# EMI Test Receivers ESIB

EMI measurements up to 40 GHz conforming to standards

**State-of-the-art technology**
- Low inherent noise
- Wide dynamic range
- Preselection + preamplification
- Automatic overload control
- Pulse-protected 2nd RF input
- Fast overview measurements

**Current standards**
- Correct weighting of pulses to CISPR 16-1 and VDE 0876
- All commercial and military standards like 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
- Receiver-oriented operating concept allowing manual operation

ROHDE&SCHWARZ

The ESIB family of EMI test receivers combines the flexibility and speed of spectrum analyzers with the large dynamic range required for EMI measurements in conformance with standards.

The ESIB family comprises three models with different upper frequency limits:

- **ESIB7 20 Hz to 7 GHz**
- **ESIB26 20 Hz to 26.5 GHz**
- **ESIB40 20 Hz to 40 GHz**

The upper frequency limit of the ESIB26 and ESIB40 can be extended up to 110 GHz by means of external mixers (option FSE-B21).

All three models are characterized by:

- high sensitivity
- excellent large-signal immunity
- low measurement uncertainty
- high measurement speed

## Measurements to standard

The ESIB carries out measurements in conformance with all industrial and military EMI standards such as CISPR, EN, VDE, ANSI, FCC, BS, ETS, VCCI, MIL-STD, VG, DEF-STAN, DO160 and GAM EG13. It goes without saying that the ESIB family complies with the basic standard, i.e. CISPR16-1 or VDE0876, which places stringent requirements on receiver dynamic range.

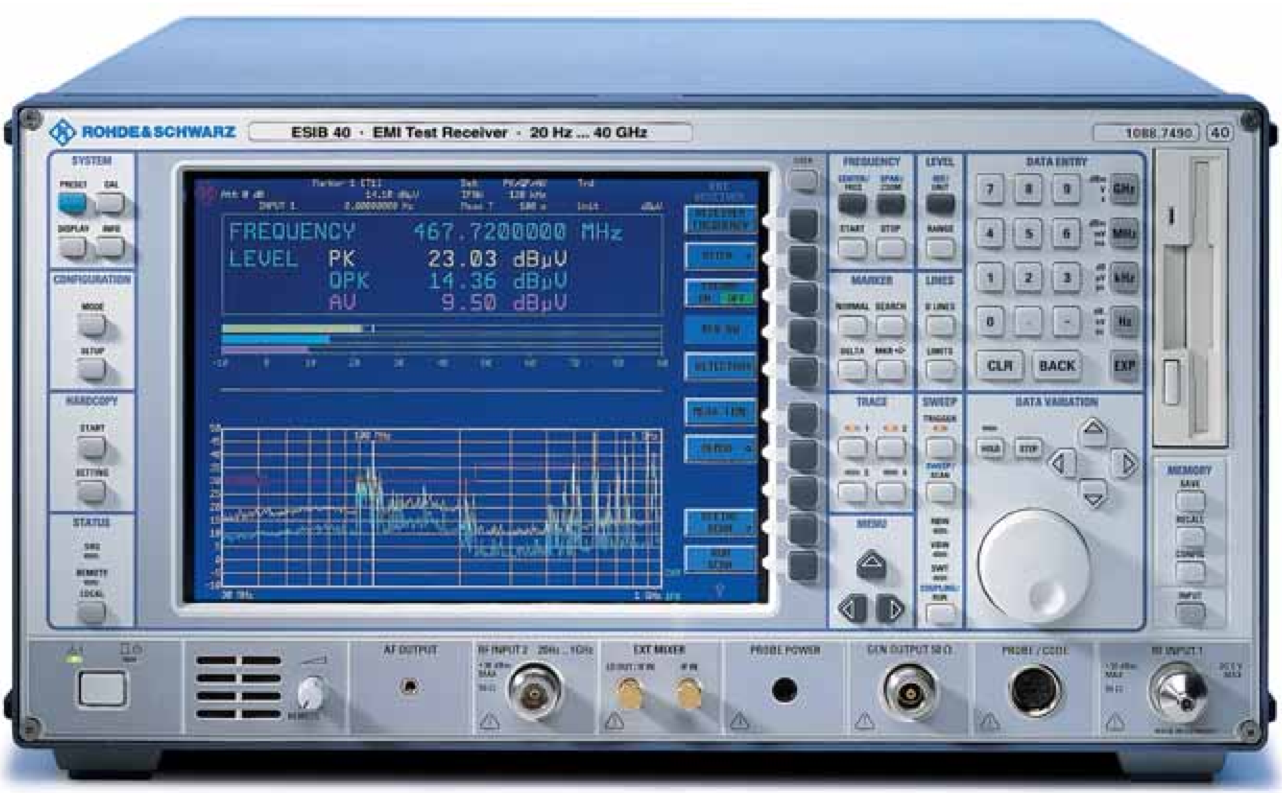
## Test routines oriented to practical requirements

During the various development phases of a product, different measurements are performed as required for each stage. The 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 ESIB at this stage primarily functions as a high-grade spectrum analyzer (see FSE data sheet, PD 757.1519.15).

The ESIB is outstanding for its low inherent noise, high intermodulation suppression and low SSB phase noise. Modulation analysis of analog or digital signals is possible with the optional Vector Signal Analyzer FSE-B7. Moreover, the ESIB provides all test routines offered by modern spectrum analyzers, such as noise measurement, phase noise measurement, channel and adjacent-channel power measurement and time-domain measurement, as known from the FSE family.

As development progresses, EMI measurements become more and more important, for example on mod-



ules 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 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 CISPR16-1 (200 Hz, 9 kHz and 120 kHz), to MIL-STD (10 Hz to 1 MHz) and 10 MHz, and analyzer bandwidths between 1 Hz and 10 MHz, selectable in steps of 1, 2, 3 and 5
- Pulse weighting using quasi-peak, peak and 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 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

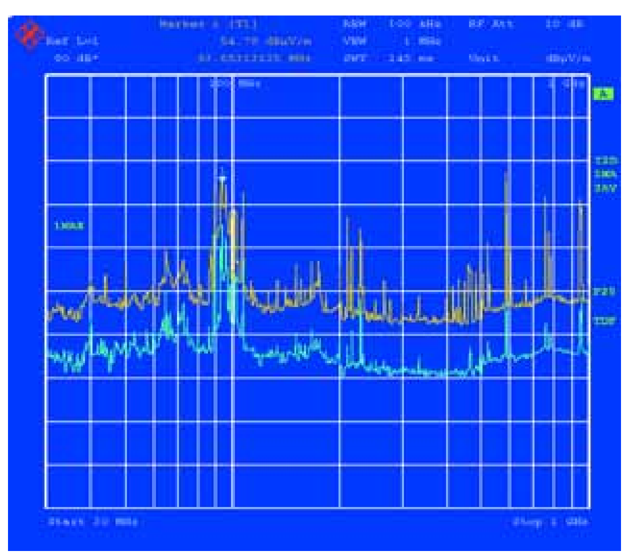
The excellent characteristics and functions of the ESIB family come into their own when compliance with relevant EMI standards is to be verified on the finished product. This may involve limit values for RFI voltage measurements using artificial mains networks, for RFI field-strength measurements by 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 ESIB solves this problem by means of a second, pulse-protected input for the frequency range 20 Hz to 1 GHz. In the case of the ESIB7, 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.

## 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)
  3 fixed-tuned and 6 or 7 tracking filters (models 26 and 40)
- Preamplifier with 20 dB gain in conjunction with preselector switch-selectable
- Resolution bandwidths
  200 Hz, 9 kHz, 120 kHz to CISPR 16-1,
  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)
  Peak (PK), average (AV), quasi-peak (QP) and RMS
- Automatic scan
  4 storable traces with up to 80000 measured values each (250000 values with one trace)
- Integrated controller function under Windows NT4.0

Overview measurement



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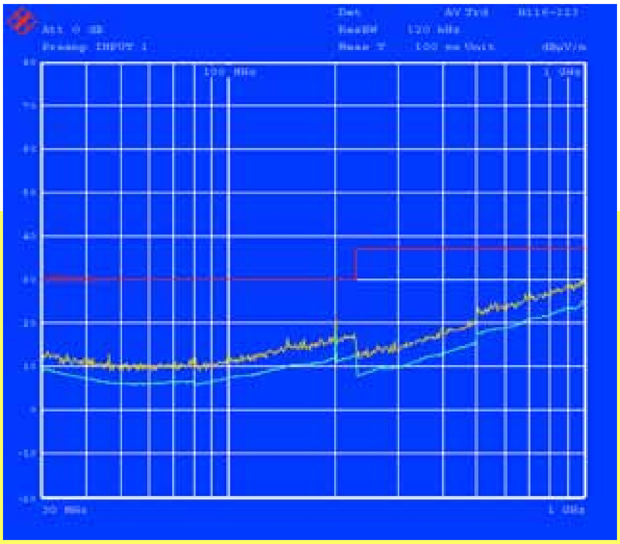

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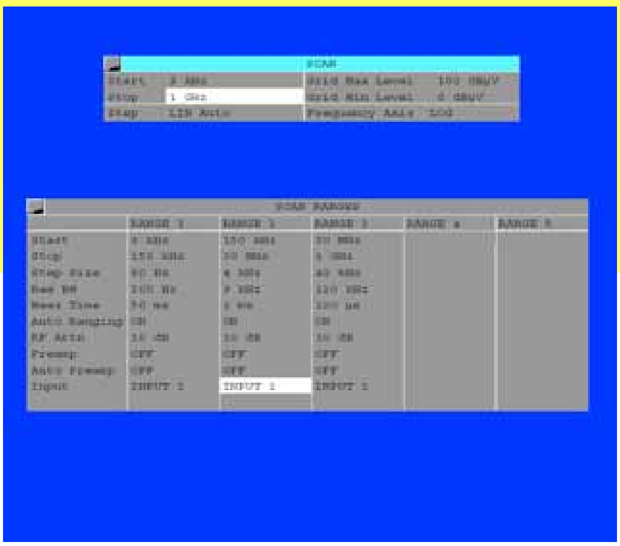

*Fig. 1:*
*Sensitivity in range 30 MHz to 1000 MHz at 120 kHz IF bandwidth, with peak detector and transducer factors for antenna + cable, displayed with limit lines for quasi-peak*

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

*Fig. 3:*
*Inherent noise from 30 Hz to 100 kHz with limit values to MIL-STD-461D RE101, using Coil HZ-10*

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

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. Up to 2 MHz, the 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 ESIB family offers a 20 dB preamplifier from 9 kHz to 7 GHz (above 7 GHz as option ESIB-B2). The preamplifier is located between the RF preselection and the input mixer to protect against overload. With this preamplifier, the inherent noise of 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. HL223) and a 10 m connecting cable clearly remains below the EN55022 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 to 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-alignment of the mixer. The ESIB con-

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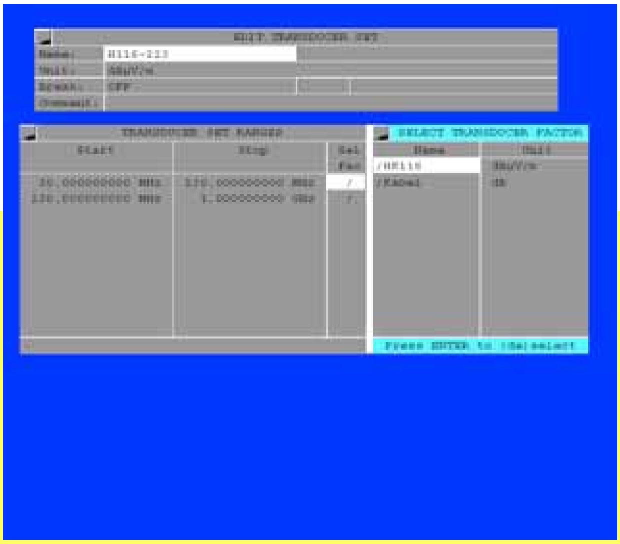


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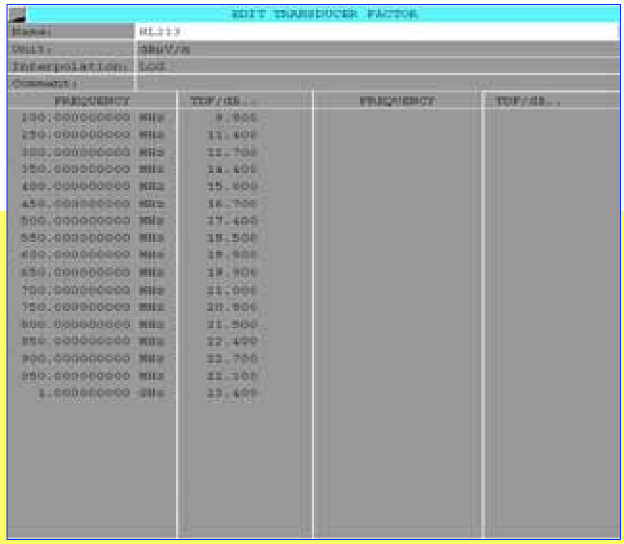


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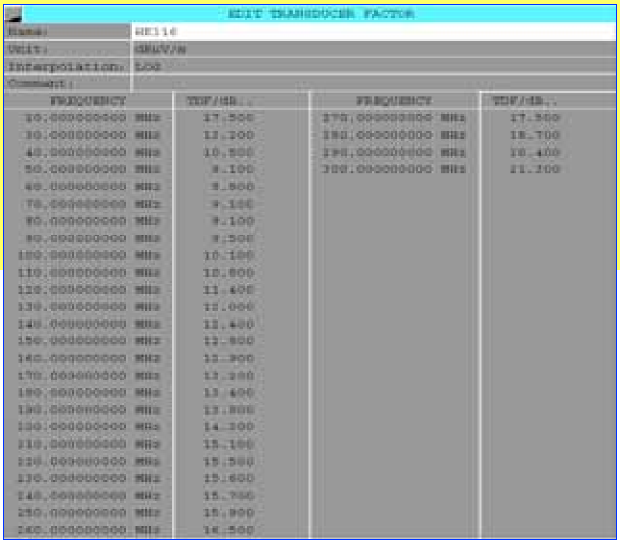


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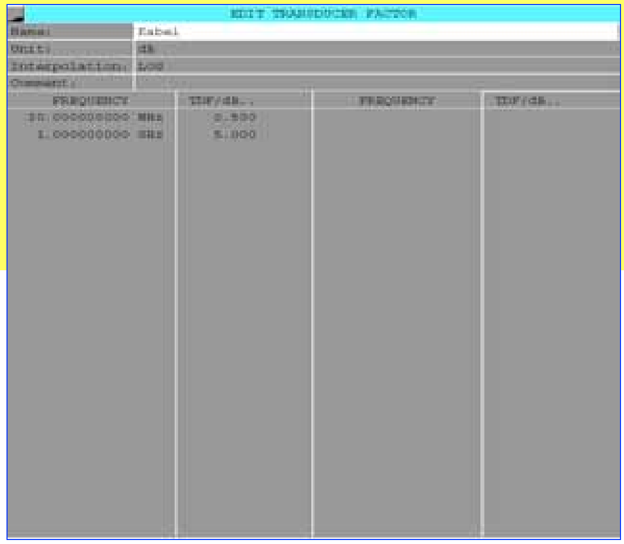


sequently features sufficient inherent noise suppression with respect to relevant limit values even at the lower frequency limit (Fig. 3).

## 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 ESIB offers a user-configurable scan table with up to 10 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 (Fig. 4 to 7).

EMI emissions are usually measured in two steps. An overview measurement made with the peak detector identifies critical emissions above or close to limit values (Fig. 8). In a second measurement with the prescribed detectors (quasi-peak and average to CISPR) and an appropriate measurement time, the critical frequencies are checked for compliance with limit values. The ESIB family supports this procedure by two independent measurement windows on the screen.

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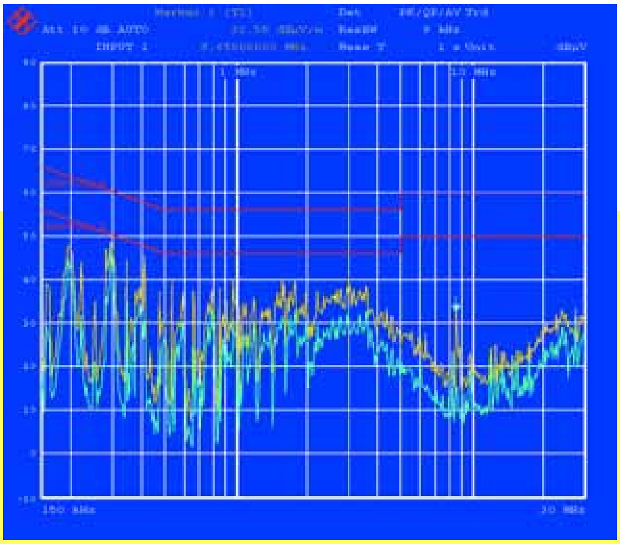

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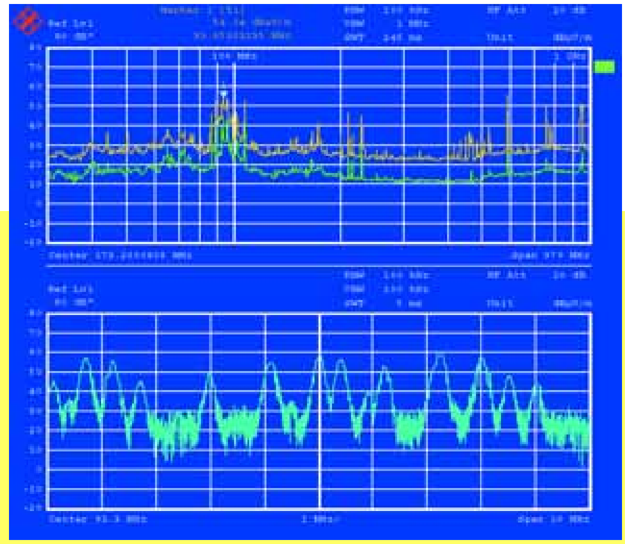

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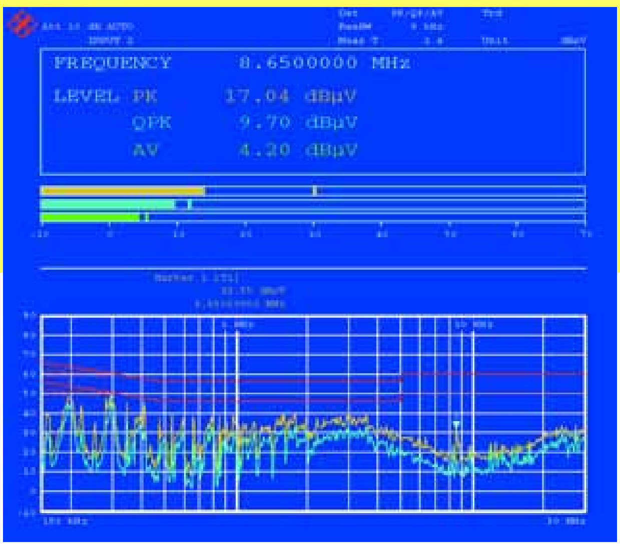


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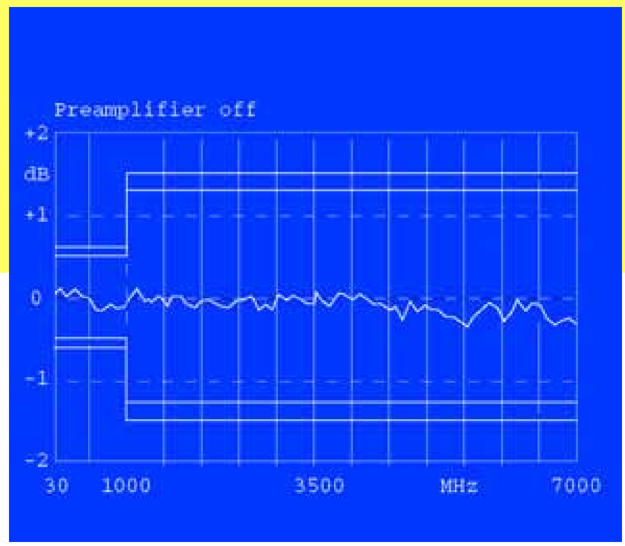



## Split-screen display

Critical emissions can be measured with numerical 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 colours (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 are used, all stored values can be displayed. For this, the ESIB can store up to 250000 measured values per trace 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 ESIB from 30 MHz up to 7 GHz***



## Documentation of results

Practically any type of printer can be used for the documentation of results. The 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 like EMF, WMF or BMP. The data can be integrated into commercial word processing programs for the generation of test reports.

## High accuracy

In the frequency range up to 1 GHz, the ESIB performs level measurements with an accuracy of ±1 dB. This is clearly better than the value of ±2 dB specified by CISPR16-1, 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 peak, average and quasi-peak detectors is implemented in the ESIB for the first time 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 ESIB makes it an ideal choice for use in automatic measurement systems. The IEC/IEEE-bus command set (IEC625-2) conforms to SCPI (1994.0).

With a second IEC/IEEE-bus card (option FSE-B17), the ESIB can be used as a test system controller. This is possible because, with the operating system Windows NT, an integrated controller function is provided as standard which allows the use of a wide variety of Rohde&Schwarz software packages.

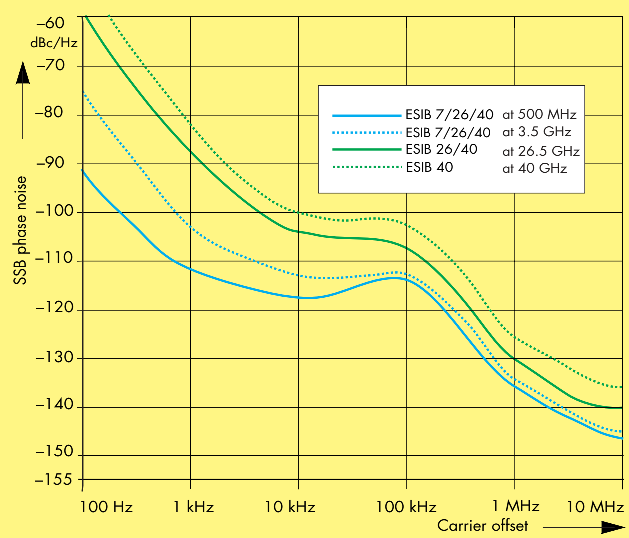
This enables the implementation of complete measurement systems without the need for an additional controller, which saves space and cost.

## Fit for the future

The 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. Tracking Generator FSE-B10 or FSE-B11 (with I/Q modulator, see data sheet PD 757.3434.11) from 9 kHz to 7 GHz makes it easy to measure shielding effectiveness or filter transfer functions.

The option FSE-B7 (see data sheet PD 757.2167) allows the analysis of signals with digital or analog modulation. ESIB is the first instrument suitable for both EMI measurements and the complete measurements of RF parameters, for example of GSM mobile or base stations. The firmware options FSE-K10 for GSM mobile stations and FSE-K11 for GSM base stations (see data sheet PD 757.3592) support the complete range of RF measurements in full compliance with ETSI standards.

# Specifications




*Typical SSB phase noise*

| | ESIB7 | ESIB26 | ESIB40 |
|---|---|---|---|
| Specifications are guaranteed under the following conditions: 30 minutes warmup at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed. Data without tolerances: typical values only. Data designated "nominal" apply to design parameters and are not tested. | | | |
| **Frequency** | | | |
| **Frequency range** 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 resolution | 0.01 Hz | | |
| **Internal reference frequency** (nominal) | | | |
| Aging per day [1)] | $1\times10^{-9}$ | | |
| Aging per year [1)] | $2\times10^{-7}$ | | |
| Temperature drift (0°C to 50°C) | $5\times10^{-8}$ | | |
| Total error (per year) | $2.5\times10^{-7}$ | | |
| **External reference frequency** | 10 MHz or n × 1 MHz, n = 1 to 16 | | |
| **Frequency display (receiver mode)** | | | |
| Display | numerical display | | |
| Resolution | 0.1 Hz | | |
| **Frequency display (analyzer mode)** | | | |
| Display | with marker | | |
| Resolution | 0.1 Hz to 10 kHz (depending on span) | | |
| Accuracy (sweep time >3 × auto sweep time) | ± (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 the left | | |
| SSB phase noise, f ≤500 MHz | | | |
| Carrier offset 100 Hz | <–81 dBc (1 Hz) | | |
| 1 kHz | <–100 dBc (1 Hz) | | |
| 10 kHz | <–114 dBc (1 Hz) | | |
| 100 kHz [2)] | <–111 dBc (1 Hz) | | |
| 1 MHz [2)] | <–129 dBc (1 Hz) | | |
| **Frequency scan (receiver mode)** | | | |
| Scan | scan with max. 10 subranges with different settings | | |
| Measurement time per frequency | 100 µs to 1000 s, selectable | | |
| **Sweep (analyzer mode)** | | | |
| 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% | | |
| Accuracy | ±1% | | |
| Picture refresh rate/s (span ≤7 GHz) | >20 updates/s with 1 trace<br>>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 | | |
| **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 | | |

| | ESIB7 | ESIB26 | ESIB40 |
|---|---|---|---|
| **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*), 10 MHz | | |
| Bandwidth error | | | |
| RBW ≤1 MHz | <10% | | |
| Shape factor $B_{60\ dB} : B_{6\ dB}$ | | | |
| RBW ≤1 kHz | <5 | | |
| RBW >1 kHz | <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 | <10% | | |
| RBW = 5 MHz | <15% | | |
| RBW = 10 MHz | +25%, –10% | | |
| Shape factor $B_{60\ dB} : B_{3\ dB}$ | | | |
| RBW <1 kHz | <6 | | |
| RBW = 1 kHz to 2 MHz | <12 | | |
| RBW > 2 MHz | <7 | | |
| Video bandwidths | 1 Hz to 10 MHz, in steps of 1/2/3/5 | | |
| FFT filter | | | |
| 3 dB bandwidths | 1 Hz to 1 kHz, in steps of 1/2/3/5 | | |
| Bandwidth error, nominal | 2% | | |
| Shape factor $B_{60dB} : B_{3\ dB}$, nominal | 2.5 | | |
| Display range for frequency axis | min. 25 × RBW, max. 100000 × RBW or 2 MHz | | |
| Additional level error (reference: RBW = 5 kHz) | <1 dB | | |
| Max. display range | 100 dB | | |
| Inherent spurious response | <–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 | |
| Max. pulse energy (10 μs) | 1 mWs | 0.5 mWs | |
| 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 | |
| Max. pulse energy (10 μs) | 30 mWs | 15 mWs | |
| **1 dB compression of input mixer** (RF attenuation 0 dB) | | | |
| Analyzer mode | +10 dBm nominal | | |
| **Intermodulation** | | | |
| 3rd-order intercept point (T.O.I.) | | | |
| Analyzer mode, Δf>5 × 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 | | |

*) according to CISPR16 tolerance for impulse bandwidths and MIL-STD (–6 dB)

| | ESIB7 | ESIB26 | ESIB40 |
|---|---|---|---|
| **Level display (receiver mode)** | | | |
| Digital | numerical, 0.1 dB resolution | | |
| Analog | bargraph display, separate for each detector | | |
| Spectrum | level axis 10 dB to 200 dB in steps of 10 dB, frequency axis freely selectable, linear or logarithmic | | |
| Units of level display | dBµV, dBm, dBµA, dBpW, dBpT, dB(µV/m), dB(µA/m), dBx[3]/MHz | | |
| Detectors | average (AV), RMS, peak (PK) and quasi-peak (QP), 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[3]/MHz (logarithmic level display); mV, µA, pW, nW (linear level display) | | |
| **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/ – | 20 dBµV to –10 dBµV / – | |
| 1 to 9 kHz, RBW = 10 Hz | –10 dBµV to –16 dBµV/ –25 dBµV to –30 dBµV | –10 dBµV to –16 dBµV/–25 dBµV to –30 dBµV | |
| 9 to 150 kHz, RBW = 200 Hz | 0 dBµV to –12 dBµV/ –10 dBµV to –24 dBµV | 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 | 5 dBµV to –5 dBµV/–7 dBµV to –17 dBµV | |
| 2 to 30 MHz, RBW = 9 kHz | <–5 dBµV/<–17 dBµV | <–5 dBµV/<–17 dBµV | |
| 30 to 200 MHz, RBW = 120 kHz | <10 dBµV/<–6 dBµV | <13 dBµV/<–3 dBµV | |
| 200 to 1000 MHz, RBW = 120 kHz | <7 dBµV/<–6 dBµV | <10 dBµV/<–3 dBµV | |
| 1 to 5 GHz, RBW = 1 MHz | <15 dBµV/<6 dBµV | <18 dBµV/<9 dBµV | |
| 5 to 7 GHz, RBW = 1 MHz | <22 dBµV/<9 dBµV | <25 dBµV/<12 dBµV | |
| 7 to 18 GHz, RBW = 1 MHz | – | <19 dBµV | <23 dBµV |
| 18 to 26.5 GHz, RBW = 1 MHz | – | <22 dBµV | <26 dBµV |
| 26.5 to 30 GHz, RBW = 1 MHz | – | – | <37 dBµV |
| 30 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 | 3 dBµV to –9 dBµV/–7 dBµV to –21 dBµV | |
| Band B | 9 dBµV to 0 dBµV/ –2 dBµV to –12 dBµV | 9 dBµV to 0 dBµV/–2 dBµV to –12 dBµV | |
| Band C | 17 dBµV /1 dBµV | 20 dBµV /4 dBµV | |
| Band D | 14 dBµV /1 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 | <–74 dBm | |
| 1 kHz | <–104 dBm | <–104 dBm | |
| 10 kHz | <–119 dBm | <–119 dBm | |
| 100 kHz | <–129 dBm | <–129 dBm | |
| 1 MHz | <–142 dBm, typ. –145 dBm | <–142 dBm, typ. –145 dBm | |
| 10 MHz to 5 GHz | <–142 dBm, typ. –147 dBm | <–138 dBm, typ. –140 dBm | |
| 5 GHz to 7 GHz | <–139, typ. –141 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 |

| | ESIB7 | ESIB26 | ESIB40 |
|---|---|---|---|
| **Max. dynamic range** | 1 Hz bandwidth | 1 Hz bandwidth | |
| 1 dB compression point / displayed noise floor | 162 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 | |
| Intermodulation free range at –40 dBm mixer input level | 105 dB | | |
| **Immunity to interference** | | | |
| Image frequency | >80 dB, typ. >90 dB | | >80 dB |
| Intermediate frequency | >75 dB | | >80 dB |
| Spurious response (f >1 MHz, without input signal, 0 dB RF attenuation) | | | |
| Receiver mode or span <30 MHz | <– 3 dBμV | | |
| Span ≥30 MHz | <7 dBμV | | |
| $f_{in}$ = 25.175 MHz, 60 MHz, 5.7172 GHz | <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 | ±0.3 dB | | |
| –50 dB to –70 dB | ±0.5 dB | | |
| –70 dB to –95 dB | ±1 dB | | |
| Linear level display | 5% of reference level | | |
| Bandwidth switching | | | |
| 1 Hz to 30 kHz /100 to 300 kHz | ±0.2 dB | | |
| 1 MHz to 10 MHz | ±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 | |
| 18 GHz to 26.5 GHz | – | ±2.5 dB [4)] | |
| 26.5 GHz to 40 GHz | – | – | ±3 dB [4)] |
| **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 [4)] | |
| 18 GHz to 26.5 GHz | – | ±3 dB [4)] | |
| 26.5 GHz to 40 GHz | – | – | ±3.5 dB [4)] |
| Additional error with preamplifier | <0.5 dB | | |

| | ESIB7 | ESIB26 | ESIB40 |
|---|---|---|---|
| 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 [4)] | |
| 18 GHz to 26.5 GHz | – | ±3 dB [4)] | |
| 26.5 GHz to 40 GHz | – | – | ±3.5 dB [4)] |
| Audio demodulation | | | |
| **Modulation modes** | AM and FM | | |
| Audio output | loudspeaker and phone jack | | |
| 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, dependent on sweep time | | |
| Trigger to gap time | 1 µs to 100 s, resolution 50 ns, dependent on sweep time | | |
| Gap length | 1 µs to 100 s, resolution 50 ns | | |
| Inputs and outputs (front panel) | | | |
| **RF input** | | | |
| Input 1 | 20 Hz to 7 GHz | 20 Hz to 26.5 GHz | 20 Hz to 40 GHz |
| | N female, 50 Ω | adapter system, 50 Ω, N male and female, 3.5 mm male and female | adapter system, 50 Ω, N male and female, K male and female |
| VSWR (receiver mode, f ≤1 GHz) | | | |
| RF attenuation <10 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 <40 GHz | – | – | <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 <40 GHz | – | – | <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 | | |
| **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 | | |

| | ESIB7 | ESIB26 | ESIB40 |
|---|---|---|---|
| Inputs and outputs (rear panel) | | | |
| **IF 21.4 MHz** | $Z_{out}$ = 50 Ω, BNC female, bandwidth >1 kHz or IF or resolution bandwidth | | |
| Level | 0 dBm at reference level, mixer level >–60 dBm | | |
| **Video output** | $Z_{out}$ = 50 Ω, BNC female | | |
| Voltage (resolution bandw. ≥1 kHz) | 0 to 1 V, full scale (open-circuit voltage); logarithmic scaling | | |
| **Reference frequency** | | | |
| Output, usable as input | BNC female | | |
| Output frequency | 10 MHz | | |
| Level | 10 dBm nominal | | |
| Input | 1 to 16 MHz, in steps of 1 MHz | | |
| Required level | >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** | BNC female, >10 kΩ | | |
| Voltage | –5 V to + 5 V, adjustable | | |
| **IEC/IEEE-bus remote control** | interface to IEC 625-2 (IEEE 488.2) | | |
| Command set | SCPI 1994.0 | | |
| Connector | 24-contact Amphenol female | | |
| Interface functions | 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 ext. monitor (VGA)** | 15-contact female | | |
| General data | | | |
| **Display** | 24 cm LC colour display (9.5") | | |
| Resolution | 640 × 480 pixels (VGA resolution) | | |
| Pixel error rate | $<2 \times 10^{-5}$ | | |
| **Mass memory** | 1.44 Mbyte 3½" disk drive, hard disk | | |
| **Operating temperature range** | | | |
| Nominal temperature range | +5°C to +40°C | | |
| Limit temperature range | 0°C to +50°C | | |
| Storage temperature range | –40°C to +70°C | | |
| **Environmental conditions** | +40°C at 95% relative humidity (IEC 68-2-3) | | |
| **Mechanical stress** | | | |
| Sinewave vibration | 5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz; to IEC 68-2-6, IEC 68-2-3, IEC 1010-1, MIL-T-28800D, class 5 | | |
| Random vibration | 10 Hz to 300 Hz, acceleration 1.2 g rms | | |
| Shock | 40 g shock spectrum, to MIL-STD-810C and MIL-T-28800D, classes 3 and 5 | | |
| **Recommended calibration interval** | 1 year (2 years for operation with external reference) | | |
| **RFI suppression** | to EMC directive of EU (89/336/EEC) and German EMC legislation | | |
| **Power supply** | | | |
| AC supply | 200 V to 240 V: 50 Hz to 60 Hz, 100 V to 120 V: 50 Hz to 400 Hz, class of protection I to VDE 411 | | |
| Power consumption | 195 VA | 230 VA | |
| Safety | to EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1, IEC 1010-1 | | |
| Test mark | VDE, GS, UL, cUL | | |
| **Dimensions (W x H x 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) x = µV, µV/m, µA or µA/m.
4) 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 ESIB7 (20 Hz to 7 GHz) | ESIB7 | 1088.7490.07 |
| EMI Test Receiver ESIB26 (20 Hz to 26.5 GHz) | ESIB26 | 1088.7490.26 |
| EMI Test Receiver ESIB40 (20 Hz to 40 GHz) | ESIB40 | 1088.7490.40 |
| **Options** | | |
| Preamplifier 20 dB, 7 GHz to 26.5 GHz | ESIB-B2 | 1137.4494.26 |
| Preamplifier 20 dB, 7 GHz to 40 GHz | ESIB-B2 | 1137.4494.40 |
| Vector Signal Analyzer | FSE-B7 | 1066.4317.02 |
| Tracking Generator 7 GHz | FSE-B10 | 1066.4769.02 |
| Tracking Generator 7 GHz with I/Q Modulator | FSE-B11 | 1066.4917.02 |
| Switchable Attenuator for Tracking Generator | FSE-B12 | 1066.5065.02 |
| Ethernet Card, RJ-45 connector | FSE-B16 | 1037.5973.04 |
| Second IEC/IEEE-bus Card | FSE-B17 | 1066.4017.02 |
| Removable Hard Disk for ESIB [1)] | FSE-B18 | 1088.6993.02 |
| Second Hard Disk for ESIB, WindowsNT | FSE-B19 | 1088.7248.10 |
| External mixer output for ESIB26/40 | FSE-B21 | 1084.7243.02 |
| **Software** | | |
| EMC Measurement Software (32 bit) | EMC32-E | 1119.4621.02 |
| EMI Software for EMI Test Receiver (Windows) | ES-K1 | 1026.6790.02 |
| Script Development Kit | ES-K2 | 1026.6890.02 |
| Driver for ESIB7/26/40 | ES-K16 | 1108.0288.02 |
| Driver for Mast (Schäfer) and Turntable (Schäfer) | ES-K30 | 1026.7196.02 |
| Driver for MDS Absorbing Clamp Slideway (Schäfer) | ES-K31 | 1026.7921.02 |
| **Recommended extras** | | |
| Service Kit | FSE-Z1 | 1066.3862.02 |
| DC Block, 5 MHz to 7000 MHz (type N) | FSE-Z3 | 4010.3895.00 |
| DC Block, 10 kHz to 18 GHz (type N) | FSE-Z4 | 1084.7443.02 |
| Microwave Measurement Cable and Adapter Set | FS-Z15 | 1046.2002.02 |
| Headphones | – | 0708.9010.00 |
| IEC/IEEE-Bus Cable, 1 m | PCK | 0292.2013.10 |
| IEC/IEEE-Bus Cable, 2 m | PCK | 0292.2013.20 |
| Control Cable 10 m, ESIB-ESH2-Z5 | EZ-5 | 0816.0625.03 |
| Control Cable 10 m, ESIB-ESH3-Z5 | EZ-6 | 0816.0683.03 |
| Control Cable 3 m, ESIB-ENV4200 | EZ-21 | 1107.2087.03 |
| Transit Case 19", 5 HU | ZZK-955 | 1013.9408.00 |
| 19" Rack Adapter, 5 HU | ZZA-95 | 0396.4911.00 |

**Recommended 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 FSE)

1) Factory-fitted.

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