EMI test receivers from 5 Hz to 26.5 GHz

Concept of EMI instrumentation has proven itself

The adoption of the European EMC Directive 89/336/EEC at the beginning of the 90s has created a need for instruments that are able to perform accurate measurements in line with the applicable EN standard. Rohde & Schwarz took up this challenge in time by introducing a new EMI test receiver generation in 1991.

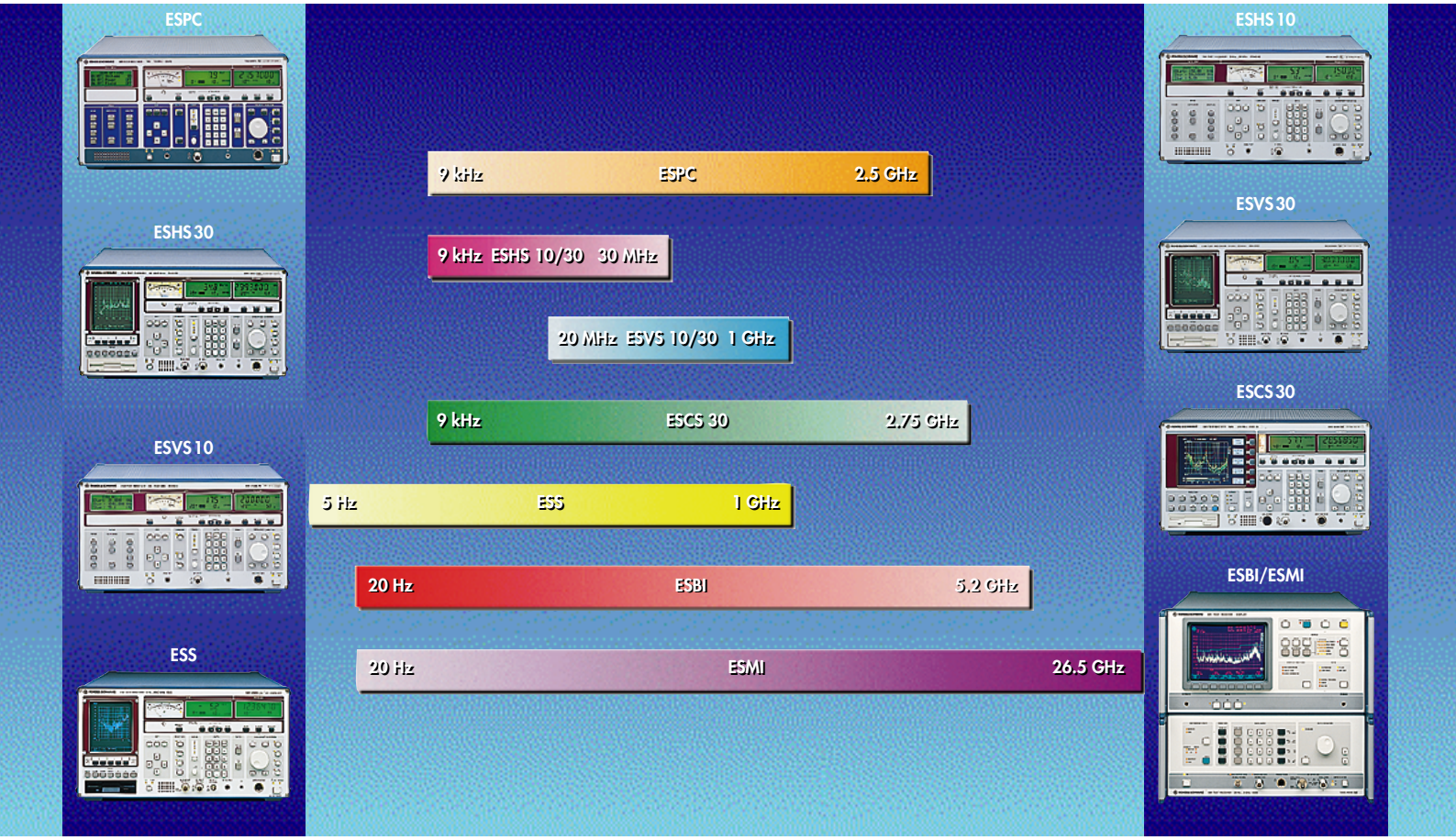

FIG 1 Overview of spectrum of Rohde & Schwarz EMI test receivers

Standard-conformal measurements of interfering emissions (EMI) place highest demands on the characteristics of a test receiver which must be able to correctly detect and evaluate pulsed or sinusoidal, modulated or intermittent interferers. The necessary pulse weighting with a CISPR quasi-peak detector demands on the one hand high immunity to overdriving and on the other high sensitivity for RFI field-strength measurements that take into account cable losses and antenna correction factors, ie a dynamic range that can be obtained only with the aid of advanced circuit design. To further increase the efficiency, time-saving test methods are of great importance. They are mostly implemented in the instrument firmware in the form of intelligent test routines, interactive macros and automatic evaluation functions. In addition, EMI software packages for commercial PCs allow automatic control of complete EMI test systems via IEC/IEEE bus.

The legal provisions prescribing compliance of devices or systems with EMC (electromagnetic compatibility) standards in all countries of the European Union since the beginning of 1996 made it necessary to adopt a new strategy for planning, development and assembly of electrical and electronic devices. EMC measurements are to be performed at all stages of development, construction and quality assurance through to market introduction and marketing of the ready-to-sell product. Besides the test setups stipulated by EMC standards, precision

measuring instruments complying with CISPR 16-1 standard are a prerequisite for performing reproducible measurements at the specified accuracy.

The instruments

Basically, all measuring instruments in line with the basic CISPR 16-1 specifications meet the demanding EMI measurement requirements. Conformity to EMC standards may be confirmed by an independent, accredited organization. All Rohde & Schwarz full-compliance test receivers conform to CISPR standards [1]. FIG 1 gives an overview of EMI test receivers and their frequency ranges.

Full-compliance sector

EMI Test Receivers ESHS10 and ESVS10

All test receiver of series 10 are able to automatically control artificial mains networks via macros and allow at the same time test reports to be output on a plotter or printer. Optional AC-supply-independent battery operation makes the instruments ideal for mobile, open-site measurements at EMC service providers, test houses and technical inspection authorities, and particularly for development and acceptance tests in industry in line with EN 55011 to EN 55022 standards.

EMI Test Receivers ESHS30 and ESVS30

Test receivers of series 30 differ from models 10 mainly by a built-in, low-leakage screen, IF spectrum analysis and built-in 3.5" floppy-disk drive for storing and calling measurement results, limit lines, correction tables and scan data records. They are equipped in addition with a tracking generator for two-port measurements or for determining cable losses. Users of ESHS30 and ESVS30 are the same as those of model 10, but the main field of application for series 30 instruments is acceptance testing at accredited EMC test houses, authorities and quality assurance departments of large companies.

EMI Test Receiver ESS

ESS [2] is the flagship of the EMI test receiver family. It covers the frequency range above 5 Hz and offers all CISPR and MIL bandwidths up to 1 MHz. The strength of this unit is its compact design combined with an extremely high sensitivity and high pulse loading capacity. Three RF input modules each using a different mixing principle guarantee excellent RF characteristics. Because of its elaborate design, ESS is mostly used by test houses and EMC service providers. Other main fields of application include computer and car manufacture, quality assurance at large companies as well as measurements up to 1 GHz in the military sector.

EMI Test Receiver ESCS30

ESCS30 [3], the latest member of the test receiver family, offers a number of unique features making it an important extension to the family. Highlights such as continuous frequency range from 9 kHz to 2.75 GHz, colour LCD with VGA resolution for displaying traces along with an analog bar for up to three parallel-operating detectors as well as time domain analysis for assessing the time response of EMI emissions are all packed into one compact receiver which, to top it, features an excellent price/performance ratio. ESCS30 complies with all commercial EMC standards to CISPR and VDE. An advanced operating concept using macros for fully or semi-automatic test runs combines convenient operation with fast and reliable receiver setting. Low weight, optional AC-supply-independent operation up to four hours from internal batteries and the built-in 3.5" disk drive make ESCS30 ideal for mobile operation. Users of ESCS30 are national authorities, approval offices, test houses, EMC service providers and industrial EMC laboratories. It is particularly noteworthy that a large number of these receivers is used by the German Post and Telecommunications Office (BAPT).

EMI Test Receivers ESBI and ESMI

These test receivers are based on the principle of a spectrum analyzer, ie they utilize the advantages of fast sweeps for prescan measurements. These features are combined with the accuracy, selectivity, dynamic range and sensitivity of a test receiver in a single compact unit. The frequency range 20 Hz to 5.2 (or 26.5) GHz and the technical concept make this receiver type ideal for test houses, military applications, research and education as well as aerospace industry.

Precertification sector

EMI Test Receiver ESPC

ESPC was especially developed for precertification measurements. Although the unit has a slightly reduced functionality, it yet features a clearly higher measurement accuracy and reliability of results than many other instruments of its class. It is mainly used for development-accompanying measurements in all sectors of industry and for all types of products, but also in research and education and even by test houses as an add-on unit.

All Rohde & Schwarz EMI test receivers are able to perform fast prescan measurements with the aid of parallel detectors, store a great number of limit lines and compare measurement results with active limit lines. To increase the measurement accuracy, transducer correction tables may be taken into account in the level display. EMI Test Receiver ESPC is the only exception regarding full compliance with EMI standards. Being mainly intended for precertification measurements, it is not fully compliant to CISPR16 when evaluating pulsed interferers using the quasi-peak detector.

Accessories and software

All Rohde & Schwarz EMI test receivers can be operated with a comprehensive range of accessories including artificial

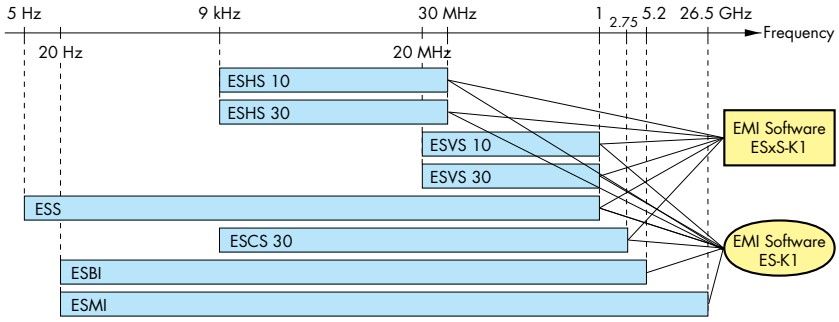

FIG 2 Software packages for full-compliance EMI test receivers

mains networks, active and passive probes, inductive probes, preamplifiers, current probes, absorbing clamps, test antennas for magnetic and electric fields, turntables, antenna masts and slideways for absorbing clamps.

Software Packages ES-K1 [4] and ESxS-K1 [5] (FIG 2) – operating under Windows™ 3.1 or 95 on any commercial PC with IEC/IEEE bus or PCMCIA card – perform all receiver settings for EMI measurements to standard. If external extras like mast, turntable and slideway systems are also to be controlled, height and polarization parameters as well as angle positions and positions of absorbing clamps are accurately monitored, set for subsequent measurements and stored.

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[4] Janssen, V.: Softwaregestützte Messungen in der EMI-Messtechnik und zu beachtende Grenzen der Automatisierbarkeit. Kompendium 1996, EMC-Journal, pp 270–274

[5] Janssen, V.: ESxS-K1 – attractively priced Windows software for EMC measurements. News from Rohde & Schwarz (1996) No. 151, pp 40–41

Condensed data of EMI test receivers

Type	Frequency range	Preselection/ preamplifier	IF bandwidths	Tracking gen./ IF analysis	Other extras	Options	Recommended extras
ESHS10	9 kHz to 30 MHz	yes/yes	200 Hz/9 kHz	no/no	macros, battery	none	rechargeable batteries
ESHS30	9 kHz to 30 MHz	yes/yes	200 Hz/9 kHz	yes/yes	macros, floppy	none	
ESVS10	20 to 1000 MHz	yes/yes	9 kHz/120 kHz	no/no	macros, battery	impulse-resistant attenuator up to 1 GHz	rechargeable batteries
ESVS30	20 to 1000 MHz	yes/yes	9 kHz/120 kHz	yes/yes	macros, floppy	none	
ESS	5 Hz to 1 GHz	yes/yes	200 Hz/9 kHz/120 kHz 2 Hz to 1 MHz	yes/yes	macros, floppy, bal. input, MIL measurements	int. oven crystal frequency	Magnetic Field Pickup Coil HZ-10
ESCS30	9 kHz to 2.75 GHz	yes/yes	200 Hz/9 kHz/120 kHz/ 1 MHz	yes/yes	macros, battery, floppy, time domain analysis	battery-supplied controller, rechargeable batteries, IF analysis, oven crystal reference, tracking gen. 9 kHz to 2750 MHz	EMI software, pulse limiter
ESBI	20 Hz to 5.2 GHz	yes/yes	200 Hz/9 kHz/120 kHz 10 Hz to 1 MHz 6 Hz to 3 MHz (–3 dB)	up to 5.2 GHz/ no	2nd RF input, MIL measurements	none	EMI Software ES-K1
ESMI	20 Hz to 26.5 GHz	yes/yes	200 Hz/9 kHz/120 kHz 10 Hz to 1 MHz 6 Hz to 3 MHz (–3 dB)	up to 5.2 GHz (opt. 26 GHz)/ no	2nd RF input, MIL measurements	tracking generator extension to 26.5 GHz	ext. mixer (up to 110 GHz), EMI Software ES-K1
ESPC	150 kHz to 1 GHz	yes/no	200 Hz/9 kHz/120 kHz	no/no	macros, battery	frequency extension 9 to 150 kHz + IF bandwidth 200 Hz, freq. extension 1 to 2.5 GHz, int. batteries	pulse limiter, El. and Magn. Field Probe Sets HZ-11, HZ-14

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