

## EMI Test Receivers ESI

# EMI professionals through to 40 GHz

The new ESI family combines the flexibility and speed of spectrum analyzers with the large dynamic range expected of EMI test receivers. They meet all requirements to the full, making them the ideal choice for EMI measurements to standards as well as for general-purpose measurements in the development lab. ESI 40, which is the successor of the ESAI, ESBI and ESMI family of test receivers, opens up the frequency range to 40 GHz in its basic configuration already.



Photo 43176/4

FIG 1 EMI Test Receiver ESI 40

The **ESI family comprises three models** with different frequency ranges:

- ESI 7      20 Hz to 7 GHz
- ESI 26     20 Hz to 26.5 GHz
- ESI 40     20 Hz to 40 GHz

The frequency ranges of models ESI 26 and ESI 40 can be extended further by connecting an external mixer (option FSE-B21).

The ESI models are based on the successful Spectrum Analyzers FSE with

their outstanding values of sensitivity and dynamic range [1; 2]. ESI features **integrated preselection** and so ensures large-signal immunity, which is a vital prerequisite for EMI test receivers.

These instruments are therefore extremely well suited for all electromagnetic emission measurements to **industrial and military EMI standards** such as CISPR, VDE, ANSI, FCC, EN, VCCI, MIL-STD, VG, DEF-STAN, BS, DO 160 or GAM EG 13.

## Complex measurements – no problem with ESI

### RFI voltage

The voltage peaks occurring in RFI voltage measurements, for example during phase switchover of an artificial mains network, really make great demands on the pulse-handling capability of the RF input. ESI overcomes this problem by means of a second input for the frequency range 20 Hz to 1 GHz, which, in the case of ESI 7 for example, can handle pulses up to 1500 V with maximum energy of 30 mWs.

The **autorange function** sets the correct combination of attenuation and gain in the signal path for the applied signal. This reliably prevents corruption of measurement results by overload while maintaining maximum possible sensitivity.

### RFI field strength

Measurement of RFI field strength in the frequency range 30 to 1000 MHz is carried out with the quasi-peak detector. To speed up measurements, it is best to make an **overview measurement with the faster peak detector** to identify critical emissions just above or below limit values. The critical frequencies that are found can be measured afterwards with bandwidth, detector and measurement time set in conformance with standards.

In measurements using the peak detector, the noise floor in CISPR bands C and D is typically 4 dB higher than with the quasi-peak detector. But ESI test receivers have an **integrated, switchable preamplifier** that increases sensitivity so that the noise floor is sufficiently below the limit value, also with the use of the peak detector and the antenna transducer factor taken into account (FIG 2).

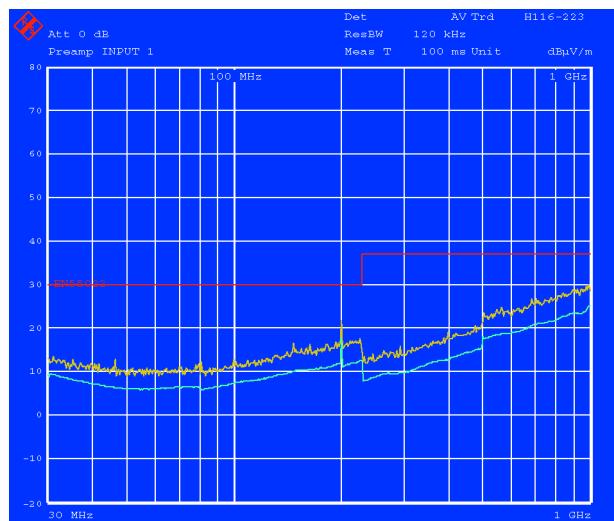
The overview measurement is carried out in scan mode. ESI measures the spectra between start and stop fre-

quencies, defined in a **user-configurable scan table**. The table may comprise up to ten frequency ranges, each of which can be combined with user-selected receiver settings such as bandwidth and measurement time to match the measurement to a given test specification (FIG 3).

ESI features **simultaneous measurement and display of four test traces**, which can be assigned different detectors and display modes. Displaying the peak value and average value both in the clear-write and max-hold mode is therefore no problem. ESI stores up to 70 000 values for each of the four traces. These are transmitted during the measurement block by block via the remote control interface and can be saved on floppy disk or hard disk.

For **final measurements in line with standards**, ESI provides graphic display of overview measurement results in one window, and receiver display with frequency and level indication in a second window. Measured values are displayed numerically and in analog form by bargraphs for up to four detectors. Critical frequencies identified in the overview measurement can be set quickly and conveniently

**FIG 2**  
Noise floor of ESI 7 with preamplifier in CISPR band C/D with peak detector. Transducer factors of test antennas (HKst 116 and HL 223 from Rohde & Schwarz) have already been taken into account. Limit line for quasi-peak to EN 55022



for final measurements by coupling the frequency indicated on the receiver display to the marker on the spectrum display using the "Marker to Peak" function.

Frequently, subbands of the spectrum have to be investigated in greater detail after the overview measurement. For this purpose, a measured trace can be displayed as a reference trace in **split-screen mode**, while in a second diagram the same frequency range or zoomed subranges of it are displayed with higher resolution, the second trace being either based on

stored measured values or measured anew.

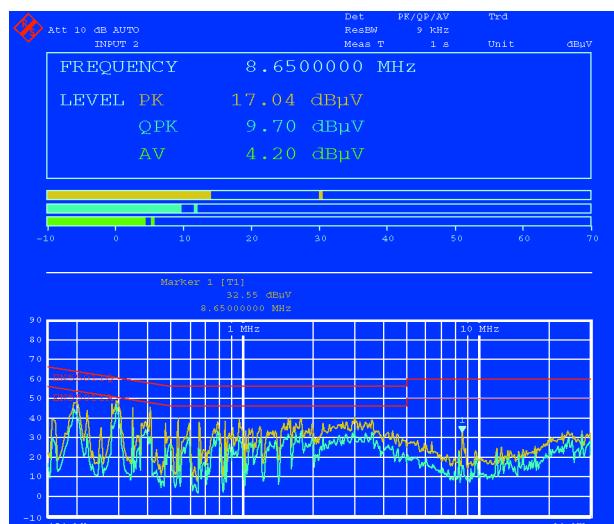
#### Measurements to military standards

Military standards also call for measurements at higher frequencies, eg between 30 Hz and 40 GHz in accordance with MIL-STD-461. The ESI models cover the required frequency range and offer the necessary IF bandwidths from 10 Hz to 1 MHz in decade steps. To achieve high sensitivity – required for measurements to MIL-STD-461 RE 101 in the frequency range above 30 Hz – the unavoidable feedthrough of the 1st LO is sup-

**FIG 3** User-configurable scan tables in ESI allow scan to be adapted to DUTs and measurement specifications



**FIG 4** Split screen with parallel detectors and bargraphs



pressed in ESI test receivers by self-alignment of the mixer. ESI consequently features a sufficient margin from relevant limit values even in the lower frequency range (FIG 5).

### Standard measurements

Apart from EMI measurements ESI is also highly suitable for general-purpose measurements as a high-grade spectrum analyzer. Its **special features** are:

- low noise floor
- high IP3
- low SSB phase noise
- automatic test routines for noise and phase noise as well as channel and adjacent-channel power measurements

With the optional Vector Signal Analyzer FSE-B7, ESI is well equipped for **modulation analysis** of analog and digital signals. **Automatic measurements of all RF parameters of mobile and base stations** are possible with firmware options FSE-K10 and FSE-K11. Thus ESI meets the demand of test houses and RF development labs for a universal instrument whose capabilities extend far beyond EMI measurements.

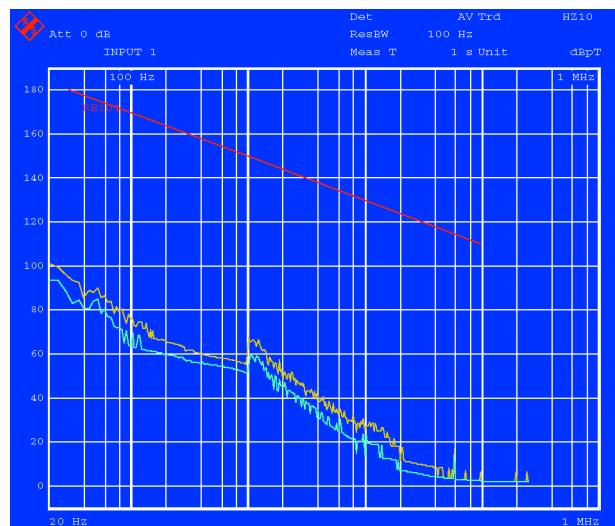
### Automatic measurements, test systems

ESI, itself a **full-featured PC with keyboard and mouse connectors**, operates under Windows NT®, which allows the use of any Windows® software and convenient integration of ESI into network environments.

Combined with EMI Software ES-K1 for example, ESI is turned into a **fully-fledged controller of complete EMI measurement systems** capable of controlling even accessories like antenna masts and turntables [3].

New products operating at higher frequencies as well as more stringent specifications are creating increasing demand for **measurements in the fre-**

FIG 5  
Noise floor from 30 Hz to 100 kHz with limit values to MIL-STD-461D RE 101. Transducer factor of Coil HZ-10 is already taken into account



**quency range above 40 GHz.** With its optional external mixer, ESI is ready for these applications too. Backed by a wide range of options (from tracking generator to vector signal analysis) ESI is a safe investment for the future.

Matthias Keller; Michael Wöhrle

### REFERENCES

- [1] Wolf, J.: Spectrum Analyzer FSEA/FSEB – New dimensions in spectral analysis. News from Rohde & Schwarz (1995) No. 148, pp 4–8
- [2] Wolf, J.: Spectrum Analyzer FSEM/FSEK – Fast spectrum analysis now through to 40 GHz. News from Rohde & Schwarz (1996) No. 152, pp 7–9
- [3] Wolle, J.: EMI Software ES-K1 – Windows for EMI measurements. News from Rohde & Schwarz (1993) No. 142, pp 22–23

### Condensed data of EMI Test Receivers ESI

Frequency range	20 Hz to 7/26.5/40 GHz
Input 1	20 Hz to 1 GHz
Input 2	9 filters (10 with ESI26 and ESI40)
Preselection	0/20 dB
Preamplifier	200 Hz, 9 kHz, 120 kHz (CISPR)
Resolution bandwidths	10 Hz to 10 MHz (in decade steps, MIL) 1 Hz to 10 MHz, in steps of 1/2/3/5 (analyzer mode)
Detectors	peak, average, quasi-peak, rms
Level measurement accuracy	±1 dB (150 kHz to 1 GHz) ±2 dB (1 GHz to 4.5 GHz) ±2.5 dB (4.5 GHz to 18 GHz) ±3 dB (18 GHz to 26.5 GHz) ±3.5 dB (26.5 GHz to 40 GHz)
Remote control	IEC625-2 (SCPI 1994.0)

Reader service card 162/02