Data sheet

Version 03.00

January 2006

EMI Test Receivers R&S®ESIB

EMI measurements up to 40 GHz conforming to standards

Outstanding performance
- High sensitivity
- Low inherent noise
- Wide dynamic range
- High measurement speed
- Preselection and preamplification
- Automatic overload detection
- Autoranging
- 2nd RF input with pulse protection

Current standards
- Correct weighting of pulses in accordance with CISPR 16-1-1 and VDE 0876
- All commercial and military standards such as CISPR, EN, ETS, FCC, VDE, ANSI, VCCI, MIL-STD, VG, DEF-STAN, etc

Straightforward operation
- Bright 24 cm LC color display
- Analog level display for each detector (parallel operation)
- Split-screen display for detailed analysis
- Receiver-oriented operating concept allowing manual operation
- Internal test routines for automated and interactive EMI measurements

ROHDE&SCHWARZ

The R&S®ESIB family of EMI test receivers combines the high sensitivity, large dynamic range and selectivity of a high-end test receiver with the flexibility and speed of a top-class spectrum analyzer in one instrument.

The R&S®ESIB family comprises three models with different upper frequency limits:

- R&S®ESIB 7 (20 Hz to 7 GHz)
- R&S®ESIB 26 (20 Hz to 26.5 GHz)
- R&S®ESIB 40 (20 Hz to 40 GHz)

The upper frequency limit of the R&S®ESIB 26 and R&S®ESIB 40 can be extended up to 110 GHz by means of external mixers (option R&S®FSE-B21 required).

All three models have the following characteristics:

- High sensitivity
- Excellent large-signal immunity
- Low measurement uncertainty
- High measurement speed

Standard-conforming measurements

The R&S®ESIB carries out measurements in conformance with all commercial and military EMI standards such as CISPR, EN, VDE, ANSI, FCC, BS, ETS, VCCI, MIL-STD, VG, DEF-STAN, DO 160 and GAM EG 13. It goes without saying that the R&S®ESIB family complies with the basic standard, i.e. CISPR 16-1-1 or VDE 0876, which places stringent requirements on receiver dynamic range.

Test routines oriented to practical requirements

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.

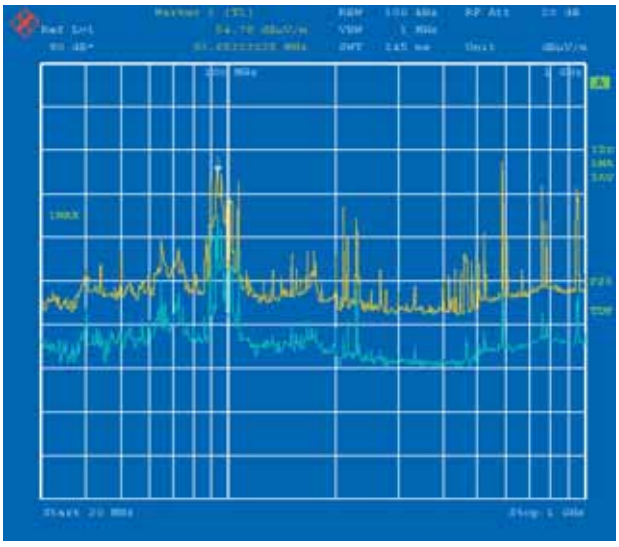
Early in development, functional measurements play the predominant role. While EMI measurements are important right from the beginning to avoid redesigns, the R&S®ESIB at this stage primarily functions as a high-grade spectrum analyzer.

The R&S®ESIB is outstanding for its low inherent noise, high intermodulation suppression and low SSB phase noise. Moreover, the R&S®ESIB provides all test routines offered by modern spectrum analyzers, such as noise measurement, phase noise measurement, channel and adjacent-channel power measurement as well as time-domain measurement.

As development progresses, EMI measurements become more and more important, for example on modules and their interfaces. Measurements are frequently carried out using sensors, probes or current transformers. Interference analysis and referencing of results to limit values are important. Here, too, the R&S®ESIB family meets all relevant requirements in terms of performance, functionality and economy of operation:

- Fast overview measurements with linear or logarithmic frequency scale in spectrum analyzer mode (sweep mode) or in test receiver mode (scan mode) with tuning in user-defined frequency steps with selectable measuring times per step
- Bandwidths conforming to CISPR 16-1-1 (200 Hz, 9 kHz, 120 kHz and 1 MHz) and MIL-STD (10 Hz to 1 MHz), plus 10 MHz bandwidth, and analyzer bandwidths between 1 Hz and 10 MHz, selectable in steps of 1, 2, 3 and 5

- Pulse weighting using quasi-peak, peak, average and CISPR-average detectors; the detectors operate in parallel and can be switched in as required
- User-selectable transducer factors for the output of results in the correct unit; transducer factors for practically any number of transducers can be stored on the internal hard disk; active transducers are powered and coded via a socket on the R&S®ESIB front panel
- User-definable limit lines with linear or logarithmic frequency scale; limit lines are stored on the internal hard disk
- Time-domain measurements at up to 50 ns resolution for interference source analysis



Overview measurement

The excellent characteristics and functions of the R&S®ESIB family come into their own when compliance with relevant EMI standards is to be verified on the finished product. This may involve limit values for RFI voltage measurements using artificial mains networks, for RFI field-strength measurements by means of test antennas, or for RFI power measurements with absorbing clamps.

Especially measurements using artificial mains networks and absorbing clamps put the pulse-handling capability of the RF input to a severe test. The R&S®ESIB solves this problem by means of a second, pulse-protected input for the frequency range from 20 Hz to 1 GHz. In the case of the R&S®ESIB 7, for example, this input can handle pulses with voltages up to 1500 V and powers up to 30 mWs without any damage being caused. Pulses generated by artificial mains networks during phase switching or during RFI power measurements on ignition cables using absorbing clamps pose no problem.

The input bandwidth of the frontend is limited by preselection filters to reduce the total voltage level at the input mixer to an extent compatible with the wide dynamic range required for quasi-peak detection in the CISPR frequency range.

Specifications in brief

- Frequency range
  - Input 1: 20 Hz to 7/26.5/40 GHz
  - Input 2: 20 Hz to 1 GHz
- Preselection in receiver mode (fixed) and analyzer mode (selectable)
- Three fixed-tuned and six or seven tracking filters (models .26 and .40)
- Preamplifier with 20 dB gain switch-selectable in conjunction with preselector
- Resolution bandwidths
  - 200 Hz, 9 kHz, 120 kHz in accordance with CISPR 16-1-1,
  - 10 Hz to 10 MHz, in decadic steps (6 dB bandwidths, receiver and analyzer mode)
  - 1 Hz to 10 MHz, adjustable in steps of 1/2/3/5 (3 dB bandwidths, analyzer mode)
- Parallel detectors (max. 4) in receiver mode
  Peak, average, CISPR-average, quasi-peak and RMS
- Automatic scan
  Four storable traces with up to 80 000 measured values each (250 000 values with one trace)
- Internal controller (Windows NT)

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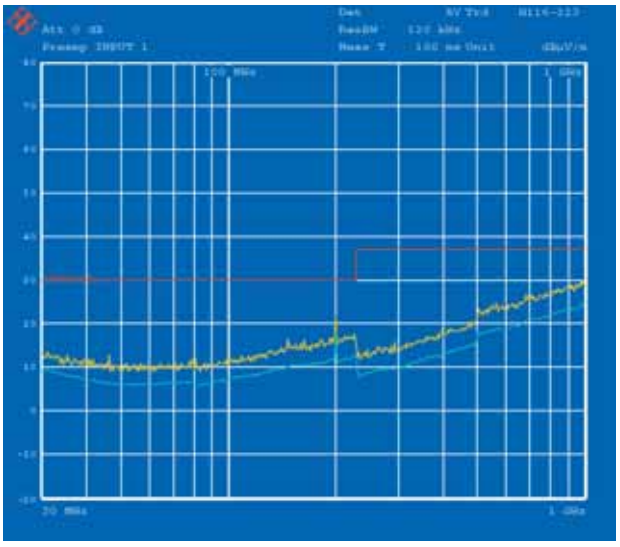

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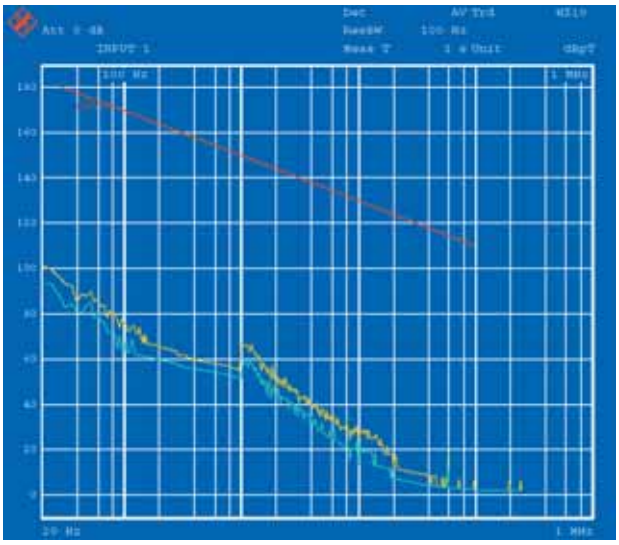

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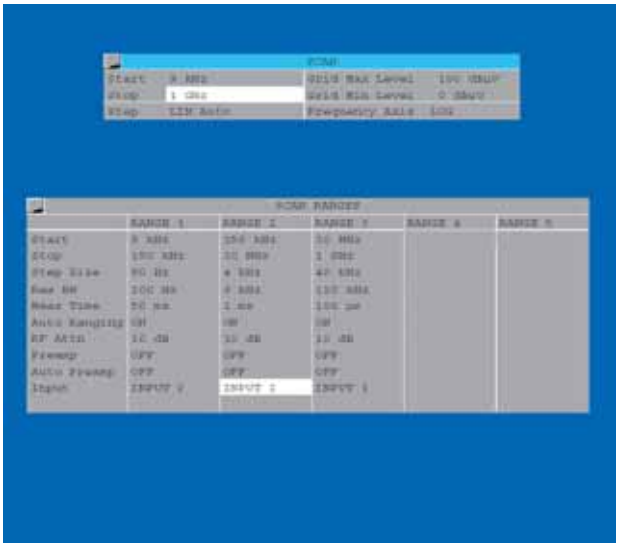

Fig. 1:
Sensitivity in 30 MHz to 1000 MHz range at 120 kHz IF bandwidth, with peak detector and transducer factors for antenna + cable, displayed with limit lines for quasi-peak

Fig. 2:
Scan table for CISPR bands A to C/D

Fig. 3:
Inherent noise from 30 Hz to 100 kHz with limit values in line with MIL-STD-461D RE 101, using the Shielded and Calibrated Magnetic Field Pickup Coil R&S®HZ-10

Figs. 4 to 7:
Example of transducer set: combination of antenna + cable

Up to 2 MHz, the R&S®ESIB family uses fixed-tuned filters; from 2 MHz to 1000 MHz, the preselection filters operate as tracking filters.

An autorange function is available for the automatic setting of attenuation and gain in the RF and IF signal paths. This function ensures the correct combination of attenuation and gain depending on the test level or any overload of a signal stage caused by pulses or sinusoidal signals. So the operator is not burdened with the internal workings of the test receiver.

To measure extremely small voltage levels occurring, for example, in EMI measurements on vehicle antennas in line with CISPR 25, the R&S®ESIB family offers a 20 dB preamplifier from 9 kHz to 7 GHz (above 7 GHz as option R&S®ESIB-B2). The preamplifier is located between the RF preselection and the input mixer to be protected against overload. With this preamplifier, the inherent noise of the R&S®ESIB is lowered to such an extent that the RFI field strength obtained in an overview measurement using the peak detector, a log-periodic antenna (e.g. R&S®HL 223) and a 10 m connecting cable clearly remains below the EN 55022 quasi-peak limit (Fig. 1).

Fig. 2 shows the SCAN table stipulated for commercial EMI measurements as a function of the prescribed CISPR bandwidths.

To achieve high sensitivity in measurements in line with MIL-STD-461D RE 101 in the frequency range from 30 Hz, the unavoidable feedthrough of the 1st LO at the input mixer is suppressed by self-

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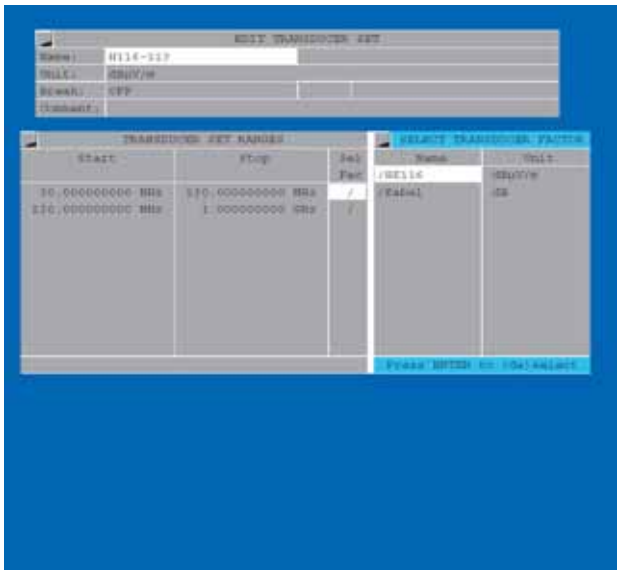

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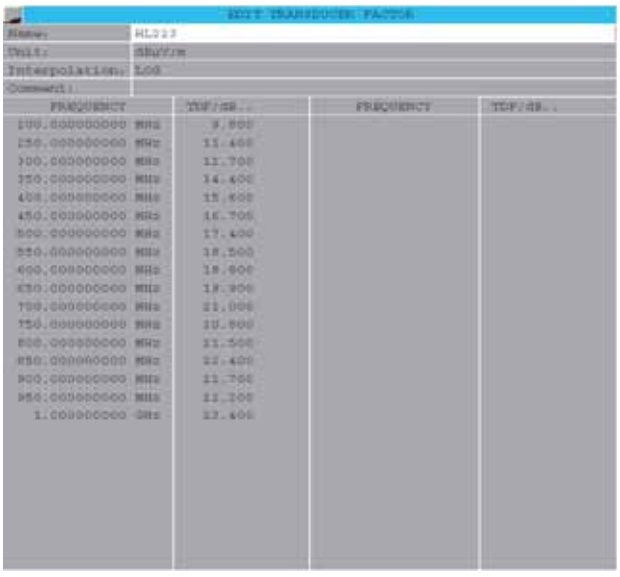

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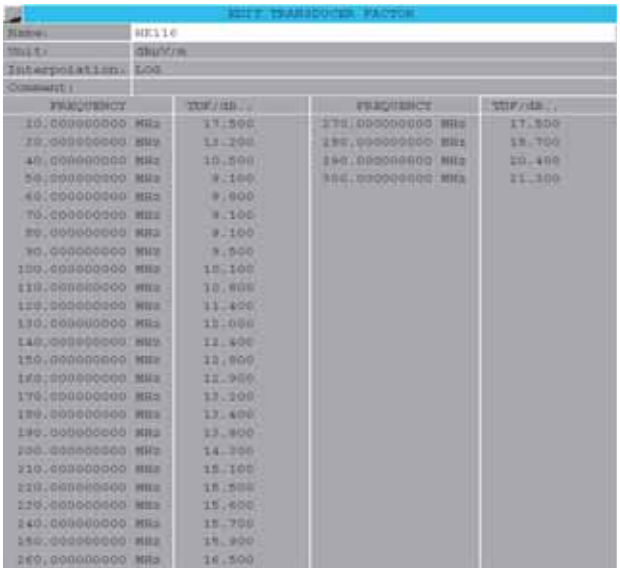

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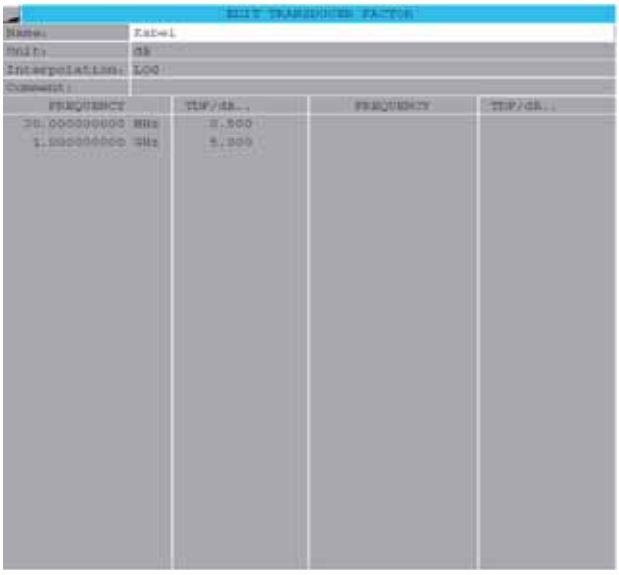

alignment of the mixer. The R&S®ESIB consequently features sufficient inherent noise suppression with respect to relevant limit values even at the lower frequency limit (Fig. 3).

Definition of standard test sequences

To meet the requirements of relevant standards, measurements over various frequency ranges and bandwidths have to be performed, using different step sizes and measurement times or different receiver settings regarding RF attenuation and preamplification. It must also be possible to configure a scan matched to DUT characteristics. For this purpose, the R&S®ESIB offers a user-configurable scan table with up to ten subranges.

Calibration values for transducer factors of absorbing clamps or antennas, for example, are stored in tables and can be switched on as required. The transducer factors can also be combined into transducer sets, for example to display the interference spectrum in the correct unit dBµV/m in measurements with an antenna and a connecting cable (Figs. 4 to 7).

EMI emissions are usually measured in two steps. An overview measurement performed with the peak detector identifies critical emissions above or close to limit values (Fig. 8). In a second measurement with the prescribed CISPR detectors and an appropriate measurement time, the critical frequencies are checked for compliance with limit values. The R&S®ESIB family supports this procedure by two independent measurement windows on the screen and offers automatic or interactive evaluation functions for preview measurements, generation of a peak list (data reduction) and final measurement.

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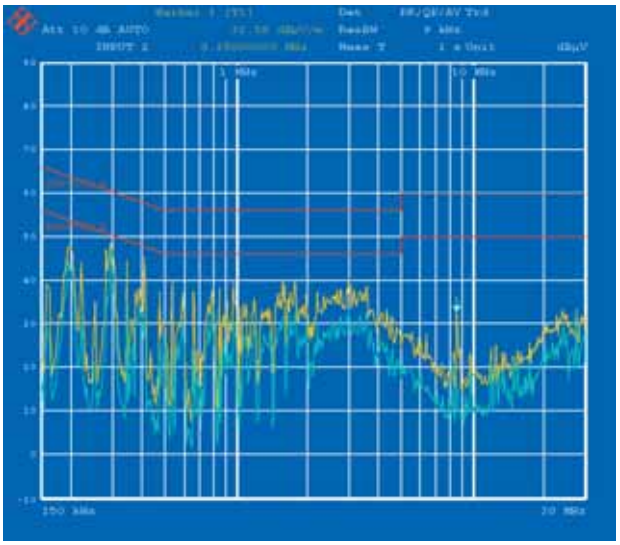

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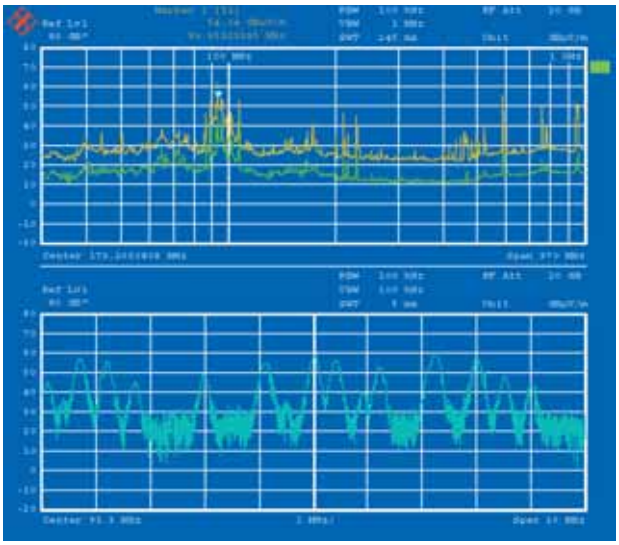

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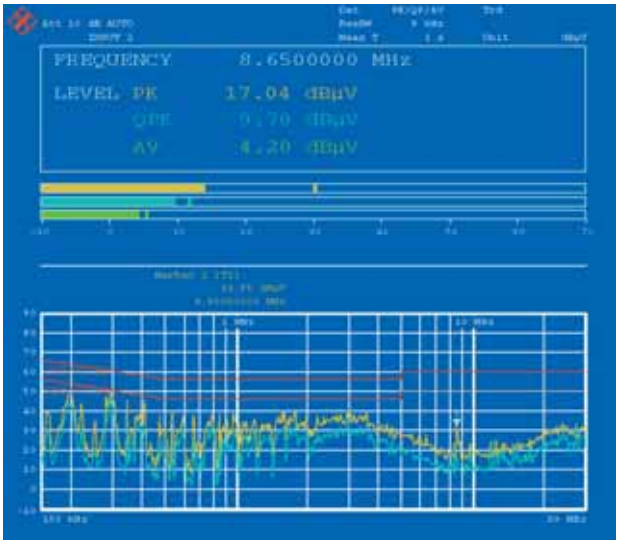

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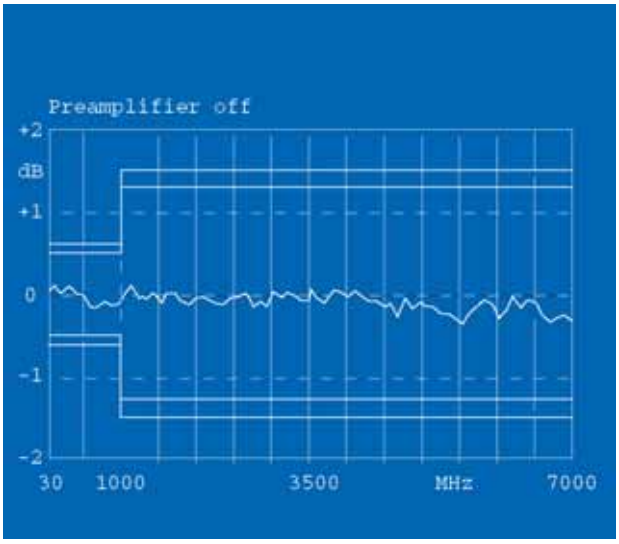


Split-screen display

Critical emissions can be measured with numeric display of frequency and level as with classic receivers. Bargraphs provide an analog display of measured values for the various detectors simultaneously and in different colors (Fig. 9). By coupling the marker in the overview spectrum to the receiver frequency, emissions can be measured fast and reliably in line with standards.

In the second window, the operator can zoom in on the displayed trace (Fig. 10).

Zooming is effected either based on stored measured data or by means of a new measurement with the selected detectors. If stored data is used, all stored values can be displayed. For this, the R&S®ESIB can store up to 250 000 measured values with one trace active in background operation. This considerably reduces measurement time, since no new measurement is needed to make a detailed analysis.

Listen, view, measure

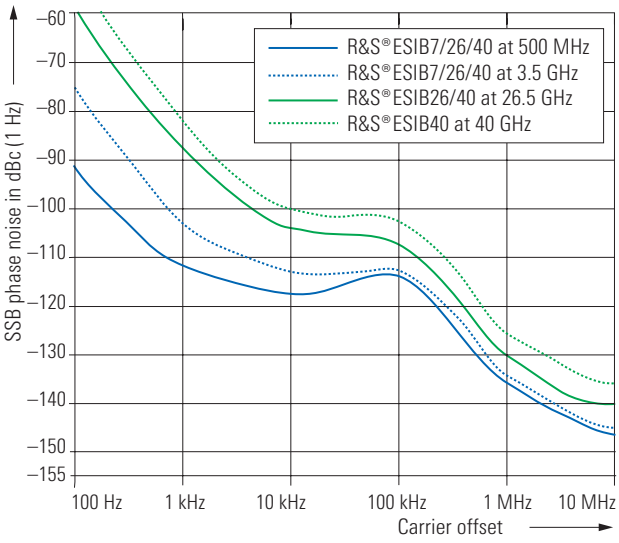
To analyze the spectrum and to exclude ambient noise, such as originating from sound or TV broadcast transmitters or the like, it is expedient to select single frequencies by means of the markers, tune the receiver frequency to the marker frequency, and activate the audio path with the built-in AM/FM demodulator by switching on the loudspeaker or headphones. Acoustic identification is very frequently and successfully used in EMI signal analysis, all the more so since manual pre-/postmeasurements and interactive operation support this approach.

Fig. 8:
Complete representation of spectrum: level display with PK and AV detectors and QP and AV limit lines

Fig. 9:
Split screen with parallel detectors and bargraph

Fig. 10:
Split screen with trace and zoomed display of trace section

Fig. 11:
Frequency response of the R&S®ESIB from 30 MHz up to 7 GHz



Typical SSB phase noise

Documentation of results

Practically any type of printer can be used for the documentation of results. The R&S®ESIB runs under Windows NT, so all printers for which Windows drivers are available can be employed.

Results can not only be output to a printer but also stored on a floppy disk or the internal hard disk in common Windows formats such as EMF, WMF or BMP. The data can be integrated into word processing programs for the generation of test reports.

High accuracy

In the frequency range up to 1 GHz, the R&S®ESIB performs level measurements with an accuracy of ±1 dB. This is clearly better than the value of ±2 dB specified by CISPR 16-1-1, and is achieved by individual correction factors stored on all modules affecting measurement uncertainty. The operator can run calibration routines for the frequency response, display linearity and signal path gain correction for the various instrument settings, thus ensuring low measurement uncertainty under all specified environmental conditions.

The required calibration sources are connected internally so that autocorrection is possible even in system applications without any external equipment such as cables being required. Pulse weighting with the prescibed detectors is implemented in the R&S®ESIB fully digitally by means of gate arrays and signal processors. This makes for the best possible reproducibility of results and does away with the discharge times between measurement periods occurring with analog detectors. As a result, measurement times are reduced considerably.

Selftest

The built-in selftest supports fault localization down to module level. With individual correction tables being stored on each module, defective modules can be replaced largely without any adjustment or additional instruments. Downtimes and repair costs are reduced to a minimum.

System integration

The fast data processing of the R&S®ESIB makes it an ideal choice for use in automatic measurement systems. The IEC/IEEE bus command set (IEC 625-2) conforms to SCPI (1994.0).

Fit for the future

The R&S®ESIB family can be upgraded by a wide variety of options to extend its range of applications and add extra functionality without requiring additional instruments. The Tracking Generator R&S®FSE-B10 from 9 kHz to 7 GHz makes it easy to measure shielding effectiveness or filter transfer functions.

Specifications

Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed. Data without tolerances: typical values only. Data designated "nominal" applies to design parameters and is not tested.

	R&S®ESIB 7	R&S®ESIB 26	R&S®ESIB 40
Frequency			
Frequency range			
Input 1 Input 2	20 Hz to 7 GHz 20 Hz to 1 GHz	20 Hz to 26.5 GHz 20 Hz to 1 GHz	20 Hz to 40 GHz 20 Hz to 1 GHz
Frequency resolution	0.01 Hz		
Internal reference frequency (nominal)			
Aging per day[1]	1×10^{-9}		
Aging per year[1]	2×10^{-7}		
Temperature drift (0 °C to 50 °C)	5×10^{-8}		
Total error (per year)	2.5×10^{-7}		
External reference frequency	10 MHz or n × 1 MHz, n = 1 to 16		
Frequency display (receiver mode)			
Display	numeric display		
Resolution	0.1 Hz		
Frequency display (analyzer mode)			
Display	with marker		
Resolution Accuracy (sweep time >3 × auto sweep time)	0.1 Hz to 10 kHz (depending on span) ± (marker frequency × reference error + 0.5 % × span + 10 % × resolution bandwidth + ½ (last digit))		
Frequency counter	measures the marker frequency		
Resolution	0.1 Hz to 10 kHz, selectable		
Count accuracy (S/N >25 dB)	± (frequency × reference error + ½ (last digit))		
Display range for frequency axis	0 Hz, 10 Hz to 7 GHz	0 Hz, 10 Hz to 27 GHz	0 Hz, 10 Hz to 40 GHz
Resolution/accuracy of display range	0.1 Hz/±1 %		
Spectral purity	for frequencies >500 MHz: see diagram on page 7		
SSB phase noise, f ≤ 500 MHz Carrier offset 100 Hz 1 kHz 10 kHz 100 kHz[2] 1 MHz[2]	 <–81 dBc (1 Hz) <–100 dBc (1 Hz) <–114 dBc (1 Hz) <–111 dBc (1 Hz) <–129 dBc (1 Hz)		
Frequency scan (receiver mode)			
Scan	scan with max. 10 subranges with different settings		
Measurement time per frequency	100 µs to 100 s, selectable		
Sweep (analyzer mode)			
Span 0 Hz (zero span)	1 µs to 2500 s, selectable in steps of 5 %		
Span ≥10 Hz	5 ms to 1000 s, selectable in steps of ≤10 %		
Accuracy	±1 %		
Picture refresh rate (span ≤7 GHz)	>20 updates/s with 1 trace >15 updates/s with 2 traces at shortest sweep time		
Sampling rate	50 ns (20 MHz A/D converter)		
Number of pixels	500		
Time measurement	with marker and cursor lines		
Resolution	50 ns		

	R&S®ESIB 7	R&S®ESIB 26	R&S®ESIB 40
Preselector (receiver mode)			
Filters	Frequency range	Bandwidth (–6 dB)	
1	<150 kHz	230 kHz	fixed
2	150 kHz to 2 MHz	2.6 MHz	fixed
3	2 MHz to 8 MHz	1.9 MHz	tracking
4	8 MHz to 25 MHz	5.6 MHz	tracking
5	25 MHz to 80 MHz	15 MHz	tracking
6	80 MHz to 200 MHz	40 MHz	tracking
7	200 MHz to 500 MHz	85 MHz	tracking
8	500 MHz to 1000 MHz	104 MHz	tracking
9	1 GHz to 7 GHz	highpass filter	fixed
10	–	7 GHz to 26.5 GHz YIG filter	7 GHz to 40 GHz YIG filter
	–	bandwidth (–3 dB): 35 MHz + f/1000	
Preamplifier (1 kHz to 7 GHz)	selectable, between preselector and 1st mixer, gain 20 dB		
IF bandwidths (receiver and analyzer mode)			
6 dB bandwidths	10 Hz, 100 Hz, 200 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz, 1 MHz[3], 10 MHz		
Bandwidth error RBW ≤1 MHz Shape factor $B_{60\,dB}$: $B_{6\,dB}$ RBW ≤1 kHz RBW >1 kHz	 <10 % <5 <10		
Resolution bandwidths (analyzer mode)			
3 dB bandwidths	1 Hz to 10 MHz, in steps of 1/2/3/5		
Bandwidth error RBW ≤3 MHz RBW = 5 MHz RBW = 10 MHz Shape factor $B_{60\,dB}$: $B_{6\,dB}$ RBW <1 kHz RBW = 1 kHz to 2 MHz RBW >2 MHz	 <10 % <15 % +25 %, –10 % <6 <12 <7		
Video bandwidths	1 Hz to 10 MHz, in steps of 1/2/3/5		
FFT filter 3 dB bandwidths Bandwidth error, nominal Shape factor $B_{60\,dB}$: $B_{3\,dB}$, nominal Display range for frequency axis Additional level error (reference: RBW = 5 kHz) Max. display range Inherent spurious response	 1 Hz to 1 kHz, in steps of 1/2/3/5 2 % 2.5 min. 25 × RBW, max. 100000 × RBW or 2 MHz <1 dB 100 dB <–100 dBm		
Level			
Display range	displayed noise floor to 137 dBµV		
Max. input level			
Input 1	20 Hz to 7 GHz	20 Hz to 26.5 GHz	20 Hz to 40 GHz
RF attenuation 0 dB			
DC voltage	0 V		
Sinewave AC voltage	127 dBµV (= 0.3 W)		
Pulse spectral density	97 dB(µV/MHz)		
RF attenuation ≥10 dB			
DC voltage	0 V		
Sinewave AC voltage	137 dBµV (= 1 W)		
Max. pulse voltage (10 µs)	150 V	50 V	50 V
Max. pulse energy (10 µs)	1 mWs	0.5 mWs	0.5 mWs

	R&S®ESIB 7	R&S®ESIB 26	R&S®ESIB 40
Input 2 (receiver mode)	20 Hz to 1 GHz		
DC voltage			
DC coupling	0 V		
AC coupling	50 V		
RF attenuation 0 dB			
Sinewave AC voltage	127 dBµV (= 0.3 W)		
Pulse spectral density	97 dB(µV/MHz)		
RF attenuation ≥10 dB			
Sinewave AC voltage	137 dBµV (= 1 W)		
Max. pulse voltage (10 µs)	1500 V	250 V	250 V
Max. pulse energy (10 µs)	30 mWs	15 mWs	15 mWs
1 dB compression of input mixer (RF attenuation 0 dB)			
Analyzer mode	+10 dBm nominal		
Intermodulation			
3rd-order intercept point (TOI)			
Analyzer mode, $\Delta f > 5 \times$ IF bandwidth or resolution bandwidth, or >10 kHz	≥12 dBm, typ. 15 dBm for f > 150 MHz		≥12 dBm, typ. 15 dBm for f > 150 MHz; ≥10 dBm for f > 7 GHz
Receiver mode, preamplifier off	≥2 dBm, typ. 5 dBm for f > 150 MHz		
Receiver mode, preamplifier on	≥–18 dBm, typ. –15 dBm for f > 150 MHz		
Intercept point k2, analyzer mode	>25 dBm, typ. for f < 150 MHz >40 dBm, typ. for f > 150 MHz		
Level display (receiver mode)			
Digital	numeric, 0.1 dB resolution		
Analog	bargraph display, separate for each detector, max. 4 simultaneously		
Spectrum	level axis 10 dB to 200 dB in steps of 10 dB, frequency axis user-selectable, linear or logarithmic		
Units of level display	dBµV, dBm, dBµA, dBpW, dBpT, dB(µV/m), dB(µA/m), dBx[4]/MHz		
Detectors	average (AV), RMS, peak (PK), quasi-peak (QP) and CISPR-average (CISPR AV); 4 detectors can be switched on simultaneously		
Measurement time	100 µs to 100 s, selectable		
Level display (analyzer mode)			
Result display	500 × 400 pixels (with one diagram displayed), max. 2 diagrams with independent settings		
Logarithmic level range	10 dB to 200 dB in steps of 10 dB		
Linear level range	10% of reference level per division (10 divisions) or logarithmic scaling		
Traces	max. 4 traces with one diagram (2 traces per diagram with 2 diagrams); quasi-analog display of all traces		
Trace detectors	max. peak, min. peak, auto peak (normal), sample, RMS, average		
Trace functions	clear/write, max. hold, min. hold, average		
Setting range of reference level			
Logarithmic level display	–130 dBm to 30 dBm in steps of 0.1 dB		
Linear level display	7.0 nV to 7.07 V in steps of 1%		
Unit of level axis	dBm, dBµV, dBµA, dBpW, dBx[4]/MHz (logarithmic level display); mV, µA, pW, nW (linear level display)		

	R&S®ESIB 7	R&S®ESIB 26	R&S®ESIB 40
Displayed noise floor (receiver mode)			
Linear average (AV) display (preamplifier off/on)			
20 Hz to 1 kHz, RBW = 10 Hz	20 dBµV to –10 dBµV/–		
1 kHz to 9 kHz, RBW = 10 Hz	–10 dBµV to –16 dBµV/–25 dBµV to –30 dBµV		
9 kHz to 150 kHz, RBW = 200 Hz	0 dBµV to –12 dBµV/–10 dBµV to –24 dBµV		
150 kHz to 2 MHz, RBW = 9 kHz	5 dBµV to –5 dBµV/–7 dBµV to –17 dBµV		
2 MHz to 30 MHz, RBW = 9 kHz	<–5 dBµV/<–17 dBµV		
30 MHz to 200 MHz, RBW = 120 kHz	<10 dBµV/<–6 dBµV	<13 dBµV/<–3 dBµV	<13 dBµV/<–3 dBµV
200 MHz to 1000 MHz, RBW = 120 kHz	<7 dBµV/<–6 dBµV	<10 dBµV/<–3 dBµV	<10 dBµV/<–3 dBµV
1 GHz to 5 GHz, RBW = 1 MHz	<15 dBµV/<6 dBµV	<18 dBµV/<9 dBµV	<18 dBµV/<9 dBµV
5 GHz to 7 GHz, RBW = 1 MHz	<22 dBµV/<9 dBµV	<25 dBµV/<12 dBµV	<25 dBµV/<12 dBµV
7 GHz to 18 GHz, RBW = 1 MHz	–	<19 dBµV	<23 dBµV
18 GHz to 26.5 GHz, RBW = 1 MHz	–	<22 dBµV	<26 dBµV
26.5 GHz to 30 GHz, RBW = 1 MHz	–	–	<37 dBµV
30 GHz to 40 GHz, RBW = 1 MHz	–	–	<41 dBµV
RMS, typ. increase rel. to AV display	+1 dB		
PK, typ. increase rel. to AV display	+11 dB		
Quasi-peak (preamplifier off/on)			
Band A	3 dBµV to –9 dBµV/–7 dBµV to –21 dBµV		
Band B	9 dBµV to 0 dBµV/–2 dBµV to –12 dBµV		
Band C	17 dBµV/1 dBµV	20 dBµV/4 dBµV	20 dBµV/4 dBµV
Band D	14 dBµV/1 dBµV	17 dBµV/4 dBµV	17 dBµV/4 dBµV
Displayed noise floor (analyzer mode) (displayed average noise floor, 0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, 20 averages, trace average, zero span, termination 50 Ω)			
Frequency			
20 Hz	<–74 dBm		
1 kHz	<–104 dBm		
10 kHz	<–119 dBm		
100 kHz	<–129 dBm		
1 MHz	<–142 dBm, typ. –145 dBm		
10 MHz to 5 GHz	<–142 dBm, typ. –147 dBm	<–138 dBm, typ. –140 dBm	<–138 dBm, typ. –140 dBm
5 GHz to 7 GHz	<–139 dBm, typ. –141 dBm	<–135 dBm, typ. –138 dBm	<–135 dBm, typ. –138 dBm
7 GHz to 18 GHz	–	<–138 dBm, typ. –140 dBm	<–134 dBm, typ. –139 dBm
18 GHz to 26.5 GHz	–	<–135 dBm, typ. –138 dBm	<–131 dBm, typ. –136 dBm
26.5 GHz to 30 GHz	–	–	<–120 dBm, typ. –125 dBm
30 GHz to 40 GHz	–	–	<–116 dBm, typ. –122 dBm
Max. dynamic range (1 Hz bandwidth)			
1 dB compression point/displayed noise floor	162 dB	160 dB	160 dB
Max. harmonics suppression, f > 50 MHz	>90 dB		
Max. intermodulation-free range			
150 MHz to 7 GHz/26.5 GHz (nominal)	115 dB	112 dB	112 dB
Intermodulation free range at –40 dBm mixer input level	105 dB		
Immunity to interference			
Image frequency	>80 dB, typ. >90 dB	>80 dB, typ. >90 dB	>80 dB
Intermediate frequency	>75 dB	>75 dB	>80 dB

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Spurious response (f > 1 MHz, without input signal, 0 dB RF attenuation) Receiver mode or span <30 MHz Span ≥30 MHz f_{in} = 25.175 MHz, 60 MHz, 5.7172 GHz	 <–3 dBµV <7 dBµV <7 dBµV		
Other spurious	<–75 dBc		
RF leakage Voltage display at field strength of 10 V/m and 0 dB RF attenuation ($f \neq f_{in}$, $f \neq f_{IF}$, $f_s \leq 1$ GHz)	<0 dBµV		
Additional error in quasi-peak display range (10 V/m) ($f \neq f_{in}$, $f \neq f_{IF}$, $f_s \leq 1$ GHz)	<1 dB		
Level measurement accuracy			
Level error at 120 MHz (level = –40 dBm, RF attenuation 20 dB, ref. level –15 dBm, RBW 5 kHz)	±0.3 dB		
Attenuator	±0.3 dB		
IF gain	±0.2 dB, typ. ±0.1 dB		
Linearity Logarithmic level display (RBW ≥1 kHz, analog, S/N >15 dB) 0 dB to –50 dB –50 dB to –70 dB –70 dB to –95 dB Linear level display	 ±0.3 dB ±0.5 dB ±1 dB 5 % of reference level		
Bandwidth switching 1 Hz to 30 kHz/100 kHz to 300 kHz 1 MHz to 10 MHz	 ±0.2 dB ±0.3 dB		
Frequency response (analyzer mode, 10 dB RF attenuation)			
≤1 GHz	±0.5 dB		
1 GHz to 7 GHz	±1 dB		
7 GHz to 18 GHz	–	±2 dB	±2 dB
18 GHz to 26.5 GHz	–	±2.5 dB[5)]	±2.5 dB[5)]
26.5 GHz to 40 GHz	–	–	±3 dB[5)]
Total error			
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[5)]	±2.5 dB[5)]
18 GHz to 26.5 GHz	–	±3 dB[5)]	±3 dB[5)]
26.5 GHz to 40 GHz	–	–	±3.5 dB[5)]
Additional error with preamplifier	<0.5 dB		
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[5)]	±2.5 dB[5)]
18 GHz to 26.5 GHz	–	±3 dB[5)]	±3 dB[5)]
26.5 GHz to 40 GHz	–	–	±3.5 dB[5)]
Audio demodulation			
Demodulation modes	AM and FM		
Audio output	loudspeaker and phone jack		

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Trigger functions			
Trigger	free-run, line, video, RF, external		
Delayed sweep			
Trigger source	free-run, line, video, external		
Delay time	100 ns to 10 s, resolution min. 1 µs or 1 % of delay time		
Error of delay time	±(1 µs + (0.05 % × delay time))		
Delayed sweep time	2 µs to 1000 s		
Gated sweep			
Trigger source	external, RF		
Gate delay	1 µs to 100 s		
Gate length	1 µs to 100 s, resolution min. 1 µs or 1 % of gate length		
Error of gate length	±(1 µs + (0.05 % × gate length))		
Gap sweep (span = 0 Hz)			
Trigger source	free-run, line, video, RF, external		
Pretrigger	1 µs to 100 s, resolution 50 ns, depending on sweep time		
Trigger to gap time	1 µs to 100 s, resolution 50 ns, depending on sweep time		
Gap length	1 µs to 100 s, resolution 50 ns		
Inputs and outputs (front panel)			
RF inputs			
Input 1	20 Hz to 7 GHz N female, 50 Ω	20 Hz to 26.5 GHz adapter system, 50 Ω, N male and female, 3.5 mm male and female	20 Hz to 40 GHz adapter system, 50 Ω, N male and female, K male and female
VSWR (receiver mode, f ≤ 1 GHz)			
RF attenuation 0 dB	<2		
RF attenuation ≥10 dB	<1.2		
f < 3.5 GHz	<1.5		
f < 7 GHz	<2.0		
f < 26.5 GHz	–	<3.0	<2.5
f < 37 GHz	–	–	<2.5
f < 40 GHz	–	–	typ. 2.5
VSWR (analyzer mode) RF attenuation ≥10 dB			
f < 3.5 GHz	<1.5		
f < 7 GHz	<2.0		
f < 26.5 GHz	–	<3.0	<2.5
f < 37 GHz	–	–	<2.5
f < 40 GHz	–	–	typ. 2.5
Attenuator	0 dB to 70 dB, selectable in steps of 10 dB		
Input 2	20 Hz to 1 GHz N female, 50 Ω		
VSWR (receiver mode)			
RF attenuation <10 dB	<2		
RF attenuation ≥10 dB	<1.2		
VSWR (analyzer mode) RF attenuation ≥10 dB	<1.5		
Attenuator	0 dB to 70 dB, selectable in steps of 5 dB, selectable AC/DC coupling		

	R&S®ESIB 7	R&S®ESIB 26	R&S®ESIB 40
Probe power supply	+15 V DC, –12.6 V DC and ground, max. 150 mA		
Power supply and coding connector for antennas etc (antenna code)	12-contact Tuchel		
Supply voltages	±10 V, max. 100 mA, ground		
AF output	Z_{out} = 10 Ω, jack plug		
Open-circuit voltage	up to 1.5 V, adjustable		
Inputs and outputs (rear panel)			
IF 21.4 MHz Level	Z_{out} = 50 Ω, BNC female, bandwidth >1 kHz or IF or resolution bandwidth 0 dBm at reference level, mixer level >–60 dBm		
Video output Voltage (resolution bandwidth ≥1 kHz)	Z_{out} = 50 Ω, BNC female 0 V to 1 V, full scale (open-circuit voltage), logarithmic scaling		
Reference frequency Output, usable as input Output frequency Level Input Required level	 BNC female 10 MHz 10 dBm nominal 1 MHz to 16 MHz, in steps of 1 MHz >0 dBm into 50 Ω		
Sweep output	BNC female, 0 V to +10 V in sweep range		
Power supply connector for noise source	BNC female, 0 V and 28 V, switch-selected		
External trigger/gate input Voltage	BNC female, >10 kΩ –5 V to +5 V, adjustable		
IEC/IEEE bus remote control Command set Connector Interface functions	interface in line with IEC 625-2 (IEEE 488.2) SCPI 1994.0 24-contact Amphenol female SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C11		
Serial interface	RS-232-C (COM1 and COM2), 9-contact female connectors		
Mouse interface	PS/2-compatible		
Printer interface	parallel (Centronics-compatible) or serial (RS-232-C)		
Keyboard connector	5-contact DIN female for MF2 keyboard		
User interface	25-contact Cannon female		
Connector for external monitor (VGA)	15-contact female		
General data			
Display Resolution Pixel error rate	24 cm LC color display (9.5") 640 × 480 pixels (VGA resolution) $<2 \times 10^{-5}$		
Mass memory	1.44 Mbyte 3½" disk drive, hard disk		
Temperature ranges Operating temperature range Permissible temperature range Storage temperature range	 +5 °C to +40 °C 0 °C to +50 °C –40 °C to +70 °C		
Environmental conditions	+40 °C at 95 % relative humidity (IEC 68-2-3)		
Mechanical stress Sinewave vibration Random vibration Shock	 5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz; in line with IEC 68-2-6, IEC 68-2-3, IEC 1010-1, MIL-T-28800D, class 5 10 Hz to 300 Hz, acceleration 1.2 g RMS 40 g shock spectrum, in line with MIL-STD-810C and MIL-T-28800D, classes 3 and 5		
Recommended calibration interval	1 year (2 years for operation with external reference)		
EMC	in line with CISPR 11/EN 55011 group 1 class B; in line with IEC/EN 61326, emission: class B (residential environment), immunity: industrial environment (including operating frequency); in line with CISPR 16-1-1		
Power supply			
AC supply	200 V to 240 V: 50 Hz to 60 Hz, 100 V to 120 V: 50 Hz to 400 Hz, safety class in line with VDE 411		
Power consumption	195 VA	230 VA	
Safety	in line with EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1, IEC 1010-1		
Test mark	VDE, GS, UL, cUL		

	R&S®ESIB 7	R&S®ESIB 26	R&S®ESIB 40
Dimensions (W × H × D)	435 mm × 236 mm × 570 mm		
Weight	25.1 kg	26.4 kg	27.0 kg

[1] After 30 days of operation.
[2] Valid for span >100 kHz.
[3] In line with CISPR 16 (tolerance for impulse bandwidths) and MIL-STD (–6 dB).
[4] x = µV, µV/m, µA or µA/m.
[5] For RF frequencies >7 GHz: error after calling peaking function. For sweep time <10 ms/GHz: additional error ±1.5 dB.

Ordering information

Designation	Type	Order No.
EMI Test Receiver (20 Hz to 7 GHz)	R&S®ESIB 7	1088.7490.07
EMI Test Receiver (20 Hz to 26.5 GHz)	R&S®ESIB 26	1088.7490.26
EMI Test Receiver (20 Hz to 40 GHz)	R&S®ESIB 40	1088.7490.40
Options		
Linear Video Output	R&S®ESIB-B1	1089.0547.02
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
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
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+	1501.9590.02
Driver for EMI Test Software R&S®ES-K1	R&S®ES-K16	1108.0288.02
Recommended extras		
Service Kit	R&S®FSE-Z1	1066.3862.02
DC Block, 10 kHz to 18 GHz (type N)	R&S®FSE-Z4	1084.7443.02
Microwave Measurement Cable and Adapter Set	R&S®FS-Z15	1046.2002.02
Headphones	–	0708.9010.00
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 3 m, between R&S®ESIB and R&S®ENV 216	R&S®EZ-Z1	1107.2087.03
Control Cable 10 m, between R&S®ESIB and R&S®ENV 216	R&S®EZ-Z1	1107.2087.10
Control Cable 10 m, between R&S®ESIB and R&S®ESH 3-Z5	R&S®EZ-6	0816.0683.03
Control Cable 3 m, between R&S®ESIB and R&S®ENV 4200	R&S®EZ-21	1107.2087.03
19" Rack Adapter, 5 HU	R&S®ZZA-95	0396.4911.00
Recommended EMI accessories		
see EMC Test & Measurement Products Catalog, Order No. 5213.5400.42		
Accessories supplied		
Power cable, operating manual, spare fuses, test port adapter N and 3.5 mm connector (female) (for R&S®ESIB 26 and R&S®ESIB 40), application software for R&S®ESIB-K1		

More information at
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