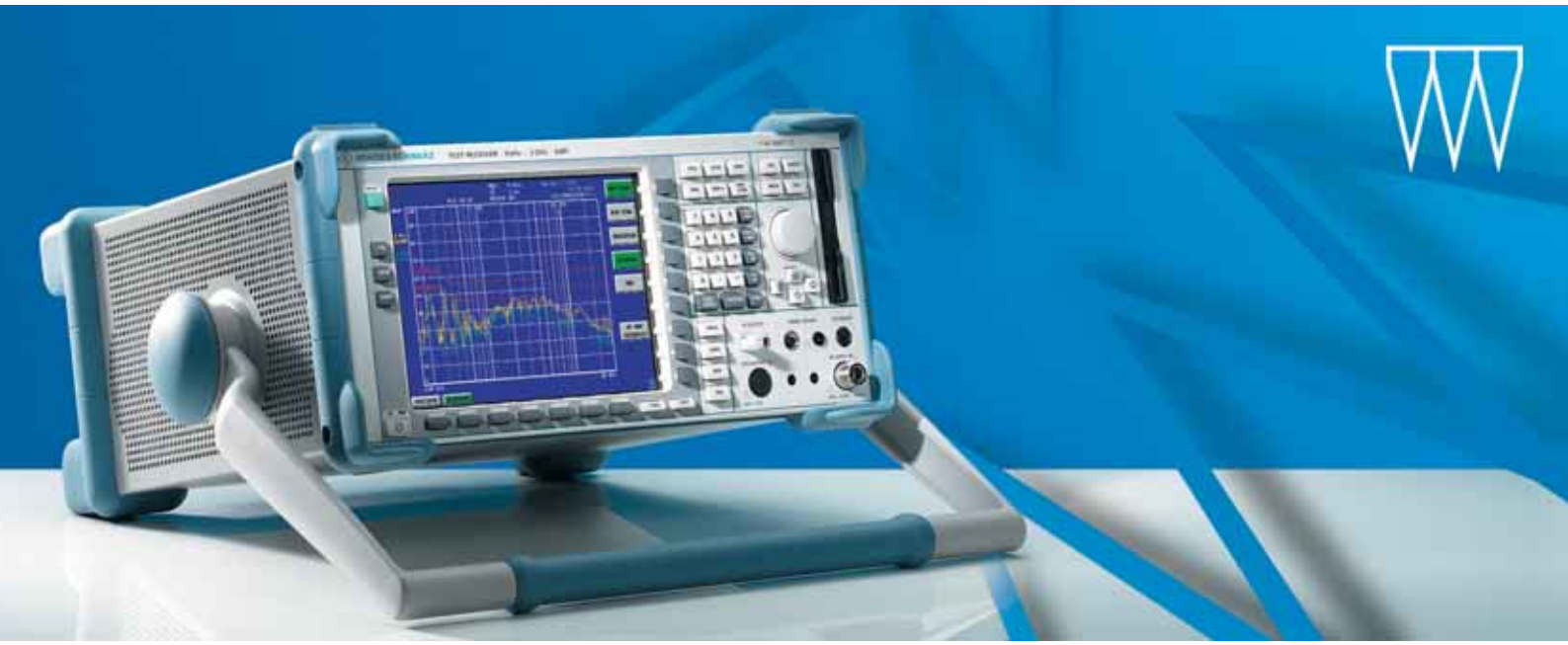


Test Receiver R&S ESPI

The precompliance standard up to 7 GHz

Excellent test receiver features

- Choice of 5 detectors (max. 3 simultaneously)
- EMI measurement bandwidths 200 Hz, 9 kHz, 120 kHz, 1 MHz
- Pulse weighting with quasi-peak detector according to CISPR
- 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 colour display

ROHDE&SCHWARZ

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

- Optimized operating concept thanks 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 top of the middle-end.

Thanks 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 front-end and largely digital signal processing, together with ASICs developed by Rohde&Schwarz, has resulted in a product with top-class specifications and high reliability.

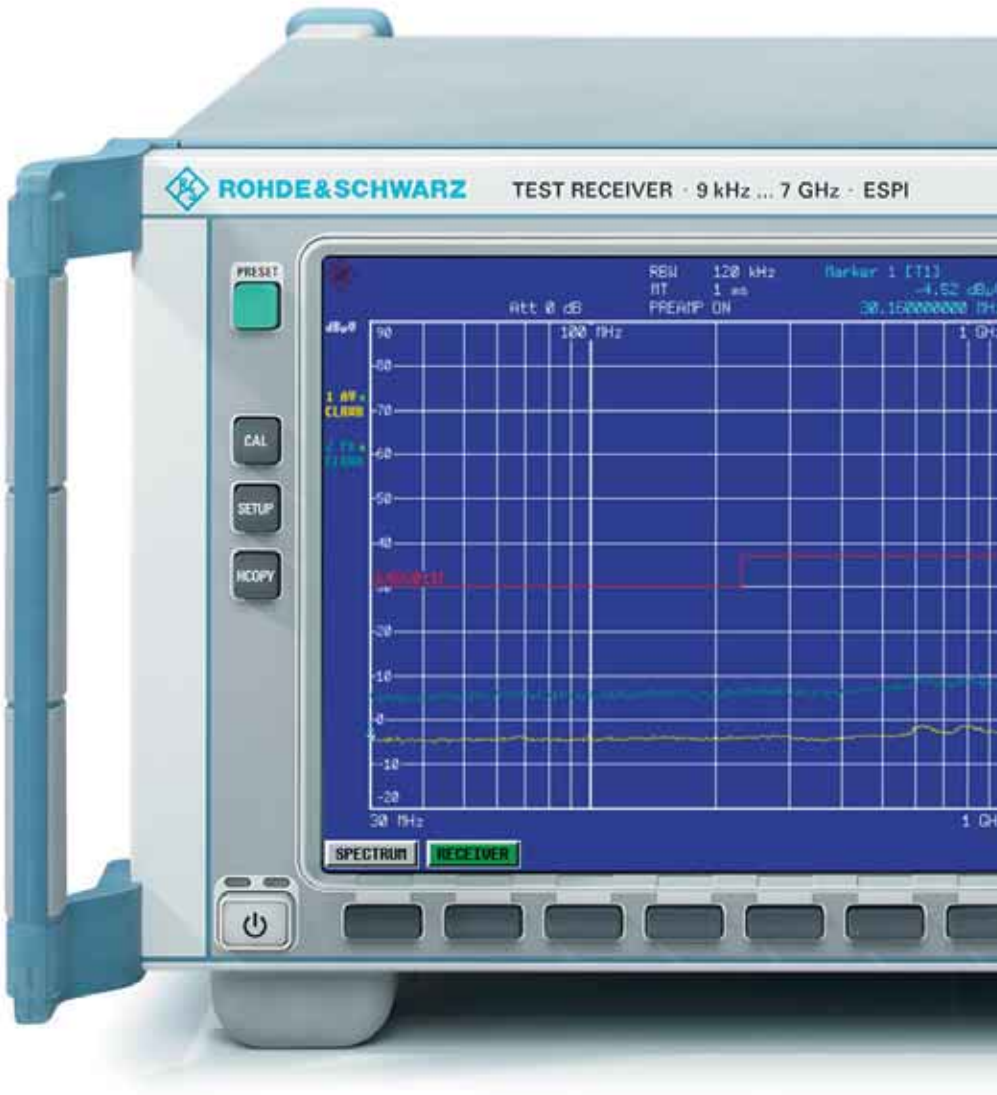
Outstanding features

TEST RECEIVER

- Peak, Quasi-Peak, RMS and AV (max. 3 detectors simultaneously)
- EMI measurement bandwidths 200 Hz, 9 kHz, 120 kHz, 1 MHz
- Correct pulse weighting to CISPR 16-1 from PRF of **10 Hz**
- 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

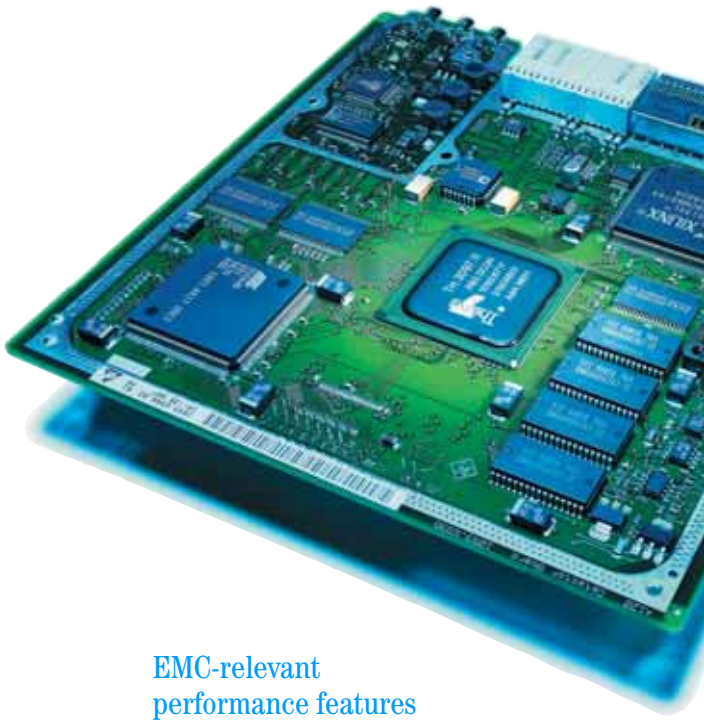
- Resolution bandwidths from 10 Hz to 10 MHz (in 1/3/10 sequence)
- RMS detector for measurements on digitally modulated signals
- Test routines for TOI, ACPR, OBW, amplitude statistics



... the standard in the EMI precompliance class

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



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-conformal 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 demodulation
- EMI bandwidths to CISPR
- Brilliant 21 cm TFT colour display

Precompliance has a name: R&S ESPI3 and R&S ESPI7

Features

The **R&S ESPI3** and **R&S ESPI7**, which are suitable for all commercial EMI standards to 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.

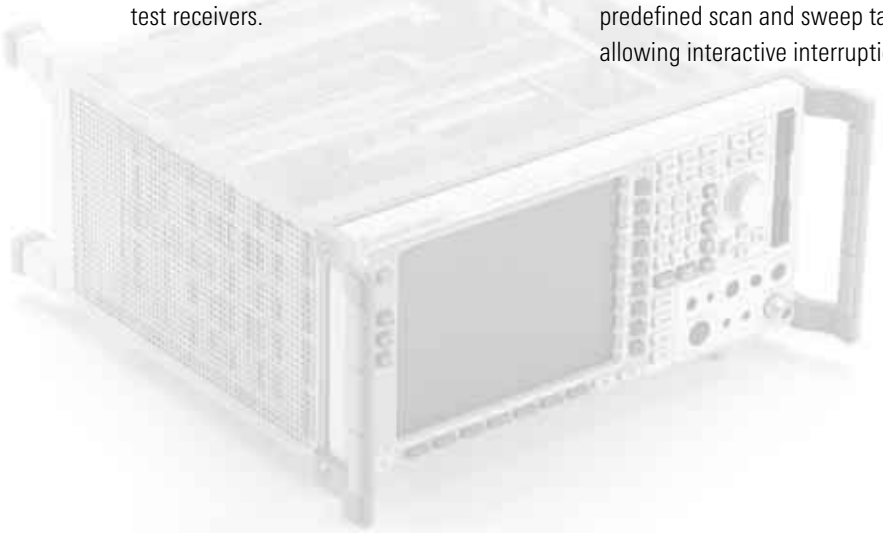
R&S ESPI3: 9 kHz to 3 GHz
R&S ESPI7: 9 kHz to 7 GHz
These two models make it possible to take products through the critical stages of development and the EMC test plan and still be on schedule for approval and market launch.

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

- Manual measurement of EMI spectra thanks 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.



EMI measurements to standard

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** to CISPR 16-1.

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, AV, RMS).

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:

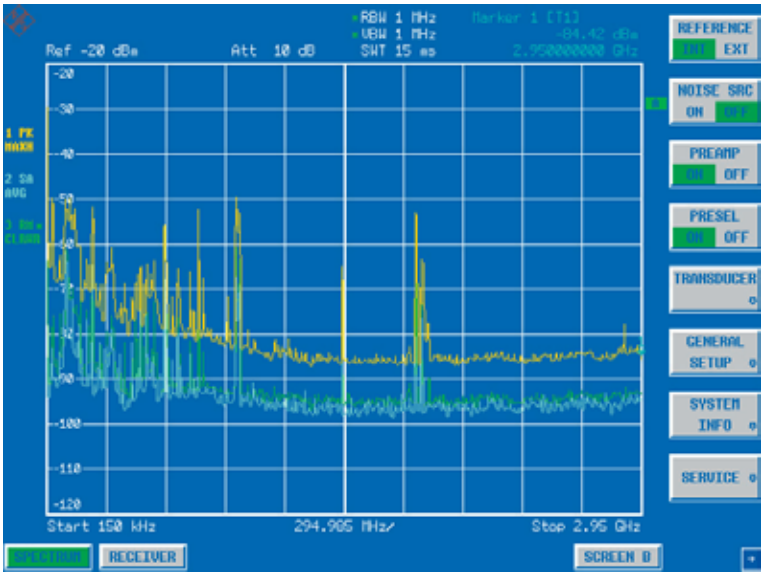
- Analyzer mode: MaxPeak, MinPeak, AutoPeak, Sample, RMS, Average
- Receiver mode: Peak, Quasi-Peak (CISPR), RMS, Average

PEAK =	peak value
QUASI-PEAK =	CISPR weighting
AV =	linear average value
RMS =	RMS value

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

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

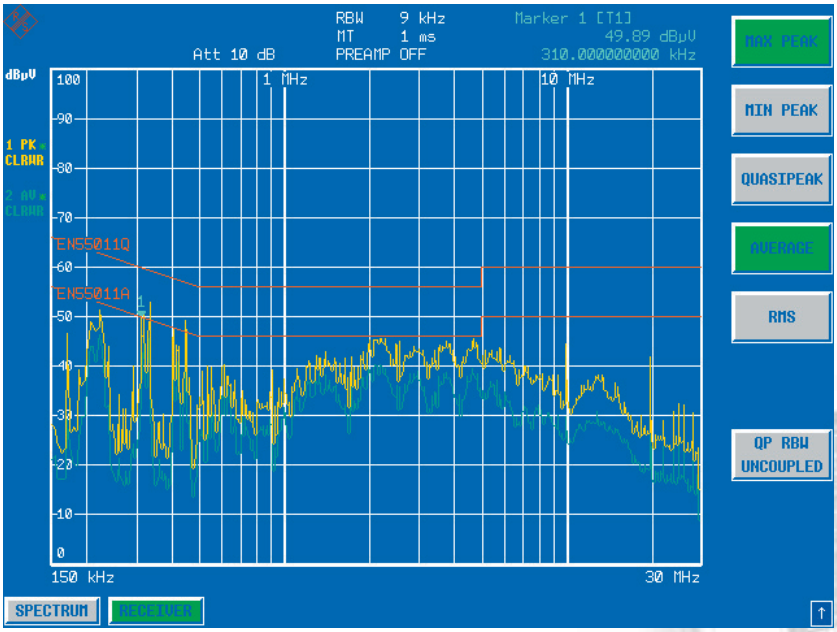
The input stages of precompliance test equipment, which often feature a rather poor overload capability, would be hopelessly overdriven without a preselection unit. This is different with the R&S ESPI where, in combination with preselection filter units, a low-noise preamplifier comes after the filter 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 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.



The measurement bandwidths

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

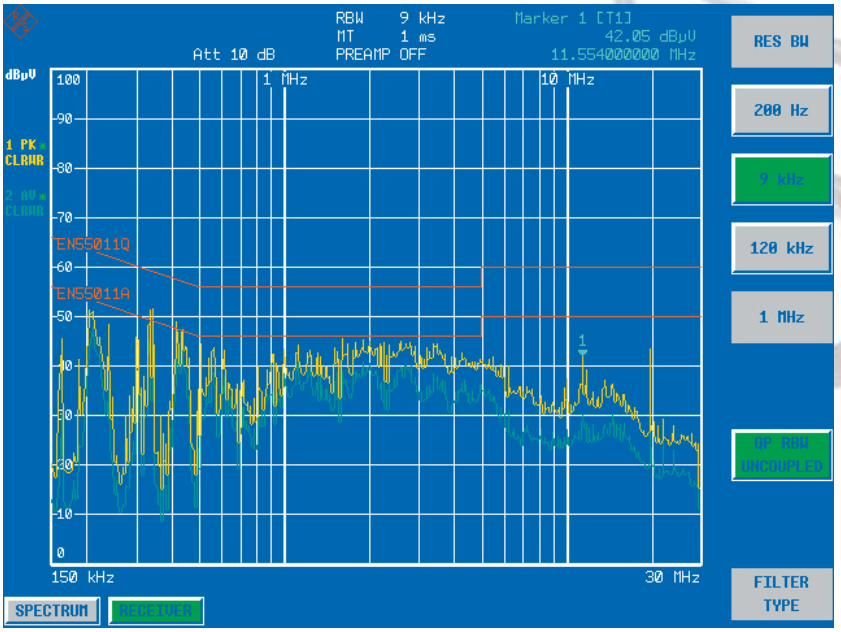
The analyzer mode provides all –3 dB bandwidths from 10 Hz to 10 MHz (in 1/3/10 sequence).

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-conformal 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.

SCAN TABLE

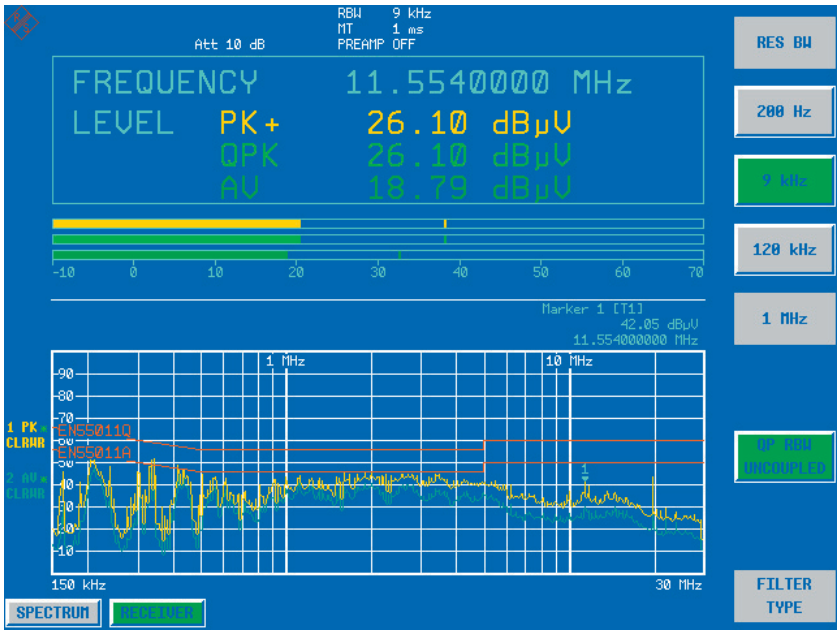
Scan Start	30 MHz				
Scan Stop	3 GHz				
Step Mode	AUTO				
	RANGE 1	RANGE 2	RANGE 3	RANGE 4	RANGE 5
Start	30 MHz	1 GHz			
Stop	1 GHz	3 GHz			
Step Size(A)	40 kHz	400 kHz			
Res BW	120 kHz	1 MHz			
Meas Time	100 µs	100 µs			
Auto Ranging	ON	ON			
RF Attn	10 dB	10 dB			
Preamp	ON	ON			
Auto Preamp	OFF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

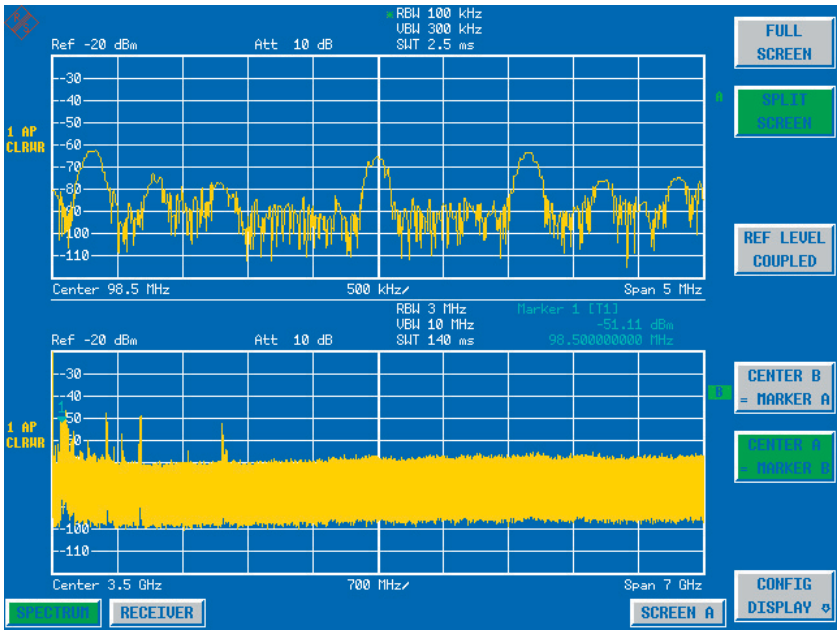
SCAN table

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, the 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

- The large 21 cm display with brilliant colours makes it easy to read parameters and displays results clearly
- 5 different detectors including quasi-peak 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)
- 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

Overview of limit lines

- Minimum sweep time of 2.5 ms supports daily efforts in the lab to cut development times

Additional applications – extra performance

Modern communication 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 thanks 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 –155 dBm (1 Hz) typ. without preamplifier
- Phase noise of –145 dBc (1 Hz) typ. at an offset of 10 MHz provides 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 thanks to a maximum bandwidth deviation of 3%.

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

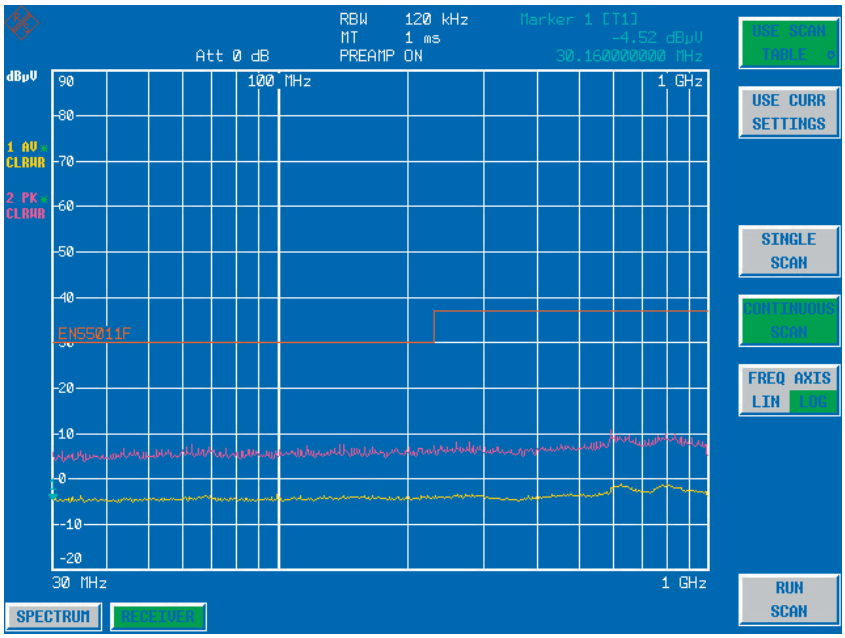
Fit for the future

Thanks 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.

Ergonomics & design

The R&S ESPI sets the new standard in the precompliance class. The 21 cm (8.4") colour 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 handle even complex measurements. Parameters like frequency and amplitude are entered by means of dedicated hardkeys and unit keys.



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

Wide dynamic range

Featuring the lowest displayed average noise level in its class (DANL –145 dBm typ. 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 100 dB typ. – an excellent value even for instruments at the higher end of the market.

Interior view: modular design of test receiver

Phase noise

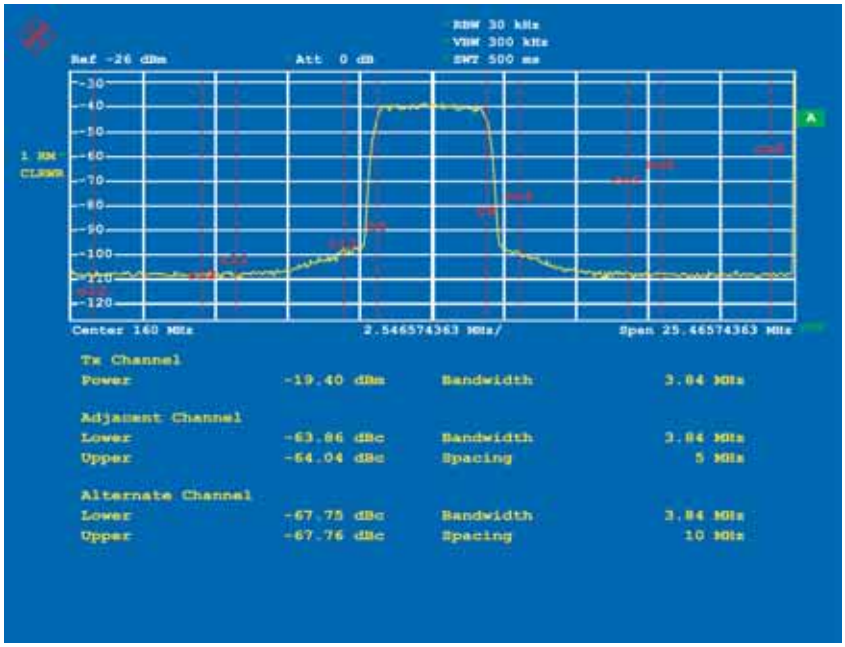
The R&S ESPI's minimal phase noise makes it suitable for demanding measurements both close to the carrier (–113 dBc (1 Hz) typ. at 10 kHz) and far from the carrier (–125 dBc (1 Hz) typ. at 1 MHz). The R&S ESPI is therefore optimally equipped for performing spectral analysis and ACPR measurements on narrowband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

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 individually.

Thanks 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 top of the mid-range – even for ACPR measurements.



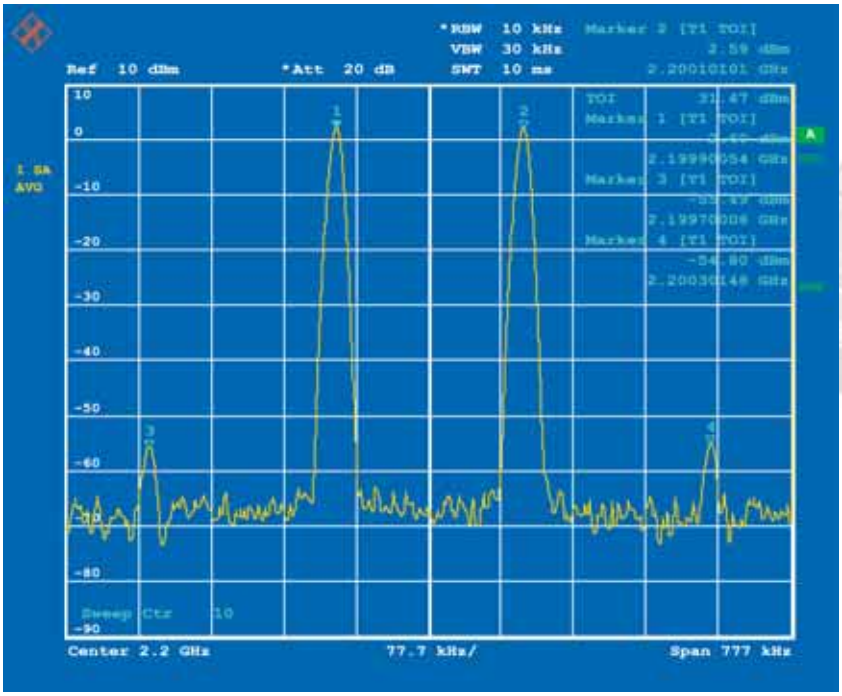
Test routines for TOI, OBW, etc are standard

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.

TOI measurement



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 give 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 like 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 softpanel 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 thanks to PC compatibility

- PC-compatible screenshots, no conversion software needed
- 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 fieldstrength of a communication 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 ks/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: SDB-T (Japan)
- 6.0 MHz: DVB-T (USA)
- 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

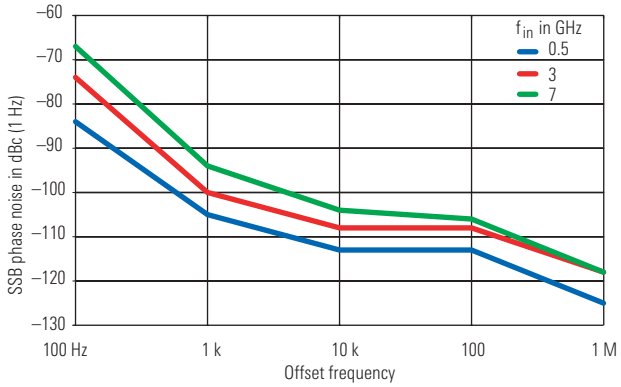
Specifications apply under the following conditions:
15 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and total calibration performed. Data designated "nominal" apply to design parameters and are not tested. Data designated "σ = xx dB"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

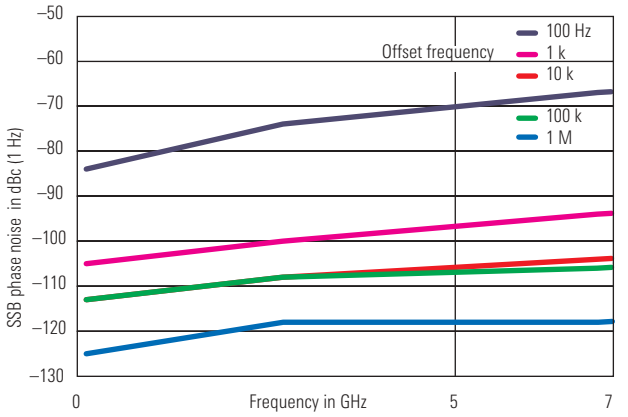
	R&S ESPI3	R&S ESPI7
Frequency		
Frequency range	9 kHz to 3 GHz	9 kHz to 7 GHz
Frequency resolution	0.01 Hz	
Internal reference frequency (nominal)		
Aging per year[1]	1×10^{-6}	
Temperature drift (+5 °C to +45 °C)	1×10^{-6}	
with option R&S FSP-B4 (OCXO)		
Aging per year[1]	1×10^{-7}	
Temperature drift (+5 °C to +45 °C)	1×10^{-8}	
External reference frequency	10 MHz	
Frequency display (receiver mode)		
Display	numerical display	
Resolution	0.1 Hz	
Frequency display (analyzer mode)		
Display	with marker or frequency counter	
Resolution	span/500	
Accuracy (sweep time >3 x auto sweep time)	± (frequency x reference error + 0.5% x span + 10% x resolution bandwidth + ½ (last digit))	
Frequency counter		
Resolution	0.1 Hz to 10 kHz (selectable)	
Count accuracy (S/N >25 dB)	± (frequency x 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	<–84, –90 typ.	
1 kHz	<–100, –108 typ.	
10 kHz	<–106, –113 typ.	
100 kHz[2]	<–110, –113 typ.	
1 MHz[2]	<–120, –125 typ.	
10 MHz	–145 typ.	
Residual FM, f = 500 MHz, RBW 1 kHz, sweep time 100 ms	3 Hz typ.	
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%	

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

Typical values for SSB phase noise (referred 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
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	

	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 x –30 dBm, Δf >5 x RBW or 10 kHz, whichever the greater value		
20 MHz to 200 MHz	>70 dBc, TOI >5 dBm	
200 MHz to 3 GHz	>74 dBc, TOI >7 dBm (10 dBm typ.)	
3 GHz to 7 GHz	–	>80 dBc, TOI >10 dBm (15 dBm typ.)
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 (5 dBm typ.)	
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 (–15 dBm typ.)	
Second harmonic intercept point (SHI)		
<100 MHz	25 dBm typ.	
100 MHz to 3 GHz	35 dBm typ.	
3 GHz to 7 GHz	–	45 dBm typ.

	R&S ESPI 3	R&S ESPI 7
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, –125 dBm typ.	
10 MHz to 1 GHz	<–142 dBm, –145 dBm typ.	<–140 dBm, –145 dBm typ.
1 GHz to 3 GHz	<–140 dBm, –145 dBm typ.	<–138 dBm, –143 dBm typ.
3 GHz to 7 GHz	–	<–138 dBm, –143 dBm typ.
with option R&S ESPI-B2, preselector switched on, preamplifier switched off		
9 kHz	<–95 dBm	
100 kHz	<–100 dBm	
1 MHz	<–120 dBm, –125 dBm typ.	
10 MHz to 1 GHz	<–142 dBm, –145 dBm typ.	<–140 dBm, –145 dBm typ.
1 GHz to 3 GHz	<–140 dBm, –145 dBm typ.	<–138 dBm, –143 dBm typ.
with option R&S ESPI-B2, preselector switched on, preamplifier switched on		
9 kHz	<–105 dBm	
100 kHz	<–110 dBm	
1 MHz	<–130 dBm, –137 dBm typ.	
10 MHz to 1 GHz	<–152 dBm, –155 dBm typ.	<–150 dBm, –153 dBm typ.
1 GHz to 3 GHz	<–150 dBm, –153 dBm typ.	<–148 dBm, –151 dBm typ.
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	numerical; 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	
Detectors	average (AV), RMS, MaxPeak, MinPeak and Quasi-Peak (QP), 3 detectors can be switched on simultaneously	
Measurement time	100 µs to 100 s, selectable	
Level display (analyzer mode)		
Result display	501 x 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	

	R&S ESPI 3	R&S ESPI 7
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 (ref. 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

Trigger functions

Trigger		
Span ≥10 Hz		
Trigger source	free run, video, external, IF level	
Trigger offset	125 ns to 100 s, resolution 125 ns min. or 1% of offset	
Span = 0 Hz		
Trigger source	free run, video, external, IF level	
Trigger offset	±125 ns to 100 s, resolution 125 ns min., depending on sweep time	
Max. deviation of trigger offset	± (125 ns + (0.1% x 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 125 ns min. or 1% of gate length	
Max. deviation of gate length	± (125 ns + (0.05% x 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	

	R&S ESPI 3	R&S ESPI 7
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 from 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 to 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 SUB-D connector	
Printer interface	parallel interface (Centronics-compatible)	
Mouse connector	PS/2 female	
User interface	25-pin SUB-D female	
Connector for external monitor (VGA)	15-pin SUB-D female	

General data

Display	21 cm TFT colour display (8.4")	
Resolution	640 x 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	
Operating temperature range		
Rated temperature range	+5°C to +40°C	
Limit 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 AC to 240 V AC, 50 Hz to 400 Hz, protection class I to VDE 411	
Power consumption	70 VA	120 VA
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	
Dimension (W x H x D)	412 mm x 197 mm x 417 mm	
Weight	10.5 kg	11.3 kg

Ordering information

Order designation	Type	Order No.
Test Receiver 9 kHz to 3 GHz	R&S ESPI3	1142.8007.03
Test Receiver 9 kHz to 7 GHz	R&S ESPI7	1142.8007.07
Accessories supplied		
Power cable, operating manual, service manual		
Options		
Preselector/Preamplifier for R&S ESPI (factory-fitted)	R&S ESPI-B2	1129.7498.02
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 100BT for all R&S ESPI models	R&S FSP-B16	1129.8042.02
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
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
Colour Monitor, 15", 230 V	R&S PMC3	1082.6004.02
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	R&S RAM	0358.5414.02
Series Resistor, 25 Ω[3]	R&S RAZ	0358.5714.02
SWR Bridge, 5 MHz to 3000 MHz	R&S ZRB2	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. Hotline: +49 89 4129 13051
Fax Hotline: +49 89 4129 13335

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ROHDE&SCHWARZ

ROHDE&SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · 81671 München · Germany · P.O.B. 80 14 69 · 81614 München · Germany · Telephone +49 89 4129-0
www.rohde-schwarz.com · Customer Support: Telephone +49 1805124242, Fax +49 89 4129-13777, E-mail: CustomerSupport@rohde-schwarz.com