R&S®FSH4/R&S®FSH8
Spectrum Analyzer
Specifications

ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 10.00

CONTENTS

Specifications

Specifications apply under the following conditions:
15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to.
Data without tolerances: typical values only. Data designated as “nominal” applies to design parameters and is not tested. Data without tolerance limits is not binding.

Frequency

Frequency range	R&S®FSH4 model .04/.14	9 kHz to 3.6 GHz
	R&S®FSH8 model .08/.18	9 kHz to 8 GHz
	R&S®FSH4 model .24	100 kHz to 3.6 GHz
	R&S®FSH8 model .28	100 kHz to 8 GHz
Frequency resolution		1 Hz

Reference frequency, internal		
Aging per year		1×10^{-6}
Temperature drift	0 °C to +30 °C	1×10^{-6}
	+30 °C to +50 °C	3×10^{-6}
Achievable initial calibration accuracy		5×10^{-7}
Total reference uncertainty		(time since last adjustment × aging rate) + temperature drift + calibration accuracy
Reference frequency, with R&S®HA-Z240 GPS receiver option		
Frequency uncertainty	GPS on, ≥ 1 minute after satellite lock	$\pm 2.5 \times 10^{-8}$
	up to 30 minutes after loosing satellite lock	$\pm 5 \times 10^{-8}$

Frequency readout		
Marker resolution		0.1 Hz
Uncertainty		±(marker frequency × reference uncertainty + 10 % × resolution bandwidth + ½ (span / (sweep points – 1) + 1 Hz)
Number of sweep (trace) points		631
Marker tuning frequency step size		span/630
Frequency counter resolution		0.1 Hz
Count uncertainty	SNR > 25 dB	±(frequency × reference uncertainty + ½ (last digit))
Frequency span		0 Hz, 10 Hz to 3.6/8 GHz
Span uncertainty		nominal 1 %

Spectral purity SSB phase noise		f = 500 MHz
Carrier offset	30 kHz	< –95 dBc (1 Hz), typ. –105 dBc (1 Hz)
	100 kHz	< –100 dBc (1 Hz), typ. –110 dBc (1 Hz)
	1 MHz	< –120 dBc (1 Hz), typ. –127 dBc (1 Hz)

Sweep time

Sweep time	span = 0 Hz	200 µs to 100 s
	10 Hz ≤ span ≤ 600 MHz	20 ms to 1000 s
	span > 600 MHz	20 ms × span/600 MHz to 1000 s
Uncertainty	span = 0 Hz	nominal 1 %
	span ≥ 10 Hz	nominal 3 %

Bandwidths

Resolution bandwidths		
Range	–3 dB bandwidth	1 Hz to 3 MHz in 1/3 sequence
Bandwidth accuracy	1 Hz ≤ RBW ≤ 300 kHz	nominal < 5 %
	RBW > 300 kHz	nominal < 10 %
Selectivity 60 dB:3 dB		nominal < 5 (Gaussian type filters)
Video filters		
Range	–3 dB bandwidth	1 Hz to 3 MHz in 1/3 sequence

Level

Display range		displayed noise floor to +30 dBm
Maximum rated input level with RF attenuation ≥ 10 dB		
DC voltage	model .04/.08/.14/.18	80 V
	model .24/.28	50 V
CW RF power		30 dBm (= 1 W)
Peak RF power	duration < 3 s	33 dBm (= 2 W)
Max. pulse voltage		150 V
Max. pulse energy	pulse width 10 µs	10 mWs
Maximum rated input level with RF attenuation < 10 dB		
DC voltage		50 V
CW RF power		20 dBm (= 100 mW)
Peak RF power	duration < 3 s	23 dBm (= 200 mW)
Max. pulse voltage		50 V
Max. pulse energy	pulse width 10 µs	1 mWs
Intermodulation		
Third-order intercept (TOI), nominal values	intermodulation-free dynamic range, signal level 2 × –20 dBm, RF attenuation = 0 dB, RF preamplifier = off	
	f_{in} < 300 MHz	> 54 dBc (TOI > +7 dBm, typ. +11 dBm)
	300 MHz ≤ f_{in} < 3.6 GHz	> 60 dBc (TOI > +10 dBm, typ. +15 dBm)
	3.6 GHz ≤ f_{in} ≤ 8 GHz	> 46 dBc (TOI > +3 dBm, typ. +10 dBm)
	intermodulation-free dynamic range, signal level 2 × –40 dBm, RF attenuation = 0 dB, RF preamplifier = on	
	f_{in} < 300 MHz	> 50 dBc (TOI > –15 dBm)
	300 MHz ≤ f_{in} ≤ 8 GHz	> 56 dBc (TOI > –12 dBm)
Second harmonic intercept (SHI), nominal values	RF attenuation = 0 dB, RF preamplifier = off	
	f_{in} = 20 MHz to 1.5 GHz	+40 dBm
	f_{in} = 1.5 GHz to 3 GHz	+30 dBm
	f_{in} = 3 GHz to 4 GHz	+20 dBm
	RF attenuation 0 dB, RF preamplifier = on	
	f_{in} = 100 MHz to 4 GHz	0 dBm
Displayed average noise level		
	0 dB RF attenuation, termination 50 Ω, RBW = 100 Hz, VBW = 10 Hz, sample detector, log scaling, tracking generator off, normalized to 1 Hz	
	frequency	preamplifier = off
	9 kHz to 100 kHz (models .04/.14/.08/.18 only)	< –108 dBm, typ. –118 dBm
	100 kHz to 1 MHz	< –115 dBm, typ. –125 dBm
	1 MHz to 10 MHz	< –136 dBm, typ. –144 dBm
	10 MHz to 2 GHz	< –141 dBm, typ. –146 dBm
	2 GHz to 3.6 GHz	< –138 dBm, typ. –143 dBm
	3.6 GHz to 5 GHz	< –142 dBm, typ. –146 dBm
	5 GHz to 6.5 GHz	< –140 dBm, typ. –144 dBm
	6.5 GHz to 8 GHz	< –136 dBm, typ. –141 dBm
	frequency	preamplifier = on
	100 kHz to 1 MHz	< –133 dBm, typ. –143 dBm
	1 MHz to 10 MHz	< –157 dBm, typ. –161 dBm
	10 MHz to 1 GHz	< –161 dBm, typ. –165 dBm
	1 GHz to 2 GHz	< –159 dBm, typ. –163 dBm
	2 GHz to 5 GHz	< –155 dBm, typ. –159 dBm
	5 GHz to 6.5 GHz	< –151 dBm, typ. –155 dBm
	6.5 GHz to 8 GHz	< –147 dBm, typ. –150 dBm

Adjacent channel leakage power ratio (ACLR)		
Dynamic range	frequency < 3.6 GHz, total power > –20 dBm	
	3GPP WCDMA	
	adjacent channel	nominal > 55 dB
	alternate channel	nominal > 58 dB
	CDMA2000®	
	adjacent channel	nominal > 58 dB
	alternate channel	nominal > 61 dB
Immunity to interference, nominal values		
Image frequencies	serial number < 105000	
	f_{in} – 2 × 21.4 MHz	< –70 dBc, typ. –80 dBc
	f_{in} – 2 × 831.4 MHz	< –70 dBc, typ. –90 dBc
	f_{in} – 2 × 4881 MHz	–60 dBc
	serial number ≥ 105000	
	f_{in} – 2 × 54.4 MHz	< –70 dBc, typ. –80 dBc
	f_{in} – 2 × 860.8 MHz	< –70 dBc, typ. –90 dBc
	f_{in} – 2 × 4892.8 MHz	–60 dBc
Intermediate frequencies	serial number < 105000	
	21.4 MHz, 831.4 MHz, 4881.4 MHz	< –60 dBc, typ. –80 dBc
	8931.4 MHz	–50 dBc
	serial number ≥ 105000	
	54.4 MHz, 860.8 MHz, 4892.8 MHz	< –60 dBc, typ. –80 dBc
	8924.8 MHz	–50 dBc
Other interfering signals, signal level – RF attenuation < –20 dBm	serial number < 105000	
	f ≤ 3.6 GHz, spurious at f_{in} – 2440.7 MHz	< –60 dBc
	3.6 GHz < f ≤ 8 GHz, spurious at f_{in} – 4465.7 MHz	< –60 dBc
	serial number ≥ 105000	
	f ≤ 3.6 GHz, spurious at f_{in} – 2446.4 MHz	< –60 dBc
	3.6 GHz < f ≤ 8 GHz, spurious at f_{in} – 4462.4 MHz	< –60 dBc
Other interfering signals, related to local oscillators	f ≤ 3.6 GHz	
	Δf < 300 kHz	–60 dBc
	Δf ≥ 300 kHz	< –60 dBc
	f > 3.6 GHz	
	Δf < 300 kHz	–54 dBc
	Δf ≥ 300 kHz	< –54 dBc
	f = receive frequency	
Residual spurious response	input matched with 50 Ω, without input signal, RBW ≤ 30 kHz, f ≥ 3 MHz, RF attenuation = 0 dB, tracking generator off	< –90 dBm
Level display		
Logarithmic level axis		1/2/5/10/20/50/100 dB, 10 divisions
Linear level axis		0 % to 100 %, 10 divisions
Number of traces		2
Trace detectors		Max Peak, Min Peak, Auto Peak, Sample, RMS
Trace functions		ClearWrite, Max Hold, Min Hold, Average, View
Setting range of reference level		–80 dBm to +30 dBm
Units of level axis		dBm, dBmV, dBµV, V, W

Level measurement uncertainty		
Absolute level uncertainty at 100 MHz	+20 °C to +30 °C	< 0.3 dB
Frequency response (+20 °C to +30 °C)	9 kHz ≤ f < 100 kHz (models .04/.14/.08/.18 only)	nominal < 1.5 dB
	100 kHz ≤ f < 10 MHz	nominal < 1.5 dB
	10 MHz ≤ f ≤ 3.6 GHz	< 1 dB
	3.6 GHz < f ≤ 8 GHz	< 1.5 dB
Attenuator uncertainty		< 0.3 dB
Uncertainty of reference level setting		nominal < 0.1 dB
Display nonlinearity	SNR > 16 dB, 0 dB to –50 dB, logarithmic level display	< 0.2 dB
Bandwidth switching uncertainty	reference: RBW = 10 kHz	nominal < 0.1 dB
Total measurement uncertainty	95 % confidence level, +20 °C to +30 °C, SNR > 16 dB, 0 dB to –50 dB below reference level, RF attenuation auto	
	10 MHz ≤ f ≤ 3.6 GHz	< 1 dB, typ. 0.5 dB
	3.6 GHz < f ≤ 8 GHz	< 1.5 dB, typ. 1 dB

Trigger functions

Trigger		
Trigger source		free run, video, external
External trigger level threshold	low → high transition	2.4 V
	high → low transition	0.7 V
Gated trigger		
Gate source		external
Gate delay		10 µs to 100 s, min. resolution 10 µs (or 1 % of delay)
Gate length		10 µs to 100 s, min. resolution 10 µs (or 1 % of gate length)

Inputs and outputs

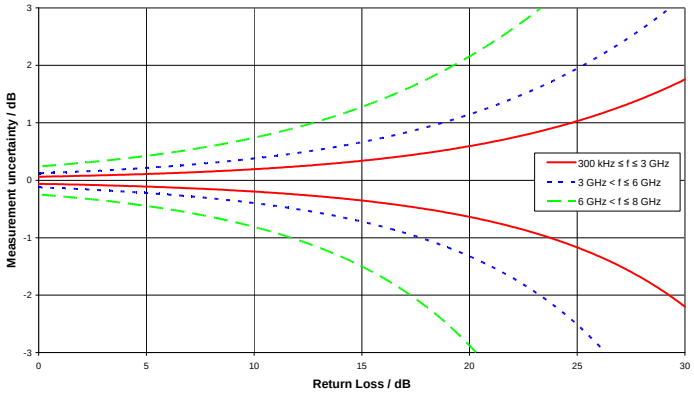
RF input		
Impedance		50 Ω
Connector		N female
VSWR	100 kHz ≤ f ≤ 1 GHz	nominal < 1.5
	1 GHz < f ≤ 6 GHz	nominal < 2
	6 GHz < f ≤ 8 GHz	nominal < 3
Input attenuator	RF input only	0 dB to 40 dB in 5 dB steps
AF output		
AF demodulation types		AM and FM
Connector		3.5 mm mini jack
Output impedance		nominal 32 Ω
Voltage (open circuit)		V_{RMS} adjustable from 0 V to > 100 mV
Power sensor		
Connector		7-contact female (type Binder 712)
Power sensors supported		see accessories
Tracking generator (models .14/.18/.24/.28 only)		
Frequency range	models .14 and .24	100 kHz to 3.6 GHz
	models .18 and .28	100 kHz to 8 GHz
Connector		N female, 50 Ω
VSWR	100 kHz ≤ f ≤ 1 GHz	nominal < 1.5
	1 GHz < f ≤ 6 GHz	nominal < 2
	6 GHz < f ≤ 8 GHz, models .18 and .28	nominal < 3
Output level	tracking generator attenuation = 0 dB	nominal 0 dBm
Tracking generator attenuator		0 dB to 40 dB in 1 dB steps
Dynamic range for isolation measurements	RF attenuation = 0 dB, tracking generator attenuation = 10 dB, RBW = 1 kHz	
	100 kHz ≤ f < 300 kHz	> 60 dB, typ. 80 dB
	300 kHz ≤ f < 6 GHz	> 70 dB, typ. 90 dB
	6 GHz ≤ f < 8 GHz, models .18 and .28	typ. > 50 dB
Reverse power		
DC voltage		50 V
CW RF power		+20 dBm (= 0.1 W)
Max. pulse voltage		50 V
Max. pulse energy (10 µs)		1 mWs
External reference, external trigger, DC bias port 2 (BNC 1)		
Connector		BNC, 50 Ω
Mode	selectable, models .24/.28	ext. reference, ext. trigger, DC bias port 2
	selectable, models .04/.08/.14/.18	ext. reference, ext. trigger
External reference	required level	0 dBm
	frequency	10 MHz
External trigger threshold	low → high transition	2.4 V
	high → low transition	0.7 V
DC bias port 2	max. rated input voltage	50 V
	max. rated input current	600 mA
IF out, DC bias port 1 (BNC 2)		
Connector		BNC, 50 Ω
Mode	selectable, models .24 and .28	IF out, DC bias port 1
	models .04/.08/.14/.18	IF out
IF out frequency	serial number < 105000	21.4 MHz
	serial number ≥ 105000	54.4 MHz
DC bias port 1	max. rated input voltage	50 V
	max. rated input current	600 mA
AUX		
Connector		7-contact female (type Binder 712)

Vector network analysis/vector voltmeter

Model .24/.28 with R&S®FSH-K42/R&S®FSH-K45 option

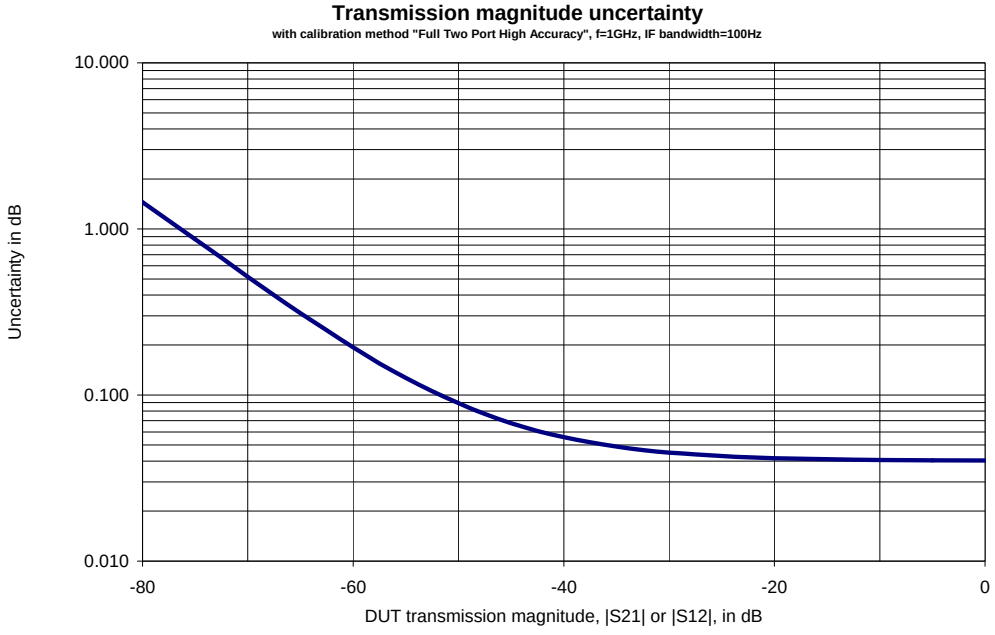
Frequency range	R&S®FSH4 model .24	300 kHz to 3.6 GHz
	R&S®FSH8 model .28	300 kHz to 8 GHz
Frequency resolution		1 Hz
Data points		631
Port power	controlled via tracking generator attenuation	nominal 0 dBm to –40 dBm in 1 dB steps
Reflection measurement		
Result formats	measurement mode = vector	magnitude, phase, magnitude + phase, VSWR, reflection coefficient, Smith chart, cable loss, group delay, electrical length
	measurement mode = vector voltmeter	magnitude + phase, Smith chart
Return loss		
Range	selectable	1/2/5/10/20/50/100 dB, linear 100 %
Resolution		0.01 dB
Measurement uncertainty		see figure “Uncertainty of reflection measurement with the R&S®FSH-K42/ R&S®FSH-K45 option”
One-port phase		
Range	selectable	90/180/360/1000° to 10000° in 1/2/5 steps
Resolution		0.01°
Measurement uncertainty	specifications are based on a matched DUT, RBW = 100 Hz, RF attenuation = 10 dB, nominal source power = 0 dBm, +20 °C to +30 °C	
	300 kHz ≤ f ≤ 3.6 GHz	
	0 dB ≤ return loss < 15 dB	nominal < 3°
	15 dB ≤ return loss < 25 dB	nominal < 6°
	25 dB ≤ return loss < 35 dB	nominal < 20°
	3.6 GHz < f ≤ 8 GHz (R&S®FSH8 only)	
	0 dB ≤ return loss < 15 dB	nominal < 3°
	15 dB ≤ return loss < 25 dB	nominal < 6°
	25 dB ≤ return loss < 35 dB	nominal < 20°
VSWR		
Range	selectable	1 to 1.1, 1.5, 2, 6, 11, 21 or 71
Smith chart		
Range		1, zoom × 2, × 4, × 8
Reflection coefficient		
mRho	range	1 to 1000 in 1, 2, 5 steps
Corrected directivity	300 kHz ≤ f ≤ 3 GHz	nominal > 43 dB
	3 GHz < f ≤ 6 GHz	nominal > 37 dB
	6 GHz < f ≤ 8 GHz	nominal > 31 dB
Corrected test port match	300 kHz ≤ f ≤ 3 GHz	nominal > 40 dB
	3 GHz < f ≤ 6 GHz	nominal > 37 dB
	6 GHz < f ≤ 8 GHz	nominal > 30 dB

Uncertainty of reflection measurement with R&S®FSH-K42/-K45 option



Uncertainty of reflection measurement with the R&S®FSH-K42/R&S®FSH-K45 option.

Transmission measurement		
Result formats	measurement mode = vector	magnitude, phase, magnitude + phase, group delay, electrical length
	measurement mode = vector voltmeter	magnitude + phase
Gain		
Measurement range		–120 dB to +80 dB
Display range	selectable	1/2/5/10/20/50/100 dB, linear 100 %
Resolution		0.01 dB
Measurement uncertainty	calibration method = Full Two Port High Accuracy	see figure “Transmission magnitude uncertainty”
Phase		
Range	selectable	90/180/360/1000° to 10000° in 1/2/5 steps
Resolution		0.01°
Measurement uncertainty	specifications are based on a matched DUT, RBW = 100 Hz, RF attenuation = 10 dB, nominal source power = 0 dBm, +20 °C to +30 °C	
	300 kHz ≤ f ≤ 50 MHz	
	0 dB ≤ insertion loss < 40 dB	nominal < 2°
	50 MHz < f ≤ 3.6 GHz	
	0 dB ≤ insertion loss < 50 dB	nominal < 2°
	50 dB ≤ insertion loss < 70 dB	nominal < 3°
	3.6 GHz < f < 6 GHz (R&S®FSH8 only)	
	0 dB ≤ insertion loss < 50 dB	nominal < 2°
	50 dB ≤ insertion loss < 70 dB	nominal < 3°
	6 GHz ≤ f < 8 GHz (R&S®FSH8 only)	
	0 dB ≤ insertion loss < 50 dB	nominal < 3°
	50 dB ≤ insertion loss < 70 dB	nominal < 5°
Dynamic range from port 1 to port 2	RF attenuation = 0 dB, tracking generator attenuation = 10 dB, RBW = 1 kHz	
	100 kHz ≤ f < 300 kHz	typ. 70 dB
	300 kHz ≤ f < 6 GHz	> 70 dB, typ. 90 dB
	6 GHz ≤ f < 8 GHz	typ. > 50 dB
Dynamic range from port 2 to port 1	RF attenuation = 0 dB, tracking generator attenuation = 10 dB, RBW = 1 kHz	
	100 kHz ≤ f < 300 kHz	typ. 80 dB
	300 kHz ≤ f < 6 GHz	> 80 dB, typ. 100 dB
	6 GHz ≤ f < 8 GHz	typ. > 60 dB
Test port match		as specified for tracking generator output/RF input

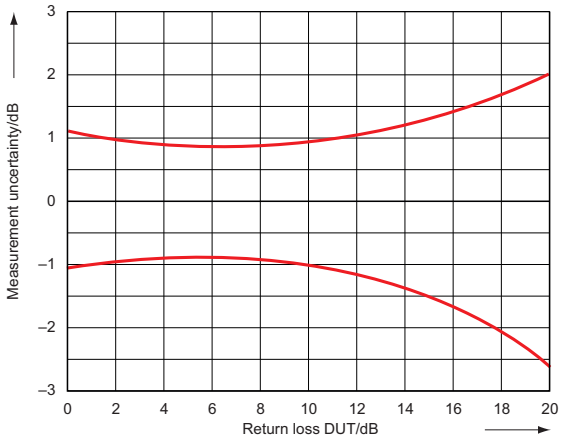


Transmission magnitude uncertainty.

Scalar network analysis

Model .24/.28 without R&S®FSH-K42 option

Frequency range	R&S®FSH4 model .24	300 kHz to 3.6 GHz
	R&S®FSH8 model .28	300 kHz to 8 GHz
Frequency resolution		1 Hz
Data points		631
Port power	controlled via tracking generator attenuation	nominal 0 dBm to –40 dBm in 1 dB steps
Reflection measurement		
Result formats		magnitude, VSWR, reflection coefficient
Return loss	range	1/2/5/10/20/50/100 dB, linear 100 %
	resolution	0.01 dB
VSWR	range	1 to 2, 6, 11, 21 or 71, selectable
Corrected directivity (20° to 30°)	300 kHz ≤ f ≤ 6 GHz	nominal > 25 dB
	6 GHz < f ≤ 8 GHz	nominal > 20 dB
Corrected test port match (20° to 30°)	300 kHz ≤ f ≤ 6 GHz	nominal > 20 dB
	6 GHz < f ≤ 8 GHz	nominal > 15 dB
Transmission measurement		
Result formats		magnitude
Dynamic range from port 1 to port 2	RF attenuation = 0 dB, tracking generator attenuation = 0 dB, RBW = 1 kHz	
	300 kHz ≤ f < 6 GHz	> 60 dB, typ. 80 dB
	6 GHz ≤ f < 8 GHz	typ. > 40 dB
Dynamic range from port 2 to port 1	RF attenuation = 0 dB, tracking generator attenuation = 0 dB, RBW = 1 kHz	
	300 kHz ≤ f < 6 GHz	> 70 dB, typ. 90 dB
	6 GHz ≤ f < 8 GHz	typ. > 50 dB
Test port match		as specified for tracking generator output/RF input



Uncertainty of reflection measurement without the R&S®FSH-K42 option.

Distance-to-fault analysis

Model .24/.28 with R&S®FSH-K41 option

Return loss	range	1/2/5/10/20/50/100 dB, linear 100 %
	resolution	0.01 dB
VSWR	range	1 to 1.1, 1.5, 2, 6, 11, 21 or 71
	resolution	0.01
Reflection coefficient		
mRho	range	1 to 1000 in 1, 2, 5 steps
Fault resolution in m		(1.5×10^8 × velocity factor/span)
Maximum permissible spurious signal	RF attenuation = 0 dB	nominal 0 dBm
Input	selectable	RF port 1 or 2
Maximum cable length	depending on cable loss	1500 m

R&S®FSH-K44 3GPP WCDMA BTS/NodeB pilot channel and pilot EVM measurement application
R&S®FSH-K44E 3GPP WCDMA BTS/NodeB code domain power and EVM measurement application with HSDPA/HSPA+ analyzer

The specifications below apply to the R&S®FSH4 and R&S®FSH8. They are based on the data sheet specifications of the R&S®FSH4 and R&S®FSH8, have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are indicated as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (SNR).

Measurements	**R&S®FSH-K44**	**R&S®FSH-K44E**
Spectrum overview	●	●
Scrambling code search	●	●
Isotropic antenna	●	●
Limits screen	●	●
Result summary	●	●
RF channel power	●	●
Carrier frequency error	●	●
Active channels	● (2 channels)	●
Scrambling code found	●	●
Composite EVM	–	●
Peak code domain error	–	●
Average RCDE	–	●
I/Q offset	–	●
Gain imbalance	–	●
P-CPICH power	●	●
P-CPICH E_C/I_0	●	●
P-CPICH symbol EVM	●	●
Sync channel power	●	●
Code domain power	–	●
Code channel power	–	●
Code channel symbol rate	–	●
Channel power	–	●
EVM	–	●
Code domain channel table	–	●
Code channel type	–	●
Channel number/spreading factor	–	●
Code channel symbol rate	–	●
Timing offset	–	●
Pilot bits	–	●
Status	–	●
Power, absolute	–	●
Power, relative to CPICH	–	●
HSDPA channel support	–	●
HSPA+ channel support	–	●

Frequency range		15 MHz to 3.0 GHz
Carrier frequency uncertainty	test case 6.3 in line with 3GPP TS 25.141	
Lock range		±1 kHz
Measurement uncertainty	SNR > 30 dB, Δf_{ref} = uncertainty of reference frequency	< 10 Hz + Δf_{ref}
RF channel power	test case 6.2.1 in line with 3GPP TS 25.141, SNR > 30 dB, +15 °C to +35 °C	
Measurement range	frequency > 15 MHz	
	preamplifier = off	–60 dBm < $P_{RF\ channel}$ < 20 dBm
	preamplifier = on	–80 dBm < $P_{RF\ channel}$ < 20 dBm
Measurement uncertainty	–80 dBm < $P_{RF\ channel}$ < 20 dBm, P_{REF_LEV} – 30 dB < $P_{RF\ channel}$ < P_{REF_LEV} + 3 dB	< 1 dB, typ. 0.5 dB
CPICH power	test case 6.2.2 in line with 3GPP TS 25.141, SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{CPICH} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{CPICH} < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
P-CCPCH power	test model 2 in line with 3GPP TS 25.141, SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < $P_{P\text{-}CCPCH}$ < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < $P_{P\text{-}CCPCH}$ < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
PSCH/SSCH power	test model 2 in line with 3GPP TS 25.141, SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{SCH} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{SCH} < $P_{RF\ channel}$	< 2.5 dB, typ. 1.5 dB
Symbol EVM	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm single channel EVM	1.5 % < EVM < 25 %
Measurement uncertainty	1.5 % < EVM ≤ 10 %	0.5 %
	10 % < EVM < 25 %	2.5 %
Residual EVM		typ. 1.5 %
Composite EVM [1]	test case 6.7.1 in line with 3GPP TS 25.141, test model 4 with P-CPICH, SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	1.5 % < EVM < 25 %
Measurement uncertainty	1.5 % < EVM ≤ 10 %	typ. 2.0 %
	10 % < EVM < 25 %	typ. 2.5 %
Residual EVM		typ. 2.5 %
Scrambling code detection	test model 1.16 in line with 3GPP TS 25.141	
Lock range		±1 kHz
Calculation time		2.5 s
CPICH E_C/I_0		> –21 dB

[1] Requires instrument with serial number ≥ 105000.

R&S®FSH-K46 CDMA2000® BTS pilot channel and EVM measurement application
R&S®FSH-K46E CDMA2000® BTS code domain power measurement application

The specifications below apply to the R&S®FSH4 and R&S®FSH8. They are based on the data sheet specifications of the R&S®FSH4 and R&S®FSH8, have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are indicated as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (SNR).

Measurements	**R&S®FSH-K46**	**R&S®FSH-K46E**
Spectrum overview	●	●
Result summary	●	●
RF channel power	●	●
Rho	●	●
Carrier frequency error	●	●
Active channels	●	●
Composite EVM	●	●
Peak to average	●	●
Pilot channel power (Cd 0)	●	●
Sync channel power (Cd 32)	●	●
Code domain power	–	●
RF channel power	–	●
Pilot power	–	●
Sync power (rel. to RF ch. pwr./pilot)	–	●
Code power (rel. to RF ch. pwr./pilot)	–	●
Carrier frequency error	–	●
Rho	–	●
Composite EVM	–	●
PN offset found	–	●
Code domain channel table	–	●
Channel type	–	●
Walsh code/spreading factor	–	●
Symbol rate (ksps)	–	●
RC	–	●
Status	–	●
Power absolute (dBm)	–	●
Power relative (rel. to RF ch. pwr./pilot)	–	●
PN scanner	–	●
Detected PN offset	–	●
Power per detected PN offset	–	●

All specifications are valid for RC3, one traffic channel, SNR > 30 dB, +15 °C to +35 °C.

Frequency range		15 MHz to 3.0 GHz
Carrier frequency uncertainty, nominal values		
Lock range		±10 kHz
Measurement uncertainty	SNR > 30 dB, Δf_{ref} = uncertainty of reference frequency	< 10 Hz + Δf_{ref}
RF channel power		
Measurement range	frequency > 15 MHz	
	preamplifier = off	–60 dBm < $P_{RF\ channel}$ < 20 dBm
	preamplifier = on	–75 dBm < $P_{RF\ channel}$ < 20 dBm
Measurement uncertainty	–75 dBm < $P_{RF\ channel}$ < 20 dBm, ref. level adjusted to RF channel power	< 1 dB, typ. 0.5 dB
PICH power	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{PICH} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{CPICH} < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
F-SYNC power	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{SYNC} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{SYNC} < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB

Composite EVM	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	1.5 % < EVM < 25 %
Measurement uncertainty	1.5 % < EVM ≤ 10%	typ. 2.0 %
	10 % < EVM < 25 %	typ. 2.5 %
Residual EVM		typ. 2.5 %
Rho	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	0.9 < Rho < 1
Measurement uncertainty	0.97 < Rho ≤ 1.0	typ. 0.005
	0.90 < Rho ≤ 0.97	typ. 0.02

R&S®FSH-K47 1xEV-DO® BTS pilot channel and EVM measurement application
R&S®FSH-K47E 1xEV-DO® BTS PN scanner and time domain power measurement application

The specifications below apply to the R&S®FSH4 and R&S®FSH8. They are based on the data sheet specifications of the R&S®FSH4 and R&S®FSH8, have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are indicated as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (SNR).

Measurements	**R&S®FSH-K47**	**R&S®FSH-K47E**
Spectrum overview	●	●
Result summary	●	●
RF channel power	●	●
Pilot Rho	●	●
Carrier frequency error	●	●
Traffic activity	●	●
Pilot EVM	●	●
PN timing (tau)	●	●
Peak to average	●	●
Pilot power	●	●
MAC power	●	●
Data power	●	●
PN scanner	–	●
Detected PN offset	–	●
Power per detected PN offset	–	●
Burst power	–	●
RF channel power	–	●
Pilot power	–	●

All specifications are valid for RC3, one traffic channel, SNR > 30 dB, +15 °C to +35 °C.

Frequency range		15 MHz to 3.0 GHz
Carrier frequency uncertainty, nominal values		
Lock range		±5 kHz
Measurement uncertainty	SNR > 30 dB, Δf_{ref} = uncertainty of reference frequency	< 100 Hz + Δf_{ref}
RF channel power		
Measurement range	frequency > 15 MHz	
	preamplifier = off	–60 dBm < $P_{RF\ channel}$ < 20 dBm
	preamplifier = on	–75 dBm < $P_{RF\ channel}$ < 20 dBm
Measurement uncertainty	–75 dBm < $P_{RF\ channel}$ < 20 dBm, ref. level adjusted to RF channel power	< 1 dB, typ. 0.5 dB
Pilot power	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{PICH} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{CPICH} < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
MAC power	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{SYNC} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{SYNC} < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
Data power	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel}$ – 20 dB < P_{SYNC} < $P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel}$ – 20 dBm < P_{SYNC} < $P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
Pilot EVM	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	1.5 % < EVM < 25 %
Measurement uncertainty	1.5 % < EVM ≤ 10 %	typ. 2.0 %
	10 % < EVM < 25 %	typ. 2.5 %
Residual EVM		typ. 2.5 %
Pilot Rho	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm	0.9 < Rho < 1
Measurement uncertainty	0.97 < Rho ≤ 1.0	typ. 0.005
	0.90 < Rho ≤ 0.97	typ. 0.02

R&S®FSH-K48 3GPP TD-SCDMA BTS power and P-CCPCH EVM measurement application

The specifications below apply to the R&S®FSH4 and R&S®FSH8. They are based on the data sheet specifications of the R&S®FSH4 and R&S®FSH8, have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are indicated as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (SNR).

Measurements	**R&S®FSH-K48**
Spectrum overview	●
Result summary	●
RF channel power	●
Carrier frequency error	●
P-CCPCH symbol EVM	●
Data power abs / rel	●
Data 1 / 2 power abs / rel	●
Midamble power abs / rel	●

Frequency range		15 MHz to 3.0 GHz
Carrier frequency uncertainty	test case 6.3 in line with 3GPP TS 25.241	
Lock range		±5 kHz
Measurement uncertainty	SNR > 30 dB, Δf_{ref} = uncertainty of reference frequency	< 10 Hz + Δf_{ref}
RF channel power	test case 6.2 in line with 3GPP TS 25.241, SNR > 30 dB, +15 °C to +35 °C	
Measurement range	frequency > 15 MHz	
	preamplifier = off	–60 dBm < $P_{RF\ channel}$ < 20 dBm
	preamplifier = on	–75 dBm < $P_{RF\ channel}$ < 20 dBm
Measurement uncertainty	–75 dBm < $P_{RF\ channel}$ < 20 dBm, P_{REF_LEV} – 30 dB < $P_{RF\ channel}$ < P_{REF_LEV} + 3 dB	< 1 dB, typ. 0.5 dB
P-CCPCH Symbol EVM	SNR > 30 dB	
Measurement range	–40 dBm < $P_{RF\ channel}$ < 20 dBm single channel EVM	1.5 % < EVM < 25 %
Measurement uncertainty	1.5 % < EVM ≤ 10 %	typ. 0.5 %
	10 % < EVM < 25 %	typ. 2.5 %
Residual EVM		typ. 0.8 %
Data power	SNR > 30 dB	
Measurement range		–60 dBm < P_{Data}< 20 dBm
Measurement uncertainty	–40 dBm < P_{Data}< 20 dBm	< 1 dB, typ. 0.5 dB
Data (1/2) power	SNR > 30 dB	
Measurement range		–60 dBm < $P_{Data\ 1/2}$< 20 dBm
Measurement uncertainty	–40 dBm < $P_{Data\ 1/2}$< 20 dBm	< 1 dB, typ. 0.5 dB
Midamble power	SNR > 30 dB	
Measurement range		–60 dBm < $P_{Midamble}$< 20 dBm
Measurement uncertainty	–40 dBm < $P_{Midamble}$< 20 dBm	< 1 dB, typ. 0.5 dB

R&S®FSH-K50/R&S®FSH-K51 LTE FDD/TDD downlink pilot channel and EVM measurement application [2]
R&S®FSH-K50E/R&S®FSH-K51E LTE FDD/TDD downlink extended channel and modulation measurement application [2]

The specifications below apply to the R&S®FSH4 and R&S®FSH8. They are based on the data sheet specifications of the R&S®FSH4 and R&S®FSH8, have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are indicated as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (S/N).

Measurements	R&S®FSH-K50/R&S®FSH-K51	R&S®FSH-K50E/R&S®FSH-K51E
Spectrum overview	●	●
Result summary	●	●
RF channel power	●	●
Carrier frequency error	●	●
I/Q offset	●	●
Cell identity	●	●
Cyclic prefix	●	●
Reference signal power	●	●
PSYNC power	●	●
SSYNC power	●	●
PBCH power	●	●
PCFICH power	●	●
PDSCH power	●	●
Reference signal EVM	●	●
PSYNC EVM	●	●
SSYNC EVM	●	●
PBCH EVM	●	●
PCFICH EVM	●	●
PDSCH EVM	●	●
Isotropic antenna	●	●
Limits screen	●	●
Constellation diagram	–	●
PSYNC	–	●
SSYNC	–	●
QPSK	–	●
16QAM	–	●
64QAM	–	●
BTS scanner	–	●
Cell identity	–	●
PSYNC power	–	●
SSYNC power	–	●
Resource allocations	–	●

All specifications are valid for SNR > 30 dB, +15 °C to +35 °C.

Frequency range		15 MHz to 3.0 GHz
Supported channel bandwidths		1.4/3/5/10/15/20 MHz
Carrier frequency uncertainty		
Lock range		±10 kHz
Measurement uncertainty	SNR > 30 dB, Δf_{ref} = uncertainty of reference frequency	< 10 Hz + Δf_{ref}
RF channel power		
Measurement range	frequency > 15 MHz	
	preamplifier = off	–60 dBm < $P_{RF\ channel}$ < 20 dBm
	preamplifier = on	–75 dBm < $P_{RF\ channel}$ < 20 dBm
Measurement uncertainty	–75 dBm < $P_{RF\ channel}$ < 20 dBm, ref. level adjusted to RF channel power	< 1 dB, typ. 0.5 dB
EVM		
Measurement range	–50 dBm < $P_{RF\ channel}$ < 10 dBm, 860 MHz < frequency < 2.69 GHz, E-UTRA test model 3.1, bandwidth 10 MHz, reference signal and PDSCH	
Residual EVM		< 2.5 %, typ. 2.0 %

[2] R&S®FSH-K50/R&S®FSH-K51/R&S®FSH-K50E/R&S®FSH-K51E options require instruments with serial number ≥ 105000.

R&S®FSH-K43 Receiver Mode and Channel Scan Measurement Application

The specifications below apply to the R&S®FSH4 and R&S®FSH8. They are based on the data sheet specifications of the R&S®FSH4 and R&S®FSH8, have not been checked separately and are not verified during instrument calibration.

Measurements	**R&S®FSH-K43**
Fixed frequency	●
Frequency scan	●
Channel scan	●
User defined channel list	●
EMI precompliance	●
CISPR bandwidths	●
CISPR detectors	●

Frequency range		see basic instrument
Measurement modes		fixed frequency, frequency scan, channel scan
Frequency scan stepsize		
scan stepsize		100 Hz to max. frequency
max. number of steps		10000
Channel scan		
channel spacing		user definable
max. number of channels		10000
Resolution bandwidths		
Range	–3 dB bandwidth	1 Hz to 3 MHz in 1/3 sequence
Detectors	CISPR bandwidths (– 6 dB)	200 Hz, 9 kHz, 120 kHz, 1 MHz
		Max Peak, Average, RMS, Quasipeak
Level		see basic instrument

General data

Manual operation		
Languages		Chinese, English, French, German, Italian, Hungarian, Japanese, Korean, Portuguese, Russian, Spanish
Remote control (R&S®FSH-K40 option)		
Command set		SCPI 1997.0
LAN interface		10/100BaseT, RJ-45
USB		mini B plug, version 1.1
Display		
Resolution		640 × 480 pixel
Audio		
Speaker		internal
USB interface		
	serial number ≥ 105000	type A plug, version 1.1
Mass memory		
Mass memory		flash memory (internal), SD card (not supplied), size ≤ 4 Gbyte
	serial number ≥ 105000	memory stick (not supplied), size ≤ 4 Gbyte, USB version 1.1 or 2.0
Data storage	internal	> 256 instrument settings and traces
	on SD card/memory stick, ≥ 1 Gbyte	> 5000 instrument settings and traces
Temperature		
	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +55 °C
	storage temperature range	–40 °C to +70 °C
	battery charging mode	0 °C to +40 °C
Climatic loading	relative humidity	+25/+40 °C at 85 % relative humidity (EN 60068-2-30)
	IP class of protection	51
	with R&S®HA-Z222 carrying holster and rain cap	54
Mechanical resistance		
Vibration	sinusoidal	EN 60068-2-6
	random	EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810F, method 516.4 procedure 1, EN 60068-2-27

Power supply		
R&S®HA-Z201 plug-in AC power supply	input specifications	100 V to 240 V AC, 50 Hz to 60 Hz, 700 mA
	output specifications	15 V DC, 2 A
	operating temperature range	0 °C to +40 °C
	storage temperature range	–40 °C to +70 °C
	test mark	VDE, CE, UL, PSE
External DC voltage		14 V to 16 V
Internal battery		Li-ion battery
Capacity	R&S®HA-Z204 (standard)	4.5 Ah
	R&S®HA-Z206 (option)	6.75 Ah
Voltage		nominal 7.2 V
Operating time with new, fully charged battery	R&S®HA-Z204 (standard)	3 h
	R&S®HA-Z206 (option)	4.5 h
Charging time	instrument switched off or R&S®HA-Z203 battery charger	
	R&S®HA-Z204 (standard)	2.5 h
	R&S®HA-Z206 (option)	3.5 h
	instrument switched on	
	R&S®HA-Z204 (standard)	3.5 h
	R&S®HA-Z206 (option)	4.5 h
Life time	charging cycles	> 500
Power consumption		typ. 12 W
Safety		IEC 61010-1, EN 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010.1-04
Test mark		VDE, GS, CSA, CSA-NRTL
EMC		in line with European EMC Directive 2004/108/EC including
		EN 61326 class B (emission)
		CISPR 11/EN 55011/group 1 class B (emission)
		EN 61326 table 2 (immunity, industrial) field strength: 30 V/m: 30 MHz to 2 GHz 3 V/m: 2 GHz to 2.7GHz
Dimensions (W × H × D)	with handle	194 mm × 300 mm × 144 mm (7.6 in × 11.8 in × 5.7 in)
	without handle	194 mm × 300 mm × 69 mm (7.6 in × 11.8 in × 2.7 in)
Weight		< 3 kg (< 6.6 lb)
Recommended calibration interval		1 year

Accessories

R&S®FSH-Z1 and R&S®FSH-Z18 power sensors

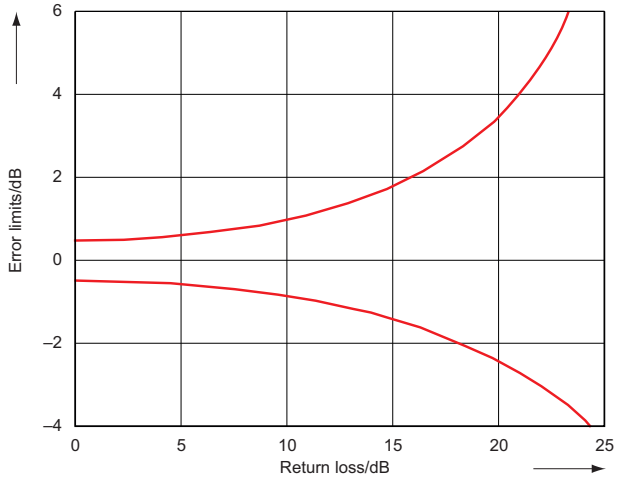
Frequency range	R&S®FSH-Z1	10 MHz to 8 GHz
	R&S®FSH-Z18	10 MHz to 18 GHz
VSWR	10 MHz to 30 MHz	< 1.15
	30 MHz to 2.4 GHz	< 1.13
	2.4 GHz to 8 GHz	< 1.20
	8 GHz to 18 GHz	< 1.25
Maximum input power	average power	400 mW (+26 dBm)
	peak power (< 10 µs, 1 % duty cycle)	1 W (+30 dBm)
Measurement range		200 pW to 200 mW (–67 dBm to +23 dBm)
Signal weighting		average power
Effect of harmonics		< 0.5 % (0.02 dB) at harmonic ratio of 20 dB
Effect of modulation		< 1.5 % (0.07 dB) for continuous digital modulation
Absolute measurement uncertainty	sine signals, no zero offset	
10 MHz to 8 GHz	+15 °C to +35 °C	< 2.3 % (0.10 dB)
	0 °C to +50 °C	< 4.2 % (0.18 dB)
8 GHz to 18 GHz	+15 °C to +35 °C	< 3.5 % (0.15 dB)
	0 °C to +50 °C	< 5.0 % (0.21 dB)
Zero offset after zeroing		< 110 pW
Dimensions (W × H × D)		48 mm × 31 mm × 170 mm (1.9 in × 1.22 in × 6.7 in)
	connecting cable	1.5 m (59 in)
Weight		< 0.3 kg (0.66 lb)

R&S®FSH-Z14 directional power sensor

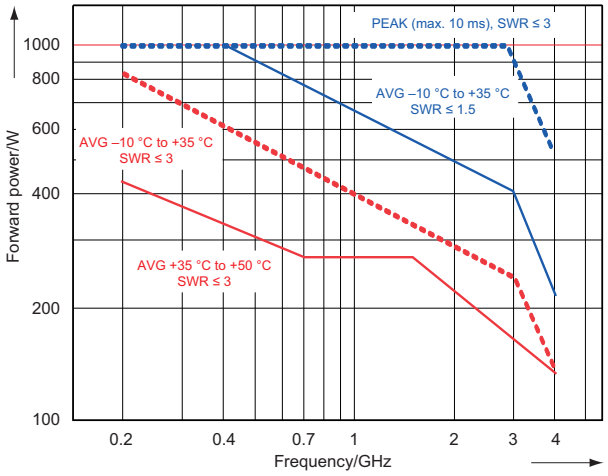
Frequency range		25 MHz to 1 GHz
Power measurement range		30 mW to 300 W
VSWR referenced to 50 Ω		< 1.06
Power-handling capacity	depending on temperature and matching (see diagram on page 20)	100 W to 1000 W
Insertion loss		< 0.06 dB
Directivity		> 30 dB
Average power		
Power measurement range		
CW, FM, PM, FSK, GMSK	CF: ratio of peak envelope	30 mW to 300 W
Modulated signals	power to average power	30 mW to 300 W/CF
Measurement uncertainty		
25 MHz to 40 MHz	sine signal	4.0 % of measured value (0.17 dB)
40 MHz to 1 GHz	+18 °C to +28 °C, no zero offset	3.2 % of measured value (0.14 dB)
Zero offset	after zeroing	±4 mW
Range of typical measurement error with modulation	FM, PM, FSK, GMSK	0 % of measured value (0 dB)
	AM (80 %)	±3 % of measured value (±0.13 dB)
	two CW carriers with identical power	±2 % of measured value (±0.09 dB)
	EDGE, TETRA	±0.5 % of measured value (±0.02 dB) [3]
Temperature coefficient	25 MHz to 40 MHz	0.40 %/K (0.017 dB/K)
	40 MHz to 1 GHz	0.25 %/K (0.011 dB/K)

[3] If standard is selected on the R&S®FSH4/R&S®FSH8.

Max. peak envelope power		
Power measurement range		
Video bandwidth	4 kHz	0.4 W to 300 W
	200 kHz	1 W to 300 W
	600 kHz	2 W to 300 W
Measurement uncertainty	same as for average power plus effect of peak hold circuit	+18 °C to +28 °C
Error limits of peak hold circuit for burst signals		
Duty cycle ≥ 0.1 and repetition rate ≥ 100/s	video bandwidth 4 kHz	±(3 % of measured value + 0.05 W) starting from a burst width of 200 µs
	video bandwidth 200 kHz	±(3 % of measured value + 0.20 W) starting from a burst width of 4 µs
	video bandwidth 600 kHz	±(7 % of measured value + 0.40 W) starting from a burst width of 2 µs
20/s ≤ repetition rate < 100/s		plus ±(1.6 % of measured value + 0.15 W)
0.001 ≤ duty cycle < 0.1		plus ±0.10 W
Temperature coefficient	25 MHz to 40 MHz	0.50 %/K (0.022 dB/K)
	40 MHz to 1 GHz	0.35 %/K (0.015 dB/K)
Load matching		
Matching measurement range		
Return loss		0 dB to 23 dB
VSWR		> 1.15
Minimum forward power	specifications complied with ≥ 0.4 W	0.06 W
Dimensions (W × H × D)		120 mm × 95 mm × 39 mm (4.72 in × 3.74 in × 1.53 in)
	connecting cable	1.5 m (59 in)
Weight		0.65 kg (1.43 lb)



Error limits for matching measurements.



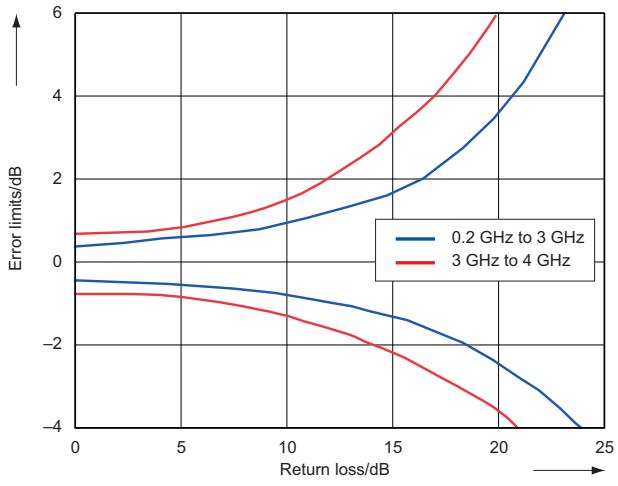
Power-handling capacity.

R&S®FSH-Z44 directional power sensor

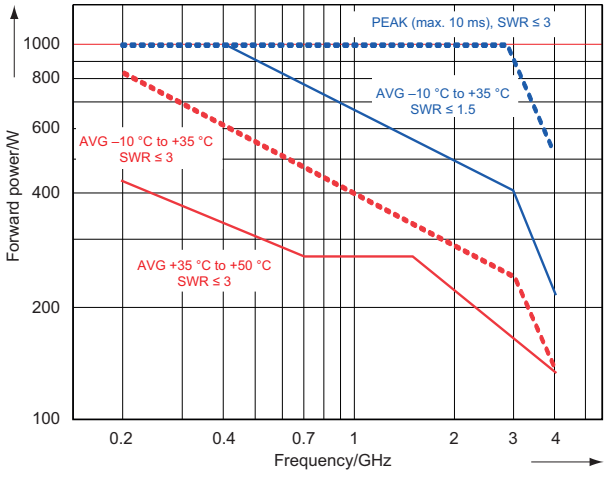
Frequency range		200 MHz to 4 GHz
Power measurement range		30 mW to 300 W
VSWR referenced to 50 Ω	200 MHz to 3 GHz	< 1.07
	3 GHz to 4 GHz	< 1.12
Power-handling capacity	depending on temperature and matching (see diagram on page 22)	120 W to 1000 W
Insertion loss	200 MHz to 1.5 GHz	< 0.06 dB
	1.5 GHz to 4 GHz	< 0.09 dB
Directivity	200 MHz to 3 GHz	> 30 dB
	3 GHz to 4 GHz	> 26 dB
Average power		
Power measurement range	CF: ratio of peak envelope power to average power	
	CW, FM, PM, FSK, GMSK	30 mW to 300 W
	3GPP WCDMA, cdmaOne, CDMA2000®, DAB, DVB-T	30 mW to 120 W
	other modulated signals	30 mW to 300 W/CF
Measurement uncertainty	sine signal, +18 °C to +28 °C, no zero offset	
	200 MHz to 300 MHz	4.0 % of measured value (0.17 dB)
	300 MHz to 4 GHz	3.2 % of measured value (0.14 dB)
Zero offset	after zeroing	±4 mW
Range of typical measurement error with modulation	FM, PM, FSK, GMSK	0 % of measured value (0 dB)
	AM (80 %)	±3 % of measured value (±0.13 dB)
	two CW carriers with identical power	±2 % of measured value (±0.09 dB)
	π/4-DQPSK	±2 % of measured value (±0.09 dB)
	EDGE	±0.5 % of measured value (±0.02 dB) [4]
	cdmaOne, DAB	±1 % of measured value (±0.04 dB) [4]
	3GPP WCDMA, CDMA2000®	±2 % of measured value (±0.09 dB) [4]
	DVB-T	±2 % of measured value (±0.09 dB) [4]
Temperature coefficient	200 MHz to 300 MHz	0.40 %/K (0.017 dB/K)
	300 MHz to 4 GHz	0.25 %/K (0.011 dB/K)
Max. peak envelope power		
Power measurement range		
DAB, DVB-T, cdmaOne, CDMA2000®, 3GPP WCDMA		4 W to 300 W
Other signals at video bandwidth	4 kHz	0.4 W to 300 W
	200 kHz	1 W to 300 W
	4 MHz	2 W to 300 W
Measurement uncertainty	+18 °C to +28 °C	same as for average power plus effect of peak hold circuit
Error limits of peak hold circuit for burst signals	duty cycle ≥ 0.1 and repetition rate ≥ 100/s	
	video bandwidth 4 kHz	±(3 % of measured value + 0.05 W) starting from a burst width of 100 µs
	video bandwidth 200 kHz	±(3 % of measured value + 0.20 W) starting from a burst width of 4 µs
	video bandwidth 4 MHz	±(7 % of measured value + 0.40 W) starting from a burst width of 1 µs
	20/s ≤ repetition rate < 100/s	plus ±(1.6 % of measured value + 0.15 W)
	0.001 ≤ duty cycle < 0.1	plus ±0.10 W
	burst width ≥ 0.5 µs	plus ±5 % of measured value
	burst width ≥ 0.2 µs	plus ±10 % of measured value
Range of typical measurement error of peak hold circuit	video bandwidth 4 MHz and standard selected on the R&S®FSH4/R&S®FSH8	
	cdmaOne, DAB	±(5 % of measured value + 0.4 W)
	DVB-T, CDMA2000®, 3GPP WCDMA	±(15 % of measured value + 0.4 W)
Temperature coefficient	200 MHz to 300 MHz	0.50 %/K (0.022 dB/K)
	300 MHz to 4 GHz	0.35 %/K (0.015 dB/K)

[4] If standard is selected on the R&S®FSH4/R&S®FSH8.

Load matching		
Matching measurement range		
Return loss	200 MHz to 3 GHz	0 dB to +23 dB
VSWR	3 GHz to 4 GHz	0 dB to +20 dB
VSWR	200 MHz to 3 GHz	> 1.15
	3 GHz to 4 GHz	> 1.22
Minimum forward power	specifications complied with ≥ 0.2 W	0.03 W
Dimensions (W × H × D)		120 mm × 95 mm × 39 mm (4.72 in × 3.74 in × 1.53 in)
	connecting cable	1.5 m (59 in)
Weight		0.65 kg (1.43 lb)



Error limits for matching measurements.



Power-handling capacity.

R&S®HA-Z240 GPS receiver

GPS location indication		latitude, longitude
Reference frequency uncertainty	GPS on, ≥ 1 minute after satellite lock	$\pm 2.5 \times 10^{-8}$
	up to 30 minutes after loosing satellite lock	$\pm 5 \times 10^{-8}$
Temperature	operating temperature range	–20 °C to +55 °C
	storage temperature range	–40 °C to +70 °C
Climatic loading	GPS receiver module	IEC 60529 IPX7 level
Connector		7-contact male (type Binder 712)
Power consumption		0.45 W
Test marks		FCC, CE
Dimensions	diameter × height	Ø 61 mm × 19.5 mm (Ø 2.4 in × 0.8 in)
	cable length	5 m (16.4 ft)
Weight		200 g (0.4 lb)

Ordering information

Designation	Type	Order No.
Spectrum Analyzer, 9 kHz to 3.6 GHz, with preamplifier	R&S®FSH4	1309.6000.04
Spectrum Analyzer, 9 kHz to 3.6 GHz, with preamplifier and tracking generator	R&S®FSH4	1309.6000.14
Spectrum Analyzer, 100 kHz to 3.6 GHz, with preamplifier, tracking generator and internal VSWR bridge	R&S®FSH4	1309.6000.24
Spectrum Analyzer, 9 kHz to 8 GHz, with preamplifier	R&S®FSH8	1309.6000.08
Spectrum Analyzer, 9 kHz to 8 GHz, with preamplifier and tracking generator	R&S®FSH8	1309.6000.18
Spectrum Analyzer, 100 kHz to 8 GHz, with preamplifier, tracking generator and internal VSWR bridge	R&S®FSH8	1309.6000.28
Accessories supplied		
Li-ion battery pack, USB cable, LAN cable, AC power supply, CD-ROM with R&S®FSH4View software and documentation, quick start guide, SD card reader for PC		

Options

Designation	Type	Order No.	Remarks
Spectrogram Measurement Application	R&S®FSH-K14	1304.5770.02	
Remote Control via LAN or USB	R&S®FSH-K40	1304.5606.02	
Distance-to-Fault Analysis (for models .24 and .28 only, requires R&S®FSH-Z320 or R&S®FSH-Z321 and R&S®FSH-Z28 or R&S®FSH-Z29)	R&S®FSH-K41	1304.5612.02	
Vector Network Analysis (for models .24 and .28 only)	R&S®FSH-K42	1304.5629.02	
Vector Voltmeter (for models .24 and .28 only)	R&S®FSH-K45	1304.5658.02	
3GPP WCDMA BTS/NodeB Pilot Channel and EVM Measurement Application	R&S®FSH-K44	1304.5641.02	
3GPP WCDMA BTS/NodeB Code Domain Power and EVM Measurement Application	R&S®FSH-K44E	1304.5758.02	
CDMA2000® BTS Pilot Channel and EVM Measurement Application	R&S®FSH-K46	1304.5729.02	
CDMA2000® BTS Code Domain Power Measurement Application (R&S®FSH-K46 required)	R&S®FSH-K46E	1304.5764.02	
1xEV-DO® BTS Pilot Channel and EVM Measurement Application	R&S®FSH-K47	1304.5787.02	
1xEV-DO® BTS PN Scanner and Time Domain Power Measurement Application (R&S®FSH-K47 required)	R&S®FSH-K47E	1304.5806.02	
3GPP TD-SCDMA BTS power and P-CCPCH EVM measurement application	R&S®FSH-K48	1304.5841.02	
LTE FDD Downlink Pilot Channel and EVM Measurement Application	R&S®FSH-K50	1304.5735.02	only for instruments with serial number ≥ 105000
LTE TDD Downlink Pilot Channel and EVM Measurement Application	R&S®FSH-K51	1304.5812.02	only for instruments with serial number ≥ 105000
LTE FDD Downlink Extended Channel and Modulation Measurement Application (R&S®FSH-K50 required)	R&S®FSH-K50E	1304.5793.02	only for instruments with serial number ≥ 105000
LTE TDD Downlink Extended Channel and Modulation Measurement Application (R&S®FSH-K51 required)	R&S®FSH-K51E	1304.5829.02	only for instruments with serial number ≥ 105000
Receiver Mode and Channel Scan Measurement Application	R&S®FSH-K43	1304.5635.02	

Accessories

Designation	Type	Order No.
RF Cable (length 1 m), DC to 8 GHz, armored, N male/N female connectors	R&S®FSH-Z320	1309.6600.00
RF Cable (length 3 m), DC to 8 GHz, armored, N male/N female connectors	R&S®FSH-Z321	1309.6617.00
Combined Open/Short/50 Ω Load Calibration Standard, DC to 3.6 GHz	R&S®FSH-Z29	1300.7510.03
Combined Open/Short/50 Ω Load Calibration Standard, DC to 8 GHz	R&S®FSH-Z28	1300.7810.03
Combined Open/Short/50 Ω Load/Through Calibration Standard, DC to 15 GHz, 3.5 mm male	R&S®ZV-Z135	1317.7677.02
Combined Open/Short/50 Ω Load/Through Calibration Standard, DC to 15 GHz, 3.5 mm female	R&S®ZV-Z135	1317.7677.03
Combined Open/Short/50 Ω Load/Through Calibration Standard, DC to 9 GHz, N male	R&S®ZV-Z170	1317.7683.02
Combined Open/Short/50 Ω Load/Through Calibration Standard, DC to 9 GHz, N female	R&S®ZV-Z170	1317.7683.03
Matching Pad 50/75 Ω, L section	R&S®RAM	0358.5414.02
Matching Pad 50/75 Ω, series resistor 25 Ω	R&S®RAZ	0358.5714.02
Matching Pad 50/75 Ω, L section, N to BNC	R&S®FSH-Z38	1300.7740.02
Adapter N (m) – BNC (f)		0118.2812.00
Adapter N (m) – N (m)		0092.6581.00
Adapter N (m) – SMA (f)		4012.5837.00
Adapter N (m) – 7/16 (f)		3530.6646.00
Adapter N (m) – 7/16 (m)		3530.6630.00
Adapter N (m) – FME (f)		4048.9790.00
Adapter BNC (m) – Banana (f)		0017.6742.00
Attenuator 50 W, 20 dB, 50 Ω, DC to 6 GHz, N(f) – N(m)	R&S®RDL50	1035.1700.52
Attenuator 100 W, 20 dB, 50 Ω, DC to 2 GHz, N(f) – N(m)	R&S®RBU100	1073.8495.20
Attenuator 100 W, 30 dB, 50 Ω, DC to 2 GHz, N(f) – N(m)	R&S®RBU100	1073.8495.30
12 V Car Adapter for cigarette lighter [5]	R&S®HA-Z202	1309.6117.00
Li-Ion Battery Pack, 4.5 Ah	R&S®HA-Z204	1309.6130.00
Li-Ion Battery Pack, 6.75 Ah	R&S®HA-Z206	1309.6146.00
Battery Charger for R&S®HA-Z204 and R&S®HA-Z206 Li-ion battery pack [6]	R&S®HA-Z203	1309.6123.00
Soft Carrying Bag	R&S®HA-Z220	1309.6175.00
Hard Case	R&S®HA-Z221	1309.6181.00
Carrying Holster, including chest harness and rain cover	R&S®HA-Z222	1309.6198.00
SD Memory Card, 2 Gbyte [7]	R&S®HA-Z232	1309.6223.00
Headphones	R&S®FSH-Z36	1145.5838.02
GSM/UMTS/CDMA antenna magnetic mount 850/900/1800/1900/2100 band, N connector	R&S®TS95A16	1118.6943.16
Active Directional Antenna, 20 MHz to 7.5 GHz	R&S®HE300	4067.5900.02
Loop Antenna for R&S®HE300, 9 kHz to 20 MHz	R&S®HE300HF	4067.6806.02
Near-Field Probe Set	R&S®HZ-15	1147.2736.02
Preamplifier for R&S®HZ-15	R&S®HZ-16	1147.2720.02
Spare USB Cable	R&S®HA-Z211	1309.6169.00
Spare Ethernet Cable	R&S®HA-Z210	1309.6152.00
Spare Power Supply, incl. mains plug for EU, GB, US	R&S®HA-Z201	1309.6100.00
Power cord + adapter for R&S®HA-Z201 power supply (changes the power supply to laptop style)		
Power cord EU	R&S®HA-Z209	1309.7465.02
Power cord GB	R&S®HA-Z209	1309.7465.03
Power cord US/JP	R&S®HA-Z209	1309.7465.04
Power cord AUS	R&S®HA-Z209	1309.7465.05
GPS Receiver	R&S®HA-Z240	1309.6700.03
Spare CD-ROM including R&S®FSH4View Software and Operating Manual for R&S®FSH4/R&S®FSH8	R&S®FSH-Z45	1309.6246.00
Spare printed Quick Start Guide for R&S®FSH4/R&S®FSH8, English	R&S®FSH-Z46	1309.6269.12
Spare printed Quick Start Guide for R&S®FSH4/R&S®FSH8, German	R&S®FSH-Z47	1309.6269.11
Portable system for EMVU measurements		
Hard Case	R&S®TS-EMF	1158.9295.05
Isotropic Antenna, 30 MHz to 3 GHz for R&S®TS-EMF	R&S®TSEMF-B1	1074.5719.02
Isotropic Antenna, 700 MHz to 6 GHz for R&S®TS-EMF	R&S®TSEMF-B2	1074.5702.02
Isotropic Antenna, 9 kHz to 200 MHz for R&S®TS-EMF	R&S®TSEMF-B3	1074.5690.02

[5] Note: The car adapter is suitable for both the instrument and the R&S®HA-Z203 external battery charger.

[6] Note: The battery charger is dedicated for charging an additional battery outside the instrument. The internal battery is charged by the instrument itself.

[7] Note: Firmware update is installed from SD memory card.

R&S®NRP-Zxx power sensors supported by the R&S®FSH4/R&S®FSH8 [8] [9]

Designation	Type	Order No.
Power Sensor, 10 MHz to 8 GHz	R&S®FSH-Z1	1155.4505.02
Power Sensor, 10 MHz to 18 GHz	R&S®FSH-Z18	1165.1909.02
Directional Power Sensor, 25 MHz to 1 GHz	R&S®FSH-Z14	1120.6001.02
Directional Power Sensor, 200 MHz to 4 GHz	R&S®FSH-Z44	1165.2305.02
Universal Power Sensor, 10 MHz to 8 GHz, 100 mW, 2-path	R&S®NRP-Z211	1417.0409.02
Universal Power Sensor, 10 MHz to 8 GHz, 200 mW	R&S®NRP-Z11	1138.3004.02
Universal Power Sensor, 10 MHz to 18 GHz, 100 mW, 2-path	R&S®NRP-Z221	1417.0309.02
Universal Power Sensor, 10 MHz to 18 GHz, 200 mW	R&S®NRP-Z21	1137.6000.02
Universal Power Sensor, 10 MHz to 18 GHz, 2 W	R&S®NRP-Z22	1137.7506.02
Universal Power Sensor, 10 MHz to 18 GHz, 15 W	R&S®NRP-Z23	1137.8002.02
Universal Power Sensor, 10 MHz to 18 GHz, 30 W	R&S®NRP-Z24	1137.8502.02
Universal Power Sensor, 10 MHz to 33 GHz, 200 mW	R&S®NRP-Z31	1169.2400.02
Thermal Power Sensor, 0 Hz to 18 GHz, 100 mW	R&S®NRP-Z51	1138.0005.02
Thermal Power Sensor, 0 Hz to 40 GHz, 100 mW	R&S®NRP-Z55	1138.2008.02
Thermal Power Sensor, 0 Hz to 50 GHz, 100 mW	R&S®NRP-Z56	1171.8201.02
Thermal Power Sensor, 0 Hz to 67 GHz, 100 mW	R&S®NRP-Z57	1171.8401.02
Wideband Power Sensor, 50 MHz to 18 GHz, 100 mW	R&S®NRP-Z81	1137.9009.02
Average Power Sensor, 9 kHz to 6 GHz, 200 mW	R&S®NRP-Z91	1168.8004.02
Average Power Sensor, 9 kHz to 6 GHz, 2 W	R&S®NRP-Z92	1171.7005.02

R&S®NRP-Zxx power sensors require the following adapter cable for operation on the R&S®ZVH		
Passive USB adapter to connect R&S®NRP-Zxx sensors to the R&S®ZVH	R&S®NRP-Z4	1146.8001.02

R&S®FSH power sensors require the following adapter cable for connection to a PC		
USB Adapter Cable for R&S®FSH-Z1/R&S®FSH-Z18	R&S®FSH-Z101	1164.6252.02
USB Adapter Cable for R&S®FSH-Z14/R&S®FSH-Z44	R&S®FSH-Z144	1145.5905.02

Service options

Service options		
Extended Warranty, one year	R&S®WE1FSH	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2FSH	
Extended Warranty, three years	R&S®WE3FSH	
Extended Warranty, four years	R&S®WE4FSH	
Extended Warranty with Calibration Coverage, one year	R&S®CW1FSH	
Extended Warranty with Calibration Coverage, two years	R&S®CW2FSH	
Extended Warranty with Calibration Coverage, three years	R&S®CW3FSH	
Extended Warranty with Calibration Coverage, four years	R&S®CW4FSH	

Extended warranty with a term of one to four years (WE1 to WE4)
Repairs carried out during the contract term are free of charge [10]. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

Extended warranty with calibration (CW1 to CW4)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [10] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

For product brochure, see PD 5214.0482.12 and www.rohde-schwarz.com.

[8] For average power measurements only.

[9] R&S®NRP-Zxx power sensors are supported by instruments with serial number ≥ 105000.

[10] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service you can rely on

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

About Rohde&Schwarz

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 more than 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability

Certified Quality System
ISO 9001

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Subject to change

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