

Rohde & Schwarz FSH3.03 Specs

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

# 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<br>+ VSWR Bridge R&S FSH-Z2<br>+ DTF Function R&S FSH-B1                              | ■           | ■                      |                            | ■                           | ■  | ■                                      |                                      |
| R&S FSH3 +<br>Power Sensor R&S FSH-Z1   | ■           | ■                      | ■                          |                             |  |  |                                      |
| R&S FSH3 incl. tracking generator<br>+ Power Sensor R&S FSH-Z1<br>+ VSWR Bridge R&S FSH-Z2<br>+ DTF Function R&S FSH-B1 | ■           | ■                      | ■                          | ■                           | ■  | ■                                      | ■                                    |

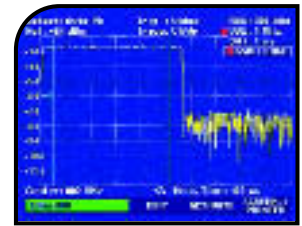
*Data transfer between R&S FSH3 and PC – interface cables and software are supplied with the instrument*



## 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-

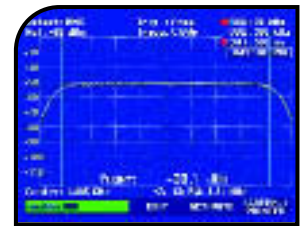
dards are predefined on the R&S FSH3 to make these measurements easier for the user. The R&S FSH3 can use external triggering or video triggering to start power measurements.



## 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

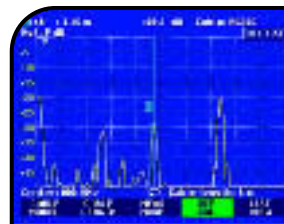
When the accessory Power Sensor R&S FSH-Z1 is fitted, the R&S FSH3 is transformed into a high-precision RF power meter with a maximum frequency of 8 GHz. As with thermal sensors, the true RMS value of the measured signal is obtained over the whole measurement range irrespective of the signal waveform.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

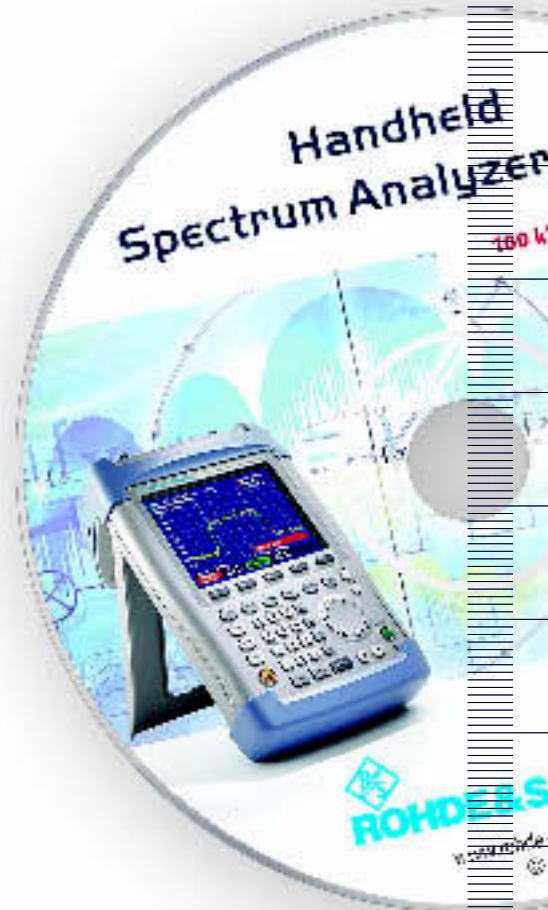
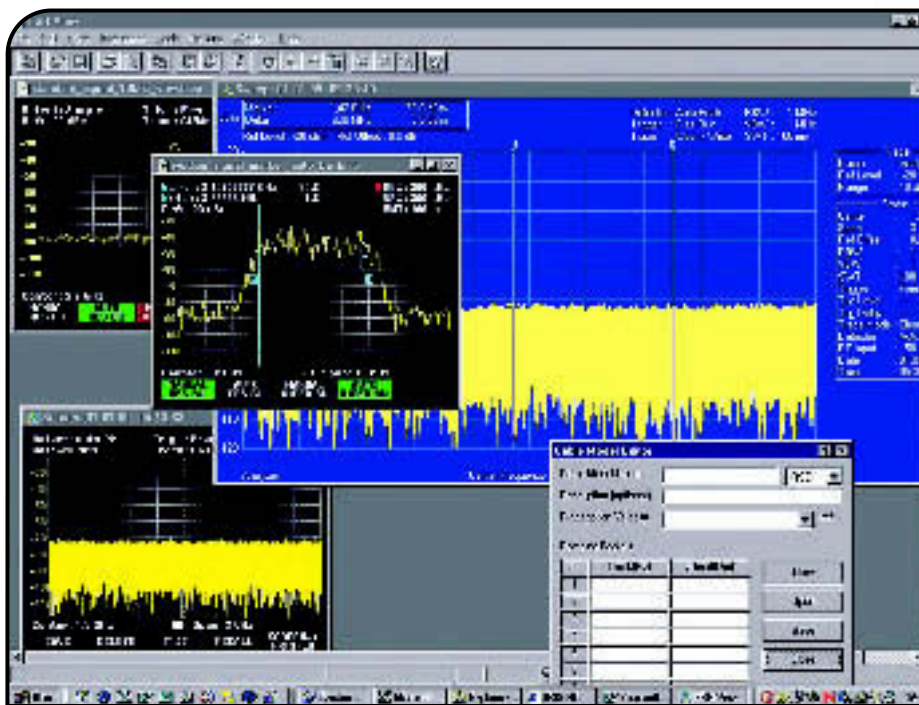
## Scalar network analysis with VSWR bridge (FSH-Z2 as accessory)

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.

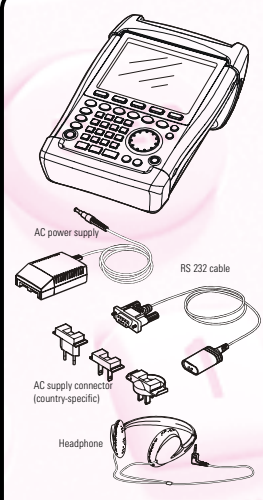


## Features:

- 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,<br>with tracking generator | R&S FSH3    | 1145.5850.13 |
| <b>Accessories supplied</b>  |             |              |
| 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,<br>comprises 1 m cable and calibration termination,<br>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,<br>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<br>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.

| <b>Frequency</b>              |   | PRINT |
|-------------------------------|---|-------|
| Frequency range               | 100 kHz to 3 GHz  |       |
| Reference frequency           |   |       |
| Aging                         | 2 ppm / year  |       |
| Temperature drift             | 2 ppm ( 0 °C to 30 °C),<br>for 30 °C to 50 °C add 2 ppm/10 °C |       |
| Frequency counter             |   |       |
| Resolution                    | 1 Hz  |       |
| Span                          | 10 kHz to 3 GHz, 0 Hz   |       |
| <b>Spectral purity</b>        |   |       |
| 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)   |       |
| <b>Sweep time</b>             |   |       |
| Span ≥10 kHz                  | 100 ms to 1000 s  |       |
| Span = 0 Hz                   | 1 ms to 100 s   |       |
| <b>Bandwidths</b>             |   |       |
| 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                                  |       |

| <b>Amplitude</b>  |   | 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<br>(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,<br>reference level $\leq$ -30 dBm | $<$ -105 dBm, -116 dBm typ.   |       |
| Spurious response   |   |       |
| Reference level $\leq$ -10 dBm, $f >$ 30 MHz,<br>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<br>coupled to the reference level |       |
| Display range   | 100 dB, 50 dB, 20 dB, linear  |       |
| Display units   |   |       |
| Logarithmic   | dBm, dB $\mu$ V, dBmV   |       |
| Linear  | $\mu$ V, mV, V, nW, $\mu$ 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   |       |
| <b>Markers</b>  | 1 marker and 1 delta marker   |       |
| Marker functions  | peak, next peak, marker to center   |       |
| Marker displays   | normal (level), noise marker, frequency counter<br>(count)                    |       |
| <b>Trigger</b>  | free-running, video trigger, external trigger                                 |       |
| <b>Audio demodulation</b>   | AM and FM   |       |

| <b>Inputs</b>          |                       | PRINT |
|------------------------|-----------------------|-------|
| RF input               | N connector, female   |       |
| Input impedance        | 50 $\Omega$           |       |
| VSWR (10 MHz to 3 GHz) | 1.5 typ.              |       |
| Trigger input          | BNC connector, female |       |
| Trigger voltage        | TTL                   |       |

| <b>Outputs</b>                               |                       | PRINT |
|--|-----------------------|-------|
| Headphones output                            | 3.5 mm mini jack      |       |
| Output impedance                             | 10 $\Omega$           |       |
| 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 $\Omega$ , nominal |       |

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

| <b>Accessories</b>  |   | PRINT |
|---|---|-------|
| <b>Power Sensor R&amp;S FSH-Z1</b>                              |   |       |
| 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<br>1 W (+30 dBm), peak power (<10 $\mu$ 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)  |       |

| <b>Power supply</b>                       |  | 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.)                                     |       |
| <b>Safety</b>                             | to EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1 |       |
| Test marks                                | VDE, GS, CSA, CSA-NRTL                         |       |
| <b>Dimensions (W x H x D)</b>             | 170 mm x 120 mm x 270 mm                       |       |
| <b>Weight</b>                             | 2.5 kg   |       |

| <b>General data</b>                   |                           | PRINT |
|---------------------------------------|---------------------------|-------|
| <b>Display</b>                        | 14 cm (5.7") colour LCD   |       |
| Resolution                            | 320 x 240 pixels          |       |
| <b>Memory</b>                         | CMOS RAM                  |       |
| Setups and traces                     | 100                       |       |
| <b>Environmental conditions</b>       |                           |       |
| <b>Temperature</b>                    |                           |       |
| 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            |       |
| <b>Climatic conditions</b>            |                           |       |
| Relative humidity                     | 95 % at 40 °C (IEC 60068) |       |

(continued on page 12)

| <b>General data</b> (continued)                     |   |
|---|---|
| <b>Mechanical resistance</b>                        |   |
| Sinusoidal vibration                                | to IEC 60068-2-1, IEC 61010-1<br>5 Hz to 55 Hz: max. 2g, 55 Hz to 150 Hz: 0.5g constant,<br>12 minutes per axis |
| Random vibration                                    | to IEC 60068-2-64<br>10 Hz to 500 Hz, 1.9 g, 30 minutes per axis  |
| Shock   | to IEC 60068-2-27<br>40 g shock spectrum  |
| <b>RFI suppression</b>                              |   |
|   | to EMC directive of EU (89/336/EEC)<br>and German EMC legislation   |
| <b>Immunity to radiated interference</b>            |   |
| 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   |

