



Version
01.00

August
2005

TV Analyzer R&S®FSH3-TV

Specifications



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Specifications

Specifications apply under the following conditions: 15 minutes warm-up time at ambient temperature, specified environmental conditions met and calibration cycle adhered to. Data without tolerances: typical values. Data designated as "nominal": design parameters, i.e. not tested.

Frequency		
Frequency range		100 kHz to 3 GHz
Reference frequency		
Aging		1 ppm/year
Temperature drift	0 °C to 30 °C 30 °C to 50 °C	2 ppm, in addition 2 ppm/10 °C
Frequency counter		
Resolution		1 Hz
Frequency span		100 Hz to 3 GHz, 0 Hz
Spectral purity		
SSB phase noise	f = 500 MHz, 20 °C to 30 °C	
	30 kHz from carrier	<85 dBc/1 Hz
	100 kHz from carrier	<100 dBc/1 Hz
	1 MHz from carrier	<120 dBc/1 Hz

Inputs		
RF input		N female
Input impedance		50 Ω
VSWR	10 MHz to 3 GHz	typ. 1.5
Maximum permissible DC voltage at RF input		80 V
Maximum power		20 dBm, 30 dBm (1 W) for max. 3 minutes
Trigger/external reference input		BNC female, selectable, same connector as video and TS-ASI output
Trigger voltage		TTL
Reference frequency		10 MHz
Required level from 50 Ω		10 dBm

Outputs		
Tracking generator		
Frequency range		5 MHz to 3 GHz
Output level		0 dBm/-20 dBm, selectable
Output impedance		50 Ω
Video output	analog TV receiver mode	BNC female, selectable, same connector as trigger/external reference input and TS-ASI output
Output level		1 V
DC position back porch		0 V
Output impedance		75 Ω
TS-ASI output	digital TV receiver mode (option R&S FSHTV-K21, R&S FSHTV-22)	BNC female, selectable, same connector as trigger/external reference input and video output
Output level, peak-to-peak		0.8 V
Data rate		270 Mbit/s
Output impedance		75 Ω
AF output		3.5 mm mini jack
Spectrum analyzer mode		AM (video voltage without AGC) and FM
Analog TV receiver mode		in line with standard
Output impedance		100 Ω
Output level		adjustable

Analog TV receiver

Standards		B, G, H, D, K, I, L, M, N,
Sound standards		IRT-A2, NICAM, BTSC, EIA-J, Korea Stereo
Video bandwidth	in line with standard	4 MHz, 5 MHz, 5.5 MHz and 6 MHz
Measurements		vision carrier power
		vision carrier frequency offset
		vision/sound carrier power ratio
		vision/sound carrier frequency offset
		luminance bar amplitude
		video S/N, weighted in line with CCIR Rec. 567
		audio mode
		NICAM bit error ratio
		vision modulation depth, residual picture carrier
		video scope
		hum modulation
		carrier-to-noise power ratio
Measurement uncertainty		
Video S/N	weighted in line with CCIR Rec. 567 (1 channel)	
	S/N <45 dB	typ. <1 dB
	S/N 45 dB to 55 dB	typ. <3 dB

Cable TV analyzer

Measurements		composite triple beat (CTB) ratio
		composite second order (CSO) ratio

Digital TV receiver (options R&S FSHTV-K21, R&S FSHTV-K22)

QAM standards	option R&S FSHTV-K21	DVB-C, J.83/A /B /C (Europe, US and Japanese cable TV)
QAM order		4, 16, 32, 64, 128 and 256QAM
Bandwidth	in line with symbol rate	6 MHz, 7 MHz and 8 MHz
Symbol rate		2 MHz to 6.999 MHz
8VSB/ATSC standard	option R&S FSHTV-K22	
Bandwidth		6 MHz
Symbol rate		10.672238 MHz
Measurements		channel power
		carrier frequency offset
		pilot carrier power and frequency (8VSB/ATSC)
		symbol rate offset
		MER (modulation error ratio) (MER measurement range up to 40 dB)
		EVM (error vector magnitude)
		bit error ratio before RS decoder
		packet error ratio or segment error ratio
		transport stream rate
		constellation diagram
		shoulder attenuation in line with ETSI TR 101 290 (QAM) or in line with FCC (8VSB/ATSC)
		carrier-to-noise power ratio

Measurement uncertainty		
Carrier frequency offset	referenced to carrier frequency	<5 ppm
Symbol rate offset	referenced to symbol rate	<5 ppm
Modulation error ratio	equalizer on, 1 channel	
	MER <33 dB	typ. <1 dB
	MER 33 dB to 38 dB	typ. <3 dB

Error vector magnitude		
	EVM >1.5 %	typ. <12 % of measured value
	EVM 0.9 % to 1.5 %	typ. <40 % of measured value
Transport stream rate		<5 ppm

Spectrum analyzer

Bandwidth		
Resolution bandwidths (-3 dB)		100 Hz to 1 MHz in 1, 3 steps; in addition 200 kHz
Tolerance	≤ 300 kHz	± 5 %, nominal
	1 MHz	± 10 %, nominal
Resolution bandwidths (-6 dB)	option R&S FSH-K3 installed	200 Hz, 9 kHz, 120 kHz
Video bandwidth		10 Hz to 3 MHz in 1, 3 steps
Sweep time		
	span > 0 Hz	20 ms to 1000 s, min. 20 ms/600 MHz
	span = 0 Hz	1 ms to 100 s
Display range		average noise level displayed to +20 dBm
Intermodulation-free dynamic range	third-order intermodulation products 2 × -20 dBm, reference level = -10 dBm third-order intercept	66 dB +13 dBm
Displayed average noise level	average value, resolution bandwidth 1 kHz, video bandwidth 10 Hz, reference level ≤ -30 dBm, 10 MHz to 3 GHz	<-105 dBm, typ. -114 dBm
	with preamplifier 0 MHz to 2.5 GHz 2.5 GHz to 3 GHz	<-120 dBm, typ. -125 dBm <-115 dBm, typ. -120 dBm
Inherent spurious	reference level ≤ -20 dBm, f > 30 MHz, RBW ≤ 100 kHz	<-80 dBm
Input related spurious	carrier offset >1 MHz	<-70 dBc, nominal
2nd harmonic		typ. <-60 dBc
	signal frequency - 2.0156 GHz for signal frequencies 2 GHz to 3.2 GHz	typ. <-55 dBc
Level display		
Reference level		-80 dBm to +20 dBm in steps of 1 dB
Display range		100 dB, 50 dB, 20 dB, 10 dB, 1 dB, linear
Display units		
Logarithmic		dBm, dBμV, dBmV with transducer also dBμV/m and dBμA/m
Linear		μV, mV, V, nW, μW, mW, W with transducer also V/m, mV/m, μV/m and W/m ²
Traces		1 trace and 1 memory trace
Detectors		auto peak, maximum peak, minimum peak, sample, RMS
Level measurement error	frequency > 1 MHz, at reference level down to -50 dB, 20 °C to 30 °C	<1.5 dB, typ. 0.5 dB

Markers		
Number of markers or delta markers		max. 6
Marker functions		peak, next peak, minimum, center = marker frequency, reference level = marker level, all markers to peak
Marker displays		normal (level), noise marker, frequency counter (count)
Trigger		free-running, video, external

Transmission measurements

Frequency range		10 MHz to 3 GHz
Dynamic range	10 MHz to 2.2 GHz scalar mode vector mode, option R&S FSH-K2	60 dB 80 dB
	2.2 GHz to 3 GHz scalar mode vector mode, option R&S FSH-K2	50 dB 65 dB

Interfaces

Optical interface, baud rate		1200, 2400, 9600, 19200, 38400, 57600 baud
Control interface, control and supply of power sensor and preselector		7-contact female connector (type Binder 712)

Accessories

Preselector R&S FSHTV-Z60

RF input		F connector (F male with adapter F female/F female)
Input impedance		75 Ω
VSWR, bypass path		typ. 1.5
VSWR, filter path, RF attenuator ≥ 5 dB		typ. 1.5
Maximum permissible DC voltage		80 V
Maximum power		+20 dBm
Additional level measurement error	frequency > 1 MHz, at reference level down to -50 dB, 20 °C to 30 °C	<1.0 dB, typ. 0.5 dB
Frequency range of filter path		100 kHz to 1 GHz
Frequency range of bypass path		100 kHz to 3 GHz
Preamplifier		100 kHz to 3 GHz, selectable
RF output		N male
Output impedance		50 Ω
Power consumption		500 mW
Dimensions		169 mm \times 116 mm \times 30 mm
Weight		500 g

Power Sensors R&S FSH-Z1 and R&S FSH-Z18

Frequency range	R&S FSH-Z1 R&S FSH-Z18	10 MHz to 8 GHz 10 MHz to 18 GHz
VSWR	10 MHz to 30 MHz 30 MHz to 2.4 GHz 2.4 GHz to 8 GHz 8 GHz to 18 GHz	<1.15 <1.13 <1.20 <1.25
Maximum input power	average power peak power <10 μ s, 1% duty cycle	400 mW (+26 dBm), 1 W (+30 dBm)
Measurement range		200 pW to 200 mW (-67 dBm to +23 dBm)
Signal weighting		average power
	effect of harmonics effect of modulation	<0.5 % (0.02 dB) at harmonic ratio of 20 dB <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	<2.5 % (0.11 dB) <4.5 % (0.19 dB)
	8 GHz to 18 GHz 15 °C to 35 °C 0 °C to 50 °C	<3.5 % (0.15 dB) <5.0 % (0.21 dB)
Zero offset after zeroing		<110 pW
Dimensions		48 mm \times 31 mm \times 170 mm, connecting cable 1.5 m
Weight		<0.3 kg

Directional Power Sensor R&S FSH-Z14

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 below)	100 W to 1000 W
Insertion loss		<0.06 dB
Directivity		>30 dB
Average power		
Power measurement range	CW, FM, PM, FSK, GMSK modulated signals	30 mW to 300 W
	CF: ratio of peak envelope power to average power	30 mW to 300 W/CF
Measurement uncertainty	sine signal, 18 °C to 28 °C, no zero offset 25 MHz to 40 MHz 40 MHz to 1 GHz	4.0 % (0.17 dB) of measured value 3.2 % (0.14 dB) of measured value
Zero offset after zeroing		± 4 mW
Range of typical measurement error with modulation	FM, PM, FSK, GMSK AM (80 %) 2 CW carriers with identical power EDGE, TETRA	0 % of measured value (0 dB) ± 3 % of measured value (± 0.13 dB) ± 2 % of measured value (± 0.09 dB) ± 0.5 % of measured value (± 0.02 dB), if standard is selected on the R&S FSH3-TV
Temperature coefficient	25 MHz to 40 MHz 40 MHz to 1 GHz	0.40 %/K (0.017 dB/K) 0.25 %/K (0.011 dB/K)
Peak envelope power		
Power measurement range		
Video bandwidth	4 kHz 200 kHz 600 kHz	0.4 W to 300 W 1 W to 300 W 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 $\geq 100/s$	video bandwidth 4 kHz 200 kHz 600 kHz 20/s \leq repetition rate <100/s 0.001 \leq duty cycle < 0.1	$\pm(3$ % of measured value + 0.05 W) starting from a burst width of 200 μ s $\pm(3$ % of measured value + 0.20 W) starting from a burst width of 4 μ s $\pm(7$ % of measured value + 0.40 W) starting from a burst width of 2 μ s plus $\pm(1.6$ % of measured value + 0.15 W) plus ± 0.10 W
Temperature coefficient	25 MHz to 40 MHz 40 MHz to 1 GHz	0.50 %/K (0.022 dB/K) 0.35 %/K (0.015 dB/K)
Load matching		
Matching measurement range	return loss VSWR	0 dB to 23 dB >1.15
Minimum forward power	specs met from 0.4 W	0.06 W
Error limits for matching measurements		

Power-handling capacity		
Dimensions	120 mm × 95 mm × 39 mm, connecting cable 1.5 m	
Weight	0.65 kg	

Directional Power Sensor R&S FSH-Z44

Frequency range		200 MHz to 4 GHz
Power measurement range		30 mW to 120 W (300 W with unmodulated envelope)
VSWR referenced to 50 Ω	200 MHz to 3 GHz 3 GHz to 4 GHz	<1.07 <1.12
Power-handling capacity	depending on temperature and matching (see diagram below)	120 W to 1000 W
Insertion loss	200 MHz to 1.5 GHz 1.5 GHz to 4 GHz	<0.06 dB <0.09 dB
Directivity	200 MHz to 3 GHz 3 GHz to 4 GHz	>30 dB >26 dB
Average power		
Power measurement range	CW, FM, PM, FSK, GMSK 3GPP WCDMA, cdmaOne, CDMA2000®, DAB, DVB-T other modulated signals CF: ratio of peak envelope power to average power	30 mW to 300 W 30 mW to 120 W 30 mW to 300 W/CF
Measurement uncertainty	sine signal, 18 °C to 28 °C, no zero offset 200 MHz to 300 MHz 300 MHz to 4 GHz	4.0 % (0.17 dB) of measured value 3.2 % (0.14 dB) of measured value
Measurement uncertainty after zeroing		±4 mW
Range of typical measurement error with modulation	FM, PM, FSK, GMSK AM (80 %) 2 CW carriers with identical power π/4-DQPSK EDGE cdmaOne, DAB 3GPP WCDMA, CDMA2000® DVB-T	0 % of measured value (0 dB) ±3 % of measured value (± 0.13 dB) ±2 % of measured value (± 0.09 dB) ±2 % of measured value (± 0.09 dB) ±0.5 % of measured value (± 0.09 dB) ¹⁾ ±1 % of measured value (± 0.04 dB) ¹⁾ ±2 % of measured value (± 0.09 dB) ¹⁾ ±2 % of measured value (± 0.09 dB) ¹⁾
Temperature coefficient	200 MHz to 300 MHz 300 MHz to 4 GHz	0.50 %/K (0.022 dB/K) 0.35 %/K (0.015 dB/K)
Peak envelope power		
Power measurement range	DAB, DVB-T, cdmaOne, CDMA2000®, 3GPP WCDMA other signals at video bandwidth 4 kHz 200 kHz 4 MHz	4 W to 300 W 0.4 W to 300 W 1 W to 300 W 2 W to 300 W
Measurement uncertainty	18 °C to 28 °C	same as for average power plus effect of peak hold circuit

¹⁾ If this standard is selected on the R&S FSH3-TV.

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

Error limits of peak hold circuit for burst signals	duty cycle ≥ 0.1 and repetition rate $\geq 100/s$ video bandwidth 4 kHz 200 kHz 4 MHz	$\pm(3\%$ of measured value + 0.05 W) starting from a burst width of 100 μs $\pm(3\%$ of measured value + 0.20 W) starting from a burst width of 4 μs $\pm(7\%$ of measured value + 0.40 W) starting from a burst width of 1 μs
	$20/s \leq$ repetition rate $< 100/s$ $0.001 \leq$ duty cycle < 0.1 burst width $\geq 0.5\mu s$ burst width $\geq 0.2\mu s$	plus $\pm(1.6\%$ of measured value + 0.15 W) plus ± 0.10 W plus $\pm 5\%$ of measured value plus $\pm 10\%$ of measured value
Range of typical measurement error of peak hold circuit	cdmaOne, DAB DVB-T, CDMA2000®, 3GPP WCDMA video bandwidth 4 MHz and standard selected on the R&S FSH3-TV	$\pm(5\%$ of measured value + 0.4 W) $\pm(15\%$ of measured value + 0.4 W)
Temperature coefficient	200 MHz to 300 MHz 300 MHz to 4 GHz	0.50 %/K (0.022 dB/K) 0.35 %/K (0.015 dB/K)
Load matching		
Matching measurement range		
Return loss	200 MHz to 3 GHz 3 GHz to 4 GHz	0 dB to 23 dB 0 dB to 20 dB
VSWR	200 MHz to 3 GHz 3 GHz to 4 GHz	>1.15 >1.22
Minimum forward power	specs met from 0.2 W	0.03 W
Error limits for matching measurements		
Power-handling capacity		
Dimensions		120 mm \times 95 mm \times 39 mm, connecting cable 1.5 m
Weight		0.65 kg

VSWR Bridge and Power Divider R&S FSH-Z2

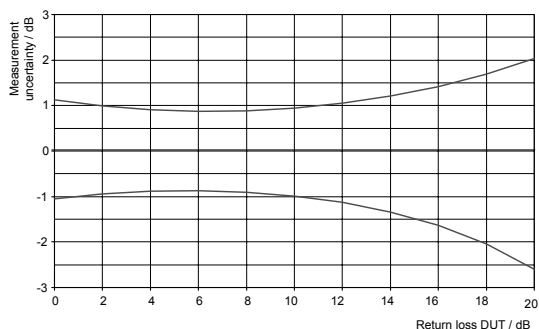
Frequency range		10 MHz to 3 GHz
Impedance		50 Ω
VSWR bridge		
Directivity	10 MHz to 1 GHz 1 GHz to 3 GHz	30 dB 25 dB
Directivity, corrected (option R&S FSH-K2)	2 MHz to 10 MHz 10 MHz to 3 GHz	40 dB 43 dB
Return loss at test port		20 dB
Return loss at test port, corrected	(option R&S FSH-K2)	35 dB
Insertion loss		9 dB
Power divider		
Return loss at test port		20 dB
Connectors		
Generator input/RF output		N male
Test port		N female
Control interface		7-contact connector (type Binder)
Calibration standards		
Short/open	50 Ω load	
Connector		N male
Impedance		50 Ω
Return loss		46 dB
Power-handling capacity		1 W
General data		
Power consumption		500 mW
Dimensions (W × H × D)		169 mm × 116 mm × 30 mm
Weight		485 g

Distance-to-Fault Measurement R&S FSH-B1

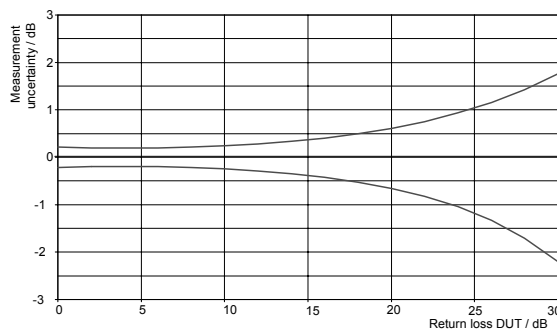
Display		301 pixels
Maximum resolution, maximum zoom		cable length/1023 pixels
Display range	return loss VSWR	10, 5, 2, 1 dB/div, linear 1 to 2 and 1 to 6, with option R&S FSH-K2 in addition 1 to 1.2 and 1 to 1.5
Cable length, depending on cable loss		3 m to max. 1000 m
Maximum permissible spurious signal		3 m to max. 1000 m first mixer 1 dB compression point typ. +10 dBm IF overload at reference level typ. +8 dB

Reflection measurements (only with R&S FSH-Z2)

Frequency range		10 MHz to 3 GHz
Display range of return loss		1 dB, 10 dB, 20 dB, 50 dB, 100 dB, selectable
VSWR display range		1 to 2 and 1 to 6, selectable, with option R&S FSH-K2 also 1 to 1.2 and 1 to 1.5
Measurement uncertainty		see diagrams



Measurement uncertainty with scalar measurements



Measurement uncertainty with vector measurements (option R&S FSH-K2)

General data

Display		14 cm (5.7") LC color display
Resolution		320 × 240 pixels
Memory		CMOS RAM
Settings and traces		100

Environmental conditions

Temperature		
Operating temperature range	R&S FSH3-TV powered from internal battery R&S FSH3-TV powered from AC power supply	0 °C to 50 °C 0 °C to 40 °C
Storage temperature range		−20 °C to +60 °C
Battery charging mode		0 °C to 40 °C
Climatic conditions		
Relative humidity		95 % at 40 °C (EN 60068)
IP class of protection		51

Mechanical resistance

Vibration	sinusoidal	complies with EN 60068-2-1, EN 61010-1 5 Hz to 55 Hz: max. 2 g, 55 Hz to 150 Hz: 0.5 g constant, 12 minutes per axis
Vibration	random	complies with EN 60068-2-64 10 Hz to 500 Hz, 1.9 g, 30 minutes per axis
Shock		complies with EN 60068-2-27 40 g shock spectrum
RFI suppression		complies with EMC directive of EU (89/336/EEC) and German EMC legislation
Immunity to radiated interference		10 V/m
Level display	at 10 V/m (reference level ≤ -10 dBm) input frequency IF other frequencies	<−75 dBm (nominal) <−85 dBm (nominal) < displayed noise level

Power supply

AC supply		plug-in AC power supply (R&S FSH-Z33) 100 V AC to 240 V AC, 50 Hz to 60 Hz, 400 mA
External DC voltage		15 V to 20 V
Internal battery		NiMH battery
Operating time with fully charged battery		3 h to 4 h depending on measurement mode
Battery charging time		4 h with instrument off
Lifetime		300 to 500 charging cycles
Power consumption in charging mode		12 W
Power consumption		7 W to 10 W depending on measurement mode
Safety		complies with EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1
Test mark		VDE, GS, CSA, CSA-NRTL
Dimensions (W × H × D)		170 mm × 120 mm × 270 mm
Weight		2.7 kg
Accessories supplied		external power supply, optical USB cable, headphones, Quick Start manual, CD- ROM with Control Software R&S FSH View and documentation

Ordering information

Designation	Type	Order No.
TV Analyzer	R&S FSH3-TV	2111.7005.63

Options

Designation	Type	Order No.
Remote Control for R&S FSH3-TV	R&S FSHTV-K1	2111.7140.02
DVB-C/J.83/A/B/C (QAM) Firmware for R&S FSH3-TV	R&S FSHTV-K21	2111.7211.02
ATSC/8VSB Firmware for R&S FSH3-TV	R&S FSHTV-K22	2111.7228.02
Distance-to-Fault Measurement, includes 1 m cable, R&S FSH-Z2 required	R&S FSH-B1	1145.5750.02
Vector Transmission and Reflection Measurements	R&S FSH-K2	1157.3387.02
Receiver Mode	R&S FSH-K3	1157.3429.02

Recommended extras

Designation	Type	Order No.
Preselector for R&S FSH3-TV	R&S FSHTV-Z60	2111.7105.02
Spare F Adapter 75 Ω , female/female for Preselector R&S FSHTV-Z60	R&S FSHTV-Z61	2111.7111.02
Power Sensor 10 MHz to 8 GHz	R&S FSH-Z1	1155.4505.02
VSWR Bridge and Power Divider, 10 MHz to 3 GHz (contains short, open and 50 Ω load for calibration)	R&S FSH-Z2	1145.5767.02
Directional Power Sensor, 25 MHz to 1 GHz	R&S FSH-Z14	1120.6001.02
Power Sensor, 10 MHz to 18 GHz	R&S FSH-Z18	1165.1909.02
Directional Power Sensor, 200 MHz to 4 GHz	R&S FSH-Z44	
Matching Pad 50/75 Ω , 0 Hz to 2700 MHz	R&S RAZ	0358.5714.02
Spare RF Cable, 1 m, N male/N female for R&S FSH-B1	R&S FSH-Z20	1145.5867.02
12 V Car Adapter	R&S FSH-Z21	1145.5873.02
Serial/Parallel Converter	R&S FSH-Z22	1145.5880.02
Carrying Bag	R&S FSH-Z25	1145.5896.02
Transit Case	R&S FSH-Z26	1300.7627.02
Combined Short/Open and 50 Ω Load for VSWR and DTF calibration	R&S FSH-Z29	1300.7504.02
Spare Short/Open Calibration for R&S FSH-Z2	R&S FSH-Z30	1145.5773.02
Spare 50 Ω Load for R&S FSH-Z2 for VSWR and DTF calibration	R&S FSH-Z31	1145.5780.02
Spare Battery Pack	R&S FSH-Z32	1145.5796.02
Spare AC Power Supply	R&S FSH-Z33	1145.5809.02
Spare RS-232-C Optical Cable	R&S FSH-Z34	1145.5815.02
Spare Headphones	R&S FSH-Z36	1145.5838.02
Spare Optical USB Cable	R&S FSH-Z37	1300.7733.02
Matching Pad 50/75 Ω , DC to 1000 MHz	R&S FSH-Z38	1300.7740.02
Spare CD-ROM with Control Software R&S FSH View and Documentation for R&S FSH3-TV	R&S FSHTV-Z65	2111.7340.02



For product brochure, see PD 0758.2648.12
and www.rohde-schwarz.com
(search term: FSH3-TV)



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