EMI Test Receiver ESCS30

Top in full-compliance testing

The highlights of EMI Test Receiver ESCS30: frequency range from 9 kHz through to 2.75 GHz in one compact, favourably-priced instrument, complete with VGA colour display and macros for automatic testing, which makes an external process controller mostly superfluous.

Even in its basic version EMI Test Receiver ESCS30 – an important extension to the worldwide successful ESHS/ESVS/ESS family [1] – is a full-compliance test receiver to CISPR and VDE. It performs EMC measurements to standards with outstanding precision, immunity to overload, dynamic range and selection (FIG 1). The built-in time domain analysis allows examination of interference versus time. When used for precertification testing of electrical equipment at the development stage, ESCS30 detects critical frequencies and serves for product optimization [2]. This reduces development and manufacturing costs, increases price calculation reliability and makes for a successful product.

Automatic tests at a keystroke

At a single keystroke ESCS30 performs complete RFI voltage, RFI power and RFI field-strength measurements. It determines the critical ranges of the spectrum by a prescan measurement using the peak detector. The Max. Hold function allows intermittent interference to be detected. Data-reduction routines serve for determining the frequencies for the final measurement, which is then carried out by means of the quasi-peak and/or average detector with standard-conforming measurement time. This concept saves valuable time that would otherwise be wasted on examining frequency ranges with low emission levels.

The test receiver automatically selects the correct CISPR bandwidth for the specific test frequency and makes comparisons with limit lines, eg to EN standard. In case of RFI voltage measurement the phase settings of the line-impedance stabilization network (LISN) are automatically set. The phase with the highest RFI level is used for final measurement and recorded. For RFI power measurement ESCS30 interactively searches for the interference maxima. For RFI field-strength measurement the highest emissions are also determined interactively and recorded.

Simple test assemblies for all types of analysis

To perform measurements to EN standards the following basic equipment is required:

**RFI voltage measurement**
EMI Test Receiver ESCS30, LISN (2-line or 4-line V network), printer/plotter

**RFI power measurement**
EMI Test Receiver ESCS30, absorbing clamp (if necessary, slideway for automatic guidance of clamp), printer/plotter

**RFI field-strength measurement**
EMI Test Receiver ESCS30, antennas (magnetic/electrical/electromagnetic), tripod/mast for fixing the antenna, printer/plotter (FIG 2)

**RF analysis** can be operated in the Spectrum Overview, Scan and Channel Scan modes.

In the Spectrum Overview mode a fast measurement is made of the spectrum between start and stop frequency according to a user-selectable scan table. The minimum measurement time is 50 μs per result and the RF attenuation is

---

**FIG 1** EMI Test Receiver ESCS30 (9 kHz to 2.75 GHz) is a high-end EMC measurement instrument for certification, precertification and development. Photo 42 783
Preselected. The step size of frequency switching is coupled to the selected IF bandwidth and ensures continuous monitoring of the frequency range. The tracking preselection remains active in the Spectrum Overview mode and ensures the necessary immunity to overload. This type of overview measurement can be switched to continuous scan for qualitative assessment of the spectrum.

In the Scan mode a standard-conforming measurement is again carried out on the basis of a user-selected scan table. The measurement, however, uses selectable step widths in a linear or logarithmic frequency raster. The switchable autoranging function increases the dynamic range and prevents measurement errors that can be caused by overload of the different receiver stages. To reduce the measurement time, peak and average value can be measured simultaneously and displayed as separate traces. CISPR ranges A, B, C and D are predefined as scan ranges and can be activated at a keystroke.

The Channel Scan mode is used if measurements have to be made time and again on the same frequencies as is the case with ready tested DUTs where a scan would not yield any new results. The Channel Scan comprises a list of up to 400 different frequencies at which the level is measured using the selected receiver settings such as measurement time, bandwidth and detector.

The time domain analysis of ESCS30 allows the time behaviour of interference to be determined. It is also very expedient for correct setting of receiver measurement time for RF analysis. The user can determine whether narrow-band interference fluctuates and the degree of fluctuation, and whether it is amplitude-modulated. Furthermore the pulse rate of broadband interference can be measured. The measurement time is correct if it is greater than or equal to the reciprocal value of the pulse rate. Devices with thermostatic or microprocessor control generate discontinuous interference. Therefore CISPR14 and EN55014 specify limit values for the RFI voltage with click-rate weighting in the range 0.15 to 30 MHz. Click interference frequently occurs only at long time intervals. In the course of time domain analysis with a peak detector ESCS30 allows the signal to be measured with quasi-peak and average detector. Together with the internal trigger that starts the measurement only when a selectable threshold is exceeded, this combination affords time-saving automatic measurement with clear result display (FIG 3). The time domain analysis with resolution of 100 µs meets the accuracy requirements for pulse-duration measurements. Up to 30,000 results can be stored and zoomed with the marker function for detailed investigation.

An important tool for identifying signals in the receive frequency range is IF spectrum analysis with realtime display. A display range between 10 kHz and 10 MHz is selected for the chosen receive frequency and the signal is assessed using a resolution bandwidth of 1, 3 or 10 kHz. The strength of IF analysis is in the fast determination of interference signals.

**Characteristics and operation**

The outstanding features of ESCS30 are:

- measurement uncertainty <1 dB (typ. <0.5 dB),
- ten integrated preselectors,
- selectable preamplifier 10 dB,
- CISPR bandwidths 200 Hz, 9 kHz, 120 kHz, 1 MHz,
- detectors (peak, average, quasi-peak) with parallel output of results and bargraph display on colour monitor,
- direct selection of CISPR measurement ranges with bandwidth, step width and measurement time,
- automatic scan of frequency ranges and lists with up to 400 different frequencies,
- automatic level calibration and built-in selftest function,
- macros for RFI voltage, RFI power and RFI field-strength measurements,
- nonvolatile storage of complete instrument setups as well as limit lines and frequency-dependent correction factors of antennas and accessories,
- storage of results, limit and correction values on built-in 3.5” disk drive,
- time domain analysis with display range from 5 ms to 1 h, manual trigger (internal and external), user-selectable zooming of up to 30,000 measured values,

FIG 3 Measurement of click interference in time domain
• IF spectrum analysis with resolution of 1, 3 or 10 kHz over a display range from 10 kHz to 10 MHz (option),
• 9 kHz to 2750 MHz tracking generator (option).

The operating concept of ESCS30 makes for great measurement convenience and fast and reliable setting of the receiver. The clear arrangement of the controls – all keys being assigned one function only – and the indication of the selected parameters such as attenuation, bandwidth and detector(s) on separate LC displays ensure great ease of operation. For solving complex EMC problems, manual measurement often is the most efficient way, since the operator can make full use of his experience in identifying interference sources. ESCS30 features the proven test receiver operation with tuning knob, indication of results on an LC display, bargraph and meter as well as acoustic monitoring via the built-in loudspeaker. Marker and zoom functions permit in-depth analysis of interference spectra. The level values of the detectors selected are displayed below the diagram in quasi-realtime as a bargraph with peak-hold indication (FIG 4). The audio section is provided with A0, AM and FM demodulators with squelch enabling acoustic identification of signals via the built-in loudspeaker or a headphones output.

System integration and documentation

The high measurement speed of ESCS30 is also useful for remote control via a fast controller (interface to IEC 625.2/IEEE 488.2). All functions of the test receiver can be remotely controlled and are supported by Rohde & Schwarz EMI software products.

ESCS30 adheres to the standardized report configuration of Test Receivers ESHS/ESVS/ESS so that reports can be compared. A comprehensive test report can be generated on a printer or plotter. It contains all relevant information required for the reproducibility of measurements, such as comments and description, test receiver settings, graphs and final results. All results (scan values as well as test frequencies and level values) can be checked by the user on the monitor prior to producing a printout. Additional comments are entered via the line editor, which in mobile testing allows test runs or parameter sets to be marked and does away with the need for an external keyboard. The final results are output in graphical and tabular form giving levels measured with quasi-peak and average detectors versus frequency. Levels exceeding the limit lines are marked.

Like all full-compliance receivers from Rohde & Schwarz ESCS30 features not only selftest facilities but also auto-calibration routines that ensure adherence to the data-sheet specifications. The current-saving circuit design and the built-in accumulator provide ideal prerequisites for mains-independent, portable use.

Volker Janssen; Matthias Keller

REFERENCES