

Handheld Spectrum Analyzer R&S FSH3

100 kHz to 3 GHz



ROHDE & SCHWARZ

Spectrum analysis – anywhere, anytime

The R&S FSH3 is the ideal spectrum analyzer for rapid, high-precision, cost-effective signal investigations. It provides a large number of measurement functions and so can handle anything from the installation or maintenance of a mobile radio base station, through on-site fault location in RF cables to development and service – an extensive range of applications.



*Power measurement with
Power Sensor R&S FSH-Z1*



Handy, robust and portable

The R&S FSH3 has been designed as a robust, portable spectrum analyzer that can be used in the field.

Robust edge protection, stable carrying handle

Easy operation

Four hours operating time on battery power

Storage of up to 100 traces and setups

Easy data transfer to PC

High measurement accuracy

Best RF characteristics in this class

The R&S FSH3 can, of course, also be used as a desktop instrument in the lab. The R&S FSH3 has an adjustable, fold-out stand to position the instrument for an optimal display viewing angle.



- Trace
- Memory Trace
- Clear/Write
- Max Hold
- Average
- Detectors
 - Auto Peak
 - Sample
 - Peak
 - RMS

Function keys

Softkey function



Selection of measurement functions:

- Spectrum analysis
- Scalar network analysis
- Channel power
- TDMA power
- DTF
- Power

Selection of following functions:

- Marker
- Delta marker
- Noise marker
- Frequency counter

- Memory for up to 100 traces and setups
- Direct printout of measurement results

Colour display, 320 x 240 pixels

RS-232-C optical interface

Simple menu-based operation via softkeys

Instrument General instrument setups

Current instrument setting

Rotary knob

Default setting

Cursor keys

AC power supply connector

Generator output, N connector

Power sensor connector

Trigger input, BNC connector

RF input, N connector



Headphones connector

Data in brief

Frequency range	100 kHz to 3 GHz
Resolution bandwidths	1 kHz to 1 MHz
Video bandwidths	10 Hz to 1 MHz
Displayed average noise level	-116 dBm (1kHz) typ.
T.O.I.	15 dBm typ.
SSB phase noise	<-100 dBc (Hz) at 100 kHz from carrier
Detectors	sample, peak, auto-peak, RMS
Level measurement accuracy	1.5 dB
Reference level	-80 dBm to +20 dBm
Dimensions	170 mm x 120 mm x 270 mm
Weight	2.5 kg

R&S FSH3 – options and applications

Two versions of the R&S FSH3 are available – one with an internal tracking generator and one without. The tracking generator extends the R&S FSH3's range of applications to cover distance-to-fault (DTF) measurements on cables and scalar network analysis. A power sensor is available as an accessory for high-precision power measurements to 8 GHz. The table below indicates which configuration is required for each application.

Product	Application	TDMA power measurement	Channel-power measurements	Power measurements to 8 GHz	Measurements on cables (distance-to-fault)	Scalar network analysis (transmission)	Scalar network analysis (reflection)
R&S FSH3	■	■					
R&S FSH3 incl. tracking generator	■	■			■		
R&S FSH3 incl. tracking generator + VSWR Bridge R&S FSH-Z2 + DTF Function R&S FSH-B1	■	■		■	■	■	
R&S FSH3 + Power Sensor R&S FSH-Z1	■	■	■				
R&S FSH3 incl. tracking generator + Power Sensor R&S FSH-Z1 + VSWR Bridge R&S FSH-Z2 + DTF Function R&S FSH-B1	■	■	■	■	■	■	■

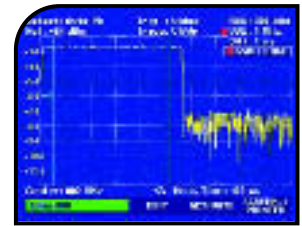
Data transfer between R&S FSH3 and PC – interface cables and software are supplied with the instrument



TDMA power measurements

Basically, when TDMA (time division multiple access) methods are employed, e.g. GSM, several users share a frequency channel. Each user is assigned a single timeslot. The R&S FSH3's TDMA POWER function performs time-domain power measurements in these timeslots. All the settings required for the GSM and EDGE stan-

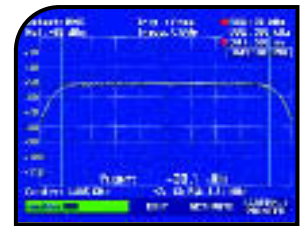
dards are predefined on the R&S FSH3 to make these measurements easier for the user. The R&S FSH3 can use external triggering or video triggering to start power measurements.



Channel-power measurements

The channel-power measurement function is for determining the power in a transmission channel specified by the user. After a few preliminary settings have been made, a single keystroke starts the R&S FSH3's spectrum measurement inside the channel, using a resolution bandwidth that is small relative to the channel bandwidth. The R&S FSH3 then integrates the measured values indicated by the trace to obtain

and display the total power. All the settings required for the digital mobile radio standards 3GPP WCDMA, cdmaOne, CDMA2000 1x are predefined ready for use. The R&S FSH3 also takes the characteristics of the selected display mode (lin or log), the selected detector and the resolution bandwidth into account so that the result accuracy is comparable to that obtained with a thermal power meter.



Power measurements

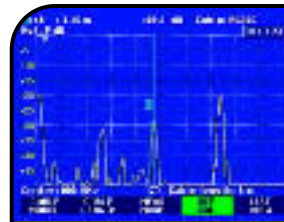
When the accessory Power Sensor R&S FSH-Z1 is fitted, the R&S FSH3 is transformed into a high-precision RF power meter with a maximum frequency of 8 GHz. As with thermal sensors, the true RMS value of the measured signal is obtained over the whole measurement range irrespective of the signal waveform. This is particularly relevant when measurements are made

on modulated signals because no additional measurement errors are introduced. The measurements are straightforward, which is very important for digitally modulated signals such as 3GPP. The large measurement range which covers 200 pW to 200 mW (equivalent to a dynamic range of 90 dB) turns the R&S FSH3 with the R&S FSH-Z1 into a universal RF power meter.



Measurements on cables (distance-to-fault)

For rapidly and accurately determining the distance to any defects in an RF cable. Distance-to-fault measurements using the VSWR Bridge R&S FSH-Z2 give an immediate overview of the state of the device under test (return loss and distance, see Fig.).



Only applies to R&S FSH3 with tracking generator, Order No. 1145.5850.13, with installed option R&S FSH-B1 (distance-to-fault measurement) and R&S FSH-Z2 (VSWR bridge and power divider)

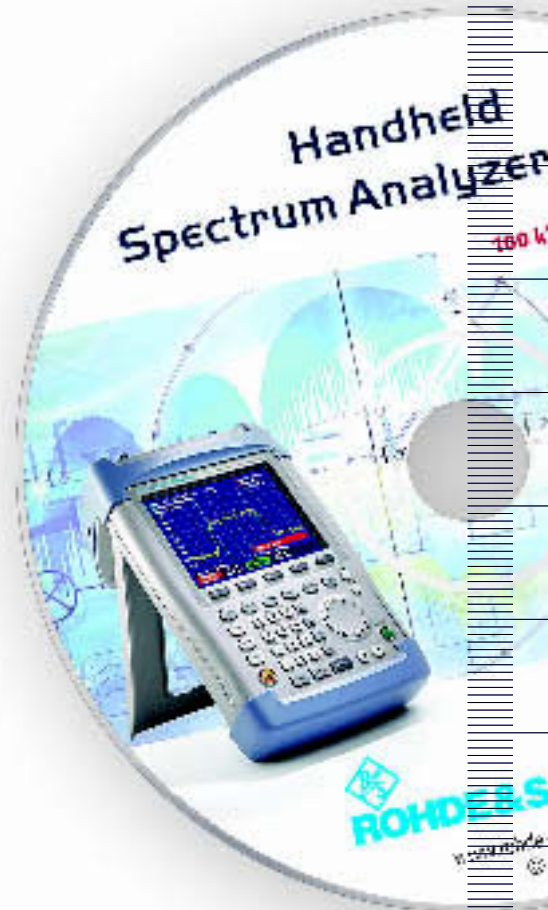
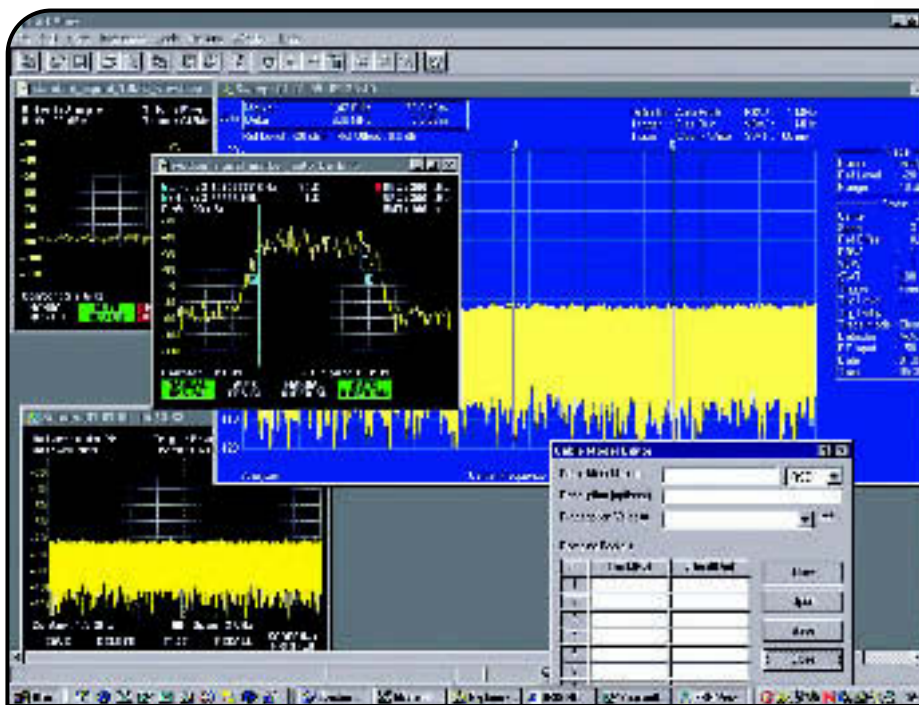
Scalar network analysis with VSWR bridge (FSH-Z2 as accessory)

The R&S FSH3 with built-in tracking generator can be used to determine the transmission characteristics (i.e. attenuation or gain) of twoports such as cables, filters, amplifiers, etc, rapidly and with a minimum of effort. A simple calibration procedure compensates for the attenuation introduced by measurement cables or any attenuators used for amplifier measurements. When the VSWR Bridge R&S FSH-Z2 is fitted, the

matching (return loss or VSWR) at the input or output of twoports can be determined as well as their transfer function. The bridge is screwed directly onto the R&S FSH3's RF input and tracking generator output, and no extra, cumbersome cabling is required.

R&S FSH View Software

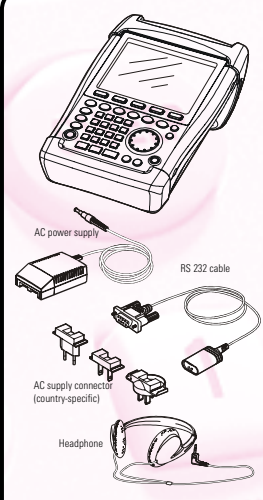
The powerful software package for documenting your measurements is supplied with every R&S FSH3.



Features:

- R&S FSH View software for Windows 98/ME/NT/2000/XP
- Permanent and continuous transfer of sweeps to the PC; facilities for subsequent analysis (markers, zoom, etc)
- Rapid and simple transfer of measurement data from the R&S FSH3 to a PC and vice versa
- Unlimited memory capacity for traces and other measurement information; comparison of new and old measurements
- Data export in ASCII or MS Excel formats
- Generation of cable data with a built-in cable editor; downloading to the R&S FSH3 for distance-to-fault measurements
- Printout of relevant data via Windows (screenshot of the R&S FSH3's display for documentation)
- Connection between PC and R&S FSH3 via interference-free, RS-232-C optical interface
- Graphics data stored in standard formats (.bmp, .pcx, .png, .wmf)

Accessories and ordering information



The image shows the R&S FSH3 handheld spectrum analyzer and its accessories. The accessories include an AC power supply, an RS 232 cable, an AC supply connector (country-specific), and headphones.

Handheld Spectrum Analyzer R&S FSH3

Description	Designation	Order No.
Handheld Spectrum Analyzer, 100 kHz to 3 GHz	R&S FSH3	1145.5850.03
Handheld Spectrum Analyzer, 100 kHz to 3 GHz, with tracking generator	R&S FSH3	1145.5850.13
Accessories supplied		
External AC power supply, battery pack (integral)		
RS-232-C optical cable		
Headphones		
CD-ROM with Control Software R&S FSH View and documentation		
Quick Start Manual		

Options

Description	Designation	Order No.
Distance-to-fault Measurement for R&S FSH3, comprises 1 m cable and calibration termination, R&S FSH-Z2 required	R&S FSH-B1	1145.5750.02



The image shows various optional accessories for the R&S FSH3 handheld spectrum analyzer. The accessories include a power sensor connector, a power sensor, a VSWR bridge and power divider, a matching pad, a 12 V cigarette-lighter adapter, a serial/parallel converter, a carrying bag, a spare RF cable, a spare short circuit, a spare 50 Ω load standard, a spare battery pack, a spare AC power supply, a spare RS 232 optical cable, a spare CD-ROM with control software, and a spare pair of headphones.

Optional accessories

Description	Designation	Order No.
Power Sensor for R&S FSH3	R&S FSH-Z1	1155.4505.02
VSWR Bridge and Power Divider, 10 MHz to 3 GHz, for R&S FSH3	R&S FSH-Z2	1145.5767.02
Matching Pad 50/75 Ω, 0 MHz to 2700 MHz	R&S RAZ	0358.5714.02
12 V Cigarette-Lighter Adapter for R&S FSH	R&S FSH-Z21	1145.5873.02
Serial/Parallel Converter for R&S FSH	R&S FSH-Z22	1145.5880.02
Carrying Bag for R&S FSH	R&S FSH-Z25	1145.5896.02
Spare RF Cable, 1 m, N connectors for FSH-B1	R&S FSH-Z20	1145.5867.02
Spare Short Circuit for FSH-Z2	R&S FSH-Z30	1145.5773.02
Spare 50 Ω Load Standard for FSH-B1	R&S FSH-Z31	1145.5780.02
Spare Battery Pack for R&S FSH	R&S FSH-Z32	1145.5796.02
Spare AC Power Supply for R&S FSH	R&S FSH-Z33	1145.5809.02
Spare RS 232 Optical Cable	R&S FSH-Z34	1145.5815.02
Spare CD-ROM with Control Software FSH View and documentation	R&S FSH-Z35	1145.5821.02
Spare Headphones	R&S FSH-Z36	1145.5838.02

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 are typical values. Data designated as “nominal” are design parameters and are not tested.

Frequency		PRINT
Frequency range	100 kHz to 3 GHz	
Reference frequency		
Aging	2 ppm / year	
Temperature drift	2 ppm (0 °C to 30 °C), for 30 °C to 50 °C add 2 ppm/10 °C	
Frequency counter		
Resolution	1 Hz	
Span	10 kHz to 3 GHz, 0 Hz	
Spectral purity		
SSB phase noise, f = 500 MHz,		
30 kHz from carrier	<85 dBc/(1 Hz)	
100 kHz from carrier	<100 dBc/(1 Hz)	
1 MHz from carrier	<120 dBc/(1 Hz)	
Sweep time		
Span ≥10 kHz	100 ms to 1000 s	
Span = 0 Hz	1 ms to 100 s	
Bandwidths		
Resolution bandwidths (-3 dB)	1 kHz to 1 MHz in 1, 3 steps	
Tolerance	±5 %	
Video bandwidths	10 Hz to 1 MHz in 1, 3 steps	

Amplitude		PRINT
Display range	average noise floor displayed to +20 dBm	
Maximum permitted DC voltage at RF input	50 V	
Maximum power	20 dBm, 30 dBm (1 W) for max. 3 s	
Intermodulation-free range		
2 x -20 dBm, reference level = -10 dBm (0 dB RF attenuation)	70 dB (+15 dBm TOI)	
Displayed average noise floor, resolution bandwidth 1 kHz		
Video bandwidth 10 Hz, 10 MHz to 3 GHz, reference level \leq -30 dBm	<-105 dBm, -116 dBm typ.	
Spurious response		
Reference level \leq -10 dBm, $f > 30$ MHz, RBW \leq 100 kHz	<-80 dBm	
Image frequency		
Carrier offset > 1 MHz	<-70 dBc (nominal)	
Level display		
Reference level	-80 dBm to +20 dBm in 1 dB steps	
RF attenuation	0 dB to 30 dB in 10 dB steps, automatically coupled to the reference level	
Display range	100 dB, 50 dB, 20 dB, linear	
Display units		
Logarithmic	dBm, dB μ V, dBmV	
Linear	μ V, mV, V, nW, μ W, mW, W	
Traces	1 trace and 1 memory trace	
Level display error		
at reference level down to -50 dB	1.5 dB (20 °C to 30 °C)	
Trace detector	AutoPeak, Max Peak, Sample, RMS	
Markers	1 marker and 1 delta marker	
Marker functions	peak, next peak, marker to center	
Marker displays	normal (level), noise marker, frequency counter (count)	
Trigger	free-running, video trigger, external trigger	
Audio demodulation	AM and FM	

Inputs		PRINT
RF input	N connector, female	
Input impedance	50 Ω	
VSWR (10 MHz to 3 GHz)	1.5 typ.	
Trigger input	BNC connector, female	
Trigger voltage	TTL	

Outputs		PRINT
Headphones output	3.5 mm mini jack	
Output impedance	10 Ω	
Open-circuit voltage	adjustable to 1.5 V	
Tracking generator (only model 1145.5850.13)	N connector, female	
Frequency range	10 MHz to 3 GHz	
Output level	-20 dBm (nominal)	
Output impedance	50 Ω , nominal	

Interfaces		PRINT
RS232 optical interface		
Baud rates	1200, 2400, 9600, 19200, 38400, 57600, 115200 baud	
Power sensor	7-contact connector (Binder 712)	

Accessories		PRINT
Power Sensor R&S FSH-Z1		
Frequency range	10 MHz to 8 GHz	
VSWR (18 °C to 28 °C)		
10 MHz to 30 MHz	<1.15	
30 MHz to 2.4 GHz	<1.13	
2.4 GHz to 8 GHz	<1.20	
Maximum input power	400 mW (+26 dBm), average power 1 W (+30 dBm), peak power (<10 μ s, 1% duty cycle)	
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)		
18 °C to 28 °C	<2.5 % (0.11 dB)	
0 °C to 50 °C	<4.5 % (0.19 dB)	

Power supply		PRINT
AC supply	external 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	
Battery voltage	6 V to 9 V	
Operating time with fully charged battery	4 h without tracking generator	
	3.5 h with tracking generator	
Battery charging time	4 h	
Battery life	300 to 500 charging cycles	
Power consumption	7 W (typ.)	
Safety	to EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1	
Test marks	VDE, GS, CSA, CSA-NRTL	
Dimensions (W x H x D)	170 mm x 120 mm x 270 mm	
Weight	2.5 kg	

General data		PRINT
Display	14 cm (5.7") colour LCD	
Resolution	320 x 240 pixels	
Memory	CMOS RAM	
Setups and traces	100	
Environmental conditions		
Temperature		
Operating temperature range		
R&S FSH3 powered from battery	0 °C to +50 °C	
R&S FSH3 powered from AC power supply	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 (IEC 60068)	

(continued on page 12)

General data (continued)	
Mechanical resistance	
Sinusoidal vibration	to IEC 60068-2-1, IEC 61010-1 5 Hz to 55 Hz: max. 2g, 55 Hz to 150 Hz: 0.5g constant, 12 minutes per axis
Random vibration	to IEC 60068-2-64 10 Hz to 500 Hz, 1.9 g, 30 minutes per axis
Shock	to IEC 60068-2-27 40 g shock spectrum
RFI suppression	
	to EMC directive of EU (89/336/EEC) and German EMC legislation
Immunity to radiated interference	
Level display at 10 V/m (ref. level \leq -10 dBm)	10 V/m
Input frequency	<-75 dBm (nominal)
IF	<-85 dBm (nominal)
Other frequencies	< noise display

