Data sheet

Version 05.03

May 2009

Test Receiver R&S®ESPI

The precompliance standard up to 7 GHz

Excellent test receiver features

- Choice of 7 detectors
- EMI measurement bandwidths 200 Hz, 9 kHz, 120 kHz, 1 MHz
- Pulse weighting with quasi-peak, average and RMS average detector in accordance with the latest CISPR 16-1-1 edition
- For all commercial EMI standards

Extremely high measurement speed

- Measurement times from 100 µs to 100 s
- **Option:** preselector and 20 dB preamplifier

Spectrum analyzer

- IF resolution bandwidths from 10 Hz to 10 MHz
- Test routines for TOI, ACP, OBW, CCDF

Outstanding performance features

- Total measurement uncertainty
  - Spectrum analyzer mode: 0.5 dB (without preselection)
  - Receiver mode: <1.5 dB
- Displayed average noise level (DANL): **–155 dBm** (1 Hz), f < 1 GHz
- NF = 21.5 dB (12 dB with preamplifier)
- Programmable scan tables
- Limit lines
- Transducer tables and sets
- Brilliant 21 cm TFT color display

ROHDE&SCHWARZ

Precompliance Test Receiver/Spectrum Analyzer R&S®ESPI...

- Optimized operating concept owing to decades of experience in EMI test receiver development
- Very high measurement speed
- High measurement accuracy

With the two R&S®ESPI test receiver models, the well-known advantages of the R&S®ESIB high-end compliance test receivers/analyzers have been systematically implemented for the upper middle-end.

Due to a common platform system, the user has the additional benefits of the R&S®FSP spectrum analyzer family which is already in place. These benefits by far exceed the capabilities and functions of conventional precompliance test equipment.

The R&S®ESPI defines the vital criteria, such as functionality, measurement speed and accuracy for middle-end equipment.

The use of innovative techniques, such as the VLSI frontend and largely digital signal processing, together with ASICs developed by Rohde&Schwarz, has resulted in a product with top-class specifications and high reliability.

Outstanding features

TEST RECEIVER

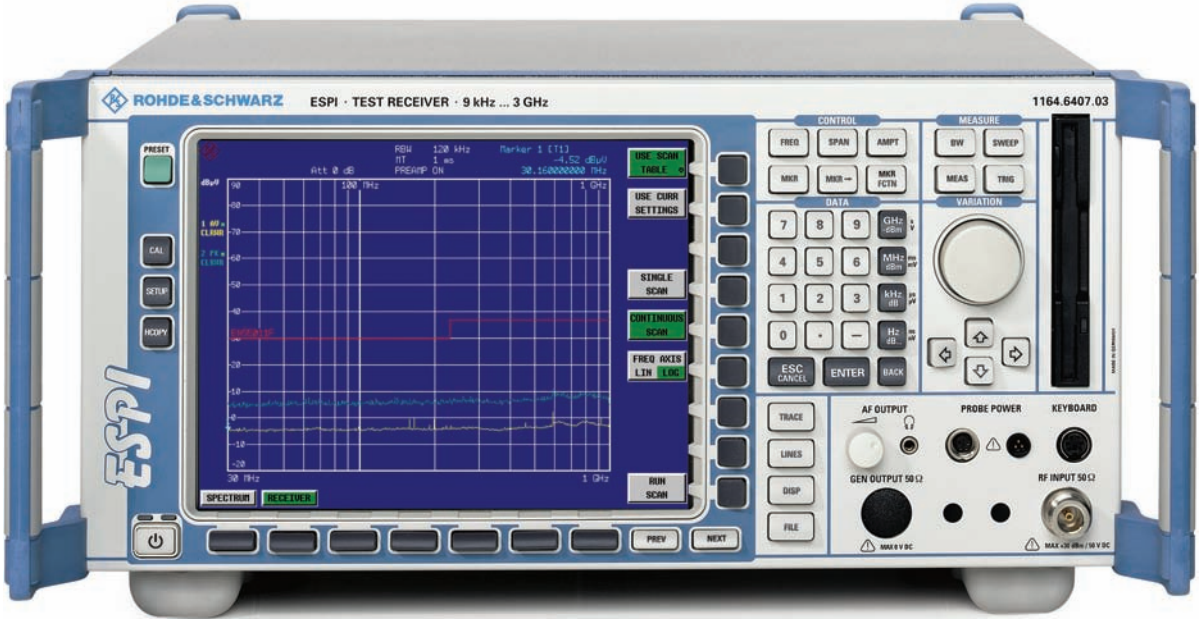
- Peak, Quasi-Peak, Average, CISPR Average, RMS and RMS Average (max. 3 detectors simultaneously)
- EMI measurement bandwidths 200 Hz, 9 kHz, 120 kHz, 1 MHz
- Correct pulse weighting in line with CISPR 16-1-1 from **10 Hz** pulse repetition frequency
- For all commercial EMI standards such as CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE
- **Option R&S®ESPI-B2:** Preselector and 20 dB preamplifier

SPECTRUM ANALYZER

- Resolution bandwidths from 10 Hz to 10 MHz (in 1/3/10 sequence)
- RMS detector for measurements on digitally modulated signals
- Test routines for TOI, ACPR, OBW, amplitude statistics

Unprecedented measurement speed

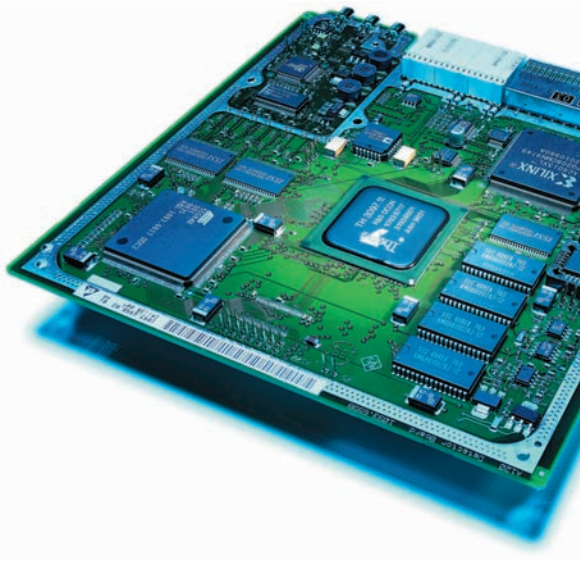
- Fast detection of critical frequencies through overview measurements:
  - Measurement time 100 µs to 100 s in receiver mode
  - up to 16000 s in analyzer mode



...the standard in the EMI precompliance class

EMC-relevant performance features

- Total measurement uncertainty
  - Spectrum analyzer mode: 0.5 dB (without preselection)
  - Receiver mode: <1.5 dB
- Displayed average noise level (DANL): **–155 dBm** (1 Hz), f < 1 GHz
- Noise figure 21.5 dB (12 dB with preamplifier option)
- Overview measurements in spectrum analyzer mode
- User-programmable scan tables
- Display of results and comparison with standard-conforming limit lines
- Correction values for cable loss, coupling networks and antennas included as transducer factor
- Data reduction and modification of a frequency list for weighted final measurement
- Bargraph display for different types of detectors
- Overload indication
- Built-in AF demodulator
- EMI bandwidths in line with CISPR
- Brilliant 21 cm TFT color display



Precompliance has a name: R&S®ESPI 3 and R&S®ESPI 7

Features

The **R&S®ESPI 3** and **R&S®ESPI 7**, which are suitable for all commercial EMI standards in line with CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE, have been specially designed for precompliance measurements in development. The aim is to perform EMC diagnostic measurements on the devices under test as quickly as possible and as accurately as necessary and to document the results.

The final compliance test will then be purely a formality. The advantages of test receiver accuracy and selectivity combined with the measurement speed of a spectrum analyzer define the crucial performance features for a new class of test receivers.

R&S®ESPI 3: 9 kHz to 3 GHz
R&S®ESPI 7: 9 kHz to 7 GHz
These two models make it possible to take products through the critical stages of development and the EMC test plan and still be on schedule for approval and market launch.

The precompliance measuring instruments from Rohde&Schwarz provide the functions that are required for in-house test sequences:

- Manual measurement of EMI spectra owing to the receiver-oriented operating concept
- Semi-automatic measurements with predefined scan and sweep tables allowing interactive interruption
- Individual evaluation of critical frequencies using markers and additional detectors assigned to the markers which are simultaneously displayed
- Fully automatic interference measurements in conjunction with external EMI software packages from Rohde&Schwarz, including, for instance, determination of the worst case by automatic switchover of the phase and protective ground settings via the USER port for remote-controlled line impedance stabilization networks

Accuracy and reproducibility are also key parameters for all applications of the R&S®ESPI test receiver family.

The combination of test receiver and spectrum analyzer provides an optimum concept for precompliance measurements in development environments.

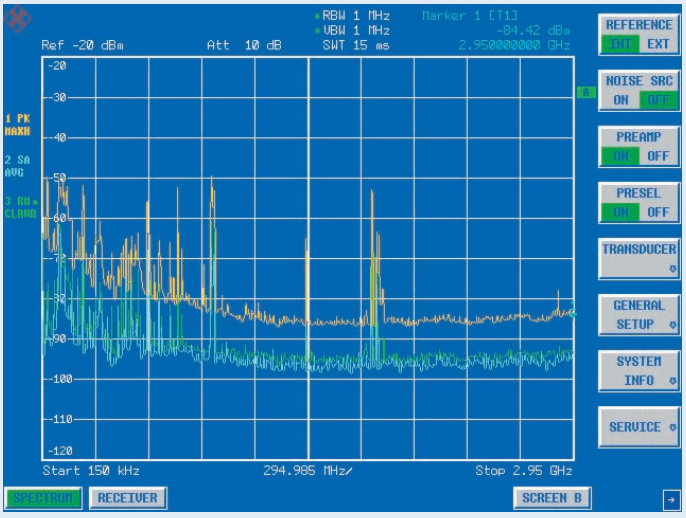
Standard-conforming EMI measurements

Fitted with the optional preselector/preamplifier (R&S®ESPI-B2), all R&S®ESPI models feature an excellent dynamic range compared with other precompliance solutions and are, therefore, able to perform precise interference measurements with pulse repetition frequencies (PRF) from **10 Hz** in line with CISPR 16-1-1.

Measurements to commercial EMI standards such as CISPR, EN 550xx, ETS, FCC, ANSI C63.4, VCCI or VDE can be carried out directly by comparing the EMI spectrum with the associated limit lines and switching on the appropriate detectors (PK, QP, CAV, AV, RMS-AV, RMS).

R&S®ESPI-B2: preamplifier and preselection filters up to 3 GHz

The input stages of precompliance test equipment, which often feature a rather poor overload capability, would be hopelessly overdriven without a preselection unit. This is different with the R&S®ESPI where, in combination with preselection filter units, a low-noise preamplifier comes after the filter module but before the mixer stage. It must be possible to switch the preamplifier on/off as required, since in the case of high signal levels, the dynamic range would be reduced by an amount numerically equal to the gain. Where low signal levels are to be expected, it is best to switch in the preamplifier. Since the Test Receivers R&S®ESPI operate both in the spectrum analyzer mode and in the test receiver mode, both modes offer the choice of switching the preamplifier on or off. In the receiver mode, the preselection filter setting is fixed, whereas in the analyzer mode it can be selected.



Spectrum analyzer mode with selectable preselection filters and preamplifier switched on

The detectors

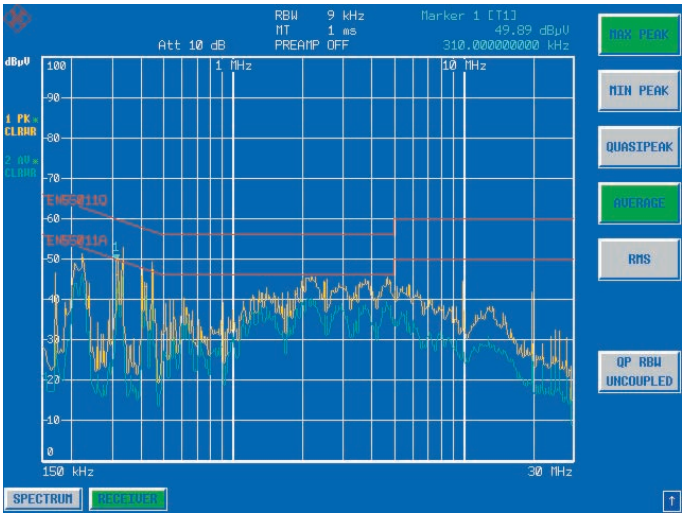
Depending on the operating mode of the R&S®ESPI3 and R&S®ESPI7, i.e. spectrum analyzer or test receiver, the following detectors are available:

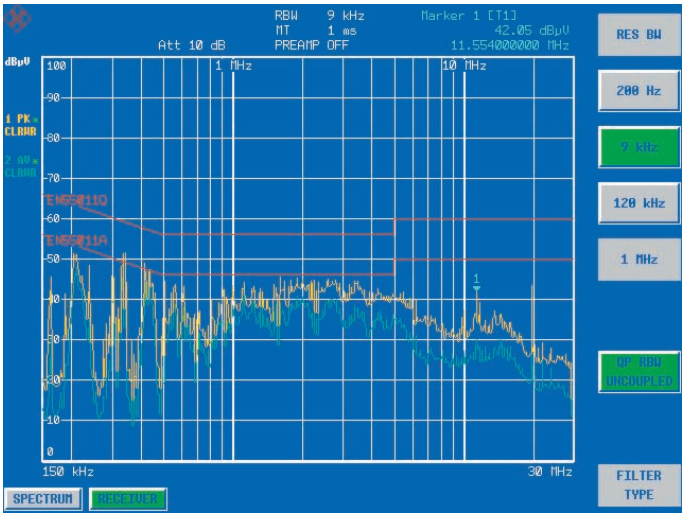
- Analyzer mode: MaxPeak, MinPeak, AutoPeak, Sample, Quasi-Peak, Average, CISPR Average, RMS, RMS Average
- Receiver mode: MaxPeak, MinPeak, Quasi-Peak, Average, CISPR Average, RMS, RMS Average

Up to 3 detectors can be activated simultaneously and the results displayed.

The bargraph display, with current detector value and MaxHold display, clearly shows the results of manual circuit adjustment when the DUT cabling is arranged for maximum emissions and when the antenna is aligned relative to the DUT for a maximum reading.

In the receiver mode, the QP detector is coupled with the time constants, prescribed by the standard, as a function of the frequency range. This ensures that the correct time constants and IF bandwidth are used for signal weighting in the CISPR bands. This means much greater ease of operation for the user.





SCAN TABLE

Scan Start	30 MHz				
Scan Stop	3 GHz				
Step Mode	AUTO				
	RANGE 1	RANGE 2	RANGE 3	RANGE 4	RANGE 5
Start	30 MHz	1 GHz			
Stop	1 GHz	3 GHz			
Step Size(A)	40 kHz	400 kHz			
Res BW	120 kHz	1 MHz			
Meas Time	100 µs	100 µs			
Auto Ranging	ON	ON			
RF Attn	10 dB	10 dB			
Preamp	ON	ON			
Auto Preamp	OFF	OFF			

SCAN table

The measurement bandwidths

The measurement bandwidths of the R&S®ESPI are designed for a large variety of applications:

The analyzer mode provides all –3 dB bandwidths from 10 Hz to 10 MHz (in 1/3/10 sequence). In the receiver mode, the –6 dB bandwidths can also be selected by softkey: 200 Hz, 9 kHz, 120 kHz plus 1 MHz bandwidth.

Moreover, approx. 40 digital channel filters are available.

Like the detectors, the standard-conforming CISPR bandwidths can be coupled as a function of the frequency range. If necessary, the coupling can be disabled.

The preselector/preamplifier option (R&S®ESPI-B2) is available as a protection against overloading by pulsed, high-power signals and for ensuring the validity of signal evaluation in the linear operating range of the measuring instrument. The advantage of this option is that, in the analyzer mode, the preselection filters or the preamplifier can be switched on or off as required.

User-selectable parameters in up to 10 subranges

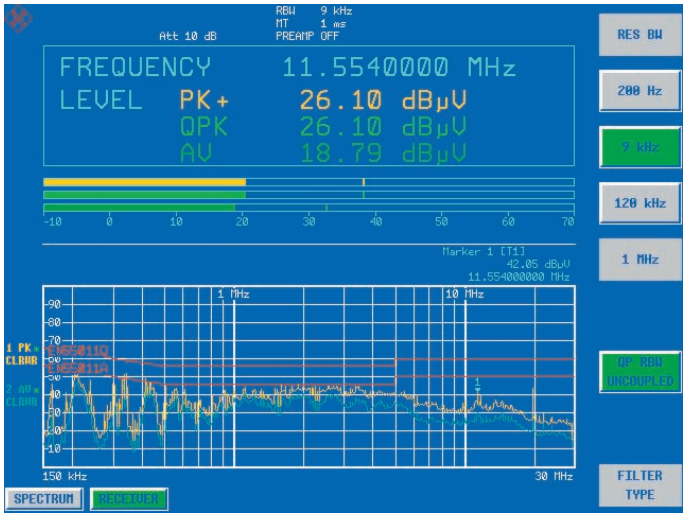
The basis for all reproducible measurements is a scan table with up to ten subranges and user-programmable frequency parameters such as START, STOP, STEP SIZE, resolution bandwidth, measurement time per frequency as well as RF attenuation setting at a constant value or coupled to AUTO RANGE overload monitoring. For sensitive measurements (if low signal levels are expected), the preamplifier can be switched on or off as a function of the subrange.

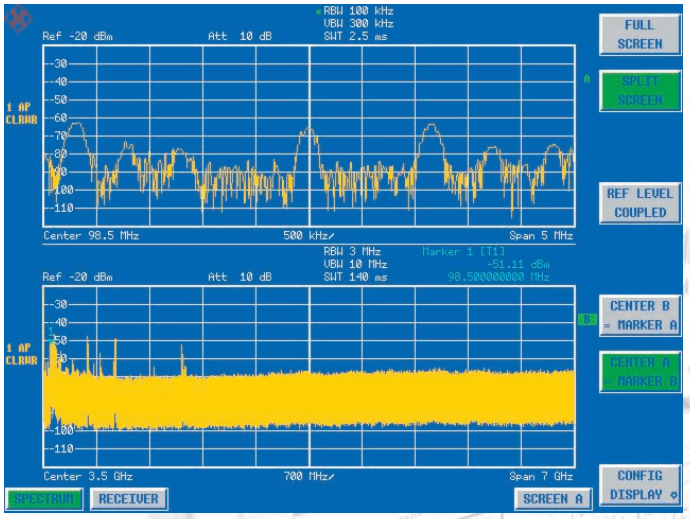
Diagram and graphics display can most easily be defined via ADJUST AXIS.

Marker functions and split-screen display

In addition to normal FULL SCREEN display, a second window is opened in the SPLIT SCREEN mode for bargraph display with current detector values and MaxHold display. By activating "Tune to Marker" the receive frequency and the amplitude of the detectors coupled to the marker are displayed as a bargraph and numerically. This makes things considerably easier for the user.

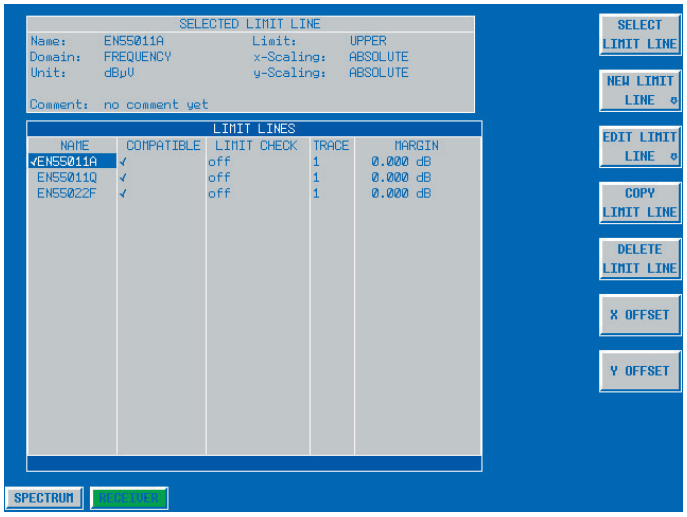
The split-screen display in the analyzer mode makes it possible to resolve fine spectrum detail. By coupling the marker frequency (in screen B) to the center frequency of screen A, parameters such as bandwidth, span, RF attenuation can be selected separately to detect spurious which are close to the signal and cannot be seen in the overview spectrum.





R&S®ESPI – the optimal balance of price and performance

- Large 21 cm display with brilliant colors which makes it easy to read parameters and displays results clearly
- Seven different detectors including average detector with meter time constant (CISPR Average) and RMS average detector, up to three of them can be selected simultaneously
- EMI bandwidths 200 Hz, 9 kHz, 120 kHz and 1 MHz
- Resolution bandwidths from 10 Hz to 10 MHz
- Editable limit lines
- Correction tables for transducers, coupling networks, accessories, antennas
- Convenient documentation of results as a hardcopy or file in PC-compatible formats
- Interfaces: GPIB, Centronics, RS-232-C, LAN (option)
- Automatic test routines for measurement of TOI, OBW, phase noise, ACP(R)



Overview of limit lines

- Split-screen display with independent settings and up to 3 traces per screen
- Fast measurements in the time domain: minimum sweep time 1 µs
- Gated sweep for measurements on TDMA signals
- Minimum sweep time of 2.5 ms, supports daily efforts in the lab to cut development times

Additional applications – extra performance

Modern communications systems are required to achieve optimum spectral efficiency at high data rates. For the 3rd generation CDMA mobile radio systems currently under development, this is achieved by a number of measures, for example high-precision power control.

The R&S®ESPI is the ideal measurement tool for diagnostic measurements, development, precertification and post-certification owing to its excellent RF characteristics:

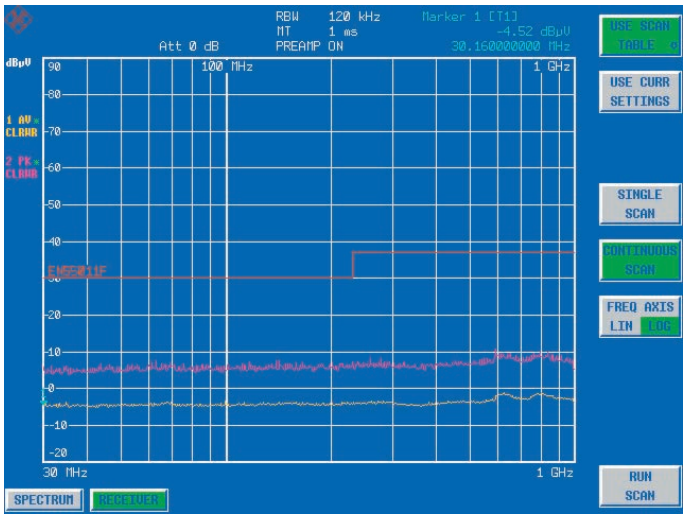
- Total measurement uncertainty
  - Spectrum analyzer mode: 0.5 dB (without preselection)
  - Receiver mode: <1.5 dB
- Displayed average noise level of typ. –155 dBm (1 Hz) without preamplifier
- Phase noise of typ. –145 dBc (1 Hz) at an offset of 10 MHz providing optimum conditions for ACPR measurements on WCDMA systems

The resolution bandwidths of up to 100 kHz are fully digital and provide – in addition to high selectivity – an ideal basis for accurate (adjacent-)channel power measurements owing to a maximum bandwidth deviation of 3%.

The R&S®ESPI comes as standard with a large variety of functions

Fit for the future

Owing to its modular design, the R&S®ESPI is optimally equipped to handle today's measurements and the measurements of the future. The design already takes into account both hardware and firmware extensions so that the R&S®ESPI will meet all requirements in the years to come as well. A safe investment for the future.



Displayed average noise level in receiver mode with preselector/ preamplifier switched on

Ergonomics & design

The R&S®ESPI sets the new standard in the precompliance class. The 21 cm (8.4") color display makes it easy for the user to read results and provides an overview of the parameters which have been selected.

Vertical and horizontal rows of softkeys make it easy to perform even complex measurements. Parameters such as frequency and amplitude are entered by means of dedicated hardkeys and unit keys.

Wide dynamic range

Featuring the lowest displayed average noise level in its class (DANL typ. –145 dBm at 10 Hz RBW), the R&S®ESPI measures even small signals precisely, when using the optional Preselector/Preamplifier R&S®ESPI-B2 from 9 kHz to 3 GHz even down to –153 dBm (10 Hz RBW). Together with the high intercept point, this yields an intermodulation-free range of typ. 100 dB – an excellent value even for higher middle-end instruments.

Phase noise

The R&S®ESPI's minimal phase noise makes it suitable for demanding measurements both close to the carrier (typ. –113 dBc (1 Hz) at 10 kHz) and far from the carrier (typ. –125 dBc (1 Hz) at 1 MHz). The R&S®ESPI is therefore optimally equipped for performing spectral analysis and ACPR measurements on narrowband systems such as IS-136 or PDC as well as on wideband systems such as IS-95 or WCDMA.

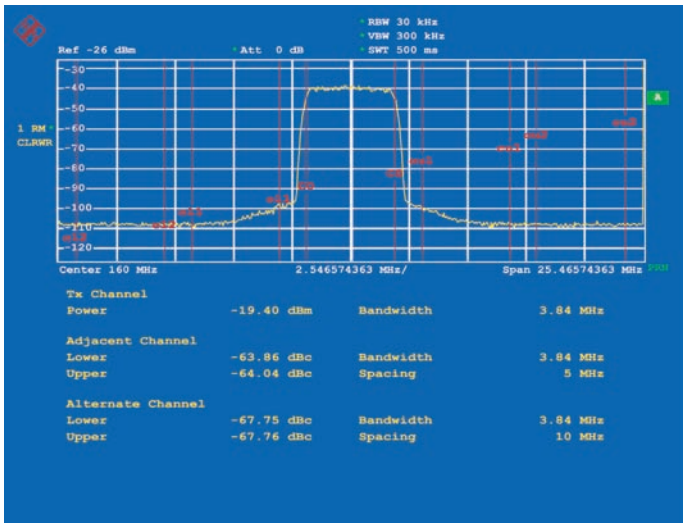
Interior view: modular design of test receiver

Spectrum analyzer application, ACPR measurements

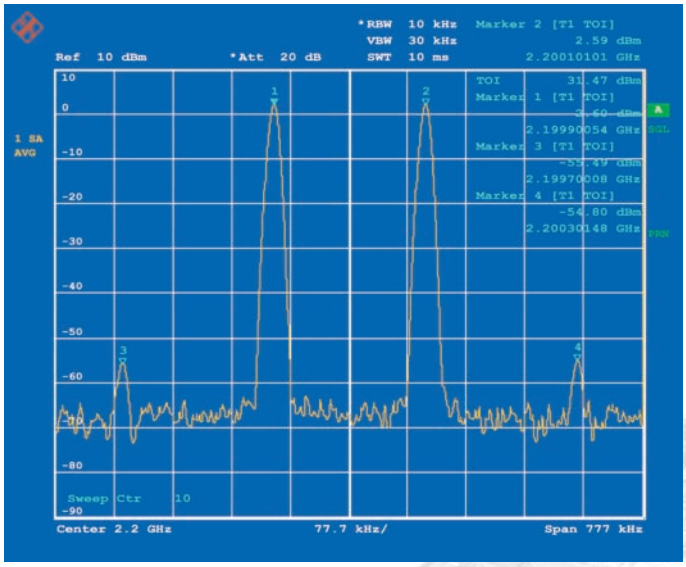
Measurement of the adjacent-channel power ratio (ACPR), which many mobile radio standards stipulate for components and units, is performed in the R&S®ESPI analyzer mode by automatic test routines. All settings, measurements and filters required for a selected standard are activated at a keystroke.

In addition to a large number of preprogrammed standards, the channel width and channel spacing can be selected as required.

Due to its excellent dynamic range, the lowest phase noise in its class and its RMS detector, the R&S®ESPI sets the new standard for the upper middle-end – even for ACPR measurements.



TOI measurement



Test routines for TOI, OBW, etc are standard

The R&S®ESPI offers fast test routines for a multitude of typical laboratory measurements. The routines make postprocessing superfluous and supply results directly:

- Determination of TOI
- Occupied bandwidth (OBW)
- Burst power with peak, average and RMS indication as well as standard deviation
- Modulation depth of AM signals
- Phase noise
- Bandwidth marker

Of course, these functions can also be used via the fast GPIB interface.

Optional tracking generator 9 kHz to 3 GHz

The optional Internal Tracking Generator R&S®FSP-B9 up to 3 GHz and External Generator Control R&S®FSP-B10 enhance the two R&S®ESPI test receiver models to yield scalar network analyzer functionality. Gain, frequency response, insertion and return loss are measured using a selective method with a wide dynamic range without being affected by harmonics or spurious from the generator. The Internal Tracking Generator R&S®FSP-B9 can be used in both R&S®ESPI models and covers the frequency range from 9 kHz to 3 GHz. A frequency offset of ±150 MHz can be set for measurements on frequency-converting modules. The tracking generator can be broadband-modulated by an external I/Q baseband signal.

Optional LAN interface

With the aid of the optional LAN Interface R&S® FSP-B16, the R&S®ESPI models can be connected to common networks such as 100Base T so that functions such as file logging on network drives or documentation of measurement results via network printer are available. The R&S®ESPI can also be remote-controlled via the LAN interface. Control is via a soft-panel that behaves exactly as if it were part of a real instrument. The LAN interface has a clear speed advantage over the IEC/IEEE bus – in particular when large blocks of data are transmitted.

Easy generation of reports owing to PC compatibility

- PC-compatible screenshots, no conversion software being required
- Windows printer support
- LabWindows driver
- LabView driver
- SCPI-compatible
- R&S®FSE/ESIB-compatible GPIB command set
- Customized training

Rear view with interfaces for tracking generator with I/Q, LAN and user port

R&S®ESPI-K50 – external trigger for measuring field-strength profiles

To measure the coverage field strength of a communications or broadcast network, continuous level measurements have to be performed at a high measurement rate and the results must be forwarded to an evaluation unit.

When a displacement sensor/GPS system is used, the external trigger input of the R&S®ESPI can be used to start the single measurements. The level values can thus be accurately assigned to the measurement site.

The coverage measurement function is only available in the receive mode and in the case of remote control. The R&S®ESPI performs the coverage measurement in two different ways:

- All measurements are performed on a discrete frequency (sample rate >100 ksample/s)
- A channel list with up to 1000 channels is cyclically processed, i.e. a new frequency is set for each measurement

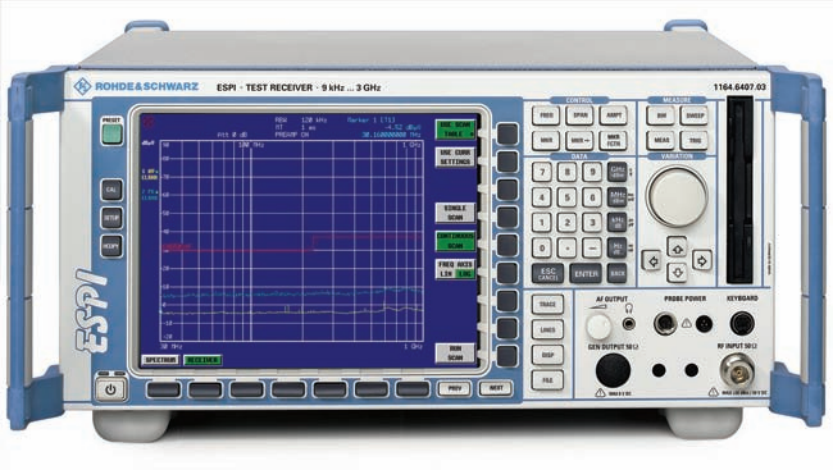
Additional channel filters

In addition to the channel filters included as standard in the R&S®ESPI, the option provides filters with bandwidths of 5.6 MHz to 8 MHz for DVB-T signals as listed below:

- 5.6 MHz: ISDB-T (Japan)
- 6.0 MHz: ATSC (USA, Korea)
- 6.4 MHz
- 7.0 MHz: DVB-T (Europe, Australia)
- 8.0 MHz: DVB-T (Europe)

Lab model or robust portable unit

Whether as a desktop model for the lab, in a 19" rack, or as a robust unit with edge protectors and carrying handle for portable use – the R&S®ESPI always looks good.



Environmental compatibility

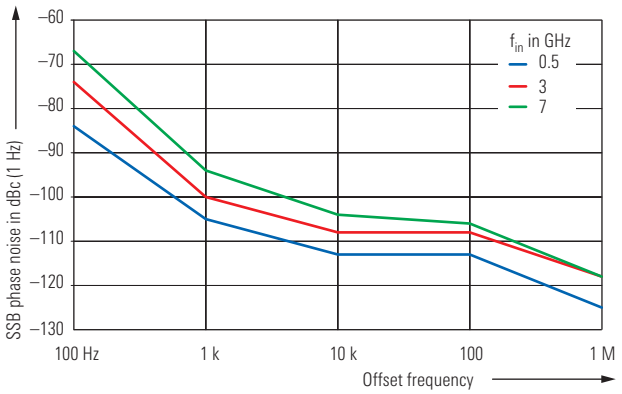
- Fast and easy disassembly
- Small number of materials
- Mutual compatibility of materials
- Easy identification of substances through appropriate marking (plastics)

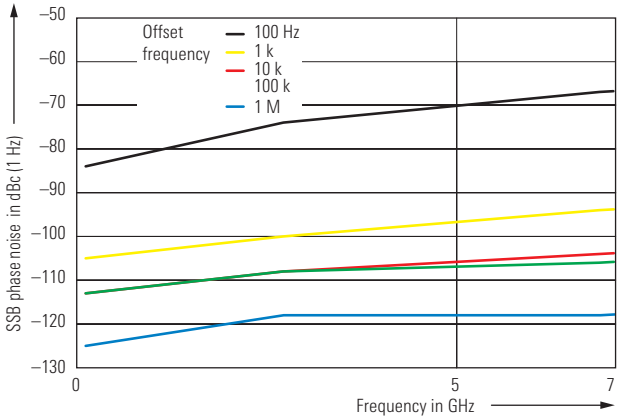
Specifications

Specifications apply under the following conditions: 15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and total calibration performed. Data designated "nominal" applies to design parameters and is not tested. Data designated "σ = xx dB" indicates the standard deviation.

	R&S®ESPI3	R&S®ESPI7
Frequency		
Frequency range	9 kHz to 3 GHz	9 kHz to 7 GHz
Frequency resolution	0.01 Hz	
Internal reference frequency (nominal)		
Aging per year[1]	1×10^{-6}	
Temperature drift (+5 °C to +45 °C)	1×10^{-6}	
With option R&S®FSP-B4 (OCXO)		
Aging per year[1]	1×10^{-7}	
Temperature drift (+5 °C to +45 °C)	1×10^{-8}	
External reference frequency	10 MHz	
Frequency display (receiver mode)		
Display	numeric display	
Resolution	0.1 Hz	
Frequency display (analyzer mode)		
Display	with marker or frequency counter	
Resolution	span/500	
Accuracy (sweep time >3 × auto sweep time)	±(frequency × reference error + 0.5 % × span + 10 % × resolution bandwidth + ½ (last digit))	
Frequency counter		
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 3 GHz	0 Hz, 10 Hz to 7 GHz
Resolution/accuracy of display range	0.1 %	
Spectral purity (dBc (1 Hz)) SSB phase noise, f = 500 MHz, for frequencies > 500 MHz see diagram		
Carrier offset 100 Hz 1 kHz 10 kHz 100 kHz[2] 1 MHz[2] 10 MHz	 <–84, typ. –90 typ. <–100, –108 typ. <–106, –113 typ. <–110, –113 typ. <–120, –125 typ. –145 typ.	
Residual FM, f = 500 MHz, RBW 1 kHz, sweep time 100 ms	typ. 3 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) Resolution	1 µs to 16000 s 125 ns	
Span ≥10 Hz Max. deviation	2.5 ms to 16000 s 1%	
IF bandwidths (receiver mode)		
Bandwidths (–3 dB)	10 Hz to 10 MHz; in 1, 3, 10 sequence	
Bandwidth error ≤100 kHz 300 kHz to 3 MHz 10 MHz	 <3% <10% +10%, –30%	
Shape factor $BW_{60\,dB}$: $BW_{3\,dB}$ ≤100 kHz 300 kHz to 3 MHz 10 MHz	 <5:1 (Gaussian filter) <15:1 (4-circuit synchronously tuned filters) <7:1	

1) After 30 days of operation.
2) Valid for span >100 kHz.





Typical values for SSB phase noise (referenced to 1 Hz bandwidth)

Carrier offset	f_{in} = 3 GHz	f_{in} = 7 GHz
100 Hz	–74 dBc	–67 dBc
1 kHz	–100 dBc	–94 dBc
10 kHz	–108 dBc	–104 dBc
100 kHz	–108 dBc	–106 dBc
1 MHz	–118 dBc	–118 dBc

Preselector (option R&S®ESPI-B2), can be switched off in analyzer mode			
Filter	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	2 MHz	tracking
4	8 MHz to 30 MHz	6 MHz	tracking
5	30 MHz to 70 MHz	15 MHz	tracking
6	70 MHz to 150 MHz	30 MHz	tracking
7	150 MHz to 300 MHz	60 MHz	tracking
8	300 MHz to 600 MHz	80 MHz	tracking
9	600 MHz to 1000 MHz	100 MHz	tracking
10	1 GHz to 2 GHz	highpass filter	tracking
11	2 GHz to 3 GHz	highpass filter	fixed
Preamplifier (9 kHz to 3 GHz)		can be switched between preselector and 1st mixer, gain 20 dB	

	R&S®ESPI 3	R&S®ESPI 7
EMI bandwidths	200 Hz, 9 kHz, 120 kHz (–6 dB) 1 MHz (pulse bandwidth)	
Bandwidth error ≤120 kHz 1 MHz	<3% 10%, nominal	
Shape factor $BW_{60\,dB}$: $BW_{6\,dB}$ ≤120 kHz 1 MHz	<5:1 (Gaussian filter) <15:1 (4-circuit synchronously tuned filters)	
Resolution bandwidths (analyzer mode)		
Bandwidths (–3 dB)	10 Hz to 10 MHz; in 1, 3, 10 sequence	
Bandwidth error ≤100 kHz 300 kHz to 3 MHz 10 MHz	<3% <10% +10%, –30%	
Shape factor $BW_{60\,dB}$: $BW_{3\,dB}$ ≤100 kHz 300 kHz to 3 MHz 10 MHz	<5:1 (Gaussian filter) <15:1 (4-circuit synchronously tuned filters) <7	
EMI bandwidths	200 Hz, 9 kHz, 120 kHz (–6 dB) 1 MHz (pulse bandwidth)	
Bandwidth error ≤120 kHz 1 MHz	<3% 10%, nominal	
Shape factor $BW_{60\,dB}$: $BW_{6\,dB}$ ≤120 kHz 1 MHz	<5:1 (Gaussian filter) <15:1 (4-circuit synchronously tuned filters)	
Video bandwidths	1 Hz to 10 MHz; in 1, 3, 10 sequence	
FFT filter		
Bandwidths (–3 dB)	1 Hz to 30 kHz (–3 dB); in 1, 3, 10 sequence	
Bandwidth error, nominal	5%	
Shape factor $BW_{60\,dB}$: $BW_{3\,dB}$, nominal	2.5	
Level		
Display range	displayed average noise level to 137 dBµV	
Maximum input level		
DC voltage	50 V	
RF attenuation 0 dB		
CW RF power	127 dBµV (= 0.3 W)	
Pulse spectral density	97 dB(µV/MHz)	
RF attenuation ≥10 dB		
CW RF power	137 dBµV (= 1 W)	
Max. pulse voltage	150 V	
Max. pulse energy (10 µs)	1 mWs	
1 dB compression of input mixer		
0 dB RF attenuation, f > 200 MHz, without preselector	0 dBm nominal	
Intermodulation		
3rd-order intermodulation (TOI)		
Intermodulation-free dynamic range, level 2 × –30 dBm, Δf > 5 × RBW or 10 kHz, whichever is larger		
20 MHz to 200 MHz	>70 dBc, TOI >5 dBm	
200 MHz to 3 GHz	>74 dBc, TOI >7 dBm (typ. 10 dBm)	
3 GHz to 7 GHz	–	>80 dBc, TOI >10 dBm (typ. 15 dBm)
With option R&S®ESPI-B2, preselector switched on, preamplifier switched off		
20 MHz to 200 MHz	>65 dBc, TOI >0 dBm	
200 MHz to 3 GHz	>69 dBc, TOI >2 dBm (typ. 5 dBm)	

	R&S®ESPI 3	R&S®ESPI 7
With option R&S®ESPI-B2, preselector switched on, preamplifier switched on		
20 MHz to 200 MHz	>45 dBc, TOI >–20 dBm	
200 MHz to 3 GHz	>49 dBc, TOI >–18 dBm (typ. –15 dBm)	
Second harmonic intercept point (SHI)		
<100 MHz	typ. 25 dBm	
100 MHz to 3 GHz	typ. 35 dBm	
3 GHz to 7 GHz	–	typ. 45 dBm
With option R&S®ESPI-B2, preselector switched on, preamplifier switched off		
4 MHz to 100 MHz	>40 dBm	
100 MHz to 3 GHz	>50 dBm	
With option R&S®ESPI-B2, preselector switched on, preamplifier switched on		
4 MHz to 100 MHz	>25 dBm	
100 MHz to 3 GHz	>35 dBm	
Displayed average noise level		
0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, 20 averages, trace average, zero span, 50 Ω termination		
9 kHz	<–95 dBm	
100 kHz	<–100 dBm	
1 MHz	<–120 dBm, typ. –125 dBm	
10 MHz to 1 GHz	<–142 dBm, typ. –145 dBm	<–140 dBm, typ. –145 dBm
1 GHz to 3 GHz	<–140 dBm, typ. –145 dBm	<–138 dBm, typ. –143 dBm
3 GHz to 7 GHz	–	<–138 dBm, typ. –143 dBm
With option R&S®ESPI-B2, preselector switched on, preamplifier switched off		
9 kHz	<–95 dBm	
100 kHz	<–100 dBm	
1 MHz	<–120 dBm, typ. –125 dBm.	
10 MHz to 1 GHz	<–142 dBm, typ. –145 dBm	<–140 dBm, typ. –145 dBm
1 GHz to 3 GHz	<–140 dBm, typ. –145 dBm	<–138 dBm, typ. –143 dBm
With option R&S®ESPI-B2, preselector switched on, preamplifier switched on		
9 kHz	<–105 dBm	
100 kHz	<–110 dBm	
1 MHz	<–130 dBm, typ. –137 dBm	
10 MHz to 1 GHz	<–152 dBm, typ. –155 dBm	<–150 dBm, typ. –153 dBm
1 GHz to 3 GHz	<–150 dBm, typ. –153 dBm	<–148 dBm, typ. –151 dBm
Immunity to interference		
Image rejection	>70 dB	
Intermediate frequency (f < 3 GHz)	>70 dB	
Spurious responses (f > 1 MHz, without input signal, 0 dB attenuation)	<–103 dBm	
Other spurious (with input signal, mixer level <–10 dBm, Δf > 100 kHz)	f < 7 GHz: <–70 dBc	
Level display (receiver mode)		
Digital	numeric; 0.01 dB resolution	
Analog	bargraph display, separately for each detector	
Spectrum	level axis 10 dB to 200 dB in 10 dB steps, frequency axis user-selectable, linear or logarithmic	
Units of level display	dBµV, dBm, dBµA, dBpW, dBpT	

	R&S®ESPI 3	R&S®ESPI 7
Detectors	MaxPeak, MinPeak, Average, Quasi-Peak (QP), Average with meter time constant (CAV), RMS and RMS Average (CRMS) 3 detectors can be switched on simultaneously	
Measurement time	100 µs to 100 s, selectable	
Level display (analyzer mode)		
Result display	501 × 400 pixels (one diagram), max. 2 diagrams with independent settings	
Log level scale	10 dB to 200 dB in 10 dB steps	
Linear level scale	10% of reference level per level division (10 divisions)	
Traces	max. 3 per diagram	
Trace detectors	MaxPeak, MinPeak, AutoPeak, Sample, RMS, Average, Quasi-Peak	
Trace functions	Clear/Write, MaxHold, MinHold, Average	
Setting range of reference level		
Logarithmic level display	–130 dBm to +30 dBm, in 0.1 dB steps	
Linear level display	70.71 nV to 7.07 V; in steps of 1%	
Units of level scale	dBm, dBmV, dBµV, dBµA, dBpW (log level display); mV, µV, mA, µA, pW, nW (linear level display)	
Level measurement accuracy		
Level accuracy at 128 MHz (level = –30 dBm, RF attenuation 10 dB, ref. level –20 dBm, RBW 10 kHz)	<0.2 dB (σ = 0.07 dB)	
Additional error with preselector/preamplifier (with option R&S®ESPI-B2)	0.1 dB	
Quasi-peak display	in line with CISPR 16-1, ≥10 Hz pulse repetition frequency (with option R&S®ESPI-B2)	
Frequency response		
<50 kHz	+0.5/–1.0 dB	
50 kHz to 3 GHz	<0.5 dB (σ = 0.17 dB)	
3 GHz to 7 GHz	–	<2 dB (σ = 0.7 dB)
With option R&S®ESPI-B2, preselector switched on		
<50 kHz	+0.8/–1.3 dB	
50 kHz to 3 GHz	<0.8 dB (σ = 0.27 dB)	
Attenuator	<0.2 dB (σ = 0.07 dB)	
Reference level switching	<0.2 dB (σ = 0.07 dB)	
Display nonlinearity log/lin (S/N > 16 dB)		
RBW ≤120 kHz 0 dB to –70 dB –70 dB to –90 dB	 <0.2 dB (σ = 0.07 dB) <0.5 dB (σ = 0.17 dB)	
RBW ≥300 kHz 0 dB to –50 dB –50 dB to –70 dB	 <0.2 dB (σ = 0.07 dB) <0.5 dB (σ = 0.17 dB)	
Bandwidth switching uncertainty (referenced to RBW = 10 kHz) 10 Hz to 100 kHz 300 kHz to 10 MHz FFT 1 Hz to 3 kHz	 <0.1 dB (σ = 0.03 dB) <0.2 dB (σ = 0.07 dB) <0.2 dB (σ = 0.03 dB)	
Total measurement uncertainty 0 Hz to 3 GHz Analyzer without preselection Receiver/analyzer with preselection	 0.5 dB <1.5 dB	
Audio demodulation		
Modulation modes	AM and FM	
Audio output	loudspeaker and headphones output	

	R&S®ESPI 3	R&S®ESPI 7
Trigger functions		
Trigger		
Span ≥10 Hz		
Trigger source	free run, video, external, IF level	
Trigger offset	125 ns to 100 s, resolution min. 125 ns or 1% of offset	
Span = 0 Hz		
Trigger source	free run, video, external, IF level	
Trigger offset	±125 ns to 100 s, resolution min. 125 ns, depending on sweep time	
Max. deviation of trigger offset	±(125 ns + (0.1% × delay time))	
Gated sweep		
Trigger source	external, IF level, video	
Gate delay	1 µs to 100 s	
Gate length	125 ns to 100 s, resolution min. 125 ns or 1% of gate length	
Max. deviation of gate length	±(125 ns + (0.05% × gate length))	
Inputs and outputs (front panel)		
RF input	N female, 50 Ω	
VSWR (RF attenuation >0 dB)		
f < 3 GHz	1.5:1	
f < 7 GHz	–	2.0:1
Input attenuator	0 dB to 70 dB in 10 dB steps	
Probe power supply	3-pin female: +15 V DC, –12.6 V DC and ground, max. 150 mA 5-pin mini DIN female: ±10 V DC and ground, max. 200 mA	
Keyboard connector	PS/2 female for MF keyboard	
AF output	mini jack	
Output impedance	10 Ω	
Open-circuit voltage	up to 1.5 V; adjustable	
Inputs and outputs (rear panel)		
IF 20.4 MHz	Z_{out} = 50 Ω, BNC female	
Level RBW ≤30 kHz, FFT RBW ≥100 kHz	 –10 dBm at reference level, mixer level >–60 dBm 0 dBm at reference level, mixer level >–60 dBm	
Reference frequency		
Output Output frequency Level	BNC female 10 MHz 0 dBm nominal	
Input Input frequency Required level	BNC female 10 MHz 0 dBm into 50 Ω	
Power supply connector for noise source	BNC female, 0 V and 28 V switchable, max. 100 mA	
External trigger/gate input	BNC female, >10 kΩ	
Voltage	1.4 V	
IEC/IEEE-bus remote control	interface in line with IEC 60625 (IEEE 488.2)	
Command set	SCPI 1997.0	
Connector	24-pin Amphenol female	
Interface functions	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0	
Serial interface	RS-232-C interface (COM), 9-pin D-SUB connector	
Printer interface	parallel interface (Centronics-compatible)	
Mouse connector	PS/2 female	
User interface	25-pin D-SUB female	
Connector for external monitor (VGA)	15-pin D-SUB female	

General data		
Display	21 cm TFT color display (8.4")	
Resolution	640 × 480 pixels (VGA resolution)	
Pixel failure rate	$<2 \times 10^{-5}$	
Mass memory	1.44 Mbyte 3½" disk drive, hard disk	
Data storage	>500 instrument settings	
Environmental conditions		
Operating temperature range	+5 °C to +40 °C	
Permissible temperature range	+5 °C to +45 °C	
Storage temperature range	–40 °C to +70 °C	
Damp heat	+40 °C at 95% rel. humidity (IEC 60068)	
Mechanical resistance		
Vibration test, sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz, meets IEC 60068, IEC 61010, MIL-T-28800D, class 5	
Vibration test, random	10 Hz to 100 Hz, acceleration 1 g (RMS)	
Shock test	40 g shock spectrum, meets MIL-STD-810C and MIL-T-28800D, classes 3 and 5	
Recommended calibration interval	2 years for operation with external reference, 1 year with internal reference	
Power supply		
AC supply	100 V to 240 V AC, 50 Hz to 400 Hz, protection class I to VDE 411	
Power consumption	70 VA (R&S®ESPI3)	120 VA (R&S®ESPI7)
Safety	meets EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1, IEC 61010	
RFI suppression	meets EMC Directive of EU (89/336/EEC) and German EMC law	
Test mark	VDE, GS, CSA, CSA-NRTL/C	
Dimensions (W × H × D)	412 mm × 197 mm × 417 mm	
Weight	10.5 kg (R&S®ESPI3)	11.3 kg (R&S®ESPI7)

Certified Quality System ISO 9001

Certified Environmental System ISO 14001

Ordering information

Designation	Type	Order No.
Test Receiver 9 kHz to 3 GHz	R&S®ESPI3	1164.6407.03
Test Receiver 9 kHz to 7 GHz	R&S®ESPI7	1164.6407.07
Accessories supplied		
Power cable, operating manual, service manual		
Options		
Preselector/Preamplifier for R&S®ESPI (factory-fitted)	R&S®ESPI-B2	1129.7498.03
Extended Environmental Specifications (random vibration 1.9 g RMS, temperature 0 °C to 55 °C)	R&S®ESPI-B20	1155.1606.03
Trigger for Coverage Measurements	R&S®ESPI-K50	1106.4386.02
Rugged Case, Carrying Handle (factory-fitted)	R&S®FSP-B1	1129.7998.02
OCXO Reference Frequency	R&S®FSP-B4	1129.6740.02
TV Trigger and Adjustable RF Power Trigger (40 dB) for R&S®FSP and R&S®ESPI	R&S®FSP-B6	1129.8594.02
Internal Tracking Generator 9 kHz to 3 GHz, I/Q modulator, for all R&S®ESPI models	R&S®FSP-B9	1129.6991.02
External Generator Control for all R&S®ESPI models	R&S®FSP-B10	1129.7246.02
LAN Interface 100BaseT for all R&S®ESPI models	R&S®FSP-B16	1129.8042.03XP
DC Power Supply for Spectrum Analyzers R&S®FSP/ESPI	R&S®FSP-B30	1155.1158.02
Battery Pack for Spectrum Analyzers R&S®FSP/ESPI[1]	R&S®FSP-B31	1155.1258.02
Spare Battery Pack for Spectrum Analyzers R&S®FSP/ESPI[2]	R&S®FSP-B32	1155.1506.02
Noise Measurement Software	R&S®FS-K3	1057.3028.02
AM/FM Measurement Demodulator	R&S®FS-K7	1141.1796.02

Designation	Type	Order No.
Recommended extras		
Pulse Limiter 0 Hz to 30 MHz	R&S®ESH3-Z2	0357.8810.54
Control Cable for V-Network R&S®ESH2-Z5 (2 m)	R&S®EZ-13	1026.5293.02
Control Cable for V-Network R&S®ESH3-Z5 (2 m)	R&S®EZ-14	1026.5341.02
Headphones	–	0708.9010.00
US Keyboard with trackball	R&S®PSP-Z2	1091.4100.02
PS/2 Mouse	R&S®FSE-Z2	1084.7043.02
IEC/IEEE-Bus Cable, 1 m	R&S®PCK	0292.2013.10
IEC/IEEE-Bus Cable, 2 m	R&S®PCK	0292.2013.20
19" Rack Adapter (not for R&S®FSP-B1)	R&S®ZZA478	1096.3248.00
Trolley	R&S®ZZK-1	1014.0510.00
Soft Carrying Case, grey	R&S®ZZT 473	1109.5048.00
Matching Pads, 75 Ω L Section Series Resistor, 25 Ω[3] SWR Bridge, 5 MHz to 3000 MHz	 R&S®RAM R&S®RAZ R&S®ZRB2	 0358.5414.02 0358.5714.02 0373.9017.52
High-Power Attenuators, 100 W 3/6/10/20/30 dB	R&S®RBU100	1073.8820.XX (XX = 03/06/10/20/30)
High-Power Attenuators, 50 W 3/6/10/20/30 dB	R&S®RBU50	1073.8695.XX (XX = 03/06/10/20/30)

1) R&S®FSP-B1 and R&S®FSP-B30 required.
2) R&S®FSP-B31 required.
3) Taken into account in device function RF INPUT 75 Ω.

See also data sheets

- Accessories for Test Receivers and Spectrum Analyzers: PD 0756.4320
- EMC Test Antennas: PD 0757.5743

For information on EMC training courses or on-the-job training please contact:

Rohde&Schwarz
Training Center
Mühldorfstr. 20
81671 München, Germany
Tel.: +49 89 4129 13051
Fax: +49 89 4129 13335

More information at
www.rohde-schwarz.com
(search term: ESPI)

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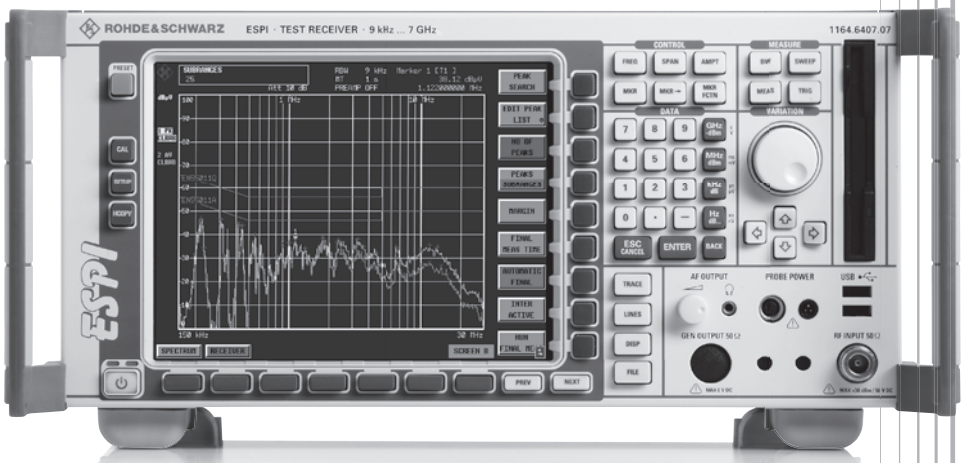
www.rohde-schwarz.com

Europe, Africa, Middle East: +49 1805 12 4242, customersupport@rohde-schwarz.com · North America: 1 888 837 87 72, customer.support@rsa.rohde-schwarz.com
Latin America: +1 410 910 79 88, customersupport.la@rohde-schwarz.com · Asia/Pacific: +65 65 13 04 88, customersupport.asia@rohde-schwarz.com

R&S®ESPI
EMI Test Receiver
Specifications



75 Years of Driving Innovation

ROHDE&SCHWARZ

Version 06.00, April 2009

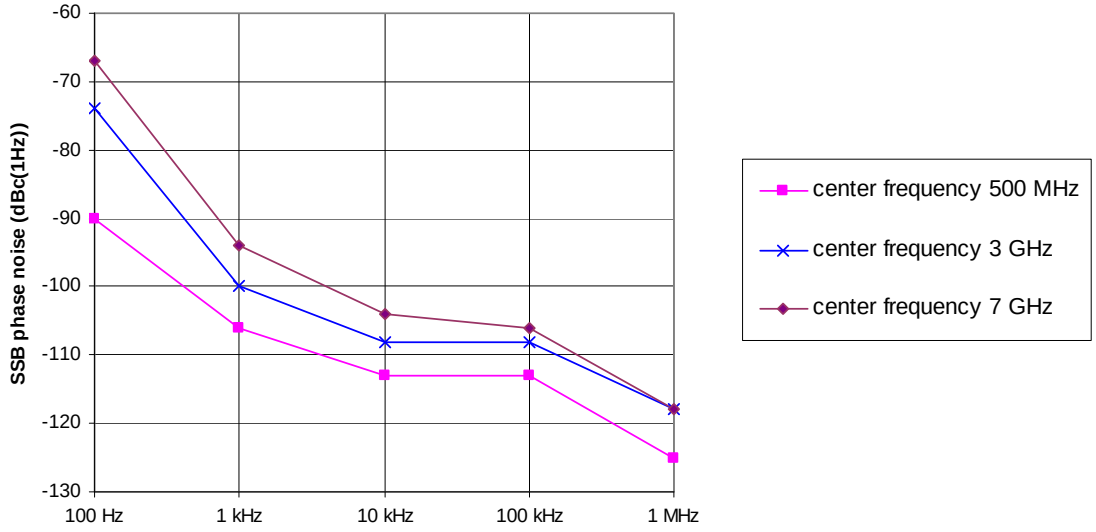
CONTENT

Specifications apply under the following conditions: 15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed. Data without tolerances: typical values only. Data designated 'nominal' applies to design parameters and is not assured by Rohde & Schwarz.

Specifications

Frequency

Frequency range	R&S®ESPI3	9 kHz to 3 GHz
	R&S®ESPI7	9 kHz to 7 GHz
Frequency resolution		0.01 Hz
Internal reference frequency (nominal)	standard	
Aging per year	after 30 days of continuous operation	1×10^{-6}
Temperature drift	+5 °C to +45 °C	1×10^{-6}
Internal reference frequency (nominal)	R&S®FSP-B4 option (OCXO)	
Aging per year	after 30 days of continuous operation	1×10^{-7}
Temperature drift	+5 °C to +45 °C	1×10^{-8}
External reference frequency		10 MHz
Frequency display (receiver mode)		numeric display
Resolution		0.1 Hz
Frequency display (analyzer mode)		with marker or frequency counter
Marker resolution		span/500
Max. deviation	sweep time > 3 × auto sweep time	±(marker frequency × reference frequency error + 0.5 % × span + 10 % × resolution bandwidth + ½ (last digit))
Frequency counter resolution	selectable	0.1 Hz to 10 kHz
Count accuracy	S/N > 25 dB	±(marker frequency × reference frequency error + ½ (last digit))
Display range of frequency axis	R&S®ESPI3	0 Hz, 10 Hz to 3 GHz
	R&S®ESPI7	0 Hz, 10 Hz to 7 GHz
Max. deviation of display range		0.1 %
Spectral purity, SSB phase noise	f = 500 MHz, for f > 500 MHz see diagram	
	100 Hz	<–84 dBc (1 Hz), typ. –90 dBc (1 Hz)
	1 kHz	<–100 dBc (1 Hz), typ. –108 dBc (1 Hz)
	10 kHz	<–106 dBc (1 Hz), typ. –113 dBc (1 Hz)
	100 kHz, span > 100 kHz	<–110 dBc (1 Hz), typ. –113 dBc (1 Hz)
	1 MHz, span > 100 kHz	<–120 dBc (1 Hz), typ. –125 dBc (1 Hz)
	10 MHz	typ. –145 dBc (1 Hz)
Residual FM	f = 500 MHz, RBW = 1 kHz, sweep time = 100 ms	typ. 3 Hz



Typical phase noise at different center frequencies

Scan (receiver mode)

Scan		scan of max. 10 subranges with different, independent settings
Measurement time per frequency	selectable	100 µs to 100 s

Sweep (analyzer mode)

Sweep time	in time domain, span = 0 Hz	1 µs to 16000 s, resolution 125 ns
	in frequency domain, span ≥ 10 Hz	2.5 ms to 16000 s
Max. deviation of sweep time		1 %

Resolution bandwidths

Sweep filters		
3 dB bandwidths		10 Hz to 3 MHz, in steps of 1/3/10
Bandwidth accuracy	≤100 kHz	<3 %
	300 kHz to 3 MHz	<10 %
Shape factor 60 dB : 3 dB	≤100 kHz	<5
	300 kHz to 3 MHz	<15
EMI bandwidths	6 dB bandwidths	200 Hz, 9 kHz, 120 kHz
	pulse bandwidth	1 MHz
Bandwidth accuracy	≤120 kHz	<3 %
	1 MHz	<10 %
Shape factor 60 dB : 6 dB	≤120 kHz	<5
	1 MHz	<15

Video bandwidths	analyzer mode	1 Hz to 10 MHz, in steps of 1/3/10

FFT filters	analyzer mode	
3 dB bandwidths		1 Hz to 30 kHz, in steps of 1/3/10
Bandwidth accuracy		5 %, nominal
Shape factor 60 dB : 3 dB		2.5, nominal

Channel filters		
Bandwidths	(RRC = raised root cosine)	100, 200, 300, 500 Hz; 1, 1.5, 2, 2.4, 2.7, 3, 3.4, 4, 4.5, 5, 6, 8.5, 9, 10, 12.5, 14, 15, 16, 18 (RRC), 20, 21, 24.3 (RRC), 25, 30, 50, 100, 150, 192, 200, 300, 500 kHz 1, 1.228, 1.28 (RRC), 1.5, 2, 3, 3.84 (RRC), 4.096 (RRC), 5 MHz

Preselection (R&S®ESPI-B2 option)

Preselection	can be switched off in analyzer mode	11 preselection filters
Bandwidths (–6 dB), nominal	<150 kHz	230 kHz, fixed-tuned lowpass filter
	150 kHz to 2 MHz	2.6 MHz, fixed-tuned bandpass filter
	2 MHz to 8 MHz	2 MHz, tracking bandpass filter
	8 MHz to 30 MHz	6 MHz, tracking bandpass filter
	30 MHz to 70 MHz	15 MHz, tracking bandpass filter
	70 MHz to 150 MHz	30 MHz, tracking bandpass filter
	150 MHz to 300 MHz	60 MHz, tracking bandpass filter
	300 MHz to 600 MHz	80 MHz, tracking bandpass filter
	600 MHz to 1 GHz	100 MHz, tracking bandpass filter
	1 GHz to 2 GHz	tracking highpass filter
	2 GHz to 3 GHz	fixed-tuned highpass filter
Preamplifier (9 kHz to 3 GHz)	switchable, between preselection and 1st mixer	20 dB

Level

Display range		displayed average noise level (DANL) to 30 dBm
Maximum input level		
DC voltage		50 V
CW RF power	RF attenuation 0 dB	20 dBm
	RF attenuation ≥ 10 dB	30 dBm
Pulse spectral density	RF attenuation 0 dB	97 dB µV/MHz
Max. pulse voltage	RF attenuation ≥ 10 dB, 10 µs	150 V
Max. pulse energy	RF attenuation ≥ 10 dB, 10 µs	1 mWs

Intermodulation		
1 dB compression of input mixer	f > 200 MHz, RF attenuation 0 dB, preselection and preamplifier OFF	0 dBm, nominal
Third-order intercept (TOI)	RF attenuation 0 dB, level 2 × –30 dBm, Δf > 5 × RBW or 10 kHz, whichever value is larger	
	without preselection	
	20 MHz to 200 MHz	>5 dBm
	200 MHz to 3 GHz	>7 dBm, typ. 10 dBm
	3 GHz to 7 GHz	> 10 dBm, typ. 15 dBm
	with R&S®ESPI-B2 option, preselection = ON, preamplifier = OFF	
	20 MHz to 200 MHz	>0 dBm
	200 MHz to 3 GHz	>2 dBm, typ. 5 dBm
	with R&S®ESPI-B2 option, preselection = ON, preamplifier = ON	
	20 MHz to 200 MHz	>–20 dBm
	200 MHz to 3 GHz	>–18 dBm, typ. –15 dBm
Second harmonic intercept (SHI)	RF attenuation 0 dB, level –10 dBm, without preselection	
	<100 MHz	typ. 25 dBm
	100 MHz to 1.5 GHz	typ. 35 dBm
	1.5 GHz to 3.5 GHz	typ. 45 dBm
	with R&S®ESPI-B2 option, preselection = ON, preamplifier = OFF, RF attenuation 0 dB, level –15 dBm	
	4 MHz to 100 MHz	>40 dBm
	100 MHz to 1.5 GHz	>50 dBm
	with R&S®ESPI-B2 option, preselection = ON, preamplifier = ON, RF attenuation 0 dB, level –35 dBm	
	4 MHz to 100 MHz	>25 dBm
	100 MHz to 1.5 GHz	>35 dBm

Displayed average noise level (DANL) (analyzer mode)	RF attenuation 0 dB, RBW = 10 Hz, VBW = 1 Hz, span = 0 Hz, trace average function over 20 sweeps, 50 Ω termination	
	without preselection	
	9 kHz	<–95 dBm
	100 kHz	<–100 dBm
	1 MHz	<–120 dBm, typ. –125 dBm
	R&S®ESPI3	
	10 MHz to 1 GHz	<–142 dBm, typ. –145 dBm
	1 GHz to 3 GHz	<–140 dBm, typ. –145 dBm
	R&S®ESPI7	
	10 MHz to 1 GHz	<–140 dBm, typ. –145 dBm
	1 GHz to 3 GHz	<–138 dBm, typ. –143 dBm
	3 GHz to 7 GHz	<–138 dBm, typ. –143 dBm
	with R&S®ESPI-B2 option, preselection = ON, preamplifier = OFF	
	9 kHz	<–95 dBm
	100 kHz	<–100 dBm
	1 MHz	<–120 dBm, typ. –125 dBm
	R&S®ESPI3	
	10 MHz to 1 GHz	<–142 dBm, typ. –145 dBm
	1 GHz to 3 GHz	<–140 dBm, typ. –145 dBm
	R&S®ESPI7	
	10 MHz to 1 GHz	<–140 dBm, typ. –145 dBm
	1 GHz to 3 GHz	<–138 dBm, typ. –143 dBm
	3 GHz to 7 GHz	<–138 dBm, typ. –143 dBm

Displayed average noise level (DANL) (analyzer mode) (continued)	with R&S®ESPI-B2 option, preselection = ON, preamplifier = ON	
	9 kHz	<–105 dBm
	100 kHz	<–110 dBm
	1 MHz	<–130 dBm, typ. –137 dBm
	R&S®ESPI3	
	10 MHz to 1 GHz	<–152 dBm, typ. –155 dBm
	1 GHz to 3 GHz	<–150 dBm, typ. –153 dBm
	R&S®ESPI7	
	10 MHz to 1 GHz	<–150 dBm, typ. –153 dBm
	1 GHz to 3 GHz	<–148 dBm, typ. –151 dBm

Noise indication (receiver mode)	nominal, calculated from DANL data, 0 dB RF attenuation, 50 Ω termination	
Average (AV) display	without preselection	
	9 kHz, BW = 200 Hz	<25 dBµV
	150 kHz, BW = 200 Hz	<20 dBµV
	150 kHz, BW = 9 kHz	<36 dBµV
	1 MHz, BW = 9 kHz	<17 dBµV
	R&S®ESPI3	
	10 MHz to 30 MHz, BW = 9 kHz	<–6 dBµV
	30 MHz to 1 GHz, BW = 120 kHz	<6 dBµV
	1 GHz to 3 GHz, BW = 1 MHz	<16 dBµV
	R&S®ESPI7	
	10 MHz to 30 MHz, BW = 9 kHz	<–4 dBµV
	30 MHz to 1 GHz, BW = 120 kHz	<8 dBµV
	1 GHz to 7 GHz, BW = 1 MHz	<18 dBµV
	with R&S®ESPI-B2 option, preamplifier = OFF	
	9 kHz, BW = 200 Hz	<25 dBµV
	150 kHz, BW = 200 Hz	<20 dBµV
	150 kHz, BW = 9 kHz	<36 dBµV
	1 MHz, BW = 9 kHz	<17 dBµV
	R&S®ESPI3	
	10 MHz to 30 MHz, BW = 9 kHz	<–6 dBµV
	30 MHz to 1 GHz, BW = 120 kHz	<6 dBµV
	1 GHz to 3 GHz, BW = 1 MHz	<16 dBµV
	R&S®ESPI7	
	10 MHz to 30 MHz, BW = 9 kHz	<–4 dBµV
	30 MHz to 1 GHz, BW = 120 kHz	<8 dBµV
	1 GHz to 7 GHz, BW = 1 MHz	<18 dBµV
	with R&S®ESPI-B2 option, preamplifier = ON	
	9 kHz, BW = 200 Hz	<15 dBµV
	150 kHz, BW = 200 Hz	<10 dBµV
	150 kHz, BW = 9 kHz	<26 dBµV
	1 MHz, BW = 9 kHz	<7 dBµV
	R&S®ESPI3	
	10 MHz to 30 MHz, BW = 9 kHz	<–16 dBµV
	30 MHz to 1 GHz, BW = 120 kHz	<–4 dBµV
	1 GHz to 3 GHz, BW = 1 MHz	<6 dBµV
	R&S®ESPI7	
	10 MHz to 30 MHz, BW = 9 kHz	<–14 dBµV
	30 MHz to 1 GHz, BW = 120 kHz	<–2 dBµV
	1 GHz to 7 GHz, BW = 1 MHz	<8 dBµV
Increase of DANL relative to AV display	Max peak	typ. +11 dB
	RMS	typ. +1 dB
	Quasi peak	
	band A	typ. +3 dB
	band B	typ. +4 dB
	bands C and D	typ. +6 dB

Immunity to interference		
Image frequency		>70 dB
Intermediate frequency		>70 dB
Spurious response	f > 1 MHz, 0 dB RF attenuation, without input signal	<–103 dBm
Other interfering signals	Δf > 100 kHz, mixer level < –10 dBm	<–70 dBc

Level display (receiver mode)		
Level display	digital	numeric, resolution 0.01 dB
	analog	bargraph display separate for each detector
Spectrum	level axis	10 dB to 200 dB in steps of 10 dB
	frequency axis	linear or logarithmic selectable
Detectors	three detectors can be switched on simultaneously	average (AV), RMS, Max Peak, Min Peak, Quasi Peak (QPK), CISPR AV, CISPR RMS
Units of level display		dBµV, dBm, dBµA, dBpW, dBpT
Measurement time	selectable	100 µs to 100 s

Level display (analyzer mode)		
Screen		501 × 400 pixel (one measurement diagram); max. 2 measurement diagrams with independent settings
Logarithmic level display range		1 dB, 10 dB to 200 dB in steps of 10 dB
Linear level display range		10 % of reference level per level division, 10 divisions
Number of traces	1 measurement diagram	3
	2 measurement diagrams	6
Trace detectors		Max Peak, Min Peak, Auto Peak, Sample, Quasi Peak, Average, RMS
Trace functions		Clear/Write, Max Hold, Min Hold, Average
Number of measurement points	default value	501
	range	125 to 8001 in steps of approx. a factor of 2
Setting range of reference level	logarithmic level display	–130 dBm to +30 dBm in steps of 0.1 dB
	linear level display	70.71 nV to 7.07 V in steps of 1%
Units of level axis	logarithmic level display	dBm, dBmV, dBµV, dBµA, dBpW
	linear level display	mV, µV, mA, µA, nW, pW

Max. uncertainty of level measurement		
Reference level uncertainty at 128 MHz	level = –30 dBm, RF attenuation 10 dB, RBW 10 kHz, reference level –20 dBm	
	without preselection	<0.2 dB (σ = 0.07 dB)
	with R&S®ESPI-B2 option, preselection/preamplifier = ON	<0.3 dB (σ = 0.1 dB)
Frequency response referenced to 128 MHz	without preselection	
	<50 kHz	+0.5 dB/–1 dB, nominal
	50 kHz to 3 GHz	<0.5 dB (σ = 0.17 dB)
	3 GHz to 7 GHz	<2 dB (σ = 0.7 dB)
	with R&S®ESPI-B2 option, preselection/preamplifier = ON	
	<50 kHz	+0.8 dB/–1.3 dB, nominal
	50 kHz to 3 GHz	<0.8 dB (σ = 0.27 dB)
Uncertainty of attenuator setting	f = 128 MHz, 0 dB to 70 dB, referenced to 10 dB RF attenuation	<0.2 dB (σ = 0.07 dB)
Uncertainty of reference level setting		<0.2 dB (σ = 0.07 dB)
Log/lin display nonlinearity	S/N > 16 dB	
	RBW ≤ 100 kHz	
	0 dB to –70 dB	<0.2 dB (σ = 0.07 dB)
	–70 dB to –90 dB	<0.5 dB (σ = 0.17 dB)
	RBW > 100 kHz	
	0 dB to –50 dB	<0.2 dB (σ = 0.07 dB)
	–50 dB to –70 dB	<0.5 dB (σ = 0.17 dB)
Bandwidth switching uncertainty	referenced to RBW = 10 kHz	
	10 kHz to 100 kHz	<0.1 dB (σ = 0.03 dB)
	300 kHz to 10 MHz	<0.2 dB (σ = 0.07 dB)
	FFT filter, 1 Hz to 3 kHz	<0.2 dB (σ = 0.07 dB)
Total measurement uncertainty	analyzer without preselection	0.5 dB
	receiver/analyzer with preselection/preamplifier	1.5 dB
Quasi-peak indication	with R&S®ESPI-B2 option, pulse repetition frequency ≤10 Hz	in line with CISPR 16-1,

Trigger functions

Trigger		
Trigger source		free run, video, external, IF level
Trigger offset	span ≥ 10 Hz	125 ns to 100 s, resolution min. 125 ns (or 1 % of offset)
	span = 0 Hz	±(125 ns to 100 s), resolution min. 125 ns, dependent on sweep time
Max. deviation of trigger offset		±(125 ns + (0.1 % × trigger offset))
Gated sweep		
Gate source		video, external, IF level
Gate delay		1 µs to 100 s
Gate length		125 ns to 100 s, resolution min. 125 ns (or 1 % of gate length)
Max. deviation of gate length		±(125 ns + (0.1 % × gate length))

Audio demodulation

AF demodulation modes		AM and FM
Audio output		loudspeaker and earphone jack
Marker hold time in analyzer mode	selectable	100 ms to 60 s

Inputs and outputs (front panel)

RF input		
Impedance		50 Ω
Connector		N female
	RF attenuation ≥ 10 dB	
	9 kHz to 3 GHz	1.5
	3 GHz to 7 GHz	2
Setting range of attenuator		0 dB to 70 dB in steps of 10 dB

Probe power supply		
Supply voltages		+15 V DC, –12.6 V DC and ground, max. 150 mA, nominal

Power supply for antennas, etc		
Supply voltages		±10 V DC and ground, max. 100 mA, nominal

USB interface		2 ports, type A plug, version 2.0

AF output		
Connector		3.5 mm jack
Impedance		10 Ω
Open-circuit voltage		adjustable up to 1.5 V

Inputs and outputs (rear panel)

IF 20.4 MHz		
Connector		BNC female
Impedance		50 Ω
Level	mixer level > –60 dBm	
	RBW ≤ 100 kHz or FFT	–10 dBm at reference level
	RBW > 100 kHz	0 dBm at reference level

Reference frequency output		
Connector		BNC female
Impedance		50 Ω
Output frequency		10 MHz
Level		0 dBm, nominal

Reference frequency input		
Connector		BNC female
Input frequency		10 MHz
Required level		0 dBm from 50 Ω

Power supply for noise source		
Connector		BNC female
Output voltage	switchable	28 V, nominal

External trigger/gate input		
Connector		BNC female
Impedance		>10 kΩ
Trigger voltage		1.4 V (TTL)

IEC/IEEE bus remote control		interface to IEC 625-2 (IEEE 488.2)
Connector		24-pin Amphenol female
Command set		SCPI 1997.0
Interface functions		SH1, AH1, T6, SR1, RL1, PP1, DC1, DT1, C0

Serial interface		RS-232-C (COM), 9-pin D-sub

Printer interface		parallel (Centronics compatible),

USB interface	upper connector	type A plug, version 1.1
	lower connector	type A plug, version 2.0

External monitor (VGA)		
Connector		VGA-compatible, 15-pin D-sub

User interface		25-pin D-sub

General data

Display		21 cm TFT color display
Resolution		640 × 480 pixel (VGA)
Pixel error rate		$<2 \times 10^{-5}$

Mass memory		1.44 Mbyte 3 ½" disk drive, hard disk
Data storage		>500 instrument setups and traces

Temperature ranges		
Nominal temperature range		+5 °C to +40 °C
	with R&S®ESPI-B20 option	0 °C to +50 °C
Permissible temperature range		+5 °C to +45 °C
	with R&S®ESPI-B20 option	0 °C to +55 °C
Storage temperature range		–40 °C to +70 °C
Climatic loading		+40 °C at 95 % relative humidity (IEC 60068-2-30: 2000-02)

Mechanical resistance		
Sinusoidal vibration		0.5 g from 5 Hz to 150 Hz, max. 2 g at 55 Hz, in line with DIN EN 60068-2-6: 1996-05, DIN EN 60068-2-30: 2000-02, DIN EN 61010-1, MIL-T-28800D, class 5
Random vibration		10 Hz to 100 Hz, acceleration 1 g (RMS)
	with R&S®ESPI-B20 option	10 Hz to 300 Hz, acceleration 1.9 g (RMS)
Shock		40 g shock spectrum, in line with MIL-STD-810C and MIL-T-28800D, classes 3 and 5

Recommended calibration interval	operation with external reference	2 years
	operation with internal reference	1 year

Power supply		
AC supply		100 V AC to 240 V AC, 50 Hz to 400 Hz, 3.1 A to 1.3 A, class of protection I to VDE 411
Power consumption	R&S®ESPI3	typ. 70 VA
	R&S®ESPI7	typ. 120 VA
Safety		in line with EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1, IEC 1010-1
EMC		EMC Directive 2004/108/EC including: EN 61326 class B (emission), CISPR 11/EN 55011/ group 1 class B (emission) EN 61326 table A.1 (immunity, industrial)
Test marks		VDE, GS, CSA, CSA-NRTL/C

Weight and dimensions		
Dimensions	W × H × D	412 mm × 197 mm × 417 mm (16.22 in × 7.76 in × 16.42 in)
Net weight without options, nominal	R&S®ESPI3	10.5 kg (23.15 lb)
	R&S®ESPI7	11.3 kg (24.91 lb)

Ordering information

Order designation	Type	Order No.
Test Receiver 9 kHz to 3 GHz	R&S®ESPI3	1164.6407.03
Test Receiver 9 kHz to 7 GHz	R&S®ESPI7	1164.6407.07
Accessories supplied		
Power cable, operating manual, service manual		

Options

Order designation	Type	Order No.	Remarks
Preselector/Preamplifier for R&S®ESPI (factory-fitted)	R&S®ESPI-B2	1129.7498.03	
Expanded Environmental Specifications	R&S®ESPI-B20	1155.1606.13	
Rugged Case with Carrying Handle	R&S®FSP-B1	1129.7998.02	
OCXO Reference Frequency	R&S®FSP-B4	1129.6740.02	
TV Trigger/RF Power Trigger	R&S®FSP-B6	1129.8594.02	
Internal Tracking Generator, I/Q Modulator	R&S®FSP-B9	1129.6991.02	
External Generator Control	R&S®FSP-B10	1129.7246.03	
LAN Interface 100BT	R&S®FSP-B16	1129.8042.03	
DC Power Supply	R&S®FSP-B30	1155.1158.02	
Battery Pack	R&S®FSP-B31	1155.1258.02	requires R&S®FSP-B1 and R&S®FSP-B30
Spare Battery Pack	R&S®FSP-B32	1155.1506.02	requires R&S®FSP-B31
Trigger for Coverage Measurements	R&S®ESPI-K50	1106.4386.02	
AM/FM Measurment Demodulator	R&S®FS-K7	1141.1796.02	

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Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Regional contact

Europe, Africa, Middle East
+49 1805 12 42 42* or +49 89 4129 137 74
customersupport@rohde-schwarz.com
North America
1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
Latin America
+1 410 910 79 88
customersupport.la@rohde-schwarz.com
Asia/Pacific
+65 65 13 04 88
customersupport.asia@rohde-schwarz.com

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Rohde&Schwarz GmbH&Co. KG
Mühldorfstraße 15 | 81671 München
Phone +49 89 41 290 | Fax +49 89 41 29 121 64

www.rohde-schwarz.com

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*0.14 €/min within German wireline network; rates may vary in other networks (wireline and mobile) and countries.