

R&S® FSH

Provided by [www.AAATesters.com](http://www.AAATesters.com)

# Spectrum Analyzer Specifications



# CONTENTS

<b>Specifications</b> .....	<b>3</b>
Frequency .....	3
Sweep time.....	4
Bandwidths.....	4
Level.....	4
Trigger functions.....	6
Inputs and outputs.....	7
Vector network analysis/vector voltmeter.....	8
<i>R&amp;S®FSH4/R&amp;S®FSH8 model .24/.28 with R&amp;S®FSH-K42/R&amp;S®FSH-K45 option</i> .....	8
<i>R&amp;S®FSH13/R&amp;S®FSH20 model .23/.30 with or without option R&amp;S®FSH-K45 option</i> .....	10
Scalar network analysis.....	12
<i>R&amp;S®FSH4/R&amp;S®FSH8 model .24/.28 without R&amp;S®FSH-K42 option</i> .....	12
Distance-to-fault analysis.....	13
<i>R&amp;S®FSH4/R&amp;S®FSH8/R&amp;S®FSH13/R&amp;S®FSH20 model .24/.28/.23/.30 with R&amp;S®FSH-K41 option</i> .....	13
R&S®FSH-K10 GSM EDGE measurement application.....	13
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 .....	14
R&S®FSH-K46 CDMA2000® BTS pilot channel and EVM measurement application R&S®FSH-K46E CDMA2000® BTS code domain power measurement application.....	16
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 .....	18
R&S®FSH-K48 3GPP TD-SCDMA BTS power and P-CCPCH EVM measurement application R&S®FSH-K48E 3GPP TD-SCDMA/HSDPA BTS code domain power and EVM measurement application .....	19
R&S®FSH-K50/R&S®FSH-K51 LTE FDD/TDD downlink pilot channel and EVM measurement application R&S®FSH-K50E/R&S®FSH-K51E LTE FDD/TDD downlink extended channel and modulation measurement application <sup>4</sup> .....	21
R&S®FSH-K43 Receiver Mode and Channel Scan Measurement Application.....	22
General data.....	23
Equivalence of specifications for different R&S®FSH part numbers.....	25
Accessories.....	26
<i>R&amp;S®FSH-Z1 and R&amp;S®FSH-Z18 power sensors</i> .....	26
<i>R&amp;S®FSH-Z14 directional power sensor</i> .....	26
<i>R&amp;S®FSH-Z44 directional power sensor</i> .....	28
<i>R&amp;S®HA-Z240 GPS receiver</i> .....	30
<i>R&amp;S®FSH-Z114 precision frequency reference</i> .....	30
<b>Ordering information</b> .....	<b>31</b>
Options.....	32
Accessories.....	33
R&S®NRP-Zxx power sensors supported by the R&S®FSH4/8/13/20 .....	34
Service options.....	35

# 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

<b>Frequency range</b>	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
	R&S®FSH13 model .13/.23	9 kHz to 13.6 GHz
	R&S®FSH20 model .20/.30	9 kHz to 20 GHz
<b>Frequency resolution</b>		1 Hz

<b>Reference frequency, internal</b>		
Aging per year		$1 \times 10^{-6}$
Temperature drift	0 °C to +30 °C	$1 \times 10^{-6}$
	+30 °C to +50 °C	$3 \times 10^{-6}$
Achievable initial calibration accuracy		$5 \times 10^{-7}$
Total reference uncertainty		(time since last adjustment × aging rate) + temperature drift + calibration accuracy
<b>Reference frequency, with R&amp;S®HA-Z240 GPS receiver option</b>		
Frequency uncertainty	GPS on, ≥ 1 minute after satellite lock	$\pm 2.5 \times 10^{-8}$
	up to 30 minutes after losing satellite lock	$\pm 5 \times 10^{-8}$
<b>Reference frequency, with R&amp;S®FSH-Z114 precision frequency reference option</b>		
Aging per year		$3.6 \times 10^{-9}$
Temperature drift	0 °C to +50 °C	$4 \times 10^{-10}$
Achievable initial calibration accuracy		$1 \times 10^{-9}$
Total reference uncertainty	R&S®FSH-Z114 connected	
	≥ 30 seconds after oscillator lock	(time since last adjustment × aging rate) + temperature drift + 3 × calibration accuracy (nominal)
	≥ 2 minutes after oscillator lock	(time since last adjustment × aging rate) + temperature drift + calibration accuracy

<b>Frequency readout</b>		
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	SNR > 25 dB	$\pm(\text{frequency} \times \text{reference uncertainty} + \frac{1}{2}(\text{last digit}))$
Frequency span		0 Hz, 10 Hz to 3.6/8/13.6/20 GHz
Span uncertainty		nominal 1 %

<b>Spectral purity SSB phase noise</b>		
Carrier offset	30 kHz	f = 500 MHz < -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 $\mu$ s to 100 s
	10 Hz $\leq$ span $\leq$ 600 MHz	20 ms to 1000 s
	span > 600 MHz	20 ms $\times$ span/600 MHz to 1000 s
Uncertainty	span = 0 Hz	nominal 1 %
	span $\geq$ 10 Hz	nominal 3 %

## Bandwidths

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

## Level

Display range		displayed noise floor to +30 dBm
<b>Maximum rated input level with RF attenuation <math>\geq</math> 10 dB</b>		
DC voltage	R&S <sup>®</sup> FSH4/ R&S <sup>®</sup> FSH 8, model .04/.08/.14/.18	80 V
	R&S <sup>®</sup> FSH4/ R&S <sup>®</sup> FSH 8, model .24/.28, R&S <sup>®</sup> FSH13, R&S <sup>®</sup> FSH 20	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 $\mu$ s	10 mWs
<b>Maximum rated input level with RF attenuation &lt; 10 dB</b>		
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 $\mu$ s	1 mWs
<b>Intermodulation</b>		
Third-order intercept (TOI), nominal values	intermodulation-free dynamic range, signal level 2 $\times$ -20 dBm, RF attenuation = 0 dB, RF preamplifier = off	
	$f_{in} < 300$ MHz	> 54 dBc (TOI > +7 dBm, typ. +11 dBm)
	300 MHz $\leq f_{in} < 3.6$ GHz	> 60 dBc (TOI > +10 dBm, typ. +15 dBm)
	3.6 GHz $\leq f_{in} \leq 20$ GHz	> 46 dBc (TOI > +3 dBm, typ. +10 dBm)
	intermodulation-free dynamic range, signal level 2 $\times$ -40 dBm, RF attenuation = 0 dB, RF preamplifier = on	
	$f_{in} < 300$ MHz	> 50 dBc (TOI > -15 dBm)
300 MHz $\leq f_{in} \leq 20$ 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
	$f_{in} = 4$ GHz to 10 GHz	+60 dBm
	RF attenuation 0 dB, RF preamplifier = on	
$f_{in} = 100$ MHz to 4 GHz	0 dBm	

<b>Displayed average noise level</b>	
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	
R&S®FSH4, R&S®FSH8 (models .04/.14/.08/.18 only)	< -108 dBm, typ. -118 dBm
R&S®FSH13, R&S®FSH20	< -96 dBm, typ. -106 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 13.6 GHz	< -136 dBm, typ. -141 dBm
13.6 GHz to 18 GHz	< -134 dBm, typ. -139 dBm
18 GHz to 20 GHz	< -130 dBm, typ. -135 dBm
frequency	preamplifier = on
100 kHz to 1 MHz	< -133 dBm, typ. -143 dBm
1 MHz to 10 MHz	
R&S®FSH4, R&S®FSH8	< -157 dBm, typ. -161 dBm
R&S®FSH13, R&S®FSH20	< -155 dBm, typ. -159 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
8 GHz to 13.6 GHz	< -158 dBm, typ. -162 dBm
13.6 GHz to 18 GHz	< -155 dBm, typ. -160 dBm
18 GHz to 20 GHz	< -150 dBm, typ. -155 dBm

<b>Adjacent channel leakage power ratio (ACLR)</b>		
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
<b>Immunity to interference, nominal values</b>		
Image frequencies	R&S®FSH4/R&S®FSH8, serial number < 105000	
	$f_{in} - 2 \times 21.4$ 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
	R&S®FSH4/R&S®FSH8, serial number $\geq$ 105000, R&S®FSH13, R&S®FSH20	
	$f_{in} - 2 \times 54.4$ MHz	< -70 dBc, typ. -80 dBc
	$f_{in} - 2 \times 860.8$ MHz	< -70 dBc, typ. -90 dBc
	$f_{in} - 2 \times 4892.8$ MHz	-60 dBc
	R&S®FSH13, R&S®FSH20	
	$f_{in} + 2 \times 6342.4$ MHz	-60 dBc
$f_{in} - 2 \times 6342.4$ MHz	-60 dBc	
Intermediate frequencies	R&S®FSH4/R&S®FSH8, serial number < 105000	
	21.4 MHz, 831.4 MHz, 4881.4 MHz	< -60 dBc, typ. -80 dBc
	8931.4 MHz	-50 dBc
	R&S®FSH4/R&S®FSH8, serial number $\geq$ 105000, R&S®FSH13, R&S®FSH20	
	54.4 MHz, 860.8 MHz, 4892.8 MHz	< -60 dBc, typ. -80 dBc
	8924.8 MHz	-50 dBc
	R&S®FSH13, R&S®FSH20	
	3171.2 MHz	-50 dBc

Other interfering signals, signal level – RF attenuation < –20 dBm	R&S®FSH4/R&S®FSH8, serial number < 105000	
	f ≤ 3.6 GHz, spurious at f <sub>in</sub> – 2440.7 MHz	< –60 dBc
	3.6 GHz < f ≤ 8 GHz, spurious at f <sub>in</sub> – 4465.7 MHz	< –60 dBc
	R&S®FSH4/R&S®FSH8, serial number ≥ 105000, R&S®FSH13, R&S®FSH20	
	f ≤ 3.6 GHz, spurious at f <sub>in</sub> – 2446.4 MHz	< –60 dBc
	3.6 GHz < f ≤ 8 GHz, spurious at f <sub>in</sub> – 4462.4 MHz	< –60 dBc
Other interfering signals, related to local oscillators	8 GHz < f ≤ 20 GHz,	< –60 dBc
	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
<b>Level display</b>		
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		clear/write, 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
<b>Level measurement uncertainty</b>		
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 ≤ 20 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 ≤ 20 GHz	< 1.5 dB, typ. 1 dB

## Trigger functions

<b>Trigger</b>		
Trigger source		free run, video, external
External trigger level threshold	low → high transition	2.4 V
	high → low transition	0.7 V
<b>Gated trigger</b>		
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)

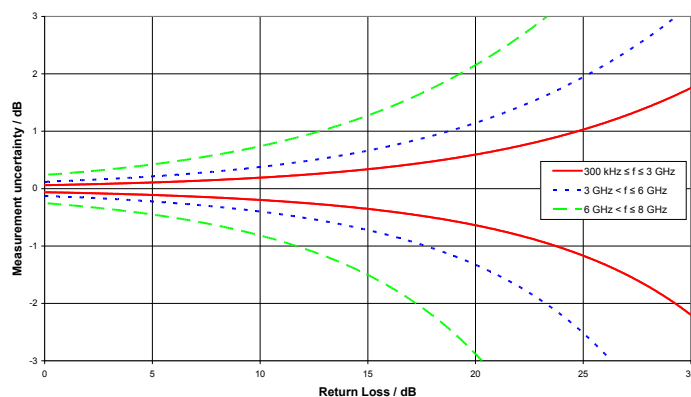
## Inputs and outputs

<b>RF input</b>		
Impedance		50 $\Omega$
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 $\leq$ 20 GHz	nominal < 3
Input attenuator	RF input only	0 dB to 40 dB in 5 dB steps
<b>AF output</b>		
AF demodulation types		AM and FM
Connector		3.5 mm mini jack
Output impedance		nominal 32 $\Omega$
Voltage (open circuit)		V <sub>RMS</sub> adjustable from 0 V to > 100 mV
<b>Power sensor</b>		
Connector		7-contact female (type Binder 712)
Power sensors supported		see accessories
<b>Tracking generator (models .14/.18/.23/.24/.28/.30 only)</b>		
Frequency range	models .14/.24	100 kHz to 3.6 GHz
	models .18/.23/.28/.30	100 kHz to 8 GHz
Connector		N female, 50 $\Omega$
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, 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 $\leq$ 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, models .18 and .28	typ. > 50 dB
<b>Reverse power</b>		
DC voltage		50 V
CW RF power		+20 dBm (= 0.1 W)
Max. pulse voltage		50 V
Max. pulse energy (10 $\mu$ s)		1 mWs
<b>External reference, external trigger, DC bias port 2 (BNC 1)</b>		
Connector		BNC, 50 $\Omega$
Mode	selectable, R&S <sup>®</sup> FSH4/R&S <sup>®</sup> FSH8, models .24/.28	ext. reference, ext. trigger, DC bias port 2
	selectable, R&S <sup>®</sup> FSH4/R&S <sup>®</sup> FSH8, other models, R&S <sup>®</sup> FSH13, R&S <sup>®</sup> FSH20	ext. reference, ext. trigger
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
<b>IF out, DC bias port 1 (BNC 2)</b>		
Connector		BNC, 50 $\Omega$
Mode	selectable, R&S <sup>®</sup> FSH4/R&S <sup>®</sup> FSH8, models .24/.28	IF out, DC bias port 1
	R&S <sup>®</sup> FSH4/R&S <sup>®</sup> FSH8, other models, R&S <sup>®</sup> FSH13, R&S <sup>®</sup> FSH20	IF out
IF out frequency	R&S <sup>®</sup> FSH4/R&S <sup>®</sup> FSH8, serial number < 105000	21.4 MHz
	R&S <sup>®</sup> FSH4/8, serial number $\geq$ 105000, R&S <sup>®</sup> FSH13, R&S <sup>®</sup> FSH20	54.4 MHz
DC bias port 1	max. rated input voltage	50 V
	max. rated input current	600 mA
<b>AUX</b>		
Connector		7-contact female (type Binder 712)

## Vector network analysis/vector voltmeter

### R&S®FSH4/R&S®FSH8 model .24/.28 with R&S®FSH-K42/R&S®FSH-K45 option

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



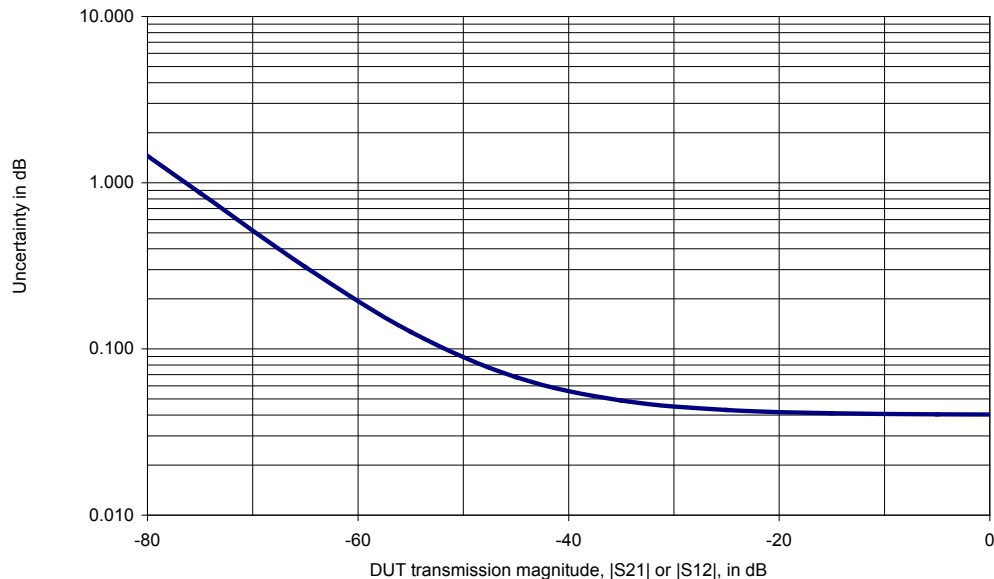
Uncertainty of reflection measurement R&S®FSH4/R&S®FSH8 with the R&S®FSH-K42/R&S®FSH-K45 option.



Transmission measurement		
Result formats	measurement mode = vector	magnitude, phase, magnitude + phase, group delay, electrical length
	measurement mode = vector voltmeter (requires R&S®FSH-K45)	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 R&S®FSH4/R&S®FSH8"
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 R&S®FSH4/R&S®FSH8

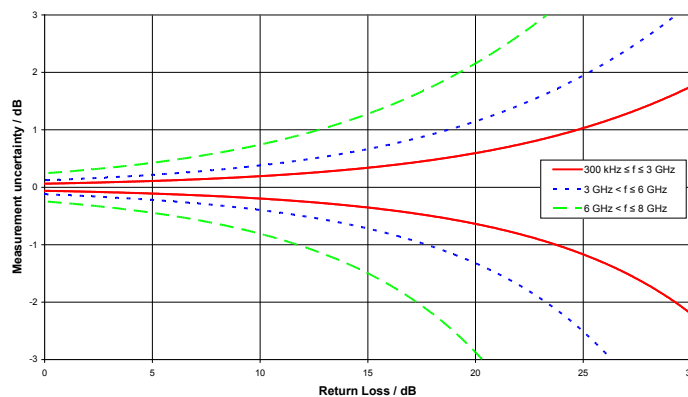
with calibration method "Full two Port High Accuracy", f = 1 GHz, IF bandwidth = 100 Hz



Transmission magnitude uncertainty R&S®FSH4/R&S®FSH8 with the R&S®FSH-K42/R&S®FSH-K45 option..

**R&S®FSH13/R&S®FSH20 model .23/.30 with or without option R&S®FSH-K45 option <sup>1</sup>**

<b>Frequency range</b>		100 kHz to 8 GHz
<b>Frequency resolution</b>		1 Hz
<b>Data points</b>		631
<b>Port power</b>	controlled via tracking generator attenuation	nominal 0 dBm to -40 dBm in 1 dB steps
<b>Reflection measurement</b>		
Result formats	measurement mode = vector	magnitude, phase, magnitude + phase, VSWR, reflection coefficient, Smith chart, cable loss, group delay, electrical length
	measurement mode = vector voltmeter (requires R&S®FSH-K45)	magnitude + phase, Smith chart
<b>Return loss</b>		
Input		RF port 2
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®FSH13 model .23/ R&S®FSH20 model .30"
<b>One-port phase</b>		
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°	
<b>VSWR</b>		
Range	selectable	1 to 1.1, 1.5, 2, 6, 11, 21 or 71
<b>Smith chart</b>		
Range		1, zoom × 2, × 4, × 8
<b>Reflection coefficient</b>		
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



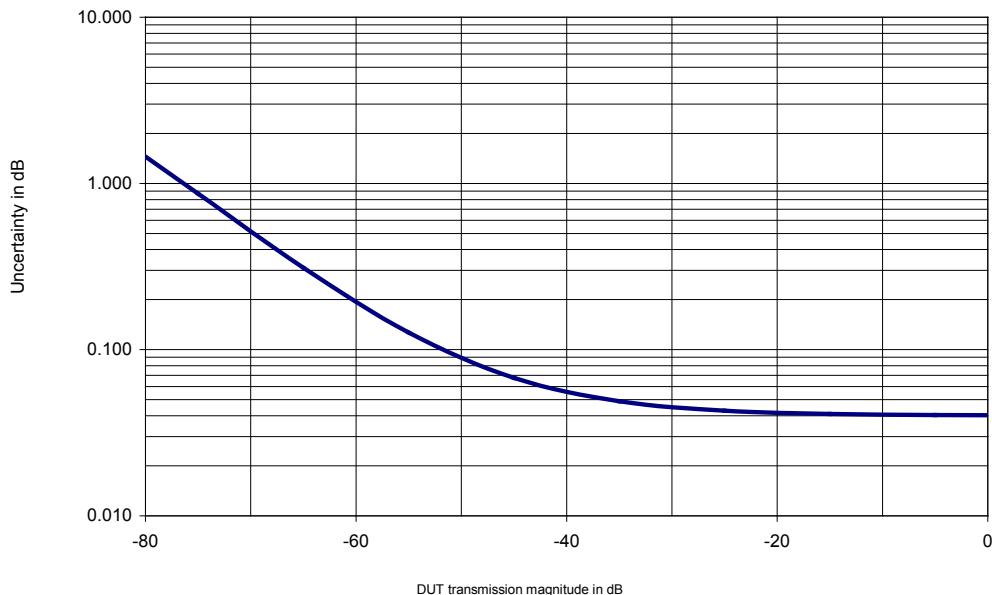
Uncertainty of reflection measurement with the R&S®FSH13 model .23/ R&S®FSH20 model .30.

<sup>1</sup> R&S®FSH13/R&S®FSH20 model .23/.30 supports one port reflection and transmission measurements as standard. For vector voltmeter support the R&S®FSH-K45 option is needed.

Transmission measurement		
Result formats	measurement mode = vector	magnitude, phase, magnitude + phase, group delay, electrical length
	measurement mode = vector voltmeter (requires R&S®FSH-K45)	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 = "Reflection port 2 + transmission reverse"	see figure "Transmission magnitude uncertainty R&S®FSH13/R&S®FSH20 model .23/.30"
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 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 R&S®FSH13/R&S®FSH20

with calibration method "Reflection port 2 + transmission reverse", f = 1 GHz, IF bandwidth = 100 Hz

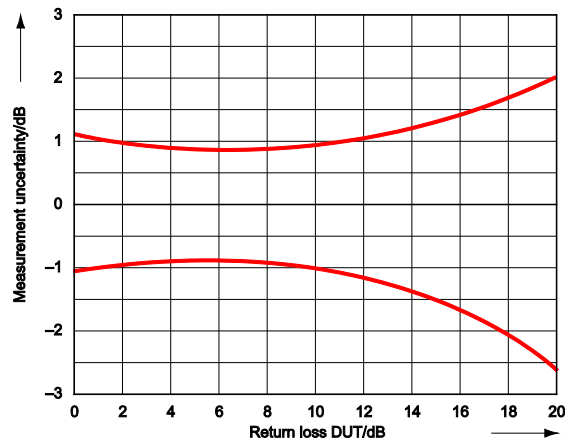


Transmission magnitude uncertainty R&S®FSH13/R&S®FSH20 model .23/.30.

## Scalar network analysis

### R&S®FSH4/R&S®FSH8 model .24/.28 without R&S®FSH-K42 option <sup>2</sup>

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
<b>Reflection measurement</b>		
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
<b>Transmission measurement</b>		
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.

<sup>2</sup> R&S®FSH13/R&S®FSH20 model .23/.30 support vector network analysis only.

## Distance-to-fault analysis

### R&S®FSH4/R&S®FSH8/R&S®FSH13/R&S®FSH20 model .24/.28/.23/.30 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		$(1.5 \times 10^8 \times \text{velocity factor}/\text{span})$
Maximum permissible spurious signal	RF attenuation = 0 dB	nominal 0 dBm
Input	model .24/.28: selectable	RF port 1 or 2
	model .23/.30	RF port 2
Maximum cable length	depending on cable loss	1500 m

### R&S®FSH-K10 GSM EDGE 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 (S/N).

Measurements	R&S®FSH-K10
Spectrum overview	•
RF channel power	•
Occupied bandwidth	•
Power within span	•
Result summary	•
RF channel power	•
Burst power	•
Carrier frequency error	•
Burst type identification	•
BCC (TSC) identification	•
GMSK phase error	•
GMSK magnitude error	•
8PSK EVM	•
Traffic activity	•
Burst power	•
RF channel power	•
Burst power	•
BCC (TSC) identification	•
Burst display (8 bursts)	•
Burst type identification	•

All specifications are given for GMSK and 8PSK modulations, SNR > 30 dB.

<b>Frequency range</b>		15 MHz to 3.0 GHz
<b>Carrier frequency uncertainty</b>	nominal	
Lock range		±8 kHz
Measurement uncertainty	SNR > 30 dB, $\Delta f_{\text{ref}}$ = uncertainty of reference frequency	< 15 Hz + $\Delta f_{\text{ref}}$
RF Channel power		
Measurement range	frequency > 15 MHz	
	preamplifier = OFF	-60 dBm < $P_{\text{total}}$ < 20 dBm
	preamplifier = ON	-75 dBm < $P_{\text{total}}$ < 20 dBm
Measurement uncertainty	-75 dBm < $P_{\text{total}}$ < 20 dBm, $P_{\text{REF\_LEV}} - 30 \text{ dB} < P_{\text{total}} < P_{\text{REF\_LEV}} + 3 \text{ dB}$	1 dB, typ. 0.5 dB
<b>Burst power</b>		
Measurement range	-40 dBm < $P_{\text{total}}$ < 20 dBm	$P_{\text{total}} - 20 \text{ dB} < P_{\text{burst}} < P_{\text{total}}$
Measurement uncertainty	$P_{\text{total}} - 20 \text{ dB} < P_{\text{burst}} < P_{\text{total}}$	1 dB, typ. 0.5 dB
<b>GMSK modulation quality</b>		
Residual phase error	SNR > 30 dB, nominal	typ. 0.3°
Residual magnitude error		typ. 0.4%
<b>8PSK modulation quality</b>		
Residual EVM	SNR > 30 dB, nominal	typ. 0.5 %

## 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	–	•

<b>Frequency range</b>		15 MHz to 3.0 GHz
<b>Carrier frequency uncertainty</b>	test case 6.3 in line with 3GPP TS 25.141	
Lock range		±1 kHz
Measurement uncertainty	SNR > 30 dB, $\Delta f_{ref}$ = uncertainty of reference frequency	< 10 Hz + $\Delta f_{ref}$
<b>RF channel power</b>	test case 6.2.1 in line with 3GPP TS 25.141, SNR > 30 dB	
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
<b>CPICH power</b>	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
<b>P-CCPCH power</b>	test model 2 in line with 3GPP TS 25.141, SNR > 30 dB	
Measurement range	-40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel} - 20\ dB < P_{P-CCPCH} < P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel} - 20\ dBm < P_{P-CCPCH} < P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
<b>PSCH/SSCH power</b>	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
<b>Symbol EVM</b>	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 % 10 % < EVM < 25 %	0.5 % 2.5 %
Residual EVM		typ. 1.5 %
<b>Composite EVM</b> <sup>3</sup>	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 % 10 % < EVM < 25 %	typ. 2.0 % typ. 2.5 %
Residual EVM		typ. 2.5 %
<b>Scrambling code detection</b>	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

<sup>3</sup> 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.



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

<b>Frequency range</b>		15 MHz to 3.0 GHz
<b>Carrier frequency uncertainty, nominal values</b>		
Lock range		±5 kHz
Measurement uncertainty	SNR > 30 dB, $\Delta f_{ref}$ = uncertainty of reference frequency	< 100 Hz + $\Delta f_{ref}$
<b>RF channel power</b>		
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
<b>Pilot power</b>		
	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
<b>MAC power</b>		
	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
<b>Data power</b>		
	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
<b>Pilot EVM</b>		
	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 %
<b>Pilot Rho</b>		
	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

## R&S®FSH-K48E 3GPP TD-SCDMA/HSDPA BTS code domain power and 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	R&S®FSH-K48E
Spectrum overview	•	•
Time domain power	–	•
Slot 0 to 6 power	–	•
DwPTS power	–	•
UpPTS power	–	•
Slot 0 to 6 composite EVM	–	•
Slot 0 to 6 C/I	–	•
Sync ID	–	•
Sync ID #	–	•
Sync ID power	–	•
Sync ID delay	–	•
Code domain power	–	•
Code #/SF (spreading factor)	–	•
Modulation type (QPSK, 8PSK, 16QAM, 64QAM)	–	•
Symbol EVM	–	•
Code power	–	•
RF channel power	–	•
Composite EVM	–	•
Code domain channel table	–	•
Code #/SF (spreading factor)	–	•
Modulation type (QPSK, 8PSK, 16QAM, 64QAM)	–	•
Symbol EVM	–	•
Code power abs/rel	–	•
Limits screen	–	•
Result summary	•	•
RF channel power	•	•
Carrier frequency error	•	•
Composite EVM	–	•
Peak code domain error	–	•
Average RCDE	–	•
I-Q offset	–	•
Gain imbalance	–	•
Active channels	–	•
Scrambling code found	•	•
P-CCPCH symbol EVM	•	•
P-CCPCH Ec/Io	•	•
Data power abs/rel	•	•
Data 1/2 power abs/rel	•	•
Midamble power abs/rel	•	•

<b>Frequency range</b>		15 MHz to 3.0 GHz
<b>Carrier frequency uncertainty</b>	test case 6.3 in line with 3GPP TS 25.142	
Lock range		±5 kHz
Measurement uncertainty	SNR > 30 dB, $\Delta f_{ref}$ = uncertainty of reference frequency	< 10 Hz + $\Delta f_{ref}$
<b>RF channel power</b>	test case 6.2 in line with 3GPP TS 25.142, SNR > 30 dB	
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
<b>P-CCPCH Symbol EVM</b>	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 %
<b>Data power, data 1/2 power, midamble power</b>	SNR > 30 dB	
Measurement range		-60 dBm < $P_{data, midamble}$ < 20 dBm
Measurement uncertainty	-40 dBm < $P_{data, midamble}$ < 20 dBm	< 1 dB, typ. 0.5 dB
<b>Composite EVM</b>	test case 6.8.1 in line with 3GPP TS 25.142, SNR > 30 dB	
Measurement range	-40 dBm < $P_{RF\ channel}$ < 20 dBm	1.5 % < EVM < 25 %
Measurement uncertainty	1.5 % < EVM ≤ 10 %	typ. 1.0 %
	10 % < EVM < 25 %	typ. 2.5 %
Residual EVM		typ. 1.0 %
<b>Code domain power</b>	SNR > 30 dB	
Measurement range	-40 dBm < $P_{RF\ channel}$ < 20 dBm	$P_{RF\ channel} - 20\ dB < P_{code} < P_{RF\ channel}$
Measurement uncertainty	$P_{RF\ channel} - 20\ dBm < P_{code} < P_{RF\ channel}$	< 1 dB, typ. 0.5 dB
<b>Sync ID detection</b>		
Lock range		±5 kHz

## R&S®FSH-K50/R&S®FSH-K51 LTE FDD/TDD downlink pilot channel and EVM measurement application <sup>4</sup>

## R&S®FSH-K50E/R&S®FSH-K51E LTE FDD/TDD downlink extended channel and modulation measurement application <sup>4</sup>

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.

<b>Frequency range</b>	15 MHz to 3.0 GHz	
<b>Supported channel bandwidths</b>	1.4/3/5/10/15/20 MHz	
<b>Carrier frequency uncertainty</b>		
Lock range	±10 kHz	
Measurement uncertainty	SNR > 30 dB, $\Delta f_{ref}$ = uncertainty of reference frequency	< 10 Hz + $\Delta f_{ref}$
<b>RF channel power</b>		
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
<b>EVM</b>		
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 %	

<sup>4</sup> 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	•

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

## General data

<b>Manual operation</b>		
Languages		Chinese, English, French, German, Italian, Hungarian, Japanese, Korean, Portuguese, Russian, Spanish
<b>Remote control (R&amp;S®FSH-K40 option)</b>		
Command set		SCPI 1997.0
LAN interface		10/100BaseT, RJ-45
USB		mini B plug, version 1.1
<b>Display</b>		
Resolution		640 × 480 pixel
<b>Audio</b>		
Speaker		internal
<b>USB interface</b>	R&S®FSH4/8, serial number ≥ 105000, R&S®FSH13, R&S®FSH20	type A plug, version 1.1
<b>Mass memory</b>		
Mass memory		flash memory (internal), SD card (not supplied), size ≤ 32 Gbyte
	R&S®FSH4/8, serial number ≥ 105000, R&S®FSH13, R&S®FSH20	memory stick (not supplied), 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
<b>Temperature</b>		
	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
<b>Climatic loading</b>		
	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
<b>Mechanical resistance</b>		
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

<b>Power supply</b>		
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)
<b>Recommended calibration interval</b>		1 year



## Equivalence of specifications for different R&S®FSH part numbers

- The specifications for part number 1309.6000.54 are equivalent to part number 1309.6000.04
- The specifications for part number 1309.6000.64 are equivalent to part number 1309.6000.14
- The specifications for part number 1309.6000.74 are equivalent to part number 1309.6000.24
- The specifications for part number 1309.6000.58 are equivalent to part number 1309.6000.08
- The specifications for part number 1309.6000.68 are equivalent to part number 1309.6000.18
- The specifications for part number 1309.6000.78 are equivalent to part number 1309.6000.28
- The specifications for part number 1314.2000.63 are equivalent to part number 1314.2000.13
- The specifications for part number 1314.2000.80 are equivalent to part number 1314.2000.20

## Accessories

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

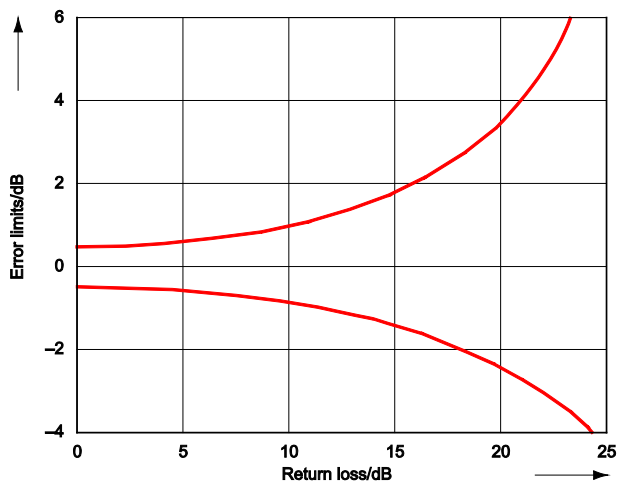
Frequency range	R&S®FSH-Z1	10 MHz to 8 GHz
	R&S®FSH-Z18	10 MHz to 18 GHz
VSWR	10 MHz to 30 MHz	< 1.15
	30 MHz to 2.4 GHz	< 1.13
	2.4 GHz to 8 GHz	< 1.20
	8 GHz to 18 GHz	< 1.25
Maximum input power	average power	400 mW (+26 dBm)
	peak power (< 10 µs, 1 % duty cycle)	1 W (+30 dBm)
Measurement range		200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

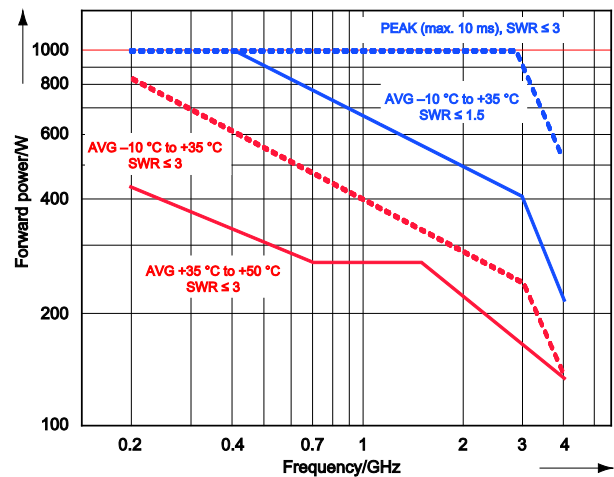
Frequency range		25 MHz to 1 GHz
Power measurement range		30 mW to 300 W
VSWR referenced to 50 Ω		< 1.06
Power-handling capacity	depending on temperature and matching (see diagram on page 20)	100 W to 1000 W
Insertion loss		< 0.06 dB
Directivity		> 30 dB
<b>Average power</b>		
Power measurement range		
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) <sup>5</sup>
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)

<sup>5</sup> If standard is selected on the R&S®FSH4/R&S®FSH8.

<b>Max. peak envelope power</b>		
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 $\geq 0.1$ 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 $\mu s$
	video bandwidth 200 kHz	$\pm(3\%$ of measured value + 0.20 W) starting from a burst width of 4 $\mu s$
	video bandwidth 600 kHz	$\pm(7\%$ of measured value + 0.40 W) starting from a burst width of 2 $\mu s$
$20/s \leq$ repetition rate $< 100/s$		plus $\pm(1.6\%$ of measured value + 0.15 W)
$0.001 \leq$ duty cycle $< 0.1$		plus $\pm 0.10$ 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 $\geq 0.4$ 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.

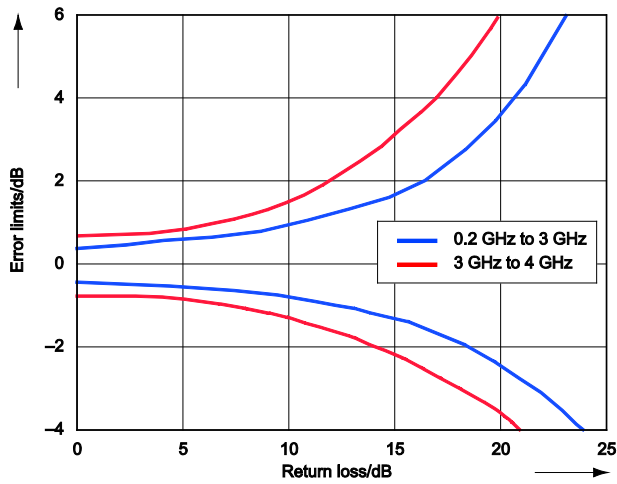
**R&S® FSH-Z44 directional power sensor**

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	
<b>Average power</b>			
Power measurement range	CF: ratio of peak envelope power to average power		
	CW, FM, PM, FSK, GMSK	30 mW to 300 W	
	LTE, 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) <sup>6</sup>	
	cdmaOne, DAB	±1 % of measured value (±0.04 dB) <sup>6</sup>	
	3GPP WCDMA, CDMA2000®	±2 % of measured value (±0.09 dB) <sup>6</sup>	
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)	
<b>Max. peak envelope power</b>			
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)	

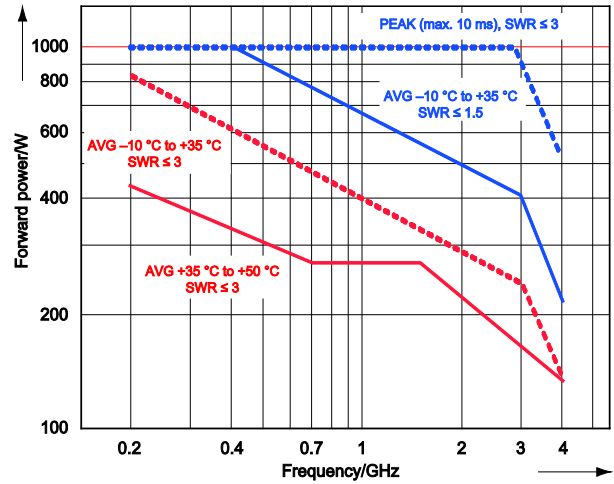
<sup>6</sup> If standard is selected on the R&S®FSH4/R&S®FSH8.

**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 $\geq 0.2$ 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, $\geq 1$ minute after satellite lock	$\pm 2.5 \times 10^{-8}$
	up to 30 minutes after losing 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 $\times$ height	$\varnothing 61$ mm $\times$ 19.5 mm ( $\varnothing 2.4$ in $\times$ 0.8 in)
	cable length	5 m (16.4 ft)
Weight		200 g (0.4 lb)

**R&S® FSH-Z114 precision frequency reference**

Temperature	operating temperature range	$-10$ °C to $+55$ °C
	storage temperature range	$-55$ °C to $+90$ °C
Climatic loading	relative humidity	$+25/+55$ °C at 95 % relative humidity (EN 60068-2-30)
	IP class of protection	51
Connector		7-contact male (type Binder 712)
Power consumption		0.20 W
Dimensions	diameter $\times$ height	88 mm $\times$ 94 mm $\times$ 26.0 mm (3.5 in $\times$ 3.5 in $\times$ 0.8 in)
	cable length	0.25 m (0.82 ft)
Weight		250 g (0.6 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
Spectrum Analyzer, 9 kHz to 13.6 GHz, with preamplifier	R&S®FSH13	1314.2000.13
Spectrum Analyzer, 9 kHz to 20 GHz, with preamplifier	R&S®FSH20	1314.2000.20
Spectrum Analyzer, 9 kHz to 13.6 GHz, with preamplifier, tracking generator and internal VSWR bridge	R&S®FSH13	1314.2000.23
Spectrum Analyzer, 9 kHz to 20 GHz, with preamplifier, tracking generator and internal VSWR bridge	R&S®FSH20	1314.2000.30
<b>Accessories supplied</b>		
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.	Remarks
<b>Hardware option</b>			
Li –Ion Battery Pack, 6.75 Ah installed in factory	R&S®FSH-B106	1304.5958.02	
<b>Software options</b>			
Spectrogram Measurement Application	R&S®FSH-K14	1304.5770.02	
Interference Analysis Measurement Application	R&S®FSH-K15	1309.7488.02	
Geotagging Measurement Application	R&S®FSH-K16	1309.7497.02	
Remote Control via LAN or USB	R&S®FSH-K40	1304.5606.02	
Distance-to-Fault Analysis	R&S®FSH-K41	1304.5612.02	for models .24/.28 only, requires R&S®FSH-Z320 or R&S®FSH-Z321 and R&S®FSH-Z28 or R&S®FSH-Z29
Vector Network Analysis ( )	R&S®FSH-K42	1304.5629.02	for models .24/.28 only, standard for models .23/.30
Vector Voltmeter	R&S®FSH-K45	1304.5658.02	for models .23/.24/.28/.30 only
GSM Edge Measurement Application	R&S®FSH-K10	1304.5864.02	
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-K46E	1304.5764.02	R&S®FSH-K46 required
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-K47E	1304.5806.02	R&S®FSH-K47 required
3GPP TD-SCDMA BTS power and P-CCPCH EVM measurement application	R&S®FSH-K48	1304.5841.02	
3GPP TD-SCDMA/HSDPA BTS Code Domain Power and EVM Measurement Application	R&S®FSH-K48E	1304.5858.02	R&S®FSH-K48 required
LTE FDD Downlink Pilot Channel and EVM Measurement Application	R&S®FSH-K50	1304.5735.02	only for R&S®FSH4/ R&S®FSH8 with serial number ≥ 105000, R&S®FSH13, R&S®FSH20
LTE TDD Downlink Pilot Channel and EVM Measurement Application	R&S®FSH-K51	1304.5812.02	only for R&S®FSH4/ R&S®FSH8 with serial number ≥ 105000, R&S®FSH13, R&S®FSH20
LTE FDD Downlink Extended Channel and Modulation Measurement Application	R&S®FSH-K50E	1304.5793.02	only for R&S®FSH4/ R&S®FSH8 with serial number ≥ 105000, R&S®FSH13, R&S®FSH20 R&S®FSH-K50 required
LTE TDD Downlink Extended Channel and Modulation Measurement Application	R&S®FSH-K51E	1304.5829.02	only for R&S®FSH4/ R&S®FSH8 with serial number ≥ 105000, R&S®FSH13, R&S®FSH20 R&S®FSH-K51 required
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
Precision Frequency Reference	R&S®FSH-Z114	1304.5935.02
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 <sup>7</sup>	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 <sup>8</sup>	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
Shoulder Strap for Carrying Holster R&S®HA-Z222	R&S®HA-Z223	1309.6075.00
SD Memory Card, 4 Gbyte <sup>9</sup>	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
Handheld Log-Periodic Antenna, 450 MHz to 8 GHz	R&S®HL300	4097.3005.02
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

<sup>7</sup> Note: The car adapter is suitable for both the instrument and the R&S®HA-Z203 external battery charger.

<sup>8</sup> Note: The battery charger is dedicated for charging an additional battery outside the instrument. The internal battery is charged by the instrument itself.

<sup>9</sup> Note: Firmware update is installed from SD memory card.

Designation	Type	Order No.
Portable system for EMVU measurements		
Hard Case	R&S <sup>®</sup> TS-EMF	1158.9295.05
Isotropic Antenna, 30 MHz to 3 GHz for R&S <sup>®</sup> TS-EMF	R&S <sup>®</sup> TSEMF-B1	1074.5719.02
Isotropic Antenna, 700 MHz to 6 GHz for R&S <sup>®</sup> TS-EMF	R&S <sup>®</sup> TSEMF-B2	1074.5702.02
Isotropic Antenna, 9 kHz to 200 MHz for R&S <sup>®</sup> TS-EMF	R&S <sup>®</sup> TSEMF-B3	1074.5690.02

## R&S<sup>®</sup>NRP-Zxx power sensors supported by the R&S<sup>®</sup>FSH4/8/13/20<sup>10 11</sup>

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

### R&S<sup>®</sup>NRP-Zxx power sensors require the following adapter cable for operation on the R&S<sup>®</sup>ZVH

Passive USB adapter to connect R&S <sup>®</sup> NRP-Zxx sensors to the R&S <sup>®</sup> ZVH	R&S <sup>®</sup> NRP-Z4	1146.8001.02
---	-------------------------	--------------

### R&S<sup>®</sup>FSH power sensors require the following adapter cable for connection to a PC

USB Adapter Cable for R&S <sup>®</sup> FSH-Z1/R&S <sup>®</sup> FSH-Z18	R&S <sup>®</sup> FSH-Z101	1164.6252.02
USB Adapter Cable for R&S <sup>®</sup> FSH-Z14/R&S <sup>®</sup> FSH-Z44	R&S <sup>®</sup> FSH-Z144	1145.5905.02

<sup>10</sup> For average power measurements only.

<sup>11</sup> R&S<sup>®</sup>NRP-Zxx power sensors are supported by instruments with serial number  $\geq 105000$ .

## 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 <sup>12</sup>. 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 <sup>12</sup> and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

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

For product brochure, see PD 5214.0482.12 and [www.rohde-schwarz.com](http://www.rohde-schwarz.com).

<sup>12</sup> Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

## Service that adds value

- | 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 80 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

## Quality management and environmental management

Rohde & Schwarz is certified in line with the ISO 9001 and ISO 14001 management systems.

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

## Rohde & Schwarz GmbH & Co. KG

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

## Regional contact

- | Europe, Africa, Middle East | +49 89 4129 12345  
[customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com)
- | North America | 1 888 TEST RSA (1 888 837 87 72)  
[customer.support@rsa.rohde-schwarz.com](mailto:customer.support@rsa.rohde-schwarz.com)
- | Latin America | +1 410 910 79 88  
[customersupport.la@rohde-schwarz.com](mailto:customersupport.la@rohde-schwarz.com)
- | Asia/Pacific | +65 65 13 04 88  
[customersupport.asia@rohde-schwarz.com](mailto:customersupport.asia@rohde-schwarz.com)
- | China | +86 800 810 8228/+86 400 650 5896  
[customersupport.china@rohde-schwarz.com](mailto:customersupport.china@rohde-schwarz.com)

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG

Trade names are trademarks of the owners

PD PD 5214.0482.22 | Version 16.00 | January 2014 (as)

R&S®FSH Spectrum Analyzer

Data without tolerance limits is not binding | Subject to change

© 2008 - 2014 Rohde & Schwarz GmbH & Co. KG | 81671 München, Germany



5214048222