

R&S® FSH4/8

Spectrum Analyzer

Specifications



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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, model .14	9 kHz to 3.6 GHz
	R&S®FSH8 model .08, model .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	0 °C to +30 °C	(time since last adjustment × aging rate) + temperature drift + calibration accuracy

Frequency readout		
Marker resolution		0.1 Hz
Uncertainty		$\pm(\text{marker frequency} \times \text{reference uncertainty} + 10\% \times \text{resolution bandwidth} + \frac{1}{2}(\text{span} / (\text{sweep points} - 1)) + 1 \text{ Hz})$
Number of sweep (trace) points		631
Marker tuning frequency step size		span/630
Frequency counter resolution		0.1 Hz
Count uncertainty	S/N > 25 dB	$\pm(\text{frequency} \times \text{reference uncertainty} + \frac{1}{2}(\text{last digit}))$
Frequency span		0 Hz, 10 Hz to 3.6 GHz / 8 GHz
Span uncertainty		nominal 1 %

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

Sweep time

Sweep time	span = 0 Hz	200 μs to 100 s
	$10 \text{ Hz} \leq \text{span} \leq 600 \text{ MHz}$	20 ms to 1000 s
	span > 600 MHz	20 ms × span / 600 MHz to 1000 s
Uncertainty	span = 0 Hz	nominal 1 %
	span $\geq 10 \text{ Hz}$	nominal 3 %

Bandwidths

Resolution bandwidths		
Range	-3 dB bandwidth	100 Hz to 3 MHz in 1,3 sequence
Bandwidth accuracy	100 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	10 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 x -20 dBm, RF attenuation = 0 dB, RF preamplifier = OFF	
	$f_{in} < 300 \text{ MHz}$	>54 dBc (TOI >+7 dBm, typ. +11 dBm)
	$300 \text{ MHz} \leq f_{in} < 3.6 \text{ GHz}$	>60 dBc (TOI >+10 dBm, typ. +15 dBm)
	$3.6 \text{ GHz} \leq f_{in} \leq 8 \text{ GHz}$	>46 dBc (TOI >+3 dBm, typ. +10 dBm)
	intermodulation-free dynamic range, signal level 2 x -40 dBm, RF attenuation = 0 dB, RF preamplifier = ON	
	$f_{in} < 300 \text{ MHz}$	>50 dBc (TOI -15 dBm)
$300 \text{ MHz} \leq f_{in} \leq 8 \text{ GHz}$	>56 dBc (TOI -12 dBm)	
Second harmonic intercept point, nominal values	RF attenuation = 0 dB, RF preamplifier = OFF	
	$f_{in} = 20 \text{ MHz to } 1.5 \text{ GHz}$	+40 dBm
	$f_{in} = 1.5 \text{ GHz to } 3 \text{ GHz}$	+30 dBm
	$f_{in} = 3 \text{ GHz to } 4 \text{ GHz}$	+20 dBm
	RF attenuation 0 dB, RF preamplifier = ON	
	$f_{in} = 100 \text{ MHz to } 4 \text{ GHz}$	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
		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

Immunity to interference, nominal values		
Image frequencies	$f_{in} - 2 \times 21.4$ MHz	<-70 dBc, typ. -80 dBc
	$f_{in} - 2 \times 831.4$ MHz	<-70 dBc, typ. -90 dBc
	$f_{in} - 2 \times 4881$ MHz	-60 dBc
Intermediate frequencies	21.4 MHz, 831.4 MHz, 4881.4 MHz	<-60 dBc, typ. -80 dBc
	8931.4 MHz	-50 dBc
Spurious response, inherent	input matched with 50 Ω , without input signal, RBW \leq 30 kHz, RF attenuation = 0 dB, tracking generator OFF	<-90 dBm
Other interfering signals, signal level – RF attenuation < -20 dBm	$f \leq 3.6$ GHz spurious at $f_{in} - 2440.7$ MHz	<-60 dBc
	3.6 GHz < $f \leq 8$ GHz spurious at $f_{in} - 4465.7$ MHz	<-60 dBc
Spurious response, related to local oscillators	$f \leq 3.6$ GHz	
	$\Delta f < 300$ kHz	-60 dBc
	$\Delta f \geq 300$ kHz	<-60 dBc
	$f > 3.6$ GHz	
	$\Delta f < 300$ kHz	-54 dBc
	$\Delta f \geq 300$ kHz	<-54 dBc
	$f =$ receive frequency	
Level display		
Logarithmic level axis		1 dB, 2 dB, 5 dB, 10 dB, 20 dB, 50 dB or 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		clear/write, max hold, min hold, average, view
Setting range of reference level		-80 dBm to +30 dBm
Units of level axis		dBm, dBmV, dB μ V, V, W
Level measurement uncertainty		
Total measurement uncertainty	95 % confidence level, +20 °C to +30 °C, S/N > 16 dB, 0 dB to -50 dB below reference level, RF attenuation auto	
	10 MHz $\leq f \leq 3.6$ GHz	<1 dB, typ. 0.5 dB
	3.6 GHz < $f \leq 8$ GHz	<1.5 dB, typ. 1 dB
Absolute level uncertainty at 100 MHz	+20 °C to +30 °C	<0.3 dB
Frequency response (+20 °C to +30 °C)	9 kHz $\leq f < 100$ kHz (models .04/.14/.08/.18 only)	nominal <1.5 dB
	100 kHz $\leq f < 10$ MHz	nominal <1.5 dB
	10 MHz $\leq f \leq 3.6$ GHz	<1 dB
	3.6 GHz < $f \leq 8$ GHz	<1.5 dB
Attenuator uncertainty		<0.3 dB
Uncertainty of reference level setting		nominal <0.1 dB
Display nonlinearity		
Logarithmic level display	S/N > 16 dB 0 dB to -50 dB	<0.2 dB
Bandwidth switching uncertainty	reference: RBW = 10 kHz	nominal <0.1 dB

Trigger functions

Trigger		
Trigger source		free run, video, external, IF power
External trigger level threshold	low \rightarrow high transition	2.4 V
	high \rightarrow low transition	0.7 V

Inputs and outputs

RF input		
Impedance		50 Ω
Connector		N female
VSWR	100 kHz \leq f \leq 1 GHz	nominal <1.5
	1 GHz < f \leq 6 GHz	nominal <2
	6 GHz < f \leq 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 mV to >100 mV
Power sensor		
Connector		7-contact female (type Binder 712)
Power sensors supported		see accessories
Tracking generator (models .14 and .24 only)		
Frequency range		100 kHz to 3.6 GHz
Connector		N female, 50 Ω
VSWR	100 kHz \leq f \leq 1 GHz	nominal <1.5
	1 GHz < f \leq 3.6 GHz	nominal <2
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 \leq f < 300 kHz	>60 dB, typ. 80 dB
	300 kHz \leq f < 3.6 GHz	>70 dB, typ. 90 dB
Reverse power		
DC voltage		50 V
CW RF power		+20 dBm (= 0.1 W)
Max. pulse voltage		50 V
Max. pulse energy (10 μ s)		1 mWs
Tracking generator (models .18 and .28 only)		
Frequency range		100 kHz to 8 GHz
Connector		N female, 50 Ω
VSWR	100 kHz \leq f \leq 1 GHz	nominal <1.5
	1 GHz < f \leq 6 GHz	nominal <2
	6 GHz < f \leq 8 GHz	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 \leq f < 300 kHz	>60 dB, typ. 80 dB
	300 kHz \leq f < 6 GHz	>70 dB, typ. 90 dB
	6 GHz \leq f < 8 GHz	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 μ s)		1 mWs
External reference, external trigger, DC bias port 2 (BNC 1)		
Connector		BNC, 50 Ω
Mode	selectable	ext. reference, ext. trigger, DC bias port 2
External reference	required level	0 dBm
	frequency	10 MHz
External trigger threshold	low \rightarrow high transition	2.4 V
	high \rightarrow 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	IF out, DC bias port 1
IF out	frequency	21.4 MHz
DC bias port 1	max. rated input voltage	50 V
AUX		
Connector		7-contact female (type Binder 712)

Vector network analysis

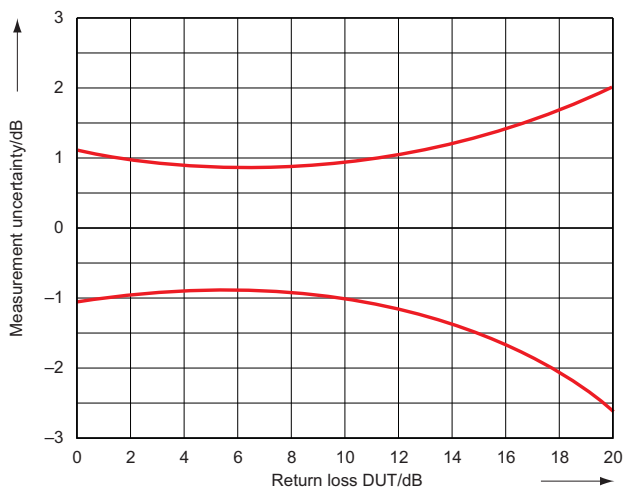
(model .24/.28 with R&S®FSH-K42 option)

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 -50 dBm in 1 dB steps
Reflection measurement		
Return loss		
Range	selectable	1 dB, 2 dB, 5 dB, 10 dB, 20 dB, 50 dB, 100 dB, linear 100 %
Resolution		0.01 dB
One-port phase		
Range	selectable	90°, 180°, 360°, 720°, 1000° to 10000° in 1, 2, 5 steps
Resolution		0.01°
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	range	0 to 1, 0 to 0.1, 0 to 0.01, 0 to 0.001
mRho	range	0 to 1000, 0 to 100, 0 to 10, 0 to 1
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
Transmission measurement		
Gain		
Measurement range		-120 dB to +80 dB
Display range	selectable	1 dB, 2 dB, 5 dB, 10 dB, 20 dB, 50 dB, 100 dB, linear 100 %
Resolution		0.01 dB
Phase		
Range	selectable	90°, 180°, 360°, 720°, 1000° to 10000° in 1, 2, 5 steps
Resolution		0.01°
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

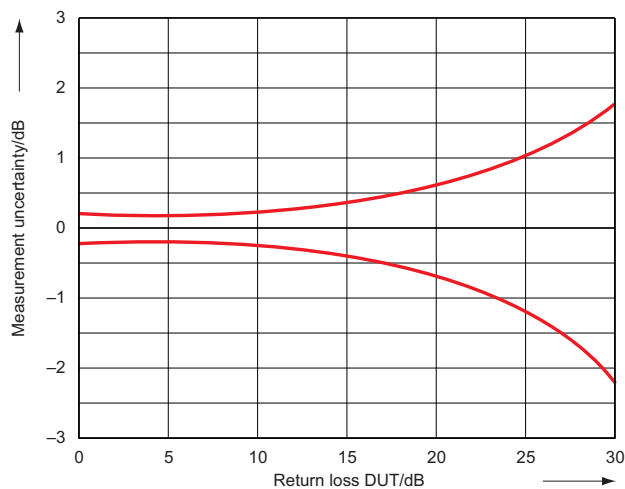
Scalar network analysis

(model .24/.28 without R&S®FSH-K42 option)

Frequency range	R&S®FSH4 model .24 R&S®FSH8 model .28	300 kHz to 3.6 GHz 300 kHz to 8 GHz
Frequency resolution		1 Hz
Data points		631
Port power	controlled via tracking generator attenuation	nominal 0 dBm to -50 dBm in 1 dB steps
Reflection measurement		
Return loss	range	1 dB, 2 dB, 5 dB, 10 dB, 20 dB, 50 dB, 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		
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 R&S®FSH-K42 option



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

R&S® FSH-K41 distance-to-fault analysis

Return loss	range	1 dB, 2 dB, 5 dB, 10 dB, 20 dB, 50 dB, 100 dB, linear 100 %
	resolution	0.01 dB
VSWR	range	10 dB, 20 dB, 50 dB, 100 dB
	resolution	0.01 dB
Reflection coefficient	range	0 to 1, 0 to 0.1, 0 to 0.01, 0 to 0.001
mRho	range	0 to 1000, 0 to 100, 0 to 10, 0 to 1
Fault resolution		(1.5 ⁸ × velocity factor / span) [meter]
Maximum permissible spurious signal	RF attenuation = 0 dB	nominal 0 dBm

General data

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 pixels × 480 pixels
Audio		
Speaker		internal
Mass memory		
Mass memory		flash memory (internal), SD card (not supplied)
Data storage	internal	>256 instrument settings and traces
	on 1 Gbyte SD card	>5000 instrument settings and traces
Temperature		
	operating temperature range	0 °C to +50 °C
	permissible temperature range	0 °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 °C/+40 °C at 85 % relative humidity (EN 60068-2-30)
	IP class of protection	51
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 AC 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 61010B-1, CSA C22.2 No. 1010-1
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 A.1 (immunity, industrial)
Dimensions (W × H × D)	with handle	192 mm × 145 mm × 300 mm (76 in × 57 in × 118 in)
	without handle	192 mm × 70 mm × 300 mm (76 in × 28 in × 118 in)
Weight		<3 kg (<6.6 lb)
Recommended calibration interval		1 year

Accessories

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

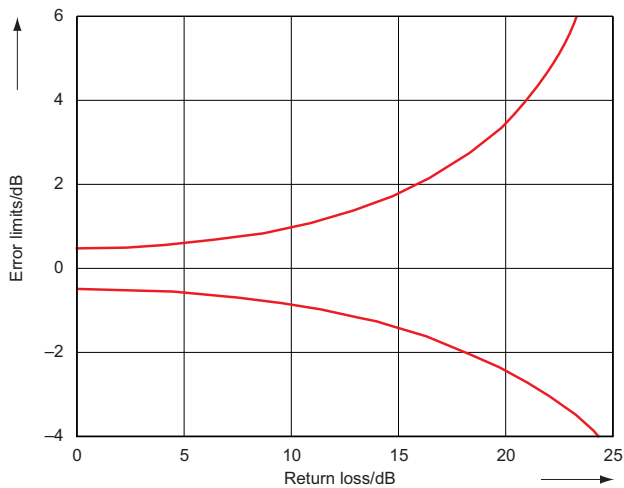
Frequency range	R&S®FSH-Z1	10 MHz to 8 GHz
	R&S®FSH-Z18	10 MHz to 18 GHz
VSWR	10 MHz to 30 MHz	<1.15
	30 MHz to 2.4 GHz	<1.13
	2.4 GHz to 8 GHz	<1.20
	8 GHz to 18 GHz	<1.25
Maximum input power	average power	400 mW (+26 dBm)
	peak power (<10 µs, 1 % duty cycle)	1 W (+30 dBm)
Measurement range		200 pW 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 0 °C to +50 °C
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		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

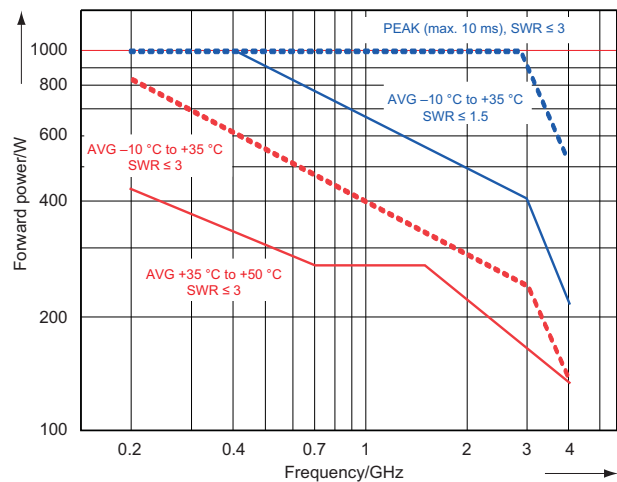
Frequency range		25 MHz to 1 GHz
Power measurement range		30 mW to 300 W
VSWR referenced to 50 Ω		<1.06
Power-handling capacity	depending on temperature and matching (see diagram on page 12)	100 W to 1000 W
Insertion loss		<0.06 dB
Directivity		>30 dB
Average power		
Power measurement range		
CW, FM, 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) ¹
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)

¹ If standard is selected on the R&S®FSH.

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 $\geq 100/s$	video bandwidth 4 kHz	$\pm(3\%$ of measured value + 0.05 W) starting from a burst width of 200 μs
	video bandwidth 200 kHz	$\pm(3\%$ of measured value + 0.20 W) starting from a burst width of 4 μs
	video bandwidth 600 kHz	$\pm(7\%$ of measured value + 0.40 W) starting from a burst width of 2 μs
$20/s \leq$ repetition rate $<100/s$		plus $\pm(1.6\%$ of measured value + 0.15 W)
$0.001 \leq$ 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	specs met from 0.4 W	0.06 W
Dimensions		120 mm \times 95 mm \times 39 mm (4.72 in \times 3.74 in \times 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

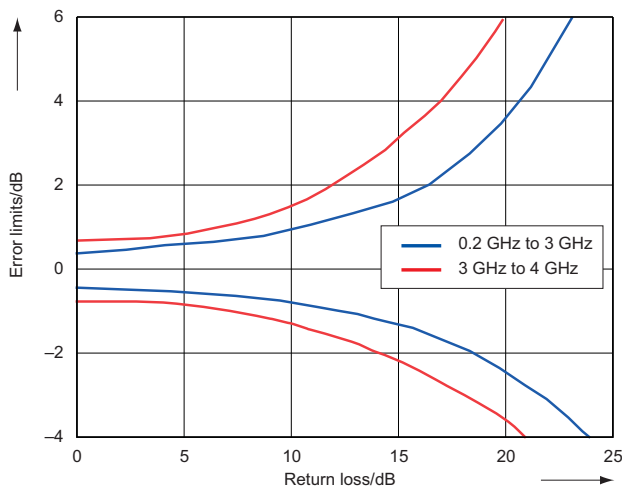
R&S® FSH-Z44 directional power sensor

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 14)	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 ² , 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) ³	
	cdmaOne, DAB	±1 % of measured value (±0.04 dB) ³	
	3GPP WCDMA, CDMA2000 ²	±2 % of measured value (±0.09 dB) ³	
Temperature coefficient	DVB-T	±2 % of measured value (±0.09 dB) ³	
	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 ² , 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®FSH		
	cdmaOne, DAB	±(5 % of measured value + 0.4 W)	
	DVB-T, CDMA2000 ² , 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)	

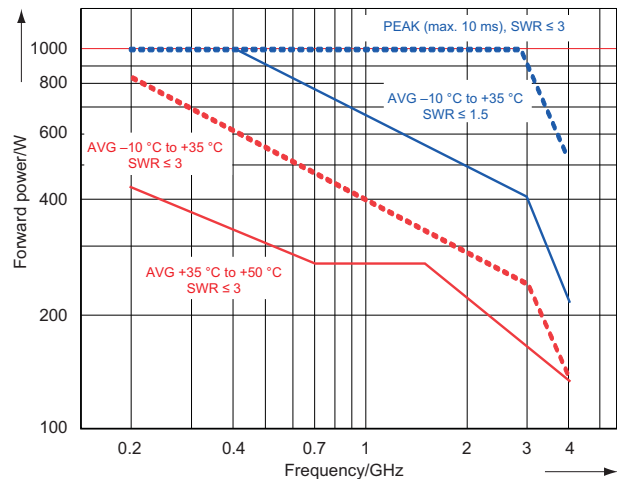
² CDMA2000[®] is a registered trademark of the Telecommunications Industry Association (TIA - USA).

³ If standard is selected on the R&S®FSH.

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	specs met from 0.2 W	0.03 W
Dimensions		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

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		

Options

Designation	Type	Order No.
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

Accessories

Order 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
RF Cable (1 m), DC to 8 GHz, armored, N male/N female connectors	R&S®FSH-Z320	1309.6600.00
RF Cable (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
Matching Pad 50 Ω / 75 Ω, L section	R&S®RAM	0358.5414.02
Matching Pad 50 Ω / 75 Ω, series resistor 25 Ω	R&S®RAZ	0358.5714.02
Matching Pad 50 Ω / 75 Ω, L section, N to BNC	R&S®FSH-Z38	1300.7740.02
Li-Ion Battery Pack, 6.75 Ah	R&S®HA-Z206	1309.6146.00
Battery Charger for Li-ion battery pack R&S®HA-Z204 and R&S®HA-Z206	R&S®HA-Z203	1309.6123.00
12 V Car Adapter for cigarette lighter	R&S®HA-Z202	1309.6117.00
Soft Carrying Bag	R&S®HA-Z220	1309.6175.00
SD Memory Card, 1 Gbyte	R&S®HA-Z231	1309.6217.00
Headphones	R&S®FSH-Z36	1145.5838.02
Active Directional Antenna, 20 MHz to 7.5 GHz	R&S®HE-300	4067.5900.02
Loop Antenna for R&S®HE300, 9 kHz to 20 MHz	R&S®HE-300-HF	1158.9295.13
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