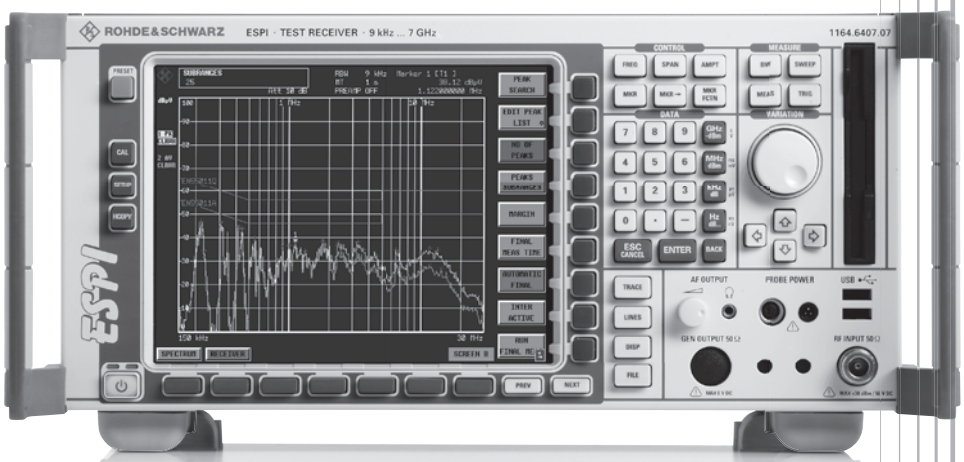
R&S®ESPI
EMI Test Receiver
Specifications



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Test & Measurement

Data Sheet | 06.00

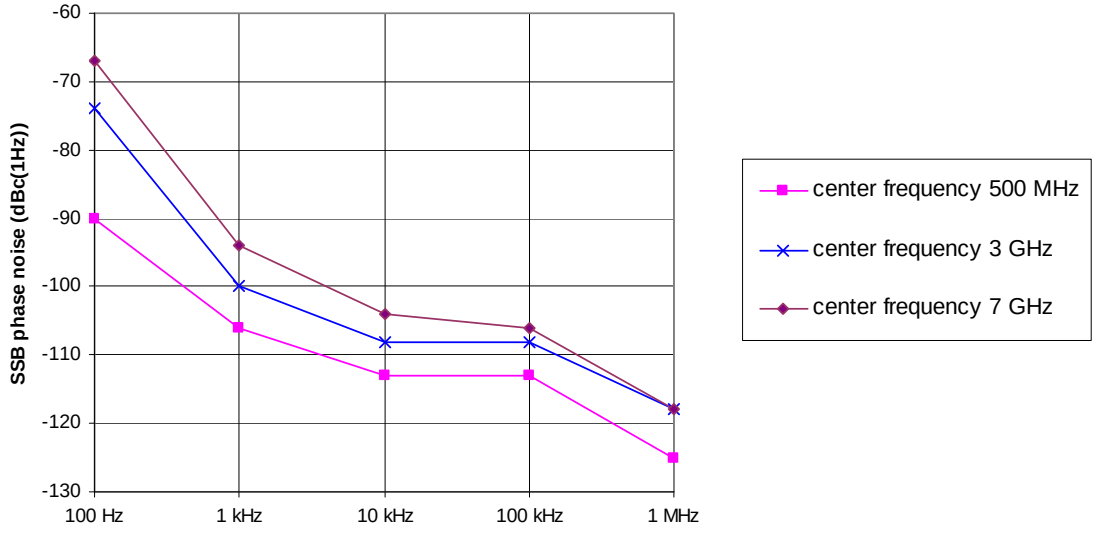
CONTENT

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.

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For product brochure,
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Subject to change

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