

# Spectrum Analyzer

## R&S® FS300/FS315

9 kHz to 3 GHz



Fourth Edition March 2006

  
**ROHDE & SCHWARZ**

# Professional test equipment for laboratory, service and production

The R&S®FS 300 is a highly accurate spectrum analyzer with a frequency range of 9 kHz to 3 GHz. Owing to its modern, digital frequency processing technique, it offers high measurement quality at a favorable price. The R&S®FS315 is additionally equipped with a built-in tracking generator from 9 kHz to 3 GHz for scalar network analysis; the tracking generator is also suitable for generating fixed-frequency signals. Plus, the R&S®FS315 includes various detectors for evaluating measurement results and allows electric field strength measurements taking into account the antenna factors.

## High-quality measurement characteristics

**Resolution bandwidths from 200 Hz to 20 MHz  
(R&S®FS315)**

**Frequency counter with 1 Hz resolution**

**Maximum input level 33 dBm**

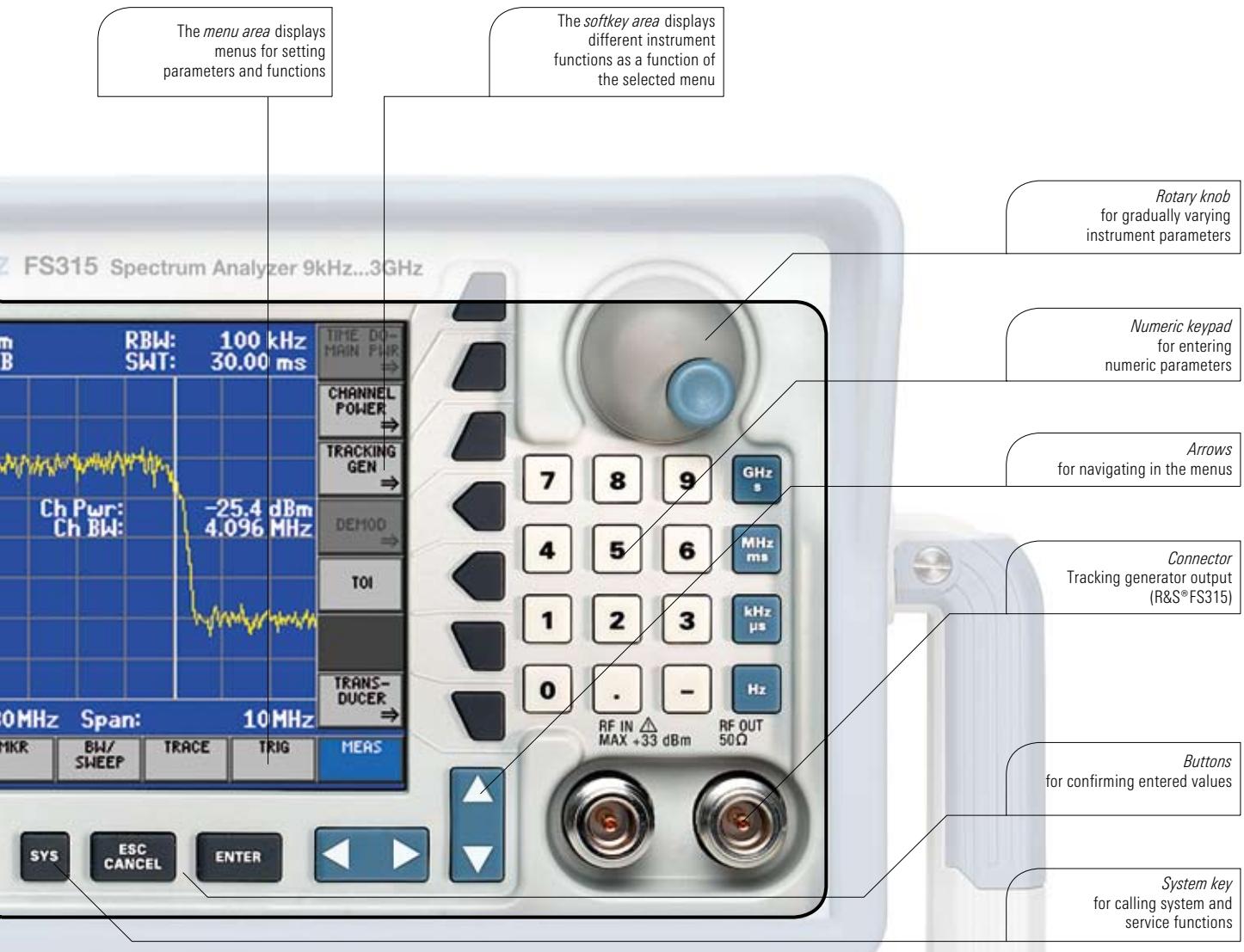
**Ergonomic user interface**

**Remote control via USB interface**

**AM/FM audio frequency demodulator output  
(R&S®FS315)**

## Condensed data

|                                  | R&S®FS300  | R&S®FS315  |
|----------------------------------|--|--|
| Frequency range                  | 9 kHz to 3 GHz                                   |  |
| Resolution bandwidths (-3 dB)    | 200 Hz to 1 MHz                                  | 200 Hz to 20 MHz   |
| Video bandwidths                 | 10 Hz to 1 MHz                                   | 10 Hz to 20 MHz  |
| Displayed average noise level    | < -110 dBm, typ. -115 dBm (300 Hz)               |  |
| Intermodulation-free range       | < -70 dBc at -36 dBm input level                 |  |
| SSB phase noise, 10 kHz offset   | < -90 dBc (1 Hz)                                 |  |
| Level uncertainty                | < 1.5 dB, typ. 0.7 dB                            |  |
| Detector                         | peak   | max/min peak, sample, average, RMS   |
| Measurement functions            | TOI, TDMA power, frequency counter, noise marker | TOI, TDMA power, frequency counter, noise marker, occupied bandwidth (OBW), return loss, transmission, channel power |
| Tracking generator               | –  | 9 kHz to 3 GHz   |
| Audio frequency demodulator      | –  | AM /FM   |
| Measurement with antenna factors | –  | yes  |



## Ergonomic user interface

Operation is menu-guided enabling even untrained users to quickly obtain correct results. Clear structures simplify navigation within the menus.

The bright TFT color display allows traces to be read even at odd angles or when the incidence of light is unfavorable.

# Application ranges

The R&S®FS300/FS315 is a versatile spectrum analyzer for comprehensive measurements in laboratory, service and production.



## PC software

A powerful software package for remote control from a PC is supplied with the R&S®FS300/FS315. The software enhances the R&S®FS300/FS315 functions and supports the generation of test reports on the PC.

**Measurement of RF spectrum (level and frequency)**

**Measurement of radiated interference (EMC)**

**Time domain measurements**

**Radiomonitoring remote-controlled via USB**

**Scalar network analysis (only R&S®FS315)**

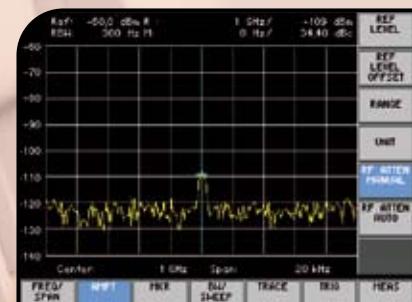
## Characteristics

- Windows 2000/XP-compatible
- PC linked to R&S®FS300/FS315 via USB interface
- Fast and simple transfer of measurements between R&S®FS300/FS315 and PC
- Permanent sweep and transmission of ongoing sweeps to the PC with evaluation capabilities (marker, zoom, etc)
- Extended range of functions (limit lines, log file)
- Practically unlimited memory capacity for storing traces and measurement information (comparison of current and previous measurements)
- Export of trace values (900 points) in txt format for import into MS Excel
- Export of displayed data (screenshots) in JPEG format
- Output of results to standard printer

## High-quality measurement characteristics

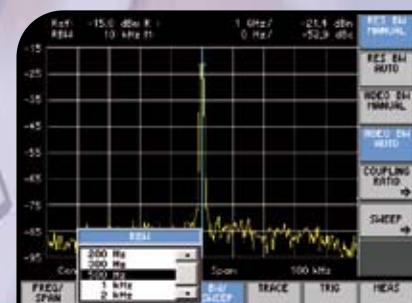
The RF characteristics of the R&S®FS300/FS315 are setting new standards in the lower price class. Since the displayed average noise level is typically  $-115$  dBm (300 Hz), even weak signals can be reliably detected. Owing to the wide dynamic range, this is also possible when strong carrier signals are present.

The points in the traces are displayed with an accuracy unrivaled in this price class. This is an essential prerequisite for any measurement task.



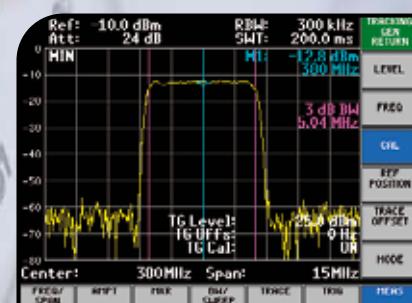
## Resolution bandwidths from 200 Hz to 1 MHz

With 16 digitally implemented resolution bandwidths from 200 Hz to 1 MHz, the R&S®FS300 can be optimally adapted to the measurement task at hand. The R&S®FS315 additionally covers the range up to 20 MHz. Wide resolution bandwidths for overall measurements ensure short sweep times, whereas narrow bandwidths are ideal for high frequency resolution and a low noise level. The R&S®FS300 and R&S®FS315 fulfill every requirement in between.



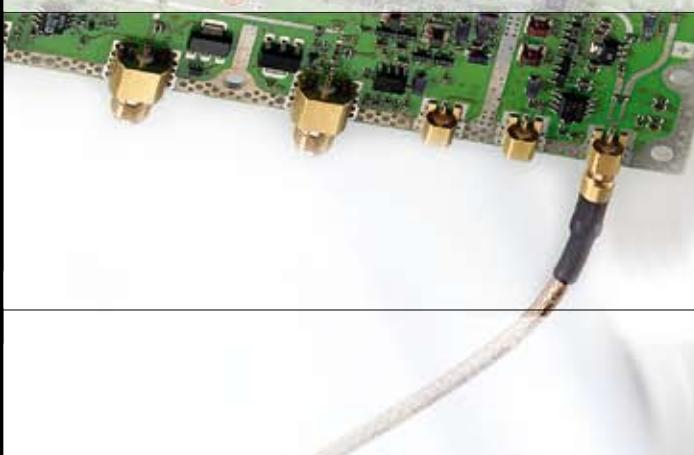
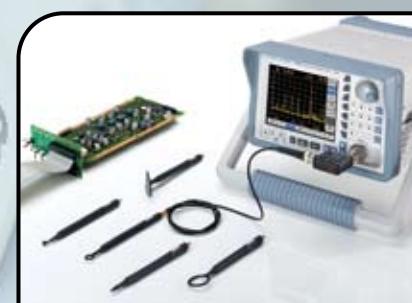
## Scalar network analysis

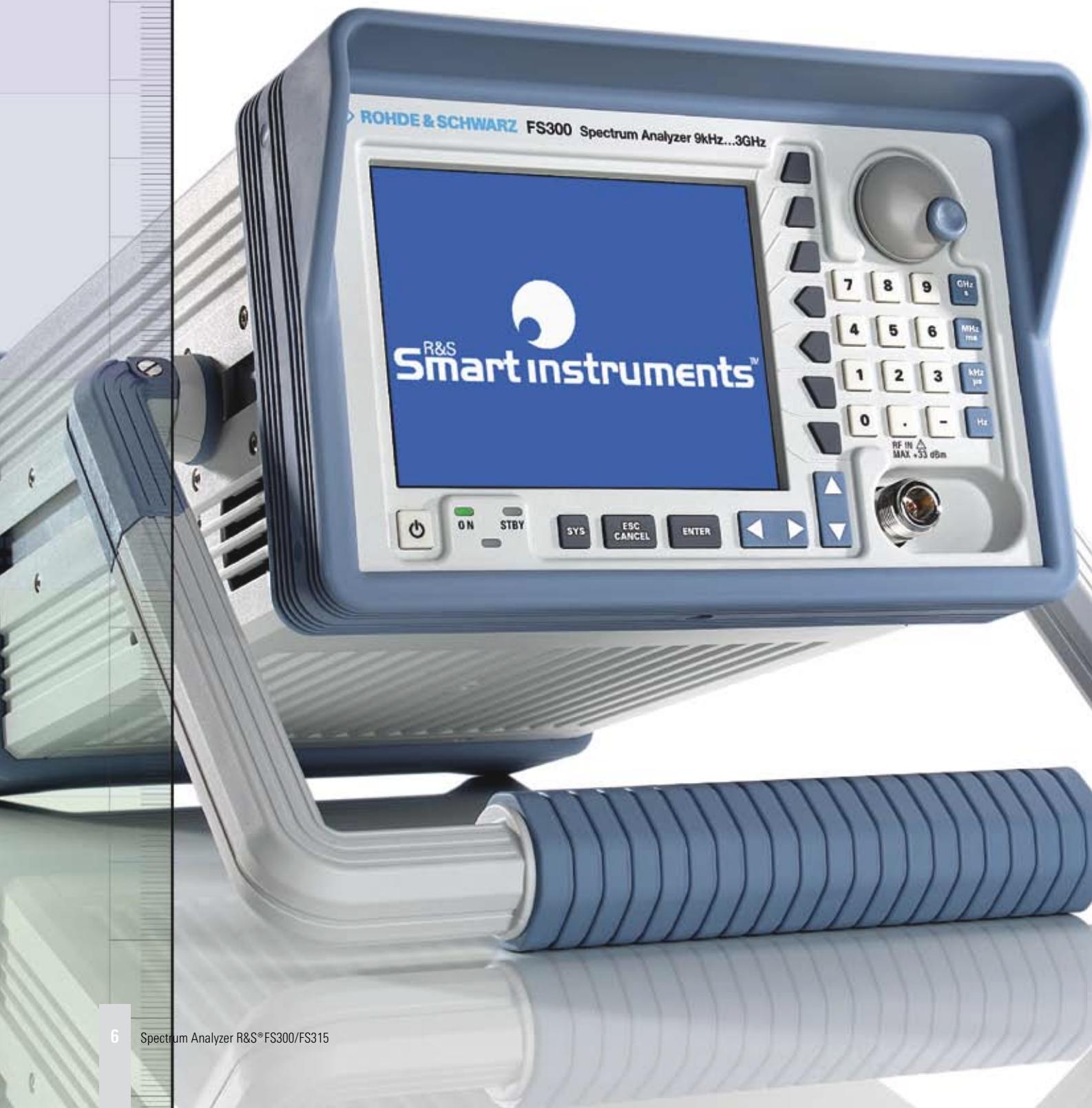
The R&S®FS315 with built-in tracking generator is the perfect solution for cost-efficient testing of the transmission behavior of filters, cables, amplifiers and so forth. Equipped with an additional VSWR bridge, reflection measurements can also be performed. Entering any frequency offset between 0 Hz and 3 GHz allows measurements on frequency-converting DUTs. With simple applications, the tracking generator can be used as a signal generator with a permanently set frequency.



## Locating EMC weak spots

The R&S®HZ-15 near-field probes are diagnostic tools used for locating EMC weak spots on printed boards, integrated circuits, cables, shieldings and other trouble spots. The Near-Field Probe Set R&S®HZ-15 is adequate for emission measurements from 30 MHz to 3 GHz. The Preamplifier R&S®HZ-16 up to 3 GHz, with approximately 20 dB gain and a noise figure of 4.5 dB, increases sensitivity for measurements. In combination with the R&S®FS300/FS315, the preamplifier and near-field probe set are a cost-effective means of analyzing and locating sources of interference during development.





# Ready for the future – the new instrument family

The R&S®FS300 and the R&S®FS315 are part of a new family of analyzers and generators for development, service and production applications. The platform on which this family is based – with its compact design, powerful processor system, fast internal bus and ergonomic user interface – provides optimum conditions for professional, favorably priced instruments.

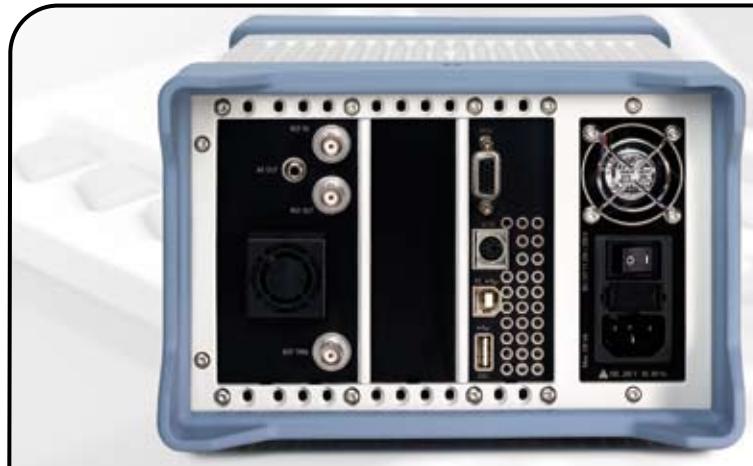
## Compact housing with adjustable handle

The R&S®FS300 and the R&S®FS315 are notable for their compact and robust design. They require only a minimum of space on your desktop or in the rack. Even two instruments of this family can easily be accommodated next to each other in a 19-inch rack. The handle, which can be turned and shifted, can be used to carry the instrument during transport and as a fold-out support to ensure an ideal angle. The handle can be conveniently tilted to the side if it interferes with smooth operation.



## Remote control via USB interface

The R&S®FS300 and the R&S®FS315 can easily be operated from a PC via the USB remote-control interface. Simply connect the PC via hot plug & play, start the supplied software and that's it. The supplied drivers for Windows 2000/XP make system software integration mere child's play.



# Specifications

Our products are continuously enhanced and upgraded. For the latest on the R&S®FS300 and the R&S®FS315, check out the Internet at [www.fs300.rohde-schwarz.com](http://www.fs300.rohde-schwarz.com)

| Frequenz               |  | R&S®FS300   | R&S®FS315       | PRINT |
|------------------------|--|---|-----------------|-------|
| Frequency range        |  | 9 kHz to 3 GHz  |                 |       |
| Frequency resolution   |  | 0.1 Hz  |                 |       |
| Reference frequency    |  | 10 MHz, nominal   |                 |       |
| Aging                  |  | $2 \times 10^{-6}/\text{year}$  |                 |       |
| Temperature drift      | 5 °C to 30 °C  | $1 \times 10^{-6}$  |                 |       |
| External reference     |  | 10 MHz  |                 |       |
| Frequency counter      |  |   |                 |       |
| Resolution             |  | 1 Hz, 10 Hz   |                 |       |
| Count accuracy         | S/N >25 dB   | $\pm(\text{marker frequency} \times \text{reference error} + \frac{1}{2} \text{ (last digit)})$ |                 |       |
| Frequency span         |  | 1 kHz to 3 GHz, 0 Hz  |                 |       |
| Span accuracy          |  | <1 %  |                 |       |
| <b>Spectral purity</b> |  |   |                 |       |
| SSB phase noise        | 9 kHz ≤ f ≤ 3 GHz  |   |                 |       |
|                        | 10 kHz carrier offset  | <-90 dBc (1 Hz), typ. 95 dBc (1 Hz)   |                 |       |
|                        | 100 kHz carrier offset   | typ. -100 dBc (1 Hz)  |                 |       |
|                        | 1 MHz carrier offset   | typ. -110 dBc (1 Hz)  |                 |       |
| Residual FM            | 1 kHz resolution bandwidth,<br>1 kHz video bandwidth<br>9 kHz ≤ f ≤ 3 GHz, weighting<br>in line with CCITT |   | <100 Hz         |       |
| <b>Sweep time</b>      |  |   |                 |       |
| Span >1 kHz            |  | 100 ms to 1000 s<br>(steps depending on RBW and span)   | 30 ms to 1000 s |       |
| Max. deviation         |  | 5 %   | 1 %             |       |
| Span = 0 Hz            |  | 100 µs to 20 s  | 5 µs to 10 s    |       |
| Resolution             |  | 150 ns  | 20 ns           |       |

| Frequency                     |                      |                 |                  |
|-------------------------------|----------------------|-----------------|------------------|
|                               |                      | R&S®FS300       | R&S®FS315        |
| <b>Bandwidths</b>             |                      |                 |                  |
| Resolution bandwidths (-3 dB) | in 1/2/3/5 sequence  | 200 Hz to 1 MHz | 200 Hz to 20 MHz |
| Bandwidth accuracy            | RBW ≤ 1 MHz          | 5 %             | <1 %             |
|                               | 2 MHz ≤ RBW ≤ 10 MHz | –               | <5 %             |
|                               | RBW 10 MHz, 20 MHz   | –               | <10 %            |
| Shape factor 60 db/3 dB       | RBW ≤ 1 MHz          | <4.6:1          |                  |
| Video bandwidths              | in 1/2/3/5 sequence  | 10 Hz to 1 MHz  | 10 Hz to 20 MHz  |

| Amplitude   |   |   |           |
|---|---|---|-----------|
|   |   | R&S®FS300                                 | R&S®FS315 |
| <b>Display range</b>  |   |   |           |
| Display range   |   | displayed average noise level to + 33 dBm |           |
| Display scaling   |   | 80 dB, 40 dB, 16 dB, 8 dB, linear         |           |
| <b>Display units</b>  |   |   |           |
| Logarithmic   |   | dBm, dB $\mu$ V, dBmV                     |           |
| Linear  |   | V, W                                      |           |
| <b>Maximum input level</b>  |   |   |           |
| DC voltage  |   | 30 V                                      |           |
|   | step from -30 V to +30 V  | 1200 V/ $\mu$ s                           |           |
| CW RF power   | RF attenuation <20 dB   | +13 dBm                                   |           |
|   | RF attenuation ≥20 dB   |   |           |
|   | 50 MHz to 3 GHz   | +33 dBm                                   |           |
|   | 20 MHz to 50 MHz  | +26 dBm                                   |           |
|   | 9 kHz to 20 MHz   | +20 dBm                                   |           |
| <b>1 dB compression point of 1st mixer</b>                          |   |   |           |
|   | f >100 kHz,<br>RF attenuation 0 dB  | -10 dBm nominal                           |           |
| <b>Linearity</b>  |   |   |           |
| Harmonics   | input level -40 dBm,<br>RF attenuation 0 dB                                     | <-60 dBc                                  |           |
| Intermodulation-free dynamic range for third-order inter-modulation | two-tone signal with level<br>2 × -30 dBm,<br>RF attenuation 6 dB               | <-70 dBc                                  |           |
| <b>Displayed average noise level</b>                                |   |   |           |
|   | 9 kHz to 3 GHz,<br>RF attenuation 0 dB,<br>300 Hz RBW, 10 Hz video<br>bandwidth | <-110 dBm, typ. -115 dBm                  |           |

| Amplitude                                    |  |  |   |
|--|--|--|---|
|  | R&S®FS300  | R&S®FS315  |   |
| <b>Spurious</b>                              |  |  |   |
| Inherent spurious                            | RF attenuation 0 dB, input terminated                        | <-85 dBm   |   |
| Other spurious                               | 10 MHz to 3 GHz, level at 1st mixer -35 dBm                  | <-60 dBc   |   |
| <b>Level settings</b>                        |  |  |   |
| Setting range of reference level             |  | -110 dBm to +36 dBm  |   |
| Resolution                                   |  | 0.1 dB   |   |
| RF attenuation range                         | manual selection or automatically coupled to reference level | 0 dB to 70 dB  |   |
| Resolution                                   |  | 2 dB   |   |
| <b>Traces</b>                                |  |  |   |
| Trace detectors                              |  | max peak   | max peak, min peak, sample, average, RMS, |
| Trace functions                              |  |  | clear/write, max hold, min hold, average  |
| <b>Max. uncertainty of level measurement</b> |  |  |   |
| Frequency response                           | 9 kHz to 3 GHz, RF attenuation 0 dB to 70 dB                 | -  | <1.0 dB                                   |
| Reference level uncertainty                  |  | -  | <0.3 dB                                   |
| Display nonlinearity                         | 0 dB to -60 dB   | -  | <0.3 dB                                   |
|  | -60 dB to -70 dB   | -  | <1 dB                                     |
| Bandwidth switching uncertainty              |  | <0.2 dB  | <0.3 dB                                   |
| <b>Total measurement uncertainty</b>         | 0 dB to -60 dB below ref. level, RBW ≤ 5 MHz                 | <1.5 dB  | 1.5 dB, typ. 0.7 dB                       |
| <b>Markers</b>                               |  |  |   |
| Number of markers and delta markers          |  | 1 marker and 1 delta marker  |   |
| Marker functions                             |  | peak, next peak left, next peak right, center frequency = marker frequency, reference level = marker level |   |
| Marker displays                              |  | normal (level), noise marker, frequency counter, n dB down (bandwidth)                                     |   |
| Audio demodulation                           | zero span only, RBW ≤ 1 MHz                                  | -  | AM and FM                                 |

| Trigger           |                                       |   |   |
|-------------------|---------------------------------------|---|---|
|                   |                                       | R&S®FS300   | R&S®FS315                                 |
| Span $\geq$ 1 kHz |                                       |   |   |
| Trigger source    |                                       | free run, external                                      |   |
| Trigger offset    | sweep time $>$ 100 ms                 | $0 \leq$ trigger offset $\leq$ 100 ms, resolution 25 ns |   |
| Span = 0 Hz       |                                       |   |   |
| Trigger source    |                                       | free run, external, video                               |   |
| Trigger offset    | negative offset limited by sweep time | –100 ms $\leq$ trigger offset $\leq$ 100 ms             | –100 ms $\leq$ trigger offset $\leq$ 10 s |

| Tracking generator             |   |                  |                 |
|--------------------------------|---|------------------|-----------------|
|                                |   | only R&S®FS315   |                 |
| <b>Frequency</b>               |   |                  |                 |
| Frequency range                |   | 9 kHz to 3 GHz   |                 |
| Frequency offset               |   |                  |                 |
| Setting range                  |   | 0 Hz to 3 GHz    |                 |
| Resolution                     |   | 0.1 Hz           |                 |
| <b>Spectral purity</b>         |   |                  |                 |
| SSB phase noise                | 10 kHz carrier offset<br>9 kHz $\leq$ f $\leq$ 3 GHz                |                  | <–90 dBc (1 Hz) |
| <b>Level</b>                   |   |                  |                 |
| Level setting range            |   | 0 dBm to –50 dBm |                 |
| Resolution                     |   | 0.1 dB           |                 |
| Max. deviation of output level | 9 kHz to 3 GHz,<br>20 °C to 30 °C<br>50 kHz $\leq$ RBW $\leq$ 1 MHz |                  | <1 dB           |
| Spurious                       |   |                  |                 |
| Harmonics                      | output level –10 dBm  |                  | <–20 dBc        |
| Nonharmonics                   | output level 0 dBm  |                  | <–30 dBm        |

| Interfaces                           |  |           |                              |
|--------------------------------------|--|-----------|------------------------------|
|                                      |  | R&S®FS300 | R&S®FS315                    |
| USB host                             | device-specific command set,<br>remote control via supplied<br>Windows driver (Windows<br>XP/2000) |           | A plug, protocol version 1.1 |
| USB device                           |  |           | B plug, protocol version 1.1 |
| Connector for external monitor (VGA) |  |           | 15-pin D-Sub female          |
| Keyboard connector                   |  |           | PS/2 female                  |

| Inputs                           |                      |                         |           |
|----------------------------------|----------------------|-------------------------|-----------|
|                                  |                      | R&S®FS300               | R&S®FS315 |
| <b>RF input</b>                  |                      |                         |           |
| Connector                        |                      | N female (front panel)  |           |
| Impedance                        |                      | 50 Ω                    |           |
| VSWR                             | RF attenuation 20 dB | <1.5                    |           |
| <b>External trigger input</b>    |                      |                         |           |
| Connector                        |                      | BNC female (rear panel) |           |
| Trigger voltage                  |                      | TTL                     |           |
| <b>Reference frequency input</b> |                      |                         |           |
| Connector                        |                      | BNC female (rear panel) |           |
| Reference frequency              |                      | 10 MHz ± 50 Hz          |           |
| Impedance                        |                      | 50 Ω                    |           |
| Input level                      |                      | 0 dBm to 20 dBm         |           |

| Outputs                               |  |                         |  |
|---------------------------------------|--|-------------------------|--|
|                                       |  | R&S®FS300               | R&S®FS315                                    |
| <b>RF output (tracking generator)</b> |  |                         |  |
| Connector                             |  | –                       | N female (front panel)                       |
| Impedance                             |  | –                       | 50 Ω   |
| VSWR                                  |  | –                       | <1.6   |
| <b>Reference frequency output</b>     |  |                         |  |
| Connector                             |  | BNC female (rear panel) |  |
| Reference frequency                   |  | 10 MHz                  |  |
| Impedance                             |  | 50 Ω                    |  |
| Output level                          |  | 7 dBm nominal           |  |
| <b>AF output</b>                      |  |                         |  |
| Connector                             |  | –                       | 3.5 mm mini jack for headphones (rear panel) |
| Impedance                             |  | –                       | 15 Ω nominal                                 |

| General data                         |   |   |       |
|--------------------------------------|---|---|-------|
|                                      | R&S®FS300   | R&S®FS315   |       |
| <b>Display</b>                       |   |   |       |
| Type                                 | 5.4" active TFT color display                                 |   |       |
| Resolution                           | 320 × 240 pixel   |   |       |
| Max. refresh rate                    | 10 pictures/s, nominal  |   |       |
| <b>Power supply</b>                  |   |   |       |
| Input voltage range                  | autoranging   | 100 V to 240 V (AC), 50 Hz to 60 Hz                                       |       |
| Power consumption                    |   | <45 W   | <60 W |
| <b>Ambient conditions</b>            |   |   |       |
| Operating temperature range          | meets EN 60068-2-1/2  | +5°C to +45°C   |       |
| Storage temperature range            |   | -20°C to +70°C  |       |
| Relative humidity                    | meets EN 60068-2-78   | 95 % at +40 °C  |       |
| <b>Mechanical resistance</b>         |   |   |       |
| Sinusoidal vibration                 | meets EN 60068-2-6,<br>EN 61010-1 and MIL-T-28800D<br>class 5 | 5 Hz to 150 Hz, max. 2 g at 55 Hz,<br>55 Hz to 150 Hz: 0.5 g constant     |       |
| Random vibration                     | meets EN 60068-2-64   | 10 Hz to 500 Hz: 1.9 g  |       |
| Shock                                | meets EN 60068-2-27 and<br>MIL-STD-810                        | shock-spectrum  |       |
| <b>Electromagnetic compatibility</b> |   | meets EN 55011 class B and EN 61326<br>(EMC Directive of EU (89/336/EEC)) |       |
| <b>EMI field strength</b>            |   | 10 V/m  |       |
| <b>Safety</b>                        |   | EN 61010-1/IEC61010-1, UL3111-1, CSA C22.2 No. 1010.1                     |       |
| <b>Dimensions (W × H × D)</b>        |   | 219 mm × 147 mm × 350 mm  |       |
| <b>Weight</b>                        |   | 8.5 kg  | 9 kg  |

| <b>Spectrum Analyzer R&amp;S® FS300/FS315</b>   |             |                  | <b>PRINT</b> |
|---|-------------|------------------|--------------|
| <b>Designation</b>  | <b>Type</b> | <b>Order No.</b> |              |
| Spectrum Analyzer   | R&S®FS300   | 1147.0991.03     |              |
| Spectrum Analyzer with Tracking Generator   | R&S®FS315   | 1147.1000.03     |              |
| Rack Adapter  | R&S®ZZA-300 | 1147.1281.00     |              |
| Transit Case  | R&S®ZZK-300 | 1147.2542.02     |              |
| <b>Accessories supplied for the R&amp;S®FS300/FS315:</b>  |             |                  |              |
| User manual (German/English), CD-ROM with PC software and documentation, USB cable for PC connection, power cable |             |                  |              |
| <b>Recommended extras for the R&amp;S®FS300/FS315:</b>  |             |                  |              |
| Near-Field Probe Set  | R&S®HZ-15   | 1147.2736.02     |              |
| Preamplifier for R&S®HZ-15  | R&S®HZ-16   | 1147.2720.02     |              |
| SWR Bridge 5 MHz to 3 GHz   | R&S®ZRB2    | 0373.9017.52     |              |
| SWR Bridge 5 MHz to 2.5 GHz   | R&S®ZRB2    | 0373.9017.53     |              |
| Spare Short/Open Calibration Standard for VSWR Calibration  | R&S®FSH-Z30 | 1145.5773.02     |              |



More information at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: Smart Instruments, FS300, FS315)



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

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