurements is ideal for batch testing

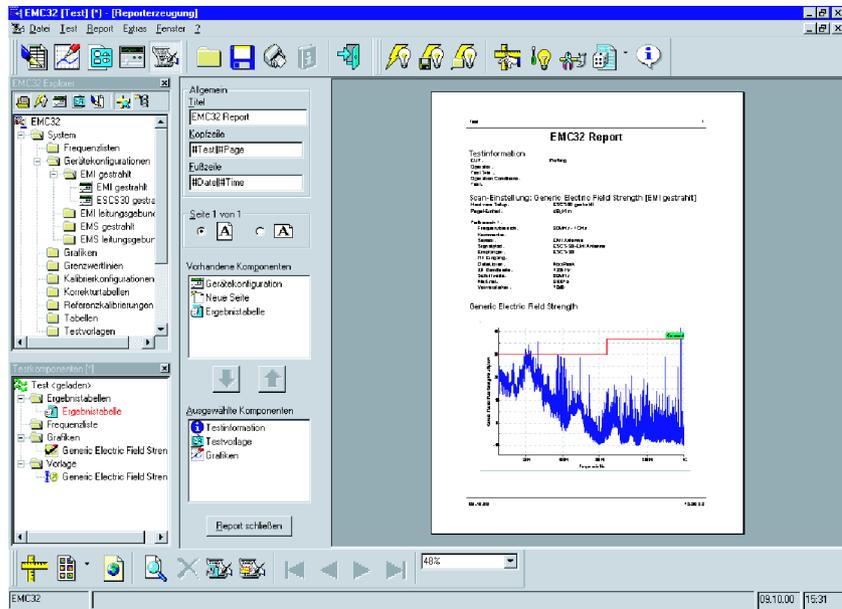
The R&S® EMC32 software offers EMI and EMS measurements for all civil product groups:

- ◆ Industrial, scientific and medical RF instruments (ISM instruments)
- ◆ Broadcast receivers and connected units

## EMC Measurement Software R&S® EMC32

- ◆ Domestic appliances and tools
- ◆ Fluorescent lamps and lighting systems
- ◆ Information technology equipment (ITE)
- ◆ Communications equipment
- ◆ Automotive products

The limit values for the applicable international standards are already included in the software. Furthermore, new test criteria can be generated by the user, stored as standard and considered as manufacturer- or product-specific limit values. This makes the software user-configurable for almost any EMC measurement task.



*R&S® EMC32 with report configuration dialog open; a report consists of several parts, e.g. header, graphs, tables, test template settings, which can be configured and arranged in this dialog*

## Specifications/system requirements

<b>Operating system</b>
Windows 2000 or XP (other MS OS on request)
<b>Administration rights</b>
Microsoft Internet Explorer 5.0 or higher
PC with Pentium class processor (at least 200 MHz)
128 Mbyte RAM
50 Mbyte free hard disk space
Super VGA monitor, screen resolution at least 1024 × 768 pixels, 65536 colours
USB interface integrated in the motherboard (for i-Key software protection) <sup>1)</sup>
IEC/IEEE-bus interface card from National Instruments

<sup>1)</sup> Software protection: R&S® EMC32 is protected by a hardware dongle (i-Key). When used for demonstrations or without control of (hardware) system components, R&S® EMC32 can be installed on a computer without further registration and can be operated without an i-Key.

### Available software modules:

R&S® EMC32 is available as a complete package for EMI and EMS measurements or as single packages for EMI or EMS measurements.	
R&S® EMC32-C	for electromagnetic interference and susceptibility test systems (EMI + EMS)
R&S® EMC32-E	for electromagnetic interference test systems (EMI)
R&S® EMC32-S	for electromagnetic susceptibility test systems (EMS)

The R&S® EMC32-E (EMI) software version supports the following Rohde&Schwarz EMI test receivers:  
 EMI Test Receivers R&S® ESIB 7/26/40  
 EMI Test Receiver R&S® ESCS30  
 Test Receiver R&S® ESPI3/7  
 EMI Test Receiver R&S® ESAI/ESBI/ESMI  
 EMI Test Receiver R&S® ESx30

An overview of further currently available device drivers (RF generators, mast and turntable controllers, etc) of R&S® EMC32 is provided on the Rohde&Schwarz website at [www.emc32.rohde-schwarz.com](http://www.emc32.rohde-schwarz.com).

## Ordering information

EMC Measurement Software R&S® EMC32		
Options		
for EMI and EMS package	R&S® EMC32-A	1159.6260.02
Multi-User Lizenze for EMI and EMS Automotive Application System Software R&S® EMC32-A	R&S® EMC32MA	1163.2720.02
for EMI and EMS package	R&S® EMC32-C	1119.4644.02
for EMI and EMS package (separate hard-locks for EMI and EMS)	R&S® EMC32-C	1119.4644.03
Multi-User Lizenze for EMI and EMS Application System Software R&S® EMC32-C	R&S® EMC32MC	1140.7778.02
for EMI package	R&S® EMC32-E	1119.4621.02
for Test Receivers R&S® ESPI3 and R&S® ESPI7	R&S® EMC32-L	1106.4286.02
for EMS package	R&S® EMC32-S	1119.4638.02
Multi-User Lizenze for EMS Application System Software R&S® EMC32-S	R&S® EMC32MS	1140.7761.02

## EMI Measurement Software R&S®EMC32E+

For manual and automated EMI measurements



### Brief description

R&S®EMC32-E+ is used to measure RFI voltage, power and field strength, and it runs on the current 32-bit operating systems from Microsoft. It is based on EMC Measurement Software R&S®EMC32 and supports both manual as well as partially and fully automated EMI measurements to civil and military standards. This ensures reliable acquisition, analysis, documentation and traceability of measurement results.

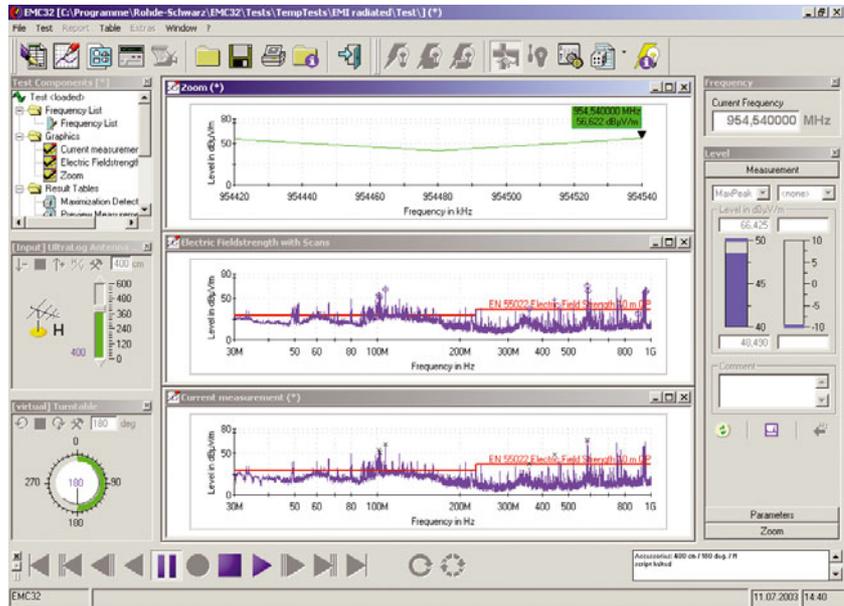
### Main features

#### Efficient

- ◆ Graphical operating concept for configuring instruments and measurement systems
- ◆ Menu-guided, intuitive user interface for all measurements
- ◆ EUT-specific test selection and data management
- ◆ Assisted installation and configuration
- ◆ Online help

#### Flexible

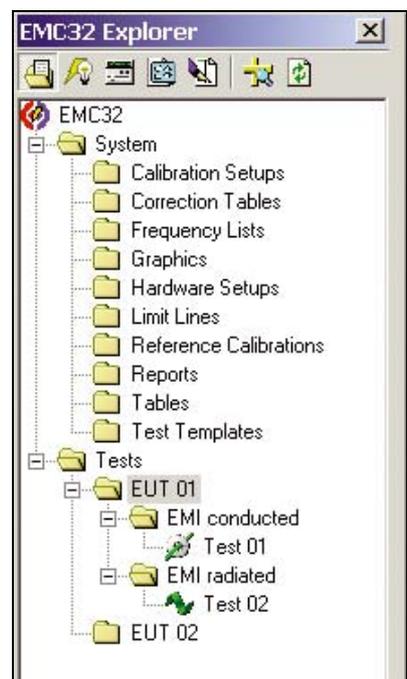
- ◆ Measurements of RFI voltage, RFI power and RFI field strength



*The R&S®EMC32-E+ screen as a "virtual" measurement instrument: Measurement mode view during measurement of RFI field strength. The test components explorer provides an overview of all loaded files of the current measurement. Below it are the (automatic or manual) settings for mast and turntable. In the center are the measurement zoom graphics for frequency optimization, the overall result with a separate trace for each result table as well as the active measurement (scan/sweep). The windows on the right provide information about the frequency setting of the test receiver and display the current measurement result numerically and as a bar graph (ClrWrite and MaxHold). The symbols at the bottom control measurement operation (pause, stop, start).*

- ◆ Support of measurements to civil and military standards (CISPR, EN, ETS, FCC, VCCI, VDE, MIL-STD, DEF-STAN)
- ◆ Manual, semi-automated and fully automated EMI measurements
- ◆ Combined use possible with all current EMI test receivers/analyzers from Rohde&Schwarz
- ◆ Drivers for numerous accessory components included

*EUT-oriented test directory structure in the R&S®EMC32-E+ file explorer. A test directory contains all measurement results plus the associated test templates, device configurations, limit lines and correction tables (transducers), which clearly define how the measurement results were obtained. This ensures traceability of results as well as reliable reproducibility of measurements (important for accreditation).*





Contents Overview

Chapter Overview

Type Index

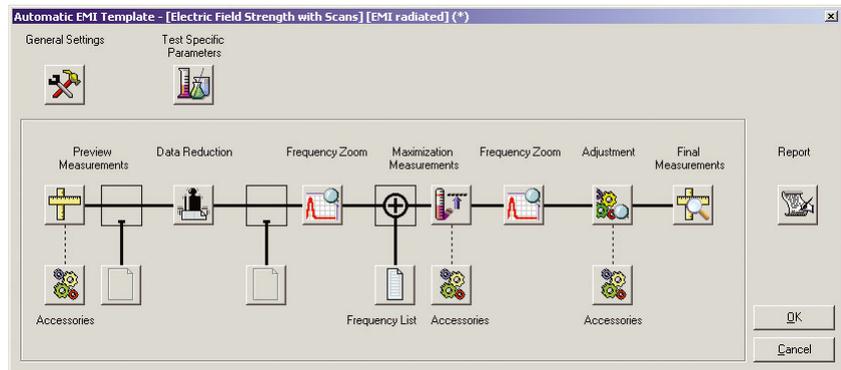
R&amp;S Addresses



## EMI Measurement Software R&amp;S®EMC32E+

## Future-oriented

- ◆ Modular program structure
- ◆ Data storage in text format
- ◆ Report generation also as PDF, RTF and HTML file
- ◆ 32-bit software, for WindowsXP and Windows2000



*Test template of an automatic RFI field strength measurement with the setting elements for preview measurement, data reduction, optional maximization of the critical frequencies with positioning of accessories, final measurement and report generation.*

## Specifications/system requirements

Operating system: WindowsXP or Windows2000
Administrator rights (for installation)
Microsoft Internet Explorer 5.0 or higher
PC with Pentium processor (min. 500 MHz)
256 Mbyte RAM (WindowsXP) or 128 Mbyte RAM (Windows2000)
100 Mbyte free hard disk space
Minimum screen resolution 1024 × 768 pixels, 65536 colours
USB interface, integrated into the motherboard (for i-Key software protection <sup>1)</sup> )
IEC/IEEE bus interface card from National Instruments
<b>Available software modules</b>
The following modules of EMC Measurement Software R&S®EMC32 are available:
R&S®EMC32-C: for electromagnetic interference and susceptibility test systems (EMI + EMS)
R&S®EMC32-A: for automotive test systems (EMI + EMS)
R&S®EMC32-E/E+: for electromagnetic interference test systems (EMI)
R&S®EMC32-S: for electromagnetic susceptibility test systems (EMS)
R&S®EMC32-L: for electromagnetic interference test systems (EMI) only in conjunction with the Test Receiver R&S®ESPI
Software modules R&S®EMC32-A, -E and -E+ support all current Rohde&Schwarz EMI test receivers/analyzers

## Ordering information

EMI Measurement Software	R&S®EMC32-E+	1501.9590.02
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Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## EMI Software R&S® ESxS-K1

**User-friendly EMI test software  
under Windows**

**Can be used for all Test Receivers of  
family R&S® ESxS**



### Brief description

EMI Software R&S® ESxS-K1 combines the main features of commercial EMI measurement requirements in one complete, easy-to-use application including: setup definition and storage, scan data capture and display with automatic data reduction, peak search with acceptance margin and subrange selection, final measurement with worst case selection, report generation and measured data storage.

R&S® ESxS-K1 provides for all test receiver and EMI test receiver families (except R&S® ESPI/ESIB/ESxI) a low-cost Windows based remote-control display and result storage solution.

Much benefits of Windows are available including: keyboard and mouse operation, report printout on any printer/plotter supported by Windows, and dynamic data exchange (DDE). Online help explains all software functions, so no user manual is required.

### Main features

- ◆ Full on-screen setup entry and storage to disk, including limit lines and transducer factors
- ◆ Colour graphic display of scan data, with automatic data reduction
- ◆ Marker function, including Marker to Peak and Tune Receiver to Marker Frequency
- ◆ Automatic Peak Search with user-definable acceptance margin and subrange/peak value count
- ◆ Peak List Edit function for automatic, semi-automatic or manual measurements
- ◆ Find Worst Case function: to find max hold level
- ◆ Zoom function: expands frequency axis to display a part of the scan in greater detail
- ◆ Report generation compatible with R&S® ESxS receiver family using any printer or plotter supported by Windows
- ◆ Report data export to other applications (WinWord, Excel)

### Hardware/software requirements

IBM-compatible machine with an 80486 processor or higher, Windows9x/ME/NT4.0/2000/XP; requires an IEC/IEEE bus interface card for receiver control, e.g. PS-B4 (model .04) from Rohde&Schwarz, or PCII/IIA, AT-GBIP from National Instruments.

### Ordering information

EMI Software	R&S® ESxS-K1	1082.9678.02
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Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

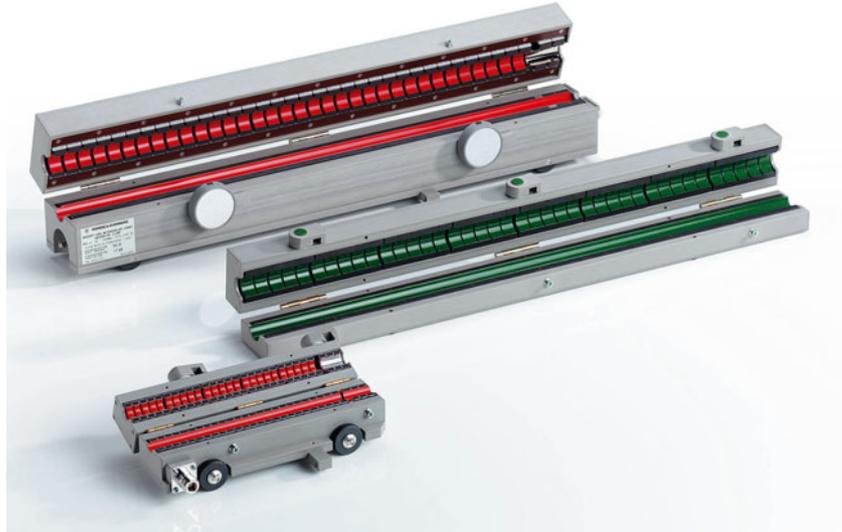
Type Index

R&S Addresses



## Absorbing Clamps R&S®MDS-21/-22, Ferrite Clamp R&S®EZ-24

**RFI power and shielding effectiveness measurements on lines.**  
**Reproducible interference field-strength and power measurements**



*Absorbing Clamps R&S®MDS-21 and R&S®MDS-22; center: Ferrite Clamp R&S®EZ-24*

### Brief description

The RFI emission of electrical appliances, machinery and systems must be kept within the limits specified by regional and international standards. Absorbing Clamps MDS can be used in conjunction with EMI test receivers to measure RFI power on lines to CISPR 14-1, EN 55014-1, VDE0875 Part 14 and EN 50083-2, and in conjunction with two-port measurement devices to measure the shielding effectiveness of lines to DIN 47250 Part 6, IEC 96-1, EN 50083-2 and DIN 0855 Part 200. MDS clamps are also used for testing the effectiveness of RFI suppression

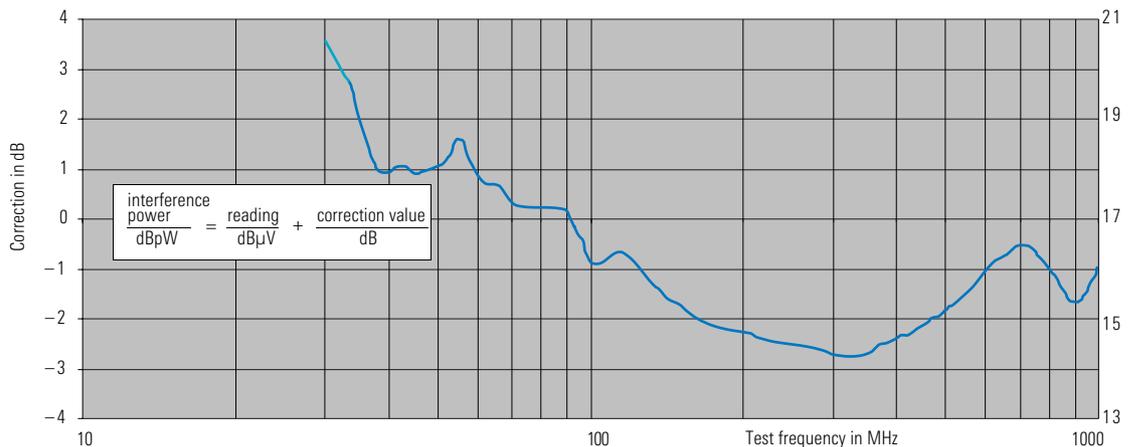
devices for high-voltage ignition systems in line with VDE0879 Part 4 and CISPR 12 (5th edition). Draft documents for the measurement of radiated interference provide for the use of ferrite absorbers for line loading to improve the reproducibility of RFI field-strength measurements. Ferrite absorbers are also used to improve RFI power and shielding effectiveness measurements.

### Interference measurements in the VHF/UHF range

In the frequency range below 30 MHz, where interference is mainly propagated via lines, this interference is determined

as laid down in many regulations by measuring the RFI voltage produced by the EUT across the terminals of a line-impedance stabilization network.

In the VHF/UHF range, where radiated emission predominates, interference is defined in terms of the RFI field strength at a certain distance. Small EUTs emit interference mainly via the connecting cables such as power lines. For the above reasons as well as to avoid complex field-strength measurement, several regulations prescribe the use of an absorbing clamp for measurement of the RFI power.



*Typical calibration curve of Absorbing Clamp R&S®MDS-21*



Contents Overview

Chapter Overview

Type Index

R&S Addresses



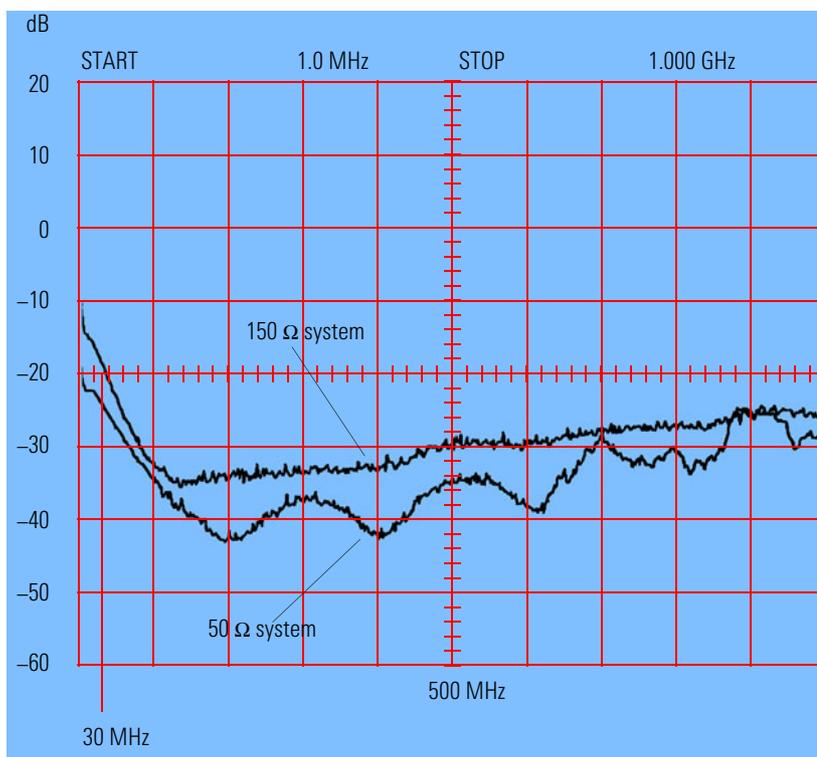
## Absorbing Clamps R&S®MDS-21/-22, Ferrite Clamp R&S®EZ-24

### Further applications

In addition to measuring the interference emitted by small appliances and the shielding effectiveness of cables, Absorbing Clamp R&S®MDS-21 can also be used for testing the effectiveness of RFI suppression devices for high-voltage ignition systems according to VDE0879 Part 4/Draft 9.89 and CISPR 12. High-energy pulses are coupled out and taken to the test receiver whose inputs are protected in a special way.

MDS clamps are also suitable for use as coupling clamps for testing the susceptibility of electronic devices.

*Insertion loss characteristic of Ferrite Clamp R&S®EZ-24*



### Specifications

	R&S®MDS-21	R&S®MDS-22
Frequency range	30 MHz to 1000 MHz	300 MHz to 2500 MHz
Insertion loss to CISPR 16-1, typ.(individual calibration report supplied with clamp)	17 ±4 dB	17 +6/-4 dB
Calibrated for receiver input impedance	50 Ω	50 Ω
Connector	N female 50 Ω	N female 50 Ω
Permissible DC current or peak value of AC current	30 A	50 A
Max. permissible RF input power for susceptibility measurement	5 W	5 W
Max. cable diameter	20 mm	12 mm
Insert sleeves supplied (diameter)	10 mm	3, 6, 9 mm
Rollers	ball bearing, dust-protected	ball bearing, dust-protected
Overall dimensions		
W × H × D in mm	610 × 115 × 80	230 × 70 × 70
Weight	6.3 kg	1.25 kg

	R&S®EZ-24
Frequency range	1 MHz to 1000 MHz
Skin current attenuation in range 30 MHz to 1000 MHz in 50 Ω circuit	>15 dB (see typ. insertion loss)
Max. permissible skin current RF power	50 W
Overall dimensions	
W × H × D in mm	626 × 57 × 80
Weight	3.5 kg

### Ordering information

<b>Absorbing Clamp</b>	R&S®MDS-21	0194.0100.50
	R&S®MDS-22	1052.3507.02
<b>Ferrite Clamp</b>	R&S®EZ-24	1107.2535.02
<b>Accessories supplied</b>		
R&S®MDS-21	1 coaxial connecting cable (for connecting R&S®MDS-21 to EMI test receiver), 5 m long with 2 × N connector; 6 dB attenuator, 2 × N connector	
R&S®MDS-22	1 calibration curve without cable insertion loss (insertion loss of connecting cable must be added)	



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Triple-Loop Antenna R&amp;S®HM020

9 kHz to 30 MHz

van Veen/Bergervoet system:

more sensitive, faster and cheaper

than former test methods to

CISPR Publication 16

Standards: CISPR 15, CISPR 16-1,

CISPR 11/12.97



Normal setup



Test setup with reduced height

## Brief description

Test method to CISPR 16-1 for electric lighting equipment to CISPR 15 and for induction sources to CISPR 11

- ◆ Fully automatic measurement of the magnetic field strength in the X, Y and Z planes of a centrally placed EUT

## Main features

- ◆ Automatic control with Software R&S®ES-K1 from test receivers or manual remote control from optional Control Unit R&S®BG020
- ◆ Loop system suitable for mobile use; can be folded in one plane
- ◆ Wooden pedestals (100 kg load capacity) for various installation heights available
- ◆ Neither EUT nor loop need to be turned during the measurement
- ◆ The effect of the shielded room on the test result is considerably reduced
- ◆ Ambient interference is strongly suppressed in open-area measurements
- ◆ The antenna is factory-calibrated with the Calibration Dipole R&S®HM020Z3 placed at the antenna center, which is available to the user for recalibration

## Specifications in brief

Frequency range	9 kHz to 30 MHz
Loops	switchable between X, Y and Z planes
Transducer factor of current probe	0 dB, referred to 1 S
RF connector	N female, 50 Ω
Dimensions (W × H × D); weight	
Loops set up, normal mode	2.49 m × 2.57 m × 2.07 m; 45 kg
Loops set up, reduced height	2.49 m × 2.09 m × 2.07 m
Transport crate	2.68 m × 2.32 m × 0.57 m
Basic Pedestal R&S®HM020Z1	0.9 m × 1 m × 0.9 m; 40 kg
Adapter Pedestal R&S®HM020Z2	0.9 m × max. 0.5 m × 0.9 m; 30 kg

## Ordering information

<b>Triple-Loop Antenna</b>	R&S®HM020	4023.4508.02
<b>Extras</b>		
Control Unit	R&S®BG020	4024.1002.02
Basic Pedestal	R&S®HM020Z1	4023.5504.02
Adapter Pedestal	R&S®HM020Z2	4023.5604.02
Calibration Dipole	R&S®HM020Z3	4023.5704.02
Control Cable	R&S®EZ-14 (included)	1026.5341.05



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&S Addresses



## Active Antennas R&S® AM524, R&S® HM525

### Active Antenna System

**R&S® AM524: 100 Hz to 1 GHz**

### Active H-Field Test Antenna

**R&S® HM525: 100 Hz to 30 MHz**

### Brief description

For measuring unwanted, compromising emissions, antennas are required which allow detection of extremely low-level signals. Active Antennas R&S® AM524 and R&S® HM525 are able to measure signals with a level 10 dB to 20 dB lower than that of signals that can be measured with conventional EMC test antennas. Therefore they are mainly used in anechoic chambers.

### Equipment supplied

R&S® AM524 consists of three antennas (R&S® HE525, R&S® HE526 and R&S® HE527) with the appropriate junction units, a basic unit with power supply, transit case and support. R&S® HM525 requires the same peripheral devices as R&S® AM524.

### Specifications in brief

Frequency	Sensitivity at 1 Hz bandwidth			
	R&S® HE525	R&S® HE526	R&S® HE527	R&S® HM525
100 Hz	0 dB(µV/m)			18 dB(µA/m)
1 kHz	-18 dB(µV/m)			-22 dB(µA/m)
10 kHz	-35 dB(µV/m)			-50 dB(µA/m)
100 kHz	-43 dB(µV/m)			-68 dB(µA/m)
1 MHz	-48 dB(µV/m)			-88 dB(µA/m)
10 MHz	-49 dB(µV/m)			-93 dB(µA/m)
30 MHz	-51 dB(µV/m)	-49 dB(µV/m)		-92 dB(µA/m)
100 MHz		-54 dB(µV/m)		
200 MHz		-48 dB(µV/m)	-49 dB(µV/m)	
300 MHz			-54 dB(µV/m)	
400 MHz			-48 dB(µV/m)	
500 MHz			-49 dB(µV/m)	
1000 MHz			-54 dB(µV/m)	



**R&S® AM524**



**R&S® HM525**

### Ordering information

<b>Active Antenna System</b>	R&S® AM524	4015.7001.02
consisting of		
Active Rod Antenna	R&S® HE525	4015.7101.02
Active Dipole Antenna	R&S® HE526	4015.7501.02
Active Dipole Antenna	R&S® HE527	4015.8008.02
Junction Unit for		
R&S® HE525	R&S® GX525	4015.9256.02
R&S® HE526	R&S® GX526	4015.9504.02
R&S® HE527	R&S® GX527	4015.9756.02
Basic Unit with power supply	R&S® KK524	4015.9004.02
Transit Case	R&S® ZR524K	4015.8508.02
Support for R&S® HE526 and HE527	R&S® AM524-Z1	4036.0506.02
<b>Active H-Field Test Antenna</b>	R&S® HM525	4031.0508.02
Support for H-Field Test Antenna	R&S® HM525-Z1	4036.1402.02
Control Unit	R&S® GS525	4035.5004.02



Contents Overview

Chapter Overview

Type Index

R&S Addresses



## Shielded, Calibrated Magnetic Field Pickup Coil R&S®HZ-10

5 Hz to 10 MHz

Measurement of magnetic field strengths to relevant standards

*R&S®HZ-10 with (right) and without (left) spacing plate*



### Brief description

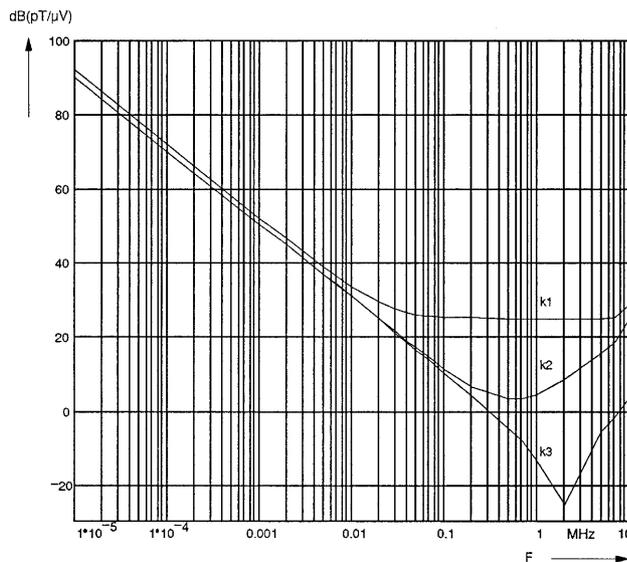
The shielded and individually calibrated Magnetic Field Pickup Coil R&S®HZ-10 allows magnetic field strengths in the frequency range from 20 Hz to 200 kHz to be measured in line with commercial and military standards MIL-STD-461/462, DEF-STAN 59-61, GAM-EG 13, VG95377 Part 13 and EN55103-1. These standards give limits for the magnetic flux density in the frequency range from 30 Hz to 50 kHz

or 200 kHz and prescribe an electrostatically shielded coil with a defined number of turns for measuring the magnetic flux density. The coil comes with a calibration certificate for the range from 5 Hz to 10 MHz.

### Main features

- ◆ Built to MIL-STD-461A and 462D
- ◆ Individually calibrated
- ◆ Shielded twin-wire connection

- ◆ Spacing plate 7 cm (MIL-STD-461, DEF-STAN 59-41) and 5 cm (VG standard)
- ◆ Isolated coil with shielded twin-wire connection to avoid galvanic surface currents induced in the shielding
- ◆ 1/4" thread for mounting on a camera tripod



**Antenna factors in dB(ρT/μV) measured and calculated by calibration: antenna factor k1 with 50 Ω, k2 with 600 Ω and k3 with 1 MΩ; k2 and k3 valid up to 100 kHz (above 100 kHz approximate values only)**

### Specifications in brief

Frequency range	5 Hz to 10 MHz
Antenna factor	see diagram (calibration certificate supplied with coil)
<b>Coil</b>	
Diameter	133 mm
Number of turns	36
Type of wire	7-41, litz wire
Resistance	10 Ω
Inductance	415 μH
Connector	Twinax female
Dimensions (W × H × D); weight	142 mm × 178 mm × 29 mm; 260 g

### Ordering information

<b>Shielded, Calibrated Magnetic Field Pickup Coil</b>	R&S®HZ-10	0816.2511.02
<b>Extras</b>		
RF Connecting Cable balanced/unbalanced, 0.2 m, Twinax/BNC connector	R&S®EZ-19	1052.2630.02



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## E and H Near-Field Probe Sets R&amp;S®HZ-11, R&amp;S®HZ-14



Probe Set R&amp;S®HZ-11



Probe Set R&amp;S®HZ-14

**R&S®HZ-11: 100 kHz to 2 GHz; R&S®HZ-14: 9 kHz to 1 GHz****Diagnostic tools for solving EMC problems****Brief description**

The near-field probe sets can be used in conjunction with test receivers, spectrum analyzers or oscilloscopes to determine electromagnetic emissions of any type. Their main applications is in the diagnosis of emissions from printed circuit boards, cables and leakage spots in shielded enclosures. The passive probes can be used for a local susceptibility test.

Probe Set R&S®HZ-11 is for a qualitative, Probe Set R&S®HZ-14 for a quantitative analysis. The probe sets come in a handy transit case.

**Equipment supplied, characteristics****Probe Set R&S®HZ-11 comprises:**

- ◆ three passive H-field probes
- ◆ two passive E-field probes
- ◆ one probe extension and
- ◆ one preamplifier with built-in battery and battery charger

The H-field probes are small (diameter of 1 cm, 3 cm and 6 cm) electrically shielded loop antennas with directional pattern;

the E-field probes, shaped as rod and spherical probes, are for omnidirectional reception of the interference source.

**Probe Set R&S®HZ-14 comprises:**

- ◆ two passive H-field probes (9 kHz to 30 MHz and 30 MHz to 1 GHz)
- ◆ one active E-field probe (9 kHz to 1 GHz)
- ◆ one 30 dB preamplifier for the H-field probe (can be powered from all Rohde&Schwarz test receivers and spectrum analyzers)
- ◆ a test jig for testing the H-field probes and simplified normalization of H-field measurements with the aid of a tracking generator and normalization functions provided in spectrum analyzers



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## E and H Near-Field Probe Sets R&amp;S®HZ-11, R&amp;S®HZ-14

## Specifications in brief

## R&amp;S®HZ-11

Type of probe	Measurement of	E- or H-field rejection	1st resonant frequency		
Loop 6 cm	H-field	41 dB	790 MHz		
Loop 3 cm	H-field	29 dB	1.5 GHz		
Loop 1 cm	H-field	11 dB	2.3 GHz		
Sphere 3.6 cm	E-field	30 dB	>1 GHz		
Rod 6 mm	E-field	30 dB	>2 GHz		
Gain of broadband preamplifier					
100 kHz	1 MHz	100 MHz	1 GHz	2 GHz	3 GHz
35 dB	38 dB	39 dB	33 dB	26 dB	14 dB
Noise figure at 500 MHz		typ. 3.5 dB			
Saturated output level at 100 MHz		typ. 12 dBm			
1 dB compression point at 100 MHz		typ. 8 dBm			

## R&amp;S®HZ-14 (9 kHz to 1 GHz)

H-field probe, max. input power	≤30 MHz: 0.5 W, >30 MHz: 0.25 W
VSWR (f >30 MHz)	<2
E-field probe	
Frequency response	3 dB
Sensitivity	13 mV/V
Connectors	SMA female
Preamplifier	9 kHz to 1 GHz
Gain	30 ±2 dB (typ. 1 dB)
Input/output	BNC female/N male
Impedance, VSWR	50 Ω, <2
Powering	10 V ±0.1 V, <100 mA
DC connector	LEMO

## Ordering information

E and H Near-Field Probe Set		
with power supply 220 V	R&S®HZ-11	0816.2770.04
with power supply 110 V	R&S®HZ-11	0816.2770.05
E and H Near-Field Probe Set		
	R&S®HZ-14	1026.7744.02



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Precision Halfwave Dipole Sets

### R&S®HZ-12, R&S®HZ-13



R&amp;S®HZ-13



R&amp;S®HZ-12

**R&S®HZ-12: 30 MHz to 300 MHz**

**R&S®HZ-13: 300 MHz to 1 GHz**

**Test standards for antenna**

**calibration and test-site**

**attenuation measurements**

### Brief description

#### Antenna calibration

Tunable halfwave dipoles are used for the calibration of VHF-UHF broadband antennas, which have their advantages in practical use but whose characteristics cannot be strictly calculated.

#### Test-site attenuation measurements

Halfwave dipoles are the only tool for checking reference sites used for antenna calibration to ANSI C63.5. They are also used for checking anechoic chamber test sites.

#### Characteristics

The dipoles contain balance-to-unbalance transformers and attenuators. The attenuation between the dipole connectors and the 50 Ω connector is about 10 dB. Two closely linked dipoles provide an attenuation of about 20 dB. This value can be very accurately measured with a network analyzer. The sum of the two antenna factors  $2k_e$  (it is only the sum that is of significance for the test-site validation) can thus be precisely calculated:

$$2k_e = 20 \text{ dB} + 2 \times 1.64 \text{ dB} \\ + 2 \times 20 \log(2\pi/\lambda) \text{ dB} \\ 1.64 \text{ dB} = \text{voltage transformation} \\ 2\pi/\lambda = \text{antenna factor of } \lambda/2 \text{ dipole}$$

#### Equipment supplied

Each dipole set comes in a transit case to protect the dipole rods. The dipole supports are fitted with flanges suitable for mounting on Rohde&Schwarz antenna masts. The manual supplied with the dipole sets contains the attenuation values of the dipole set and a table for height-dependent correction of the antenna factors above a conductive ground plane.

### Specifications in brief

Frequency range	
R&S®HZ-12	30 MHz to 300 MHz
R&S®HZ-13	300 MHz to 1000 MHz
Power attenuation of dipole pair (closely coupled)	20 dB (calibration curve supplied with set)

Antenna factor	
R&S®HZ-12	7.5 dB to 27.6 dB (proportional to f)
R&S®HZ-13	27.4 dB to 38 dB (proportional to f)

### Ordering information

Precision Halfwave Dipole Set	R&S®HZ-12	0816.2870.02
	R&S®HZ-13	0816.2940.02



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Active Receiving Dipoles R&S®HE202, R&S®HE302



R&S®HE302



R&S®HE202

### Brief description

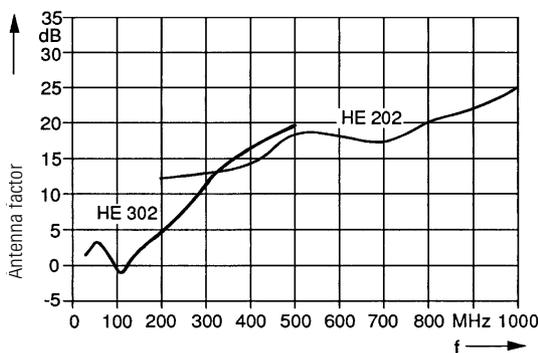
Despite their extremely large bandwidth, R&S®HE202 and R&S®HE302 feature a field-strength sensitivity that is in the entire frequency range comparable to that of antennas with smaller bandwidth and considerably larger dimensions.

The degree of nonlinear distortion in the test system is important for signal field strength and interference field-strength

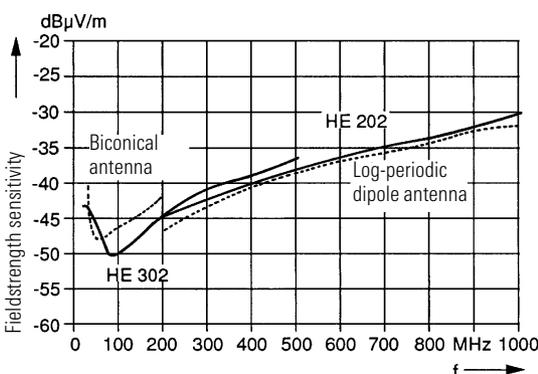
measurements in shielded rooms. With 1-dB compression, for example, the Active Receiving Dipole R&S®HE302 is in the linear range for field strengths up to 5 V/m at 20 MHz and up to 8 V/m at 500 MHz. At frequencies below 20 MHz the maximum field strength increases by 40 dB per decade thanks to the reactive components in the input circuit.

### Main features

- ◆ Extremely small size
- ◆ High sensitivity
- ◆ Wide frequency range
- ◆ High immunity to nonlinear distortion, comparable to passive antennas in conjunction with high-grade preamplifier
- ◆ High immunity to nearby lightning strikes
- ◆ Shock- and vibration-resistant



Antenna factor as a function of frequency



Field-strength sensitivity of R&S®HE202, R&S®HE302 compared to that of passive antennas with a receiver noise figure of 10 dB

### Specifications in brief

	R&S®HE202	R&S®HE302
Frequency range	200 to 1000 MHz	20 to 500 MHz
Polarization	linear	linear
Connector	N female, 50 Ω	N female, 50 Ω
VSWR	<2.5	<2.5
Electronic gain	5 dB to 9 dB	-11 dB to +8 dB
Practical gain	7 dB to 11 dB	-9 dB to +10 dB
Directivity	2 dB average	2 dB average
Antenna factor and field-strength sensitivity	see diagrams	see diagrams
Noise figure	200 MHz: 6 dB 1000 MHz: 7 dB	20 MHz: 28 dB 500 MHz: 9 dB
Intercept point	2nd order >55 dBm 3rd order >30 dBm	>60 dBm >30 dBm
Power supply (from Power Supply Unit R&S®IN115), DC voltage	18 V to 30 V, via RF cable 200 mA	170 mA
Dimensions (L × H)	512 mm × 238 mm	1 m × 240 mm
Weight	2.1 kg	2.5 kg

### Ordering information

Active Receiving Dipoles	R&S®HE202	R&S®HE302
	0630.0310.0x	0644.1114.0x
(x = 2: for monitoring; x = 3: calibrated to ANSI C63.5)		
Extras		
Mast Adapter	R&S®HE202 Z1	0649.7510.02
RF Cable	R&S®HE202 Z2	0649.7785.02
Antenna Adapter	R&S®AM524Z2	4036.0658.02
Calibration at Delivery	R&S®HE202, R&S®HE302	0758.3109.23

## HF Antennas

### Loop Antenna R&S®HFH2-Z2

Broadband active loop antenna for measuring the magnetic field-strength components



### Inductive Probe R&S®HFH2-Z4

Inductive probe for the assessment of the magnetic field-strength components



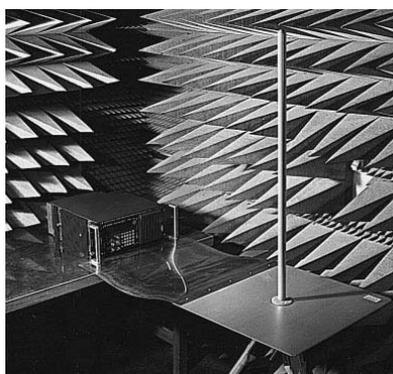
### Power Supply R&S®HZ-9



Power supply for feeding the active Antennas R&S®HFH2-Z1/Z2/Z6 if these antennas cannot be powered from the test receiver

### Rod Antenna R&S®HFH2-Z6

Broadband active rod antenna for measuring the electrical component of radiated EMI in test setups to MIL-STD-461/462 and similar MIL standards



### Specifications in brief R&S®HZ-9

Output voltages	±10 V ±0.5 %
Min. current load	100 mA
DC connector	12-contact Tuchel female
AC supply	100 V to 240 V, -15/+10%
Dimensions (W × H × D)	125 mm × 70 mm × 188 mm
Weight	1.5 kg

### Ordering information R&S®HZ-9

<b>Power Supply for</b>	
Active Antennas R&S®HZ-9	0816.1015.02

### Specifications in brief

	Loop Antenna R&S®HFH2-Z2	Inductive Probe R&S®HFH2-Z4	Rod Antenna R&S®HFH2-Z6
Frequency range	9 kHz to 30 MHz	100 kHz to 30 MHz	9 kHz to 30 MHz
Antenna factor k, referred to 1/m	20 dB (E field)	80 dB (E field)	10/20 dB, selectable
Accuracy	1 dB	6 dB	1 dB
Measurement range (IF bandwidth 200 Hz, AV ind.)			
Lower limit, frequency-dependent	9 kHz to 1 MHz: +40 to +10 dB(μV/m) 1 MHz to 30 MHz: +10 to +5 dB(μV/m)	50 dB(μV/m) (≈0 dB(μA/m))	+15 to -18 dB(μV/m)
Upper limit	140 dB(μV/m)	>190 dB(μV/m) (≈140 dB(μA/m))	140 dB(μV/m) 130 dB(μV/m) (k=10 dB)
Connectors			
RF	BNC female, 50 Ω	BNC male, 50 Ω	BNC female, 50 Ω
Supply and coding (antenna factor)	12-contact Tuchel female	12-contact Tuchel male	12-contact Tuchel female
Length of connecting cables	10 m	1 m	10 m
Current drain (±10 V)	<40 mA	—	<45 mA
Dimensions	loop dia.: 590 mm	outer dia.: 50 mm, height: 20 mm	base: 60 mm × 60 mm, rod height: 1000 mm
Weight	in transit case, without cable: 12 kg	with cable: 0.3 kg	without cable: 5 kg
Order No.	0335.4711.52	0338.3016.52	0837.1866.54

## VHF, UHF and SHF Antennas

### Biconical Antenna R&S® HK 116,

### Log Periodic Antennas

### R&S® HL223, R&S® HL023A1,

### R&S® HL040 and R&S® HL050,

### High-gain Log. Periodic Antenna

### R&S® HL046

### Brief description

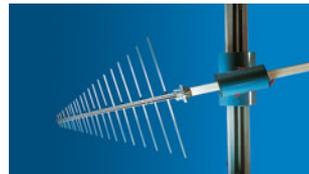
These linearly polarized antennas are used for EMI and EMS measurements in line with commercial and military standards. Depending on frequency and type of antenna, maximum field-strength values between 10 V/m and 300 V/m can be achieved. The use of Conical Log Spiral Antenna R&S® HUF-Z4 with circular polarization is limited to measurements in line with MIL-STD-461 A to C.



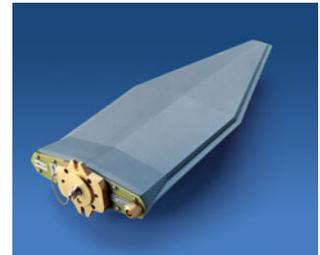
R&S® HUF-Z4



R&S® HL050



R&S® HL223  
(R&S® HL023A1 on page 98)



R&S® HL040



R&S® HL046 with option  
R&S® HL046-P



R&S® HK 116

### Specifications in brief

	R&S® HK 116	R&S® HL223	R&S® HL023 A1	R&S® HL040	R&S® HL050	R&S® HUF-Z4
Frequency range	20 MHz to 300 MHz	0.2 GHz to 1.3 GHz	0.08 GHz to 1.3 GHz	0.4 GHz to 3 GHz	0.85 to 26.5 GHz	0.2 GHz to 1 GHz
Antenna factor k	21 dB to 8 dB	10 dB to 26 dB	4 dB to 25 dB	17 dB to 33 dB	20 dB to 50 dB	17.5 to 27 dB
Power-handling capacity	70 W	1500 W to 600 W	700 W to 230 W	50 W	10 W to 2 W	100 W
Max. field strength for distance 1 m	10 to 60 to 20 V/m	280 V/m	110 V/m to 180 V/m	50 V/m to 100 V/m	40 V/m to 20 V/m	10 V/m to 50 V/m
VSWR	typ. 2.5	typ. 1.6 (<2)	typ. 2 (<2.5)	typ. 2 (<2.5)	<2.5	<3
Connector/nominal impedance	N female/50 Ω	N female/50 Ω	N female/50 Ω	N female/50 Ω	SMA female	N female/50 Ω
Weight	3 kg	2 kg	7.7 kg	2.8 kg	0.7 kg	7.7 kg
Order No.	4000.7752.02	4001.5501.02	0577.8017.02	4035.8755.02	4062.4063.02	0837.2210.52

### Specifications in brief R&S® HL046

Frequency range	80 MHz to 1300 MHz
Polarization	linear
Polarization isolation	typ. 20 dB
Front-to-back ratio	typ. >20 dB
VSWR	<2
Max. input power (T <sub>amb</sub> = +40 °C)	
80 MHz	1000 W + 100% AM
500 MHz	500 W + 100% AM
1000 MHz	300 W + 100% AM
1300 MHz	250 W + 100% AM
Gain	>7 dBi

RF connector	N female, 50 Ω
Dimensions (W × H × L)	
without trolley (in m)	0.85 × 1.57 × 1.75
with trolley (in m)	0.86 × 1.9 (variable up to 2.6 m) × 1.85
Weight without/with trolley	12.5 kg/22.5 kg

### Ordering information R&S® HL046

High-gain Log. Per. Antenna	R&S® HL046	4040.8708.02
Extras		
Pneumatic Control	R&S® HL046-P	4053.1694.02
Pedestal, movable	R&S® HL046Z1	4061.0106.02



Contents Overview

Chapter Overview

Type Index

R&S Addresses



## ULTRALOG R&S® HL562

**30 MHz to 3000 MHz**

**EMI and EMS measurements  
in an extremely wide frequency  
range**

### Brief description

The ULTRALOG antenna combines the characteristics of a biconical and a log-periodic antenna. The ULTRALOG antenna is mainly used for measuring emissions in the broad frequency range from 30 MHz to 3 GHz without change of the antenna. Symmetry and matching (VSWR) of the ULTRALOG allow its use in EMS measurements where field strengths of 10 V/m or higher are required.



*R&S® HL562 with option R&S® HL562Z1*

The log-periodic part of the antenna is V-shaped in order to increase the system sensitivity in particular from 500 MHz to 1 GHz. Unlike with conventional designs, this gain-increasing measure brings about the compact size of the ULTRALOG.

### Special features

- ◆ Only one antenna required to cover wide frequency range
- ◆ Selectable polarization plane
- ◆ Suitable for EMS measurements with high field strengths
- ◆ Gain increase at high frequencies
- ◆ Compact size
- ◆ Individual calibration (ANSIC63.5 and DIN 45003)

### Specifications

Frequency range	30 MHz to 3000 MHz
Polarization	linear
Polarization isolation	>20 dB (acc. to CISPR 16-1)
Nominal impedance	50 Ω
VSWR	typ. <2
Max. input power (T <sub>amb</sub> = +40 °C)	
30 MHz	150 W + 100% AM
80 MHz	300 W + 100% AM
250 MHz	500 W + 100% AM
1000 MHz	280 W + 100% AM
3000 MHz	180 W + 100% AM

Frequency range	30 MHz to 3000 MHz
Gain	typ. 8 dBi from 200 MHz
RF connector	N female
Class of application	laboratory
Dimensions (W × H × L)	approx. 0.60 m × 1.65 m × 1.68 m
Weight	approx. 5 kg

### Ordering information

<b>ULTRALOG</b>	R&S® HL562	4041.3000.02
<b>Extra</b>		
Tripod, movable	R&S® HL562Z1	4041.3900.02



Contents Overview

Chapter Overview

Type Index

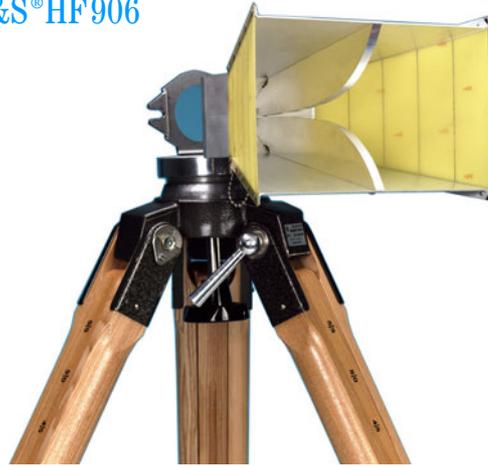
R&S Addresses



## Double-Ridged Waveguide Horn Antenna R&S® HF906

1 GHz to 18 GHz

Broadband directional antenna,  
preferably for use in EMI measurements



R&S® HF906 with optional  
Wooden Tripod R&S® HZ-1

### Brief description

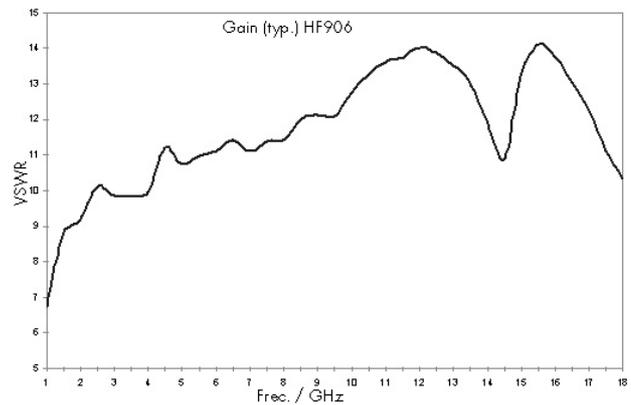
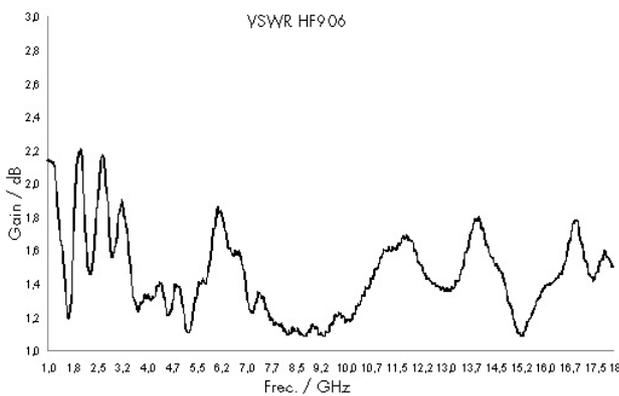
The Double-Ridged Waveguide Horn Antenna R&S® HF906 with linear polarization is a broadband compact transmitting and receiving antenna for the frequency range from 1 GHz to 18 GHz. The calibrated antenna is ideal for use in EMI measurements. High gain and low VSWR allow the generation of high field-

strength levels without any significant return loss as well as the measurement of weak signals. The principle of the exponential double-ridged waveguide makes for the wide frequency range from 1 GHz to 18 GHz of the Antenna R&S® HF906 despite its small dimensions. The gain increases with the frequency. The horn antenna requires little space and is easy to handle. The use of an N connector

allows easy adaptation to existing units as well as high input power. The antenna is made of aluminium and tinned GRP boards to keep its weight low.

### Main features

- ◆ Wide frequency range
- ◆ High gain
- ◆ Input power up to 300 CW/500 W PEP



### Specifications

Frequency range	1 GHz to 18 GHz
Polarization	linear
Nominal impedance	50 Ω
VSWR	typ. <1.5
Max. input power	300 W CW/500 PEP
Gain	typ. 7 dB to 14 dB (see diagram)
Connector	N female
Operating temperature	0°C to +50°C
Dimensions (L × W × H)	290 mm × 250 mm × 160 mm
Weight	1.5 kg

### Ordering information

Double-Ridged Waveguide Horn Antenna	R&S® HF906	4044.4507.02
Extra		
Wooden Tripod	R&S® HZ-1	0837.2310.02



Contents Overview

Chapter Overview

Type Index

R&S Addresses



## Broadband Dipole R&S® HUF-Z1

The antenna complies with CISPR 16-1. The antenna factor k is nearly constant in the range 25 MHz to 80 MHz; a factor of 15 dB or 20 dB can be selected.

### Specifications in brief

Frequency range	20 MHz to 80 MHz
Connector	N female
Nominal impedance	50 Ω
VSWR	
for k = 15 dB	<2
for k = 20 dB	<1.3
Antenna factor k	
for k = 15 dB	
20 MHz to 25 MHz	22.5 dB to 15 dB
25 MHz to 80 MHz	15 dB
for k = 20 dB	
20 MHz to 25 MHz	27.5 dB to 20 dB
25 MHz to 80 MHz	20 dB
Dipole length	1.77 m
Folded size	0.9 m × 0.13 m dia.
Weight	2.5 kg



R&S® HUF-Z1

### Ordering information

<b>Broadband Dipole</b>	R&S® HUF-Z1	0358.0512.52
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## Mast and Tripod R&S® HFU-Z

### Brief description

The mast consists of three epoxy glass laminate tubes, a swivel arm holder and an antenna carrier. Guy ropes and pegs are supplied with the mast. The receiving antenna can be positioned at a height between 1 m and 5 m. Azimuth and polarization plane can be chosen as desired; the elevation angle can be varied by a maximum of ±30°.



Mast and Tripod R&S® HFU-Z with Antenna R&S® HL023A1

### Specifications in brief

Dimensions (folded)	
Mast	length: 1.65 m
Tripod	length: 0.9 m dia.: 0.22 m
Transport weight	
Mast	36 kg (with crate)
Tripod	9 kg

### Ordering information

<b>Mast</b>	R&S® HFU-Z	0100.1120.02
<b>Tripod</b>	R&S® HFU-Z	0100.1114.02

## Wooden Tripod R&S® HZ-1

### Brief description

This tripod supports the Antennas R&S® HFH 2-Z6, R&S® HK116, R&S® HL223 and R&S® HUF-Z4.

- ◆ Light-metal universal ball joint tiltable all round up to 25°; lockable in any position
- ◆ Antenna holder with captive ¼" screw
- ◆ Each two-section tripod leg extensible between 830 mm and 1360 mm

### Specifications in brief

Length, collapsed	910 mm
Weight	6.5 kg

### Ordering information

<b>Wooden Tripod</b>	R&S® HZ-1	0837.2310.02
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Contents Overview

Chapter Overview

Type Index

R&S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## V-Networks R&amp;S® ESH2-Z5, R&amp;S® ESH3-Z6

Interference measurements on

AC-powered loads: R&amp;S® ESH 2-Z5

for remote-control via

Rohde&amp;Schwarz EMI test

receivers, insertion loss calibrated

to ANSIC63.4



R&amp;S® ESH2-Z5



R&amp;S® ESH3-Z6

## Main features

- ◆ AC voltage supply to EUT
- ◆ Isolation of test circuit from line interference
- ◆ Standardized load impedance
- ◆ Defined feed of interference voltage produced by EUT to EMI test receiver

## R&amp;S® ESH 2-Z5

Four-line V-network (50  $\mu$ H + 5  $\Omega$ ) shunted by 50  $\Omega$  in line with VDE0876 and CISPR 16-1. It uses air-core inductances and contains an artificial hand as well as a PE simulating network that can be bypassed. A built-in fan with its own AC supply provides automatically controlled or permanent cooling, as required.

## R&amp;S® ESH3-Z6

R&S® ESH3-Z6 is a single-phase V-network (5  $\mu$ H + 1  $\Omega$ ) shunted by 50  $\Omega$  complying with the requirements of VDE 0876 Part 1 (onboard power supply systems), CISPR Publ. 16 (low-impedance power supplies) as well as MIL-STD-462 Notice 3, MIL-I-6181D, MIL-I-16910C, MIL-E-55301, DEF-STAN 59-41 and DO 160 in the frequency range 100 kHz to 200 MHz.

## Specifications in brief

	R&S® ESH2-Z5	R&S® ESH3-Z6
Frequency range	9 kHz to 30 MHz	0.1 MHz to 200 MHz
Impedance accuracy	$\pm 20\%$	$\pm 20\%$
Continuous current	4 $\times$ 25 A	100 A (150 A to $T_{amb} = 35^\circ\text{C}$ )
Max. short-time current	4 $\times$ 50 A (2 min)	500 A (30 s)
Max. AC supply voltage	250 V rms	250 V rms; 600 V DC
Max. AC supply frequency	63 Hz	440 Hz
AC supply input connector	4 $\times$ 32 A (Cekon male) European male for fan	screw terminal M8
AC supply connector for EUT	4 $\times$ 32 A (Cekon female) 2 $\times$ 16 A (earthing-contact, female)	screw terminal M8, reference ground to metallic ground plate
RF output to test receiver	BNC female	N male
Remote-control input from test receiver	50-contact Amphenol female	–
Input for artificial hand	two 4 mm jacks	–
Dimensions (H $\times$ W $\times$ D)	492 mm $\times$ 294 mm $\times$ 603 mm	122 mm $\times$ 128 mm $\times$ 322 mm
Weight	26 kg	1.9 kg

## Ordering information

V-Network	0338.5219.53	0836.5016.52
<b>Extras</b>		
Control cable to test receiver		
R&S® ESxl/ESlx	R&S® EZ-5 (0816.0625.02) (10 m)	–
R&S® ESCS/ESPI	R&S® EZ-13 (1026.5293.02)	–



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Two-Line V-Network R&amp;S®ENV216

## RFI voltage measurements on single-phase EUTs

## Brief description

The Two-Line V-Network R&S®ENV216 ( $50 \mu\text{H} + 5 \Omega$ )/ $50 \Omega$  satisfies the requirements of VDE0876 and CISPR Publ. 16-1 for V-networks (incl. the requirements of the planned extension for CISPR/A/413/CD regarding the isolation between EUT and power port and the impedance with respect to magnitude and phase) in the frequency range 9 kHz to 30 MHz. It is based on air-core inductances and contains an artificial hand.

## Main features

- ◆ V-network to CISPR, EN, VDE, ANSI and MIL-STD-461 D and E; meets CISPR/A/413/CD
- ◆ Calibrated to CISPR 16-1:1999 and ANSIC63.4
- ◆ Frequency range 9 kHz to 30 MHz

## Specifications in brief

Frequency range	9 kHz to 30 MHz
Impedance characteristic of V-network to CISPR 16-1:1999	$(50 \mu\text{H} + 5 \Omega)/50 \Omega$
Error limits (to CISPR 16-1)	
Impedance magnitude	$\pm 20\%$
Phase	$\pm 11.5^\circ$
Max. permissible constant current for plug and socket (dependent on country)	
Model .02, .04	16 A
Model .03	13 A
Model .05, .06	15 A
Max. permissible AC supply voltage against reference ground	$V_{\text{rms}} = 255 \text{ V}$
Max. permissible DC voltage against reference ground	$V_{\text{DC}} = 50 \text{ V}$
Max. permissible RFI (from EUT)	1 W
Highpass filter (integrated, switch-selectable)	150 kHz
Attenuator (built-in)	10 dB
Response threshold of built-in pulse limiter (output level)	140 dB( $\mu\text{V}$ )
AC supply frequency	0 Hz to 63 Hz
<b>Connectors</b>	
AC supply voltage input	plug with earthing contact and 1.8 m cable (country-specific models)
AC supply voltage input for EUT	socket with earthing contact (country-specific models)
RF output	N connector, female, $50 \Omega$
Remote control input	25-contact Sub-D connector, female



- ◆ Power-handling capacity 16 A, constant current
- ◆ 150 kHz highpass filter, switch-selectable
- ◆ Built-in 10 dB attenuator and pulse limiter
- ◆ Highpass switch and phase select remote controllable with Rohde&Schwarz test receivers
- ◆ Range of models with country specific plug systems
- ◆ Compact, low weight

Input for artificial hand	4 mm connector, female, with knurled clamp
Reference ground connection	ground bar with 3 M4 threads
Protective earth connection	threaded bolt with wing nut
Connector for external power supply	DC hollow connector, 5.5/2.1 mm dia., 10 V to 18 V DC, 250 mA (met by supplied plug-in power supply)
<b>General data</b>	
Operating temperature range	0°C to +45°C
Storage temperature range	-25°C to +70°C
Dimensions (W × H × D)	219 mm × 147 mm × 350 mm

## Ordering information

Two-Line V-Network	R&S®ENV216	3560.6550.yy
Germany (earthing-type connector)		yy = 02
United Kingdom		yy = 03
France		yy = 04
China, Australia		yy = 05
USA		yy = 06

## Accessories supplied

Manual, calibration record, plug-in power supply (country-specific)

## Extras

Remote control cable, 25-contact (Control by receiver of R&S®ESxS, R&S®ESIBx, R&S®ESPlx series connector/connector, 1:1 wiring; two cables required for shielded rooms)		
Control Cable, 3 m	R&S®EZ-21	1107.2087.03
Control Cable, 10 m	R&S®EZ-21	1107.2087.10



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## 200-A Four-Line V-Network R&amp;S® ENV4200

## 150 kHz to 30 MHz

For RFI voltage measurements at high currents

## Brief description

Four-Line V-Network R&S® ENV4200 is used for measuring RFI voltages on AC supply connections of EUTs carrying very high currents.

It uses air-core inductances and contains an artificial hand. R&S® ENV4200 satisfies the requirements of CISPR 16-1, VDE0876 and ANSI C63.4 for V-networks with an impedance of  $50 \mu\text{H} \parallel 50 \Omega$  in the frequency range 150 kHz to 30 MHz.

CISPR 16-1 specifies two types of V-networks for the frequency range 150 kHz to 30 MHz: one with an impedance of  $50 \mu\text{H} \parallel 50 \Omega$  and another with an impedance of  $(50 \mu\text{H} + 5 \text{ W}) \parallel 50 \Omega$ . V-Network R&S® ENV4200 corresponds to type 1.

## Specifications in brief

<b>Frequency range</b>	150 kHz to 30 MHz
<b>Impedance characteristic of V-network</b>	$50 \mu\text{H} \parallel 50 \Omega$
<b>Error limits (to CISPR 16-1)</b>	$\pm 20\%$
<b>Test path (to EUT)</b>	
<b>Max. permissible continuous current</b>	4 × 100 A with fans switched off 4 × 200 A with fans switched on
<b>Operating time derated</b>	at higher currents
<b>DC resistance per path</b>	typ. 6.7 mΩ
<b>AC supply frequency range</b>	0 Hz to 63 Hz
<b>Max. permissible AC supply voltage</b>	260 V/450 V
<b>Test path (to test receiver)</b>	
<b>Pulse limiter</b>	to 150 dBμV (built-in)
<b>Voltage attenuation between EUT and test receiver</b>	10 dB (built-in attenuator pad)
<b>Cooling</b>	with 4 built-in fans
<b>Connectors</b>	
<b>EUT connectors</b>	knob for 15 mm terminals
<b>Ground</b>	screw terminal M8
<b>Reference ground</b>	uninsulated busbars
<b>RF connector</b>	BNC female
<b>Remote control</b>	25-pin Cannon female



The maximum attainable current of the V-network is limited by the voltage drop at the standardized inductances (CISPR 16-1 prescribes the voltage drop at 5% of the AC supply voltage) and by unavoidable heat losses.

## Main features

- ◆ V-network to CISPR, EN, VDE, ANSI
- ◆ Impedance  $50 \mu\text{H} \parallel 50 \Omega$
- ◆ Artificial hand
- ◆ Continuous current up to 4 × 200 A
- ◆ Air-core design
- ◆ Remote control with TTL levels
- ◆ Calibrated to CISPR/A/201/CDV and ANSI C63.4

General data	
Rated temperature range	+5°C to +40°C
Storage temperature range	−30°C to +70°C
Dimensions (W × H × D); weight	450 mm × 315 mm × 670 mm; 43 kg

## Ordering information

<b>Four-Line V-Network</b>	R&S® ENV4200	1107.2387.02
<b>Extras</b>		
25-wire remote control cable for control by Test Receivers of		
R&S® ESxS Series:		
Control Cable 3 m	R&S® EZ-21	1107.2087.03
Control Cable 10 m	R&S® EZ-21	1107.2087.10
(2 required for shielded room)		
R&S® EBxI Series:		
Control Cable 3 m	R&S® EZ-22	1107.2235.03
(Combination with R&S® EZ-21 required for shielded chamber)		



Contents Overview

Chapter Overview

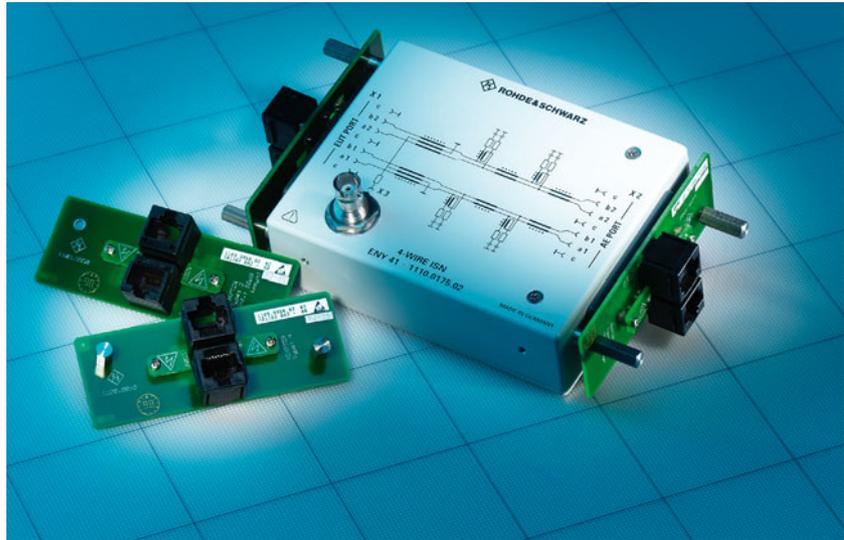
Type Index

R&S Addresses



## Coupling Networks R&S®ENY

for EMI emission and immunity tests on unshielded symmetrical telecommunication ports



### Brief description

Coupling Networks R&S®ENY22 and R&S®ENY41 have been designed to measure the asymmetrical (common-mode) RFI voltage of unshielded symmetrical telecommunication ports of EUTs in the frequency range 150 kHz to 30 MHz according to CISPR 22, 1997/EN 55022, 1998.

In these product standards, this type of coupling networks is referred to as ISN (impedance stabilization network), whereas in basic standards they are called AAN (asymmetrical artificial network) or Y-network (CISPR 16) or CDN (coupling/decoupling network, IEC 61000-4-6).

In addition to emission measurements, R&S®ENY22 and R&S®ENY41 also enable immunity testing of the above-mentioned EUTs in the frequency range 150 kHz to 80 MHz according to CISPR 24, 1997/EN 55024, 1998 and IEC 61000-4-6. They meet the requirements of CISPR 22/1997.

*The table gives an overview of available RJ45 adapter sets. The four types I through IV are available for the four-wire ISN R&S®ENY41. For the double two-wire ISN, type V is available. For the latter, pins 3, 4 and 5, 6 are connected in parallel. In addition, there is an adapter set for user-selectable wiring (type VI).*

### Main features

- ◆ Four-wire and double two-wire networks (ISNs)
- ◆ Conducted emission measurements to CISPR 22/1997 and EN 55022/1998 (150 kHz to 30 MHz)
- ◆ Conducted immunity measurements to CISPR 24 and EN 55024 (150 kHz to 80 MHz)
- ◆ Adapter sets to meet LCL requirements (LCL: 50 dB, 60 dB and 80 dB) and various telecommunication standards
- ◆ High transfer bandwidth for useful signal (100 MHz)

Interface standard	Usual connectors		Pin configuration of RJ45 connector							Type	
	RJ45		8	7	6	5	4	3	2		1
		RJ11		6	5	4	3	2	1		
Deutsche Telekom	X				a	W	E	b		I	
Deutsche Telekom V <sub>PN</sub> , V <sub>PO/E</sub>	X				a			b		V	
Siemens	X				E	b	a	W		I	
Siemens V <sub>PN</sub> , V <sub>PO/E</sub>	X					b	a			V	
US standard	X				W	b	a	E		I	
Token Ring	X				RX	TX	TX	RX		I	
10Base T	X				RX			RX	TX	TX	II
100Base T	X				RX			RX	TX	TX	II
ATM	X		X	X					X	X	III
FDDI	X		X	X					X	X	III
ISDN basic rate access	X				X	X	X	X			I
ISDN primary rate access 2048 kbit/s	X					X	X		X	X	IV
ISDN primary rate access 1544 kbit/s	X					X	X		X	X	IV



Contents Overview

Chapter Overview

Type Index

R&S Addresses



## Coupling Networks R&amp;S®ENY

## Description

R&S®ENY22 comprises two separate two-wire networks with two receiver ports in one box, whereas R&S®ENY41 includes one four-wire network.

R&S®ENY22 and R&S®ENY41 terminate the interface of the EUT with 150 Ω (asymmetrical or common-mode impedance) and couple the asymmetrical impedance to the test receiver with a voltage-division factor of approx. 10 dB. The useful symmetrical (differential-mode) signal passes through the network almost unattenuated with a bandwidth of up to 100 MHz (measured for a symmetrical impedance of 100 Ω). At the same time the coupling network decouples the test circuit from interference effects (RFI voltage, impedance) at the AE (auxiliary equipment) port.



ISN Functional Test Set R&S®ENYBS incl. 2 baluns R&S®ENYB21 and one Set of ISN test boards

## Specifications

<b>Frequency range</b>	
Emission measurements	150 kHz to 30 MHz
Immunity measurements	150 kHz to 80 MHz
<b>Asymmetrical impedance</b>	
Impedance in range 0.15 MHz to 30 MHz	150 Ω ± 20 Ω
Phase angle in range 0.15 MHz to 30 MHz	0 ± 20°
Impedance in range 150 kHz to 80 MHz	150 Ω ± 40 Ω
<b>Voltage-division factor</b>	
In asymm. circuit in range 150 kHz to 30 MHz	10 dB ± 1 dB typ. (calibration data supplied <sup>1)</sup> )
<b>Transfer bandwidth (3 dB)</b>	
In symm. circuit	>100 MHz (for 100 Ω source and load impedances)
<b>Differential-mode rejection (LCL)</b>	
80 dB adapter	
150 kHz to 1.5 MHz	(80 – 3) dB
1.5 MHz to 30 MHz	>(80 to 55) dB – 3 dB
60 dB adapter	
150 kHz to 1.5 MHz	(60 ± 3) dB
1.5 MHz to 30 MHz	(60 to 35) dB ± 3 dB
50 dB adapter	
150 kHz to 1.5 MHz	(50 ± 3) dB
1.5 MHz to 30 MHz	(50 to 25) dB ± 3 dB
<b>Decoupling attenuation</b>	
150 kHz to 1.5 MHz	>35 dB to 55 dB (linear increase with log frequency)
1.5 MHz to 80 MHz	>55 dB
<b>Maximum values</b>	
Max. permitted RF input voltage	17 V
Max. permitted DC and low-frequency AC voltage between symm. line and ground	160 V
Max. DC current (phantom current)	150 mA (current on each individual wire of one pair or on different pairs)
<b>Connectors</b>	
Output to receiver/input from signal generator	BNC connectors
EUT and auxiliary equipment (AE)	adapters with screw terminals and RJ45 connectors
<b>General data</b>	
Nominal temperature range	+ 5°C to 40°C
Storage temperature range	–40°C to + 70°C
Dimensions of basic unit	144 mm × 95 mm × 52 mm
Dimensions of unit with adapters	168 mm × 96 mm × 52 mm
Weight of unit with adapters	535 g
Weight of carrying case with basic adapter set	2170 g
Weight of option R&S®ENY 4-B1	330 g

<sup>1)</sup> The calibration data contain: asymmetrical impedance and phase, voltage-division factor, differential-mode rejection ratio.

## Ordering information

<b>Double Two-Wire ISN to CISPR22</b>	R&S®ENY22	1109.9508.02
<b>Four-Wire ISN to CISPR22</b>	R&S®ENY41	1110.0175.02
Option for R&S®ENY41: 3 additional RJ45 adapter sets	R&S®ENY4-B1	1109.9950.02
<b>Accessories supplied</b>	plastic carrying case with foam material, calibration data	
<b>Extra</b>		
ISN Functional Test Set	R&S®ENBY	1110.0298.03



Contents Overview

Chapter Overview

Type Index

R&S Addresses



## Antenna Impedance Converter R&S® EZ-12



R&S® EZ-12 is a broadband matching unit for test receivers and spectrum analyzers with low-impedance inputs. It is used for high-impedance measurements of interference voltage at the feedpoint of a vehicle-mounted antenna in the long-, medium- and shortwave bands to VDE0879 Part 2 and CISPR25.

## Current Probe R&S® EZ-17



Model .02 with its extremely flat frequency response is optimal for current measurements as well as for measuring shielding effectiveness. Due to its high load capacity, model .03 is recommended for EMS measurements (bulk current injection). Thanks to their high magnetic overload capacity, these two models can be employed on power lines with currents up to 300 A without having an adverse effect on the measurement results.

For measurements in the VHF-FM range antenna signal can be switched to a separate 50-Ω input.

- ◆ Flat frequency response
- ◆ High sensitivity
- ◆ High overload capability
- ◆ Rugged metal case

The R&S® EZ-12 can be directly powered from Rohde&Schwarz test receivers or spectrum analyzers. Should this not be possible, it is recommended to use Power Supply R&S® HZ-9 (see page 94).

### Specifications in brief

Frequency range	150 kHz to 30 MHz (120 MHz)
RF input	DIN 415845
Input impedance	>100 kΩ, <10 pF (at 1 MHz)

### Current Probes R&S® EZ-17 comply with the following standards:

- ◆ CISPR 16-1 and VDE0876 Part 1 for measurement of RFI currents
- ◆ MIL-STD-461 CE 01 and CE 03
- ◆ VG95373 Part 20, VG95377 Part 14
- ◆ DEF-STAN59-41 DCE 01 and 02
- ◆ RTCA/DO-160 C

### Specifications in brief

	Model .02	Model .03
Frequency range	20 Hz to 100 MHz	20 Hz to 100 MHz
Range with constant transducer factor (−3 dB)	1 MHz to 100 MHz	2 MHz to 100 MHz
Transducer factor reduced by 20 dB/decade in range	20 Hz to 1 MHz	20 Hz to 2 MHz
RF connector	N female	N female
Source impedance	≤0.8 Ω	≤1 Ω
Transfer impedance $Z_T$ in range with constant transducer factor	3.16 Ω	7.1 Ω
Transducer factor k in range with flat frequency response	−10 dB	−17 dB
Load capacity (RF current measurement)		
Max. DC current or peak AC current	300 A (f <1 kHz)	300 A (f <1 kHz)
Max. RF current (rms)	2 A (f >1 MHz)	1 A (f >1 MHz)
Load capacity (EMS measurement)		
Max. power at RF connector	–	10 W (f >1 MHz)

### Ordering information

Current Probe R&S® EZ-17	0816.2063.02	0816.2063.03
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Frequency range	150 kHz to 30 MHz (120 MHz)
Gain factor for	
direct input to antenna connector	0 ±1 dB
correction factor −10 dB	+11.2 dB
AM output	BNC female, 50 Ω
VSWR	≤1.4
FM output, remote controlled	BNC female, 50 Ω
Noise voltage at output (input terminated with antenna simulator; average detector, BW = 10 kHz)	
f >150 kHz	≤−5 dBμV
f >500 kHz	≤−7 dBμV
1 dB compression point	>107 dBμV
Power supply	+10 V ±0.1 V
Current drain	<50 mA
Dimensions (W × H × D)	125 mm × 110 mm × 40 mm
Weight	0.6 kg

### Ordering information

Antenna Impedance Converter	R&S® EZ-12	1026.4800.03
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### Main features

- ◆ High sensitivity and overload capability
- ◆ Wide frequency range
- ◆ High load capacity for DC and AC current (300 A)
- ◆ Small dimensions in spite of large inner diameter (30 mm)
- ◆ Simple clamping thanks to spring-loaded mechanism



Contents Overview

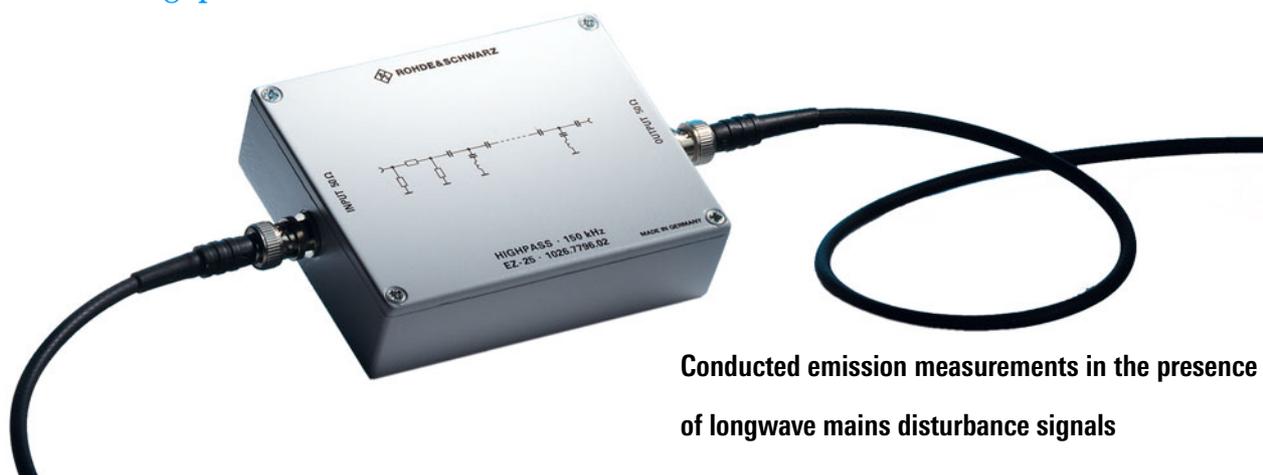
Chapter Overview

Type Index

R&S Addresses



## 150 kHz Highpass R&amp;S® EZ-25



### Conducted emission measurements in the presence of longwave mains disturbance signals

#### Brief description

During signal transmission in low-voltage networks below 150 kHz, very high voltage levels may occur near the upper limit frequency of 148.5 kHz. This has been described in EN50065-1. The selectivity of the CISPR measuring receiver specified in CISPR 16-1 can cause problems in the conformance of the equipment with the RFI voltage limits at 150 kHz. For this reason a highpass has been specified in CISPR 16-1, which can be used in front of the CISPR measuring receiver in order to improve the selectivity and so to achieve the values defined in part 1 of EN50065,

without affecting the passband of the measuring receiver.

Problems with high interfering voltages in the range below 150 kHz can also occur with EUTs, which are not involved with low-voltage signalling. Only very few EMC standards specify limits in the frequency range below 150 kHz. Therefore equipment manufacturers use suppression filters with extremely steep slopes to meet the requirements above 150 kHz. In these cases measuring receivers may be overloaded, entailing measurement errors in the frequency range above 150 kHz. Highpass R&S® EZ-25 prevents this and allows exact measurements.

#### Main features

- ◆ Conducted emission measurements to EN50065 Part 1
- ◆ Pass frequency range 150 kHz to 30 MHz
- ◆ Very steep slope acc. to CISPR 16-1: 1999 (selectivity)
- ◆ Suitable for any CISPR measuring receiver
- ◆ Relative attenuation >50 dB below 130 kHz
- ◆ Built-in 10 dB attenuation pad for exact 50  $\Omega$  termination of the LISN
- ◆ High pulse energy capability (50 mWs)
- ◆ Calibrated response

#### Specifications

Passband	150 kHz to 30 MHz
Insertion loss in passband	9,5 dB to 11 dB (calibration data supplied)
Stopband	below 130 kHz
Minimum attenuation in stopband	60 dB
Attenuation in the transition region	
146 kHz	<12 dB
145 kHz	>12 dB
140 kHz	>24 dB
130 kHz	>60 dB

Maximum input voltage (continuous)	137 dB $\mu$ V
Maximum impulse energy (50 $\mu$ s)	50 mWs
Connectors	BNC female
Nominal temperature range	0°C to + 40°C
Dimensions (L $\times$ W $\times$ H)	144 mm $\times$ 95 mm $\times$ 34 mm
Weight	400 g

#### Ordering information

<b>150 kHz Highpass</b>	R&S® EZ-25	1026.7796.02
<b>Accessories supplied</b>	Short description with calibration data	



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## VHF Current Probe R&S® ESV-Z1

### Brief description

Current Probe R&S® ESV-Z1 is used for selective or broadband measurement of very small as well as of very large RF currents in electric lines. They are shielded against electrostatic effects and comply with CISPR16-1 and VDE0876.

### Specifications in brief

Frequency range	20 MHz to 300 MHz
Measurement range (average indication)	-33 dBμA to +117 dBμA (IF bandwidth 7.5 kHz)
Transfer admittance $Y_t = I_{in}/V_{out}$	0.1 S
Transducer factor $k = 20 \log(Y_t/s)$	-20 dB
Max. current (superimposed on RF current or peak AC current)	50 A
Max. diameter of conductor	13.5 mm
RF connector	N male, 50 Ω, 1 m
Coding connector (transducer factor)	12-contact Tuchel
Dimensions (dia./height)	55 mm/20 mm
Weight	130 g



### Ordering information

<b>VHF Current Probe</b>	R&S® ESV-Z1	0353.7019.02
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## Pulse Limiter R&S® ESH3-Z2

### Brief description

#### Pulse Limiter R&S® ESH3-Z2, Attenuator R&S® ESH2Z11

High RF input levels and high-energy interfering pulses generated on artificial mains networks when the DUT is switched on and off can damage the RF input circuits of test receivers.

**Pulse Limiter R&S® ESH3-Z2** limits and **Attenuator R&S® ESH2Z11** reduces the interference level.

### Specifications in brief

	R&S® ESH3-Z2	R&S® ESH2Z11
Frequency range	0 Hz to 30 MHz	0 Hz to 1500 MHz
Insertion loss	10 dB ±0.3 dB	–
$f \leq 500$ MHz	–	20 dB ±0.25 dB
$f \leq 1000$ MHz	–	20 dB ±0.5 dB
$f \leq 1500$ MHz	–	20 dB ±1.5 dB
Frequency response	≤±0.3 dB	–
SWR with 50 Ω termination, input/output	≤1.06/≤1.25	–
Power-handling capacity in continuous mode	1 W	10 W
Pulse power-handling capacity	E = 0.1 Ws (6 μs)	P = 750 W (3 μs)
RF connectors	N (female/male), 50 Ω	N (female/male), 50 Ω
Dimensions (L × W × H or L × Ø)	94 mm × 25 mm × 25 mm	97 mm × 42 mm
Weight	120 g	150 g

### Ordering information

<b>Pulse Limiter</b>	R&S® ESH3-Z2	0357.8810.54
<b>Attenuator</b>	R&S® ESH2Z11	0349.7518.52



R&amp;S® ESH3-Z2

R&amp;S® ESH2Z11



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses





Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses



## Probes R&amp;S® ESH2-Z2, R&amp;S® ESH2-Z3



R&amp;S® ESH2-Z3

**Active Probe R&S® ESH2-Z2**

The active probe is used for measuring AC voltages on lines that do not carry AC supply voltage.

**Passive Probe R&S® ESH2-Z3**

The passive probe is suitable for measuring RFI voltages (on AC supply lines) to CISPR16-1 and VDE0876.

**Attenuator R&S® ESH2-Z31**

For checking the interference source impedance to VDE 0877, Part 1 and CISPR16-2

## Specifications in brief

	R&S® ESH2-Z2	R&S® ESH2-Z3
Frequency range	9 kHz to 30 MHz	9 kHz to 30 MHz
Measurement range (average indication, IF bandwidth 200 Hz with Rohde&Schwarz Test Receivers)	-20 dB $\mu$ V to +120 dB $\mu$ V	+10 dB $\mu$ V to +150 dB $\mu$ V
Attenuation/error	10 dB/<1 dB	30 dB/-1 dB to +5 dB
Input impedance	118 k $\Omega$ $\pm$ 5%    8 pF	1.5 k $\Omega$ $\pm$ 2%    9 pF
Max. input voltage		
f <63 Hz	100 V	250 V
f <500 Hz	5 V	250 V
9 kHz to 30 MHz	3 V	30 V

## Ordering information

<b>Active or Passive Probe R&amp;S® ESH2-Zx</b>	0299.7210.52	0299.7810.52
Attenuator R&S® ESH2-Z31	0827.6513.02	0827.6513.02
BNC Adapter R&S® URV-Z	0241.1110.02	0241.1110.02

RF Connecting Cables  
R&S® HFU2-Z4, R&S® HFU2-Z5

Low-loss cables for connecting antennas to test receivers. With this type of cable the outer sheath is filled with a special ferrite to reduce sheath currents.

## Ordering information

RF Connecting Cable		
12 m	R&S® HFU2-Z4	0252.0090.56

## Feeder Cables R&amp;S® HZ-3, R&amp;S® HZ-4

Connecting cables with 12-contact Tuchel male/female connectors for remote feeding of active antennas from the test receiver or from Power Supply R&S® HZ-9, page 94. The correction factor for automatic correction of unit and level display on the test receiver is also transmitted.

## Ordering information

Feeder Cable		
3 m	R&S® HZ-3	0837.3469.02
10 m	R&S® HZ-4	0816.0519.02



Contents Overview

Chapter Overview

Type Index

R&amp;S Addresses

