Product brochure

Version 06.00

December 2003

Spectrum Analyzer R&S®FSU

The high-end spectrum analyzer with unrivalled performance

Features

Versatile resolution filters
- Gaussian, FFT, channel, RRC

Comprehensive test routines
- TOI, OBW, CCDF
- Channel power, ACPR, multicarrier ACPR

Full choice of detectors

Optional electronic attenuator

Preamplifier up to 26 GHz

Measurement functions for following standards
- GSM/EDGE
- *Bluetooth* wireless technology
- WCDMA node B and UE
- cdma2000, cdma2000 1×EV-DO (BTS) and cdma2000 1×EV-DV (MS)

Speed

- Fast ACP test routine in time domain
- User-configurable list for fast measurements at frequencies of interest
- Up to 70 measurements/s in time domain via IEC/IEEE bus (including trace data transfer)
- Fast frequency counter with 0.1 Hz resolution in 30 ms

Unrivalled performance

Unmatched dynamic range
- TOI typ. +25 dBm
- 1 dB compression +13 dBm
- Phase noise
  typ. –123 dBc (1 Hz) at 10 kHz offset
  typ. –160 dBc (1 Hz) at 10 MHz offset
- Excellent display linearity <0.1 dB
- 84 dB ACLR/3GPP with noise correction

ROHDE&SCHWARZ

Performance surpassing all expectations …

Milestones in spectrum analysis

The name Rohde&Schwarz has been synonymous with innovative spectrum analyzers since 1986, the unique features of which have repeatedly set standards in this technology. Examples are the analyzers of the R&S®FSE and R&S®FSIQ families.

The Spectrum Analyzer R&S®FSU is another milestone. New circuit concepts, advanced RF components, A/D converters, ASIC technology, plus extensive experience gained from a variety of applications and customer requirements – all these combine to form a solid basis on which the R&S®FSU was developed. Its unparalleled features enable the use of new test methods – to your advantage. The future-oriented concept fuses unprecedented performance with continuity. The R&S®FSU is compatible with the R&S®FSE and R&S®FSIQ, the industry standards to date. Test routines and sequences generated for the R&S®FSE or R&S®FSIQ can be used on the R&S®FSU too. The R&S®FSU family thus safeguards your investment.

The operating concept of the high-end Spectrum Analyzer R&S®FSU is the same as that of the R&S®FSP general-purpose analyzer, so these instruments offer a uniform platform for a variety of applications. The R&S®FSU even surpasses the proven excellent RF data of the R&S®FSE and R&S®FSIQ families. Measurements calling for an extremely wide dynamic range become even simpler, faster and more reliable – in development, quality management and production.

The R&S®FSU is the reference spectrum analyzer with the widest dynamic range to date.

Rohde&Schwarz innovation in spectrum analyzers

1986 **R&S®FSA** – first colour display, first spectrum analyzer to feature –154 dBm (6 Hz) displayed average noise level without the use of preamplifiers, quasi-continuously variable resolution bandwidths, phase noise optimization

1995 **R&S®FSE** – fastest analyzer

1996 **R&S®FSE** – first spectrum analyzer with RMS detector

1997 **R&S®FSE-B7** – universal vector signal analysis and spectrum analyzer capability combined for the first time

1998 **R&S®FSIQ** – first analyzer offering 75 dB dynamic range for UMTS/WCDMA ACLR measurements

1999 **R&S®FSP** – 0.5 dB total measurement uncertainty as standard, fast ACP test routines in time domain, digital channel filters, CCDF

2000 **R&S®FSP-B25** – first electronic attenuator for wear-free use in production

2001 **R&S®FSU** – 0.3 dB total measurement uncertainty, 50 MHz resolution bandwidth, +25 dBm TOI

R&S®FSU – ideal for signals requiring wide dynamic range

- TOI >20 dBm, typ. +25 dBm
- 1 dB compression: +13 dBm (0 dB RF attenuation)
- Displayed average noise level: –158 dBm (1 Hz bandwidth)
- typ. 77 dB ACLR for 3GPP, typ. 84 dB with noise correction
- HSOI typ. 55 dBm
- Phase noise: typ.–160 dBc (1 Hz) at 10 MHz carrier offset

Wealth of functions

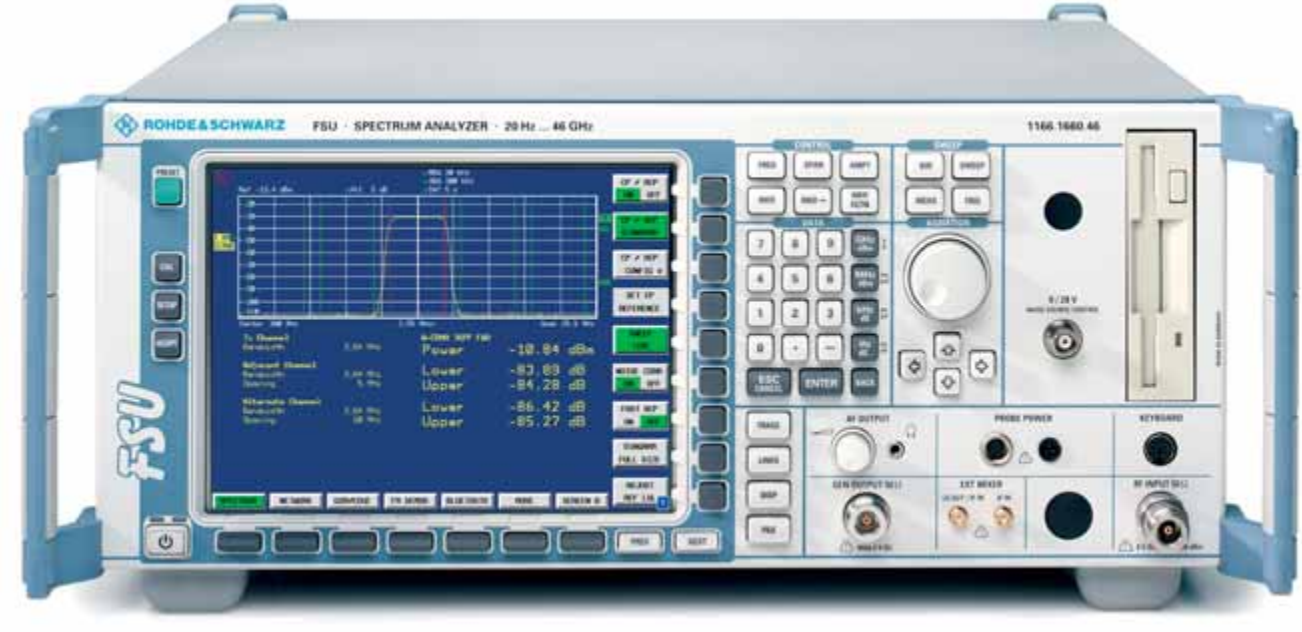
Highly selective digital filters from 10 Hz to 100 kHz	Up to 80 measurements/s in manual mode
Fast FFT filters from 1 Hz to 30 kHz	Up to 70 measurements/s on GPIB interface
Channel filters from 100 Hz to 5 MHz	SCPI-compatible GPIB command set
RRC filters	R&S®FSE/R&S®FSIQ-compatible GPIB command set
Resolution bandwidth from 1 Hz to 50 MHz	8566A/B/859x-compatible GPIB command set
QP detector and EMI bandwidths 200 Hz, 9 kHz, 120 kHz	Fast ACP measurement in time domain
2.5 ms sweep time in frequency domain	Statistical signal analysis with CCDF function
1 µs sweep time in time domain	RMS detector of 100 dB dynamic range
Number of measurement points/trace selectable between 155 and 10001	Transducer factor for correcting antenna or cable frequency responses
Time-selective spectrum analysis with gating function	Limit lines with PASS/FAIL evaluation
GPIB interface, IEEE 488.2	Peak list function for fast spurious measurement
RS-232-C serial interface, 9-pin Sub-D	2-year calibration cycle
VGA output, 15-pin Sub-D	3-year warranty[1)]
PC-compatible screenshots on diskette, hard disk or USB flash memory stick	External reference from 1 MHz to 20 MHz in 1 Hz steps

[1)] Except parts subject to wear and tear (e.g. attenuators).

… the R&S®FSU

Condensed specifications

	R&S®FSU3	R&S®FSU8	R&S®FSU26	R&S®FSU46
Frequency range	20 Hz to 3.6 GHz	20 Hz to 8 GHz	20 Hz to 26.5 GHz	20 Hz to 46 GHz
Reference frequency	aging: 1 x 10^{-7}/year; with option R&S®FSU-B4: 2 x 10^{-8}/year			
Spectral purity				
Phase noise	typ. –123 dBc (1 Hz) at 10 kHz from carrier			
Residual FM	1 Hz			
Sweep time				
Span ≥10 Hz	2.5 ms to 16000 s			
Span 0 Hz (zero span)	1 µs to 16000 s			
Resolution bandwidth	10 Hz to 50 MHz, FFT filter: 1 Hz to 30 kHz, channel filter, EMI bandwidth			
Video bandwidth	1 Hz to 10 MHz			
Display range	displayed average noise level to +30 dBm			
Displayed average noise level (10 Hz RBW)				
1 GHz	typ. –148 dBm	typ. –145 dBm	typ. –145 dBm	typ. –146 dBm
7 GHz	–	typ. –144 dBm	typ. –146 dBm	typ. –143 dBm
13 GHz	–	–	typ. –143 dBm	typ. –143 dBm
26 GHz	–	–	typ.–138 dBm	typ. –138 dBm
40 GHz	–	–	–	typ. –133 dBm
Displayed average noise level with preamplifier ON (R&S®FSU-B25), 1 GHz, 10 Hz RBW	–152 dBm	–152 dBm	–152 dBm	–152 dBm
Displayed average noise level with preamplifier ON (R&S®FSU-B23), 26 GHz, 10 Hz RBW	–	–	–140 dBm	–
Trace detectors	max peak, min peak, auto peak, sample, RMS, average, quasi-peak			
Total measurement error, f <3.6 GHz	0.3 dB			
Display linearity	0.1 dB (0 dB to –70 dB)			



Shorter development cycles through versatile functions …

To handle the wide variety of measurement tasks in product development, an instrument must offer ample functionality and excellent performance in all areas of interest. The R&S®FSU fully meets these requirements.

Full choice of detectors for adaptation to a wide range of signal types (Fig. 1):

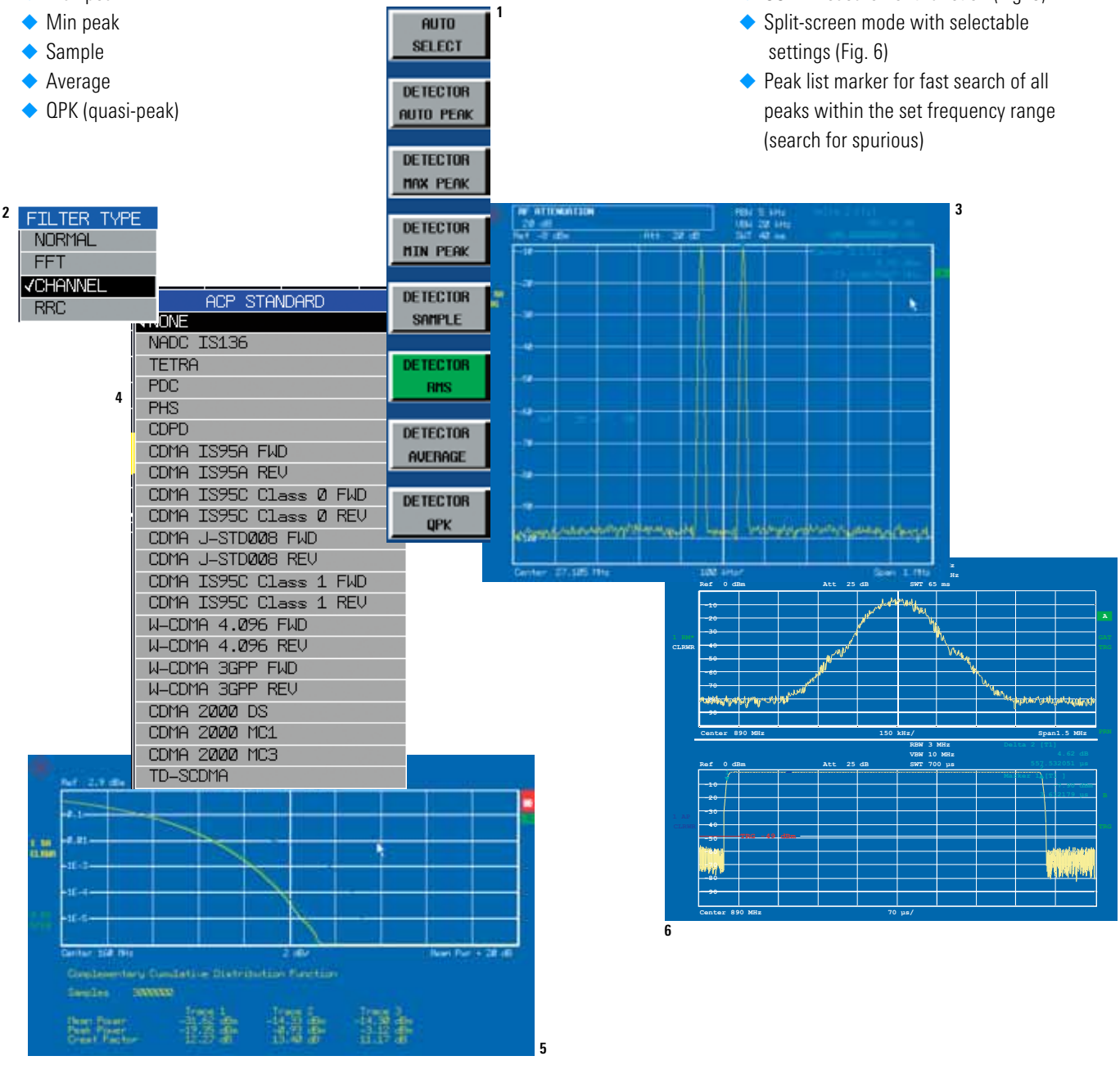
- RMS
- Auto peak
- Max peak
- Min peak
- Sample
- Average
- QPK (quasi-peak)

The most versatile resolution filter characteristics and largest bandwidth found in a spectrum analyzer:

- Standard resolution filters from 10 Hz to 50 MHz in steps of 1, 2, 3, 5
- FFT filters from 1 Hz to 30 kHz
- 32 channel filters with bandwidth from 100 Hz to 5 MHz
- RRC filters for NADC and TETRA
- EMI filters: 200 Hz, 9 kHz, 120 kHz

Full range of analysis functions:

- Time-domain power in conjunction with channel or RRC filters turn the R&S®FSU into a fully-fledged channel power meter (Fig. 2)
- TOI marker (Fig. 3)
- Noise/phase-noise marker
- Versatile channel/adjacent-channel power measurement functions with wide selection of standards, user-configurable (Fig. 4)
- CCDF measurement function (Fig. 5)
- Split-screen mode with selectable settings (Fig. 6)
- Peak list marker for fast search of all peaks within the set frequency range (search for spurious)

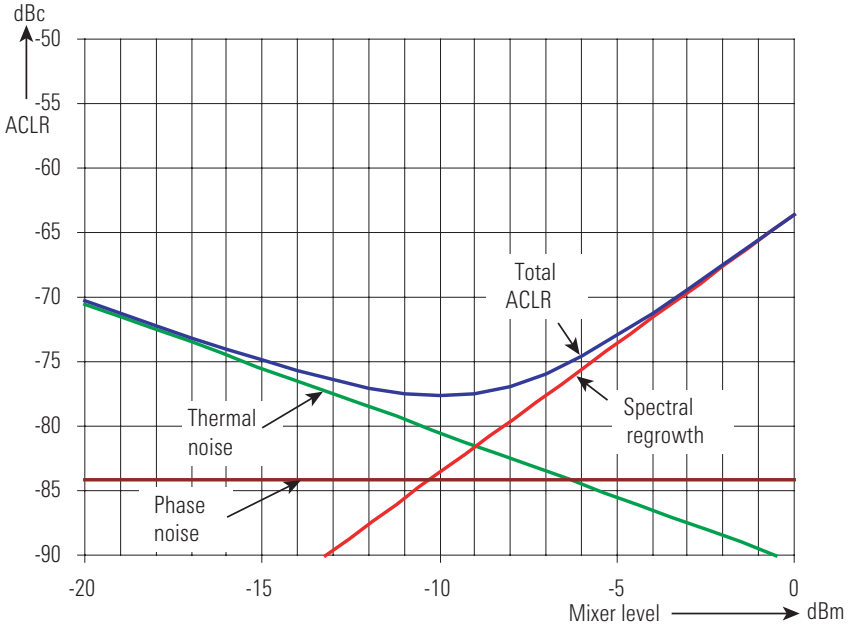


… wide dynamic range and future-proof performance

The wide dynamic range comes in handy when solving difficult measurement problems.

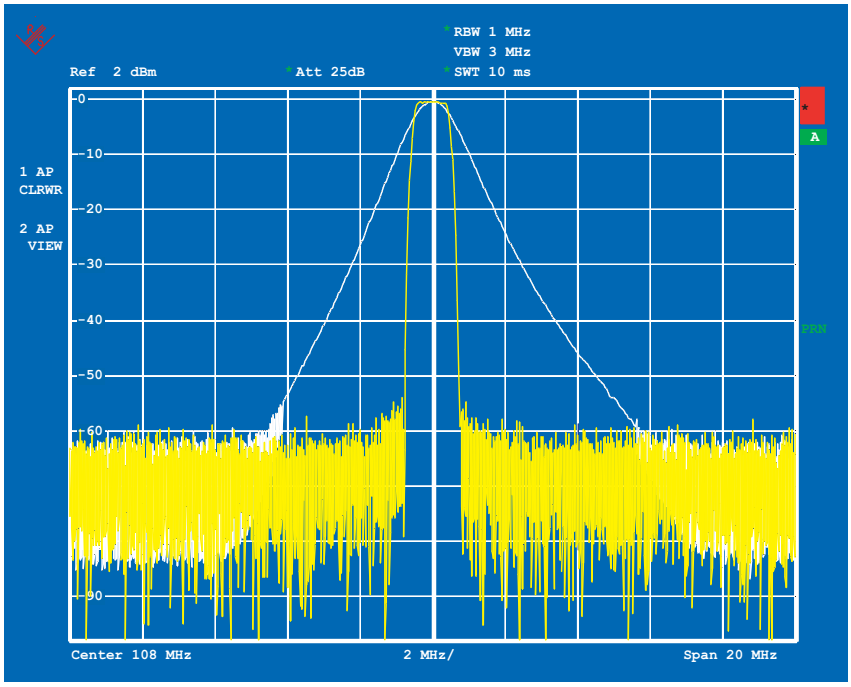
For 3GPP adjacent-channel power measurements, a figure of 77 dB ACLR – or 84 dB ACLR with noise correction – allows very good adjacent-channel power ratios to be verified and demonstrated very simply and with high accuracy. A higher-performance node B can thus be built, proving the fact.

The high harmonic second-order intercept point means optimum dynamic range for multichannel cable TV measurements.



Dynamic range of the R&S® FSU for adjacent-channel power measurement on WCDMA signal without noise correction.

Some mobile radio standards such as TETRA and IS-136 require RRC filters for power measurement such as available in the R&S® FSU. In addition, channel filters are available that support other analog and digital methods such as cdmaOne, AM/FM radio and ETS 300 113. Adjacent-channel power resulting from switching operations can also be measured using the channel filters. For conventional mobile radio standards, the R&S® FSU includes measurement routines (fast ACP) for determining the adjacent-channel power in the time domain, yielding shorter measurement times and higher reproducibility.



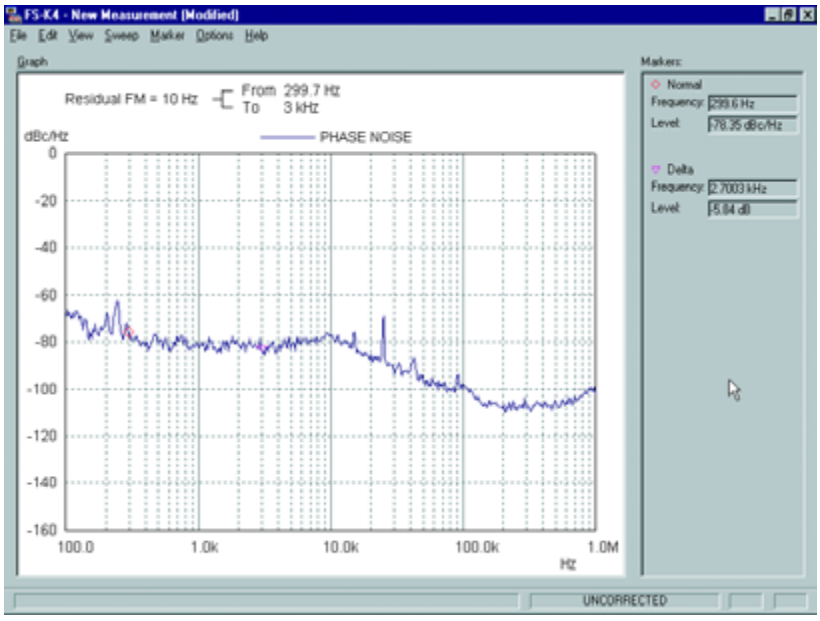
1 MHz channel filter versus normal 1 MHz resolution filter.

Shorter development cycles through versatile functions …

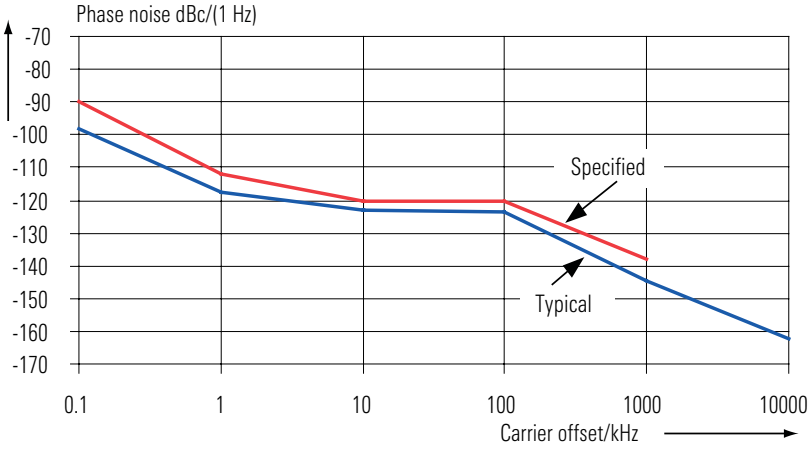
Whether in synthesizer development or frontend design, additional applications add to the R&S®FSU functionality while user-friendliness is maintained.

Phase Noise Measurement Software R&S®FS-K4 automates measurement over a complete offset frequency range and determines residual FM from the phase noise characteristic. This in conjunction with the R&S®FSU's extremely low phase noise generally does away with the need for an extra phase noise measurement system, which can be difficult to operate anyway.

The extremely low phase noise, particularly far away from the carrier, makes it possible to measure nonharmonics (spurious) without an additional filter even on base station signals.



Phase noise measurement with Software R&S®FS-K4.



SSB phase noise of the R&S®FSU.

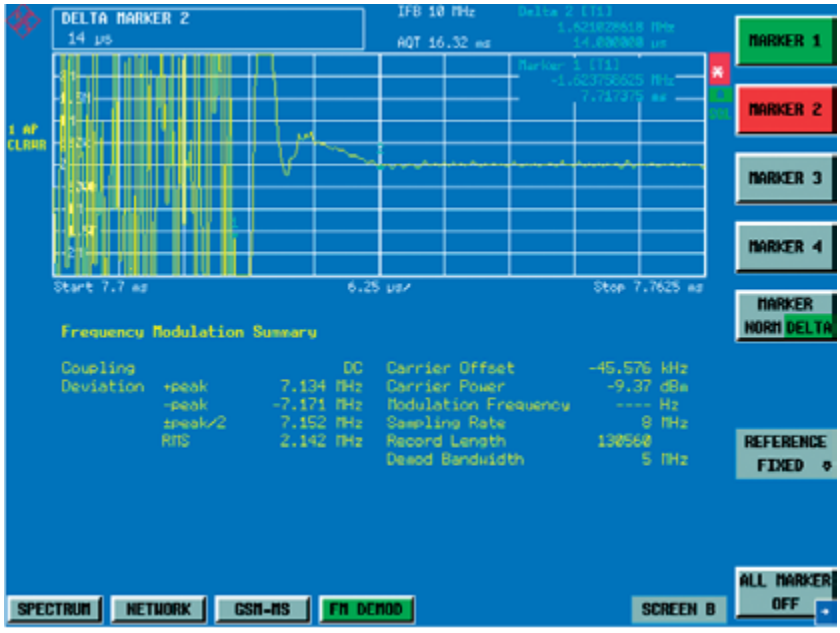
Software options and function expansions for general applications

R&S®FS-K3	Noise figure measurements (Windows software) Recommended options: Preamplifier R&S®FSU-B23, R&S®FSU-B25
R&S®FS-K4	Phase noise measurements (Windows software)
R&S®FS-K7	FM/PM measurement demodulator for general applications
R&S®FS-K9	Power sensor measurements
R&S®FS-K30	Noise figure measurements (application firmware), functions similar to R&S®FS-K3, but remote-controllable

… wide dynamic range and future-proof performance

Measuring frequency deviation after settling

The option R&S®FS-K7 adds a universal FM/PM measurement demodulator to the R&S®FSU for determining not only the frequency deviation but, for example, also the frequency settling of oscillators.

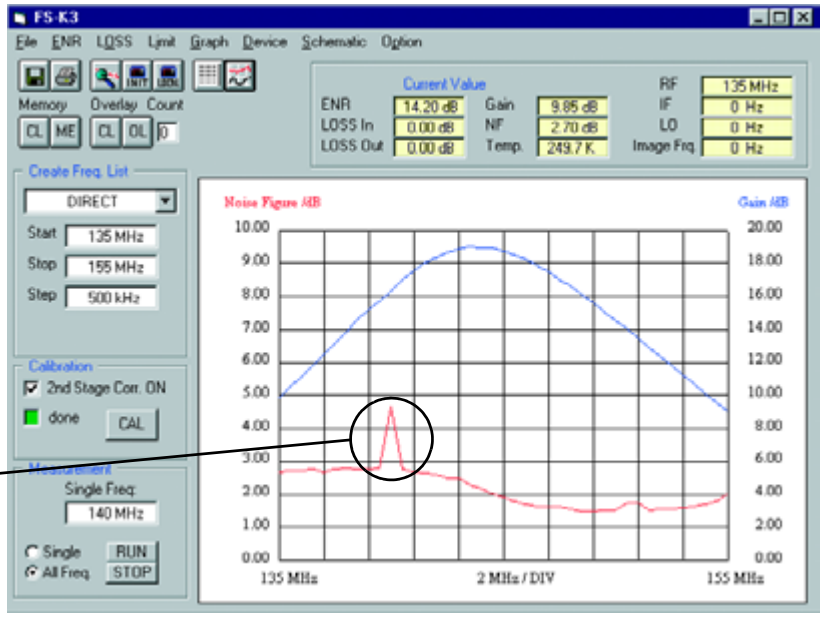


Settling of a synthesizer.

Noise figure measurement

Noise Measurement Software R&S®FS-K3 is a convenient way to determine the noise figure of amplifiers and frequency-converting UUTs throughout the R&S®FSU's frequency range, thus enabling complete documentation. The high linearity and extremely accurate power measurement routines of the R&S®FSU deliver precise and reproducible results, eliminating the need for a noise figure meter.

If the R&S®FSU3/8 is equipped with the option R&S®FSU-B25 and the R&S®FSU26 with the options R&S®FSU-B25 and -B23, a separate preamplifier is not required for measuring very low noise figures.



Noise figure measurement with Software R&S®FS-K3.

Fast and simple analysis of anomalies: the cause – spurious or RFI – can easily be traced with the basic analyzer function without additional measuring equipment.

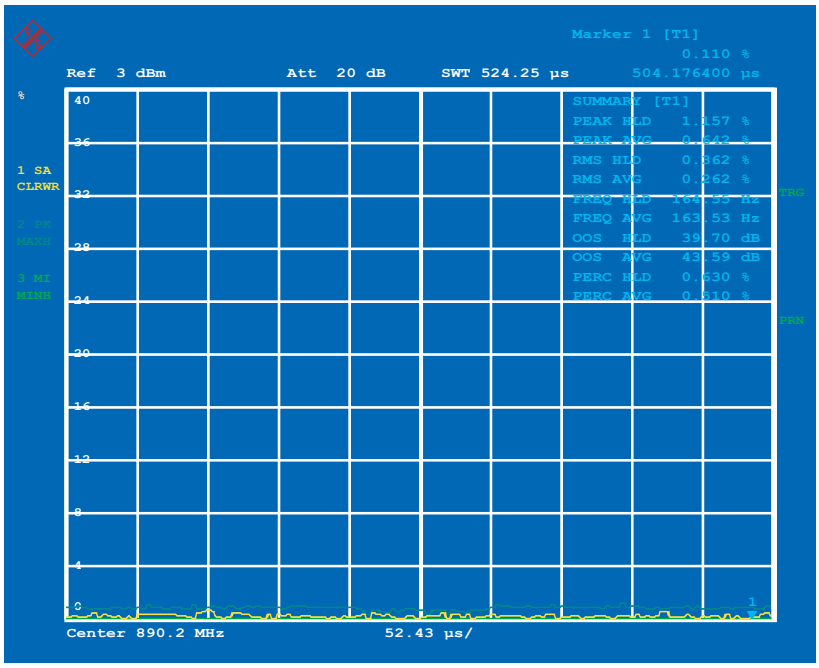
From GSM to UMTS …

From GSM to UMTS – ready for 3G mobile radio

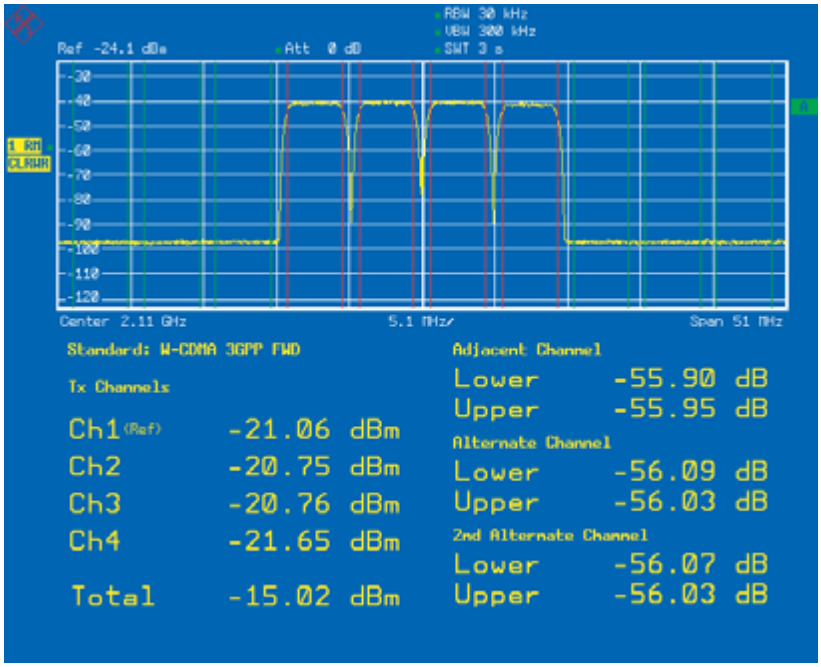
The above features plus its wide dynamic range make the R&S®FSU an ideal tool in base station development and testing. This is enhanced by excellent characteristics already incorporated in the standard unit, e.g. <0.3 dB total measurement uncertainty, gated sweep and IF power trigger.

Even in its basic version, the R&S®FSU offers the functionality and characteristics needed to develop, verify and produce 3G mobile radio systems:

- RMS detector, provided as standard in Rohde&Schwarz analyzers for many years and allowing accurate power measurements independently of signal form; 3GPP specifications stipulate RMS power measurements for most tests
- ACP measurement function for 3GPP with 3.84 MHz bandwidth RRC filter for standard-conformant adjacent-channel power measurements with a dynamic range limit of 77 dB or 84 dB
- Dedicated CCDF measurement function that determines the probability of instantaneous signal power exceeding average power; CCDF measurement is indispensable in determining optimum transmit power for CDMA signals, assuming that clipping at known, short intervals is tolerable



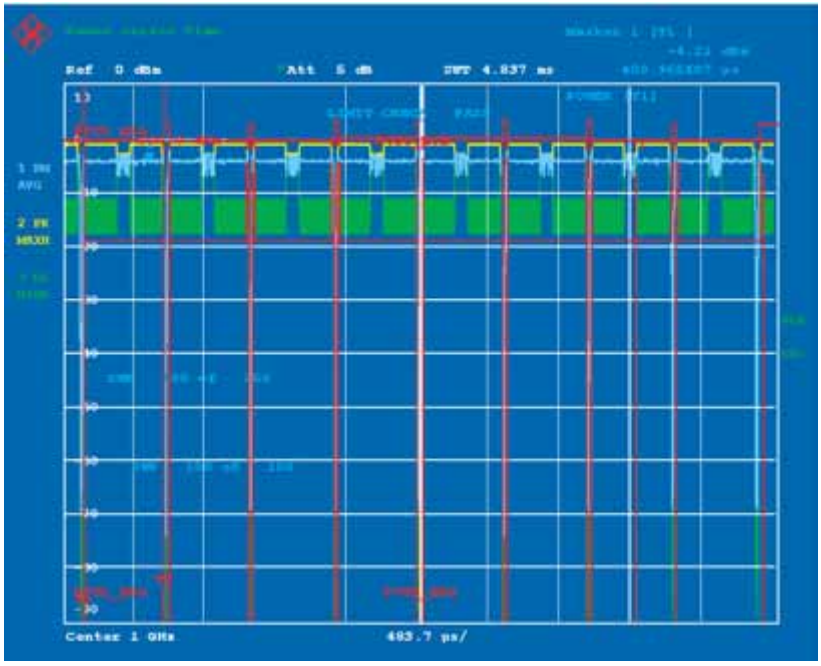
Measurement of modulation accuracy on EDGE burst.



ACP measurement with 4 channels.

In conjunction with GSM/EDGE Application Firmware R&S®FS-K5, the R&S®FSU offers complete functionality for RF and modulation measurements in GSM systems. EDGE (generation 2.5) is already included in the R&S®FS-K5 option.

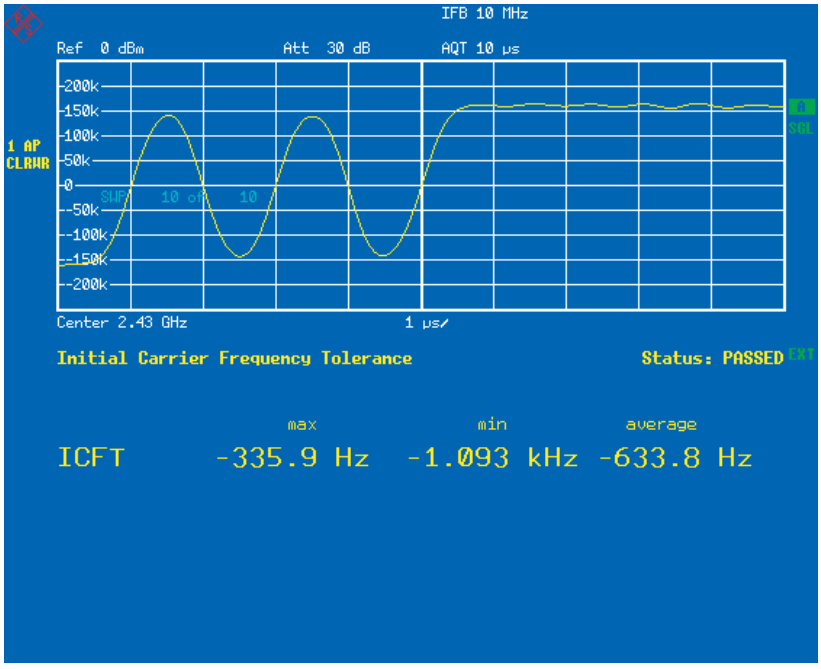
- Phase/frequency error for GSM
- Modulation accuracy for EDGE with:
  - EVM and ETSI-conformant weighting filters
  - OOS
  - 95:th percentile
  - Power versus time with synchronization to midamble
  - Spectrum due to modulation
  - Spectrum due to transients



Simultaneous measurement of power versus time on an EDGE signal with eight slots.

Bluetooth® signal measurements

- Enhanced measurement functionality in line with *Bluetooth* RF Test Specification (*Bluetooth* SIG) Rev. 0.91
- Measurement functions
  - Output power
  - Adjacent channel power (ACP)
  - Modulation characteristics
  - Initial carrier frequency tolerance (ICTF)
  - Carrier frequency drift
- Simultaneous display of traces and all numerical measurement results
- Automatic limit value monitoring
- Ideal for use in development and production of *Bluetooth* modules

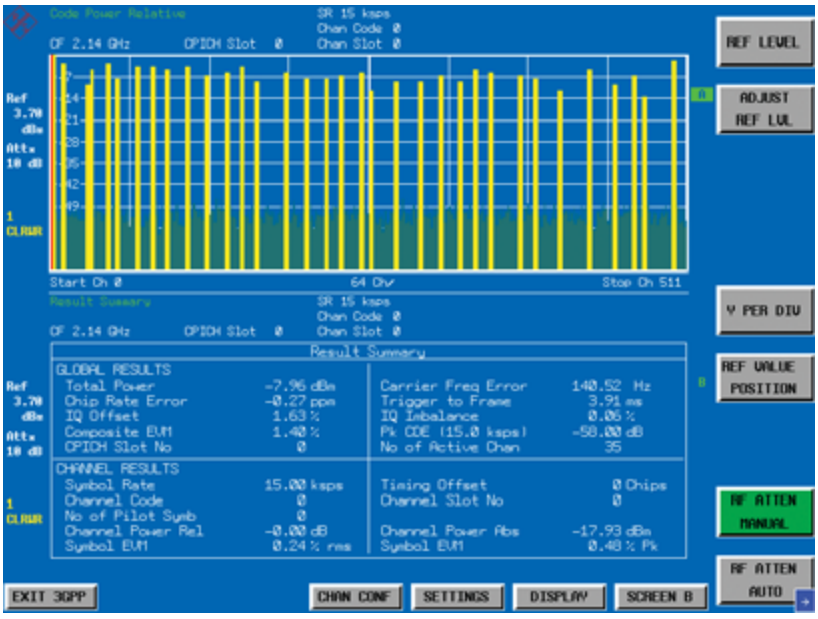


Measurement of initial carrier frequency tolerance on a Bluetooth signal with R&S®FS-K8.

… ready for 3G mobile radio

Standard 3GPP modulation and code domain power measurements

- Additional measurement functions in line with 3GPP specifications for FDD mode
- For BTS/node B signals: Application Firmware R&S®FS-K72
- For cdma2000/3GPP3 base station signals: Application Firmware R&S®FS-K82/-K84
- For UE signals: Application Firmware R&S®FS-K73
- High measurement speed of 4 s/measurement
- Code domain power and CPICH power
- Code domain power and rho (cdma2000/3GPP2)
- EVM and PCDE
- Code domain power versus slot
- EVM/code channel
- Spectrum emission mask



WCDMA code domain power measurement with the R&S®FSU and R&S®FS-K72.

Firmware options for mobile radio applications

Type	Designation and/or application
R&S®FS-K5	Modulation and spectrum measurements on GSM/EDGE base station and mobile signals
R&S®FS-K8	*Bluetooth* transmitter measurements
R&S®FS-K72	Modulation and code domain power measurements to 3GPP TS 24.141 on base station signals (node B)
R&S®FS-K73	Modulation and code domain power measurements to 3GPP TS 25.121 on mobile station signals (UE)
R&S®FS-K74	HSDPA extension for R&S®FS-K72
R&S®FS-K76	Modulation and code domain power measurements on TD-SCDMA base station signals
R&S®FS-K82	Modulation and code domain power measurements to cdma2000/3GPP2 on base station signals (also for measurements on IS-95/cdmaOne signals)
R&S®FS-K83	Modulation and code domain power measurements on cdma2000/1xEV-DV mobile station signals (UE)
R&S®FS-K84	Modulation and code domain power measurements to 1xEV-DO on base station signals

Profit from the advantages of networking

Versatile documentation and networking capabilities

The standard disk drive makes it easy to integrate results into documentation – simply save the screen contents as a BMP or WMF file and import the file into your word processing system. To process trace data, save it as an ASCII file (CSV format), which not only documents trace data but also the main instrument settings.

Make use of the advantages offered by networking

The standard LAN interface opens up versatile networking capabilities:

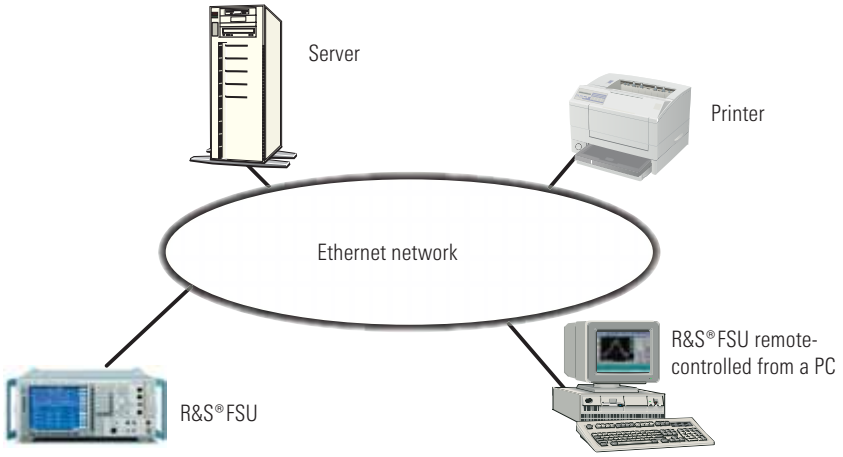
- Link to standard network (Ethernet 10/100BaseT)
- Running under Embedded XP, the R&S®FSU can be configured for network operation. Applications such as data output to a central network printer or saving results on a central server can easily be implemented. The R&S®FSU can thus be optimally matched to any work environment
- You can import screen contents directly into Word for Windows or, by using a Microsoft Excel macro, into your documentation programs and thus immediately create data sheets for your products or documents for quality assurance

The standard USB host interface allows functions such as the following:

- Quick firmware update from a USB flash memory stick or a USB CD-ROM drive
- Connection of PC peripheral devices (mouse, keyboard)
- Simple file transfer, including large volumes of data via a USB flash memory stick

Remote control by Ethernet is even simpler:

- Allows mouse operation of the R&S® FSU after assigning it a TCP/IP address. All elements of the R&S®FSU screen are represented by a soft front panel function; the Windows XP remote desktop function is used to transmit the complete R&S®FSU screen to the remote PC
- Special RSIB interface: It links your application to the TCP/IP protocol and acts like an IEC/IEEE bus driver. The RSIB interface is available for Windows and the UNIX world. The R&S®FSU can be programmed via this interface just like on the familiar IEC/IEEE bus



Networked operation of the R&S®FSU.

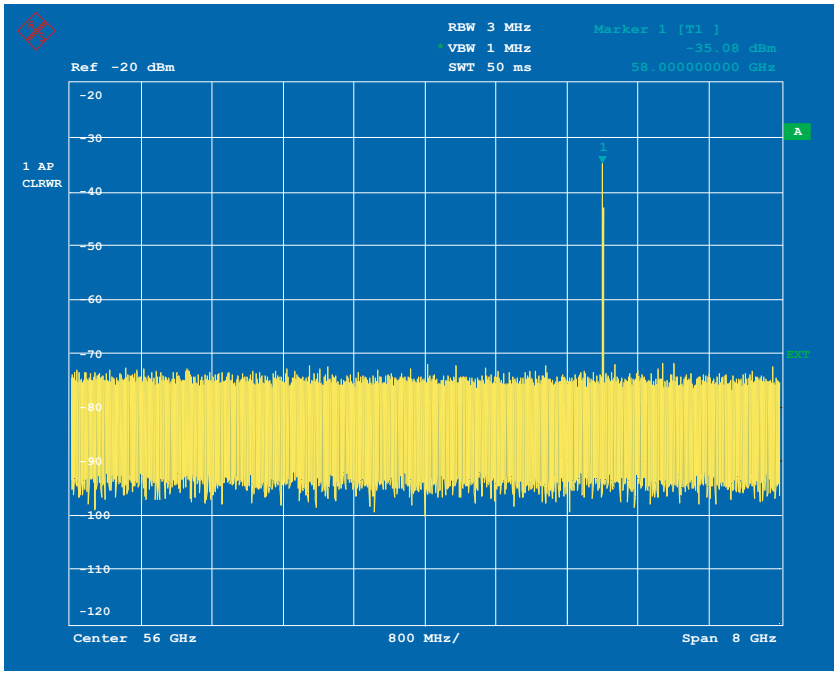
Remote control of the R&S®FSU.

Innovative solutions …

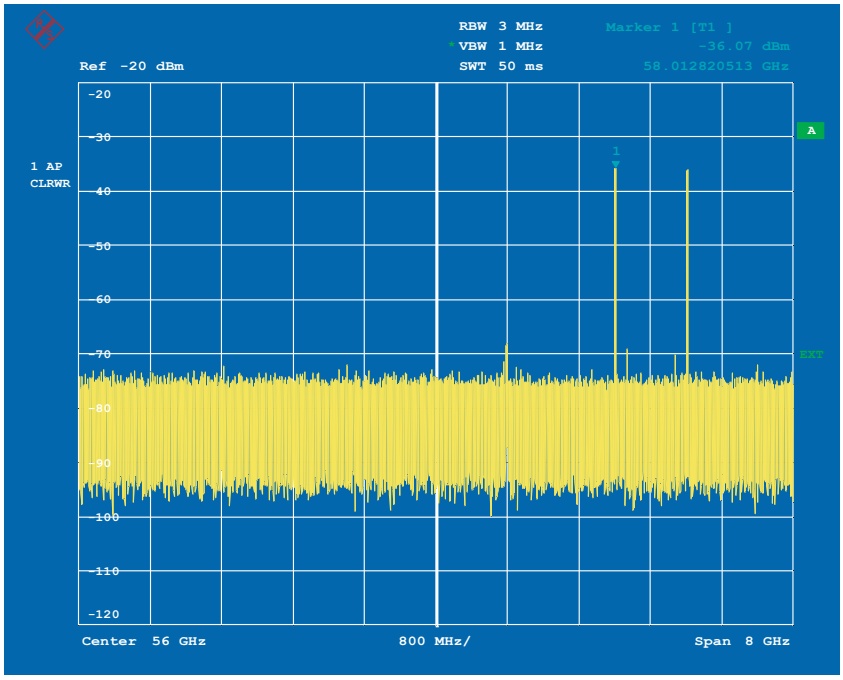
Expansion of the frequency range to 110 GHz and above

The option R&S®FSU-B21 (LO/IF ports for external mixers and external harmonic mixers, e.g. R&S®FS-Z60/-Z75/-Z90/-Z110) expands the frequency range of the R&S®FSU26 and R&S®FSU46 to 110 GHz and above.

- Easy-to-use software preselector that identifies and suppresses unwanted signals arising from image frequency response or reception with a harmonic number other than the one set
- Supports two- and three-port mixers that can operate with an IF of 404.4 MHz and an LO frequency range from 7 GHz to 15.5 GHz
- Maximum harmonic number that can be selected: n = 66 (or 1.022 THz)
- High LO frequency range, allowing low harmonic numbers to be used; fewer unwanted products are created and the phase noise remains lower



The software preselector suppresses image frequency response and unwanted spurious reception as can be seen by comparing the two figures.

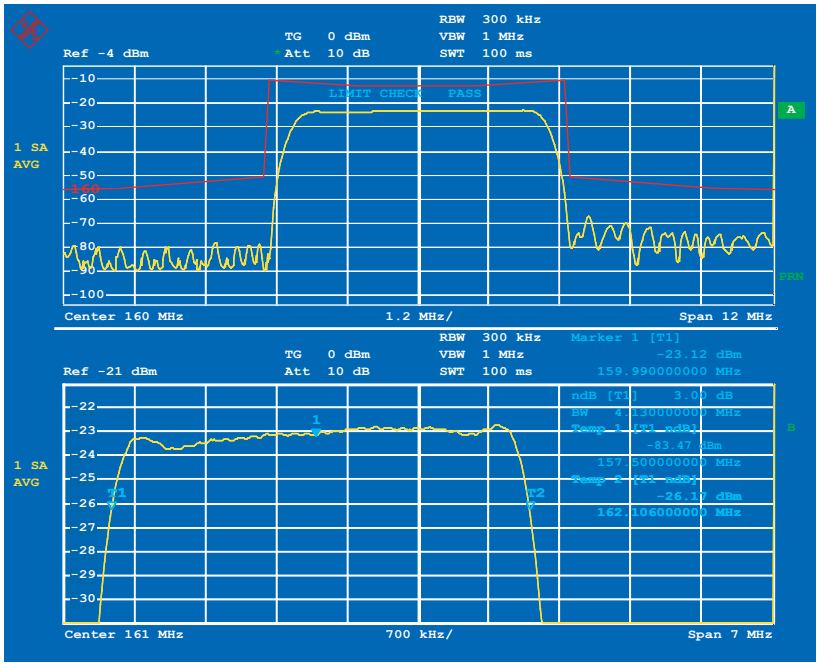


… through customized options

Scalar network analysis with wide dynamic range

The options R&S®FSU-B9 (internal tracking generator up to 3.6 GHz) and R&S® FSP-B10 (external generator control) turn the R&S®FSU signal generators into scalar network analyzers. Through selective measurement, the gain, frequency response, insertion loss and return loss can be measured with a wide dynamic range without being influenced by harmonics or spurious from the generator. The internal Tracking Generator R&S® FSU-B9 can be implemented in all R&S® FSU models and covers the frequency range from 100 kHz to 3.6 GHz; a frequency offset for measuring frequency-converting modules of ±150 MHz can be set. The tracking generator can be broadband-modulated using an external I/Q baseband signal.

The option R&S®FSP-B10 uses conventional RF signal generators as an external tracking source, controlled via GPIB or a TTL bus. Together with microwave generators such as the R&S®SMR or R&S®SMP, the frequency range can be expanded up to 46 GHz for scalar transmission, loss and reflection measurements.



This solution covers the functions of the internal tracking generator:

- Normalization with interpolation including for reflection measurements with open and short
- Automatic bandwidth measurement via the "n dB down" function
- Tolerance characteristics with PASS/ FAIL evaluation

Certified Quality System ISO 9001 DQS REG. NO 1954 QM

Certified Environmental System ISO 14001 DQS REG. NO 1954 UM

What can we do …

Short test cycles, high throughput

The R&S®FSU is just the right instrument for this purpose. Fast data transfer on the IEC/IEEE bus or an Ethernet LAN plus intelligent routines optimized for speed make for very short measurement times:

- Fast ACP: for the major mobile radio standards with high reproducibility and accuracy
- List mode: combined measurement of various parameters at a single command
- Fast time domain power measurement using channel or RRC filters
- Up to 70 measurements/s in zero span via IEC/IEEE bus including trace data transfer
- Fast-sweeping FFT filters for spurious measurement at low levels
- Fast frequency counter: 0.1 Hz resolution for a measurement time of <30 ms

Downtime and repair time cut to a minimum

No limited lifetime of mechanical attenuators due to high throughput
The optional electronic attenuator R&S® FSU-B25 with 25 dB setting range does away with any mechanical switching – so the R&S®FSU's high accuracy is maintained without any early failure. A two-year calibration cycle minimizes downtime for instrument calibration.

Spurious emission measurements without notch filter
The R&S®FSU is the ideal choice for this type of measurement, even for tests on GSM base stations. The extremely low phase noise and high 1 dB compression point of the R&S®FSU enable direct measurements without the use of extra automatic or manually tuned notch filters. This eliminates possible sources of error and makes measurements simpler and more reliable. It also enhances the reliability of your test system.

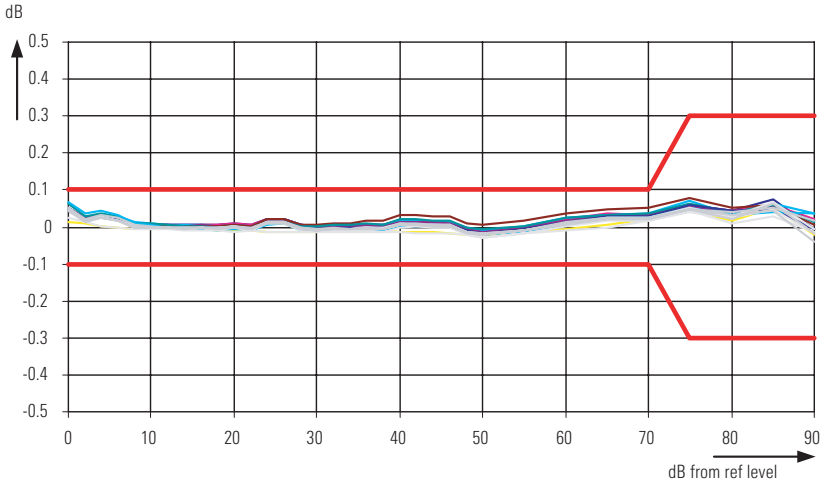
Existing programs for the R&S®FSE, R&S®FSIQ or R&S®FSP can be used on the R&S®FSU
The R&S®FSU complies with SCPI conventions and is IEC/IEEE-bus-compatible with respect to the R&S®FSE and R&S® FSIQ. These instruments can in most cases be directly replaced with only minor, if any, changes to the software. If changes have to be made, they affect only those program parts that concern the speed-optimized measurement routines of the R&S®FSU.

External frequency standards
The R&S®FSU accepts signals between 1 MHz and 20 MHz in steps of 1 Hz.

Higher production yield
Enhanced measurement accuracy makes for higher production yield. The safety margins that usually compensate for the measurement uncertainty of test systems can be reduced, thus increasing the accept (passed) region. Given the same spread of results, more products will pass the test. The R&S®FSU helps you to boost your production yield due to a total measurement uncertainty of <0.3 dB (2σ).

LAN interface

With the aid of the optional LAN Interface R&S®FSU-B16, the R&S®FSU can be connected to common networks such as 100BaseT so that functions such as file logging on network drives or documentation of measurement results via a network printer are available. In addition, the R&S®FSU can be remote-controlled via a LAN. This yields a clear speed advantage over the IEC/IEEE bus in particular for the transmission of large data blocks.



Display linearity at ≤100 kHz resolution bandwidth (measured on 30 instruments).

… to boost your production yield?

859x/8566-compatible IEC/IEEE bus command set

In many applications, existing test software is to be used in automatic test systems with new devices. For this reason, the R&S®FSU is provided as standard with an IEC/IEEE bus command set that is compatible not only with the R&S®FSEx/ R&S®FSIQ family but also with the spectrum analyzers of the 859x/8566 series.

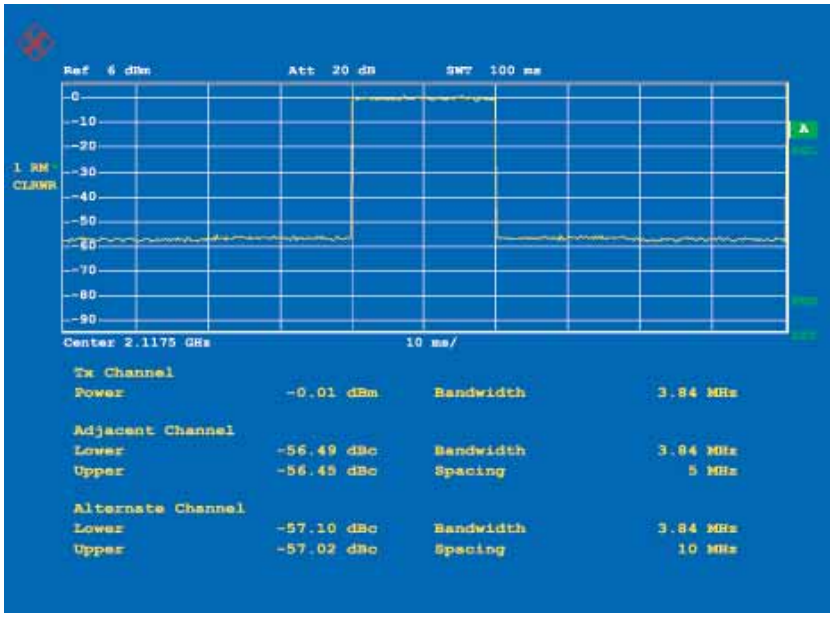
It was of utmost importance to achieve maximum compatibility in order to minimize the effort required to change from one to the other:

- Approx. 175 commands in IEEE 488.2 format (incl. CF, AT, ST)
- The most important commands in IEEE 488-1 format (8566A, for exclusive use only)
- Selectable presets
- Selectable trace format

The IEC/IEEE bus commands in IEEE 488.2 format can be used together with the R&S®FSU command set, so that it is possible to enhance and complete available software by using the innovative instrument functions of the R&S®FSU (such as list mode, channel filters) without having to redesign the test software.

	Sweeps/s Span 10 MHz, sweep time 2.5 ms	**Sweeps/s** Span 0 Hz, sweep time 100 µs
Binary IEEE 754 format	50	70

Measurement speed on GPIB interface.
Settings: display off, default coupling, single trace, 625 points.



Measurement of adjacent-channel power versus time: fast ACP.

With 80 measurements/s in manual mode, minimum sweep time of 2.5 ms and 1 µs zero span as standard, the R&S® FSU is ideal for time-critical applications.

The highly selective, fast-sweeping digital filters featuring "analog response" allow measurements on pulsed signals as well as use of the built-in frequency counter.

Remote control of the R&S®FSU via IEC/IEEE bus in list mode cuts down on measurement time.

Ordering information

Order designation	Type	Order No.
Spectrum Analyzer, 20 Hz to 3.6 GHz	R&S®FSU3	1166.1660.03
Spectrum Analyzer, 20 Hz to 8 GHz	R&S®FSU8	1166.1660.08
Spectrum Analyzer, 20 Hz to 26.5 GHz	R&S®FSU26	1166.1660.26
Spectrum Analyzer, 20 Hz to 46 GHz	R&S®FSU46	1166.1660.46

Accessories supplied
Power cable, operating manual, service manual.
R&S®FSU26: test port adapter with 3.5 mm female (1021.0512.00) and N female (1021.0535.00) connector
R&S®FSU46: test port adapter with K female (1036.4790.00) and N female (1036.4777.00) connector

Options

Order designation	Type	Order No.
Options		
Low-Aging OXCO	R&S®FSU-B4	1144.9000.02
Tracking Generator, 100 kHz to 3.6 GHz	R&S®FSU-B9	1142.8994.02
External Generator Control	R&S®FSP-B10	1129.7246.02
Attenuator for Tracking Generator	R&S®FSU-B12	1142.9349.02
Removable Hard Disk	R&S®FSU-B18[1) 2)]	1145.0242.04
Second Hard Disk for R&S®FSU-B18	R&S®FSU-B19[2)]	1145.0394.04
Extended Environmental Specification	R&S®FSU-B20[1) 3)]	1155.1606.08
LO/IF Ports for External Mixers	R&S®FSU-B21	1157.1090.02
RF Preamplifier, 3.6 GHz to 26 GHz, for R&S®FSU26	R&S®FSU-B23[1) 4) 5)]	1157.0907.02
Electronic Attenuator, 0 dB to 30 dB, and 20 dB preamplifier	R&S®FSU-B25	1144.9298.02
Software		
Noise Measurement Software	R&S®FS-K3	1057.3028.02
Phase Noise Measurement Software	R&S®FS-K4	1108.0088.02
GSM/EDGE Application Firmware	R&S®FS-K5	1141.1496.02
FM/PM Measurement Demodulator	R&S®FS-K7	1141.1796.02
Application Firmware for *Bluetooth* Measurements	R&S®FS-K8	1157.2568.02
Power Sensor Measurements	R&S®FS-K9	1157.3006.02
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02
3GPP BTS/Node B FDD Application Firmware	R&S®FS-K72	1154.7000.02
3GPP UE FDD Application Firmware	R&S®FS-K73	1154.7252.02
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02
3GPP TD-SCDMA Application Firmware	R&S®FS-K76	1300.7291.02
cdma2000 BTS Application Firmware	R&S®FS-K82	1157.2316.02
cmda2000 1xEV-DV MS Application Firmware	R&S®FS-K83	1157.2416.02
cdma2000 1xEV-DO BTS Application Firmware	R&S®FS-K84	1157.2851.02
Service Kit	R&S®FSU-Z1	1145.0042.02

1) Factory installation only.
2) Not with R&S®FSU-B20.
3) Not with R&S®FSU-B18/-B19.
4) Not for retrofit.
5) R&S®FSU-B25 required.

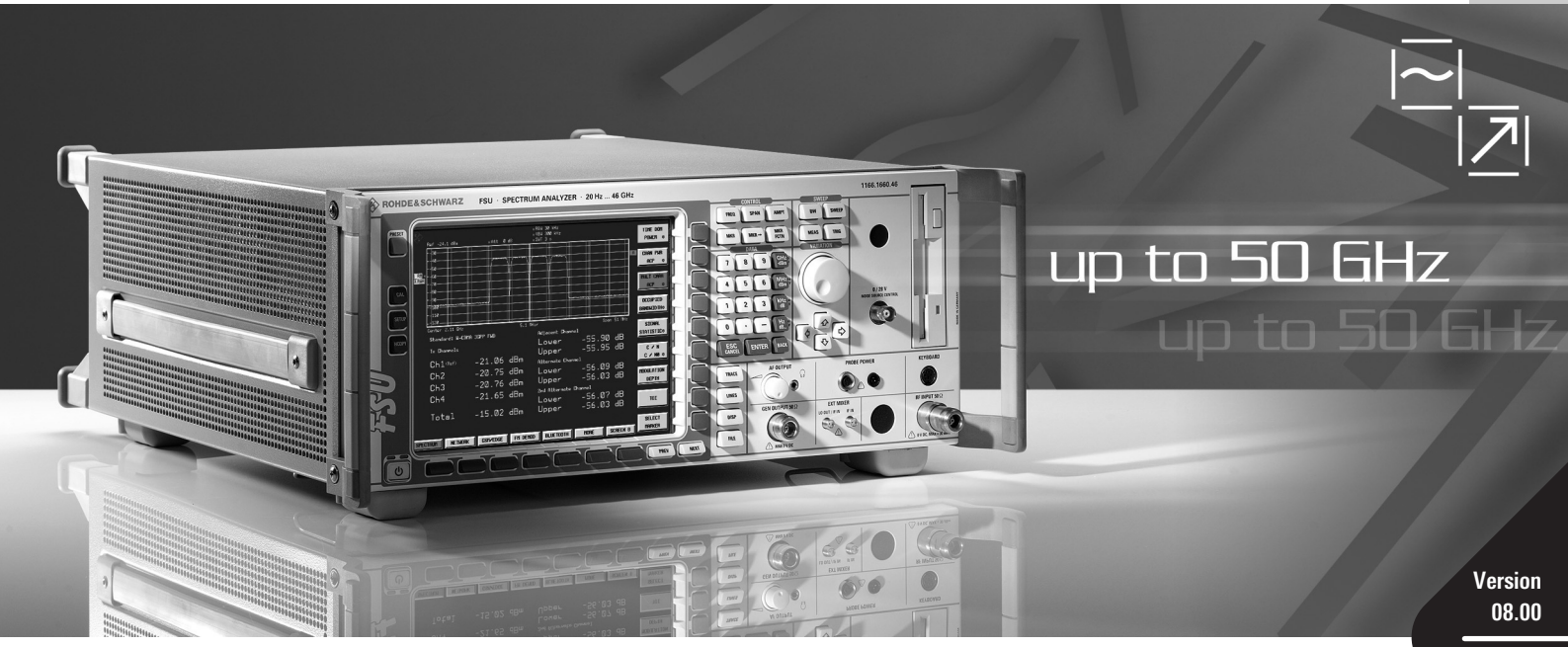
For specifications see PD 0758.0016.22
and www.rohde-schwarz.com
(search term: FSU)

Printed in Germany (Pe as)

ROHDE&SCHWARZ

Rohde&Schwarz GmbH&Co. KG · Mühldorfstraße 15 · 81671 München · Germany · P.O.B. 80 14 69 · 81614 München · Germany · Telephone +49 89 4129-0
www.rohde-schwarz.com · Customer Support: Telephone +49 1805124242, Fax +49 89 4129-13777, E-mail: CustomerSupport@rohde-schwarz.com

Specifications



Version 08.00

April 2004

Spectrum Analyzer R&S®FSU

Specifications

ROHDE&SCHWARZ

Specifications

Specifications are valid under the following conditions:
30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed. Data without tolerances: typical values only. Data designated 'nominal' applies to design parameters and is not tested.

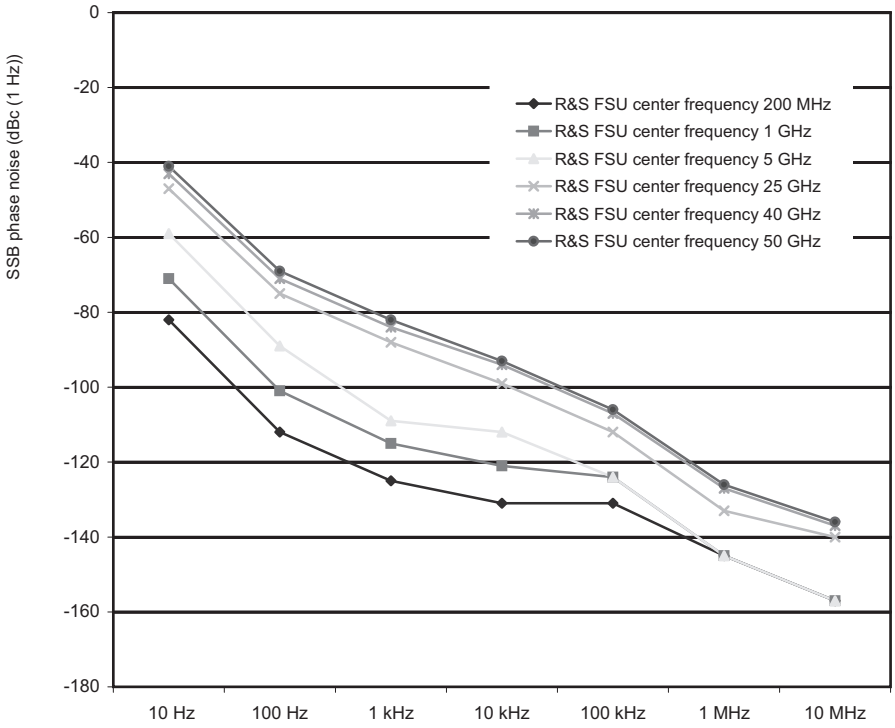
Frequency

Frequency range	R&S FSU3:	DC coupled	20 Hz to 3.6 GHz
		AC coupled	1 MHz to 3.6 GHz
	R&S FSU8:	DC coupled	20 Hz to 8 GHz
		AC coupled	1 MHz to 8 GHz
	R&S FSU26:	DC coupled	20 Hz to 26.5 GHz
		AC coupled	10 MHz to 26.5 GHz
	R&S FSU46:	DC coupled	20 Hz to 46 GHz
	R&S FSU50:	DC coupled	20 Hz to 50 GHz
Frequency resolution			0.01 Hz

Reference frequency, internal, nominal	**standard OCXO**	
Aging per day	after 30 days of continuous operation	1×10^{-9}
Aging per year	after 30 days of continuous operation	1×10^{-7}
Temperature drift	+5° C to +45° C	8×10^{-8}
Total error	per year	1.8×10^{-7}
Reference frequency, internal, nominal	**option R&S FSU-B4**	
Aging per day	after 30 days of continuous operation	2×10^{-10}
Aging per year	after 30 days of continuous operation	3×10^{-8}
Temperature drift	+5° C to +45° C	1×10^{-9}
Total error	per year	5×10^{-8}
External reference frequency		1 MHz to 20 MHz, 1 Hz steps

Frequency display		with marker or frequency counter
Marker resolution		span / 624
Maximum deviation	sweep time >3 x auto sweep time	±(marker frequency x reference error + 0.5% x span +10% x resolution bandwidth + ½ (last digit))
Frequency counter resolution	selectable	0.1 Hz to 10 kHz
Count accuracy	S/N >25 dB	±(frequency x reference error + ½ (last digit))
Display range for frequency axis		0 Hz, 10 Hz to max. frequency
Resolution		0.1 Hz
Max. span deviation		1%

Spectral purity, SSB phase noise	f = 640 MHz	
Residual FM	RBW 10 kHz, RMS	1 Hz nominal
Carrier offset	10 Hz	– 73 dBc (1 Hz), nominal
	10 Hz with option R&S FSU-B4 fitted	– 86 dBc (1 Hz), nominal
	100 Hz	<–94 dBc (1 Hz), typ. –100 dBc (1 Hz)
	1 kHz	<–112 dBc (1 Hz), typ. –116 dBc (1 Hz)
	10 kHz	<–120 dBc (1 Hz), typ. –123 dBc (1 Hz)
	100 kHz	<–120 dBc (1 Hz), typ. –123 dBc (1 Hz)
	1 MHz	<–138 dBc (1 Hz), typ. –144 dBc (1 Hz)
	10 MHz	typ. –160 dBc (1 Hz)



Sweep

Sweep time	time sweep, span = 0 Hz	1 µs to 16000 s in 5% steps
	frequency sweep, span ≥ 10 Hz	2.5 ms to 16000 s in steps ≤10%
Max. deviation of sweep time		3%
Measurement in time domain		with marker and cursor lines (resolution 31.25 ns)

Resolution bandwidths

Sweep filters		
3 dB bandwidths		10 Hz to 20 MHz in 1/2/3/5 sequence, 50 MHz
Bandwidth uncertainty		
	10 Hz to 100 kHz (digital)	<3%
	200 kHz to 5 MHz (analog)	<10%
	10 MHz	–30% to +10%
	20 MHz	–20% to +20%
	50 MHz, f ≤ 3.6 GHz 50 MHz, f > 3.6 GHz	–20% to +20% –30% to +100%
Shape factor 60 dB:3 dB		
	≤100 kHz	<6
	200 kHz to 2 MHz	<12
	3 MHz to 10 MHz	<7
	20 MHz, 50 MHz	<6, nominal

FFT filters		
3 dB bandwidths		1 Hz to 30 kHz in 1/2/3/5 sequence
Bandwidth uncertainty		5%, nominal
Shape factor 60 dB:3 dB		<3, nominal

EMI filters		
6 dB bandwidths		200 Hz, 9 kHz, 120 kHz
Bandwidth uncertainty		3%, nominal
Shape factor 60 dB:3 dB		<6, nominal

Channel filters		
Bandwidths		100, 200, 300, 500 Hz, 1, 1.5, 2, 2.4, 2.7, 3, 3.4, 4, 4.5, 5, 6, 8.5, 9, 10, 12.5, 14, 15, 16, 18 (RRC), 20, 21, 24.3 (RRC), 25, 30, 50, 100, 150, 192, 200, 300, 500 kHz, 1, 1.2288, 1.28 (RRC), 1.5, 2, 3, 3.84 (RRC), 4.096 (RRC), 5 MHz
Shape factor 60 dB:3 dB		<2, nominal
Bandwidth uncertainty		2%, nominal

Video bandwidths		1 Hz to 10 MHz in 1/2/3/5 sequence

Level

Display range		displayed noise floor to +30 dBm

Maximum input level		
DC voltage	RF input AC coupled RF input DC coupled	50 V 0 V
CW RF power	RF attenuation 0 dB RF attenuation ≥10 dB	20 dBm (= 0.1 W) 30 dBm (= 1 W)
Pulse spectral density		97 dBµV/MHz
Max. pulse voltage	RF attenuation ≥10 dB	150 V
Max. pulse energy	RF attenuation ≥10 dB, 10 µs	1 mWs

Intermodulation		
1 dB compression of input mixer	0 dB RF attenuation ≤3.6 GHz >3.6 GHz R&S FSU8 R&S FSU26, R&S FSU46, R&S FSU50	 +13 dBm, nominal +10 dBm, nominal +7 dBm, nominal
Third-order intercept point (TOI)	level 2 x –10 dBm, Δf >5 x RBW or 10 kHz, whichever is larger R&S FSU 3: 10 MHz ≤ f < 300 MHz 300 MHz ≤ f ≤ 3.6 GHz R&S FSU 8: 10 MHz ≤ f < 300 MHz 300 MHz ≤ f ≤ 3.6 GHz 3.6 GHz ≤ f ≤ 8 GHz R&S FSU26, R&S FSU46, R&S FSU50: 10 MHz ≤ f < 300 MHz 300 MHz ≤ f < 3.6 GHz 3.6 GHz ≤ f < 26.5 GHz R&S FSU46: 26.5 GHz ≤ f ≤ 40 GHz f > 40 GHz R&S 50: 26.5 GHz ≤ f < 28 GHz 28 GHz ≤ f ≤ 40 GHz f > 40 GHz	 >17 dBm, typ. 20 dBm >19 dBm, typ. 25 dBm >17 dBm, typ. 20 dBm >20 dBm, typ. 25 dBm >18 dBm, typ. 23 dBm >17 dBm, typ. 20 dBm >22 dBm, typ. 27 dBm >12 dBm, typ. 15 dBm >12 dBm, typ. 15 dBm 12 dBm, nominal >8 dBm, typ. 11 dBm >12 dBm, typ. 15 dBm 12 dBm, nominal
Second harmonic intercept (SHI)	f <100 MHz 100 MHz < f ≤ 400 MHz 400 MHz < f ≤ 500 MHz 500 MHz < f ≤ 1 GHz 1 GHz < f ≤ 1.8 GHz > 1.8 GHz	>35 dBm >45 dBm, typ. 55 dBm >52 dBm, typ. 60 dBm >45 dBm, typ. 55 dBm >35 dBm 80 dBm, nominal

Displayed average noise level		
	0 dB RF attenuation, termination 50 Ω, RBW = 1 kHz, VBW = 3 kHz, zero span, sweep time 50 ms, trace average, sweep count = 20, mean marker, normalized to 10 Hz RBW	
	20 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz 10 MHz	<–80 dBm <–100 dBm <–110 dBm <–120 dBm <–120 dBm <–130 dBm <–143 dBm
	R&S FSU3	
	20 MHz ≤ f < 2.0 GHz 2.0 GHz ≤ f ≤ 3.0 GHz 3.0 GHz ≤ f ≤ 3.6 GHz	<–145 dBm, typ. –148 dBm <–143 dBm, typ. –147 dBm <–142 dBm, typ. –146 dBm
	R&S FSU8	
	20 MHz ≤ f < 2.0 GHz 2.0 GHz ≤ f < 3.0 GHz 3.0 GHz ≤ f < 7 GHz 7 GHz ≤ f < 8 GHz	<–145 dBm, typ. –148 dBm <–143 dBm, typ. –145 dBm <–142 dBm, typ. –144 dBm <–140 dBm, typ. –142 dBm
	R&S FSU26	
	20 MHz ≤ f < 2 GHz 2 GHz ≤ f < 3.6 GHz 3.6 GHz ≤ f < 8 GHz 8 GHz ≤ f < 13 GHz 13 GHz ≤ f < 18 GHz 18 GHz ≤ f < 22 GHz 22 GHz ≤ f < 26.5 GHz	<–142 dBm, typ. –146 dBm <–140 dBm, typ. –143 dBm <–142 dBm, typ. –146 dBm <–140 dBm, typ. –143 dBm <–138 dBm, typ. –141 dBm <–137 dBm, typ. –140 dBm <–135 dBm, typ. –138 dBm
	R&S FSU46	
	20 MHz ≤ f < 2 GHz 2 GHz ≤ f < 13 GHz 13 GHz ≤ f < 18 GHz 18 GHz ≤ f < 22 GHz 22 GHz ≤ f < 26.5 GHz 26.5 GHz ≤ f < 40 GHz 40 GHz ≤ f < 46 GHz	<–142 dBm, typ. –146 dBm <–140 dBm, typ. –143 dBm <–138 dBm, typ. –141 dBm <–137 dBm, typ. –140 dBm <–135 dBm, typ. –138 dBm <–128 dBm, typ. –131 dBm <–123 dBm, typ. –128 dBm
	R&S FSU50	
	20 MHz ≤ f < 2 GHz 2 GHz ≤ f < 13 GHz 13 GHz ≤ f < 18 GHz 18 GHz ≤ f < 22 GHz 22 GHz ≤ f < 26.5 GHz 26.5 GHz ≤ f < 32 GHz 32 GHz ≤ f < 46 GHz 46 GHz ≤ f < 50 GHz	<–142 dBm, typ. –146 dBm <–140 dBm, typ. –143 dBm <–138 dBm, typ. –141 dBm <–137 dBm, typ. –140 dBm <–135 dBm, typ. –138 dBm <–128 dBm, typ. –131 dBm <–123 dBm, typ. –126 dBm <–118 dBm, typ. –121 dBm

Maximum dynamic range		
1 dB compression to DANL (1 Hz)		170 dB

Immunity to interference		
Image frequency	f ≤ 3.6 GHz f > 3.6 GHz f > 40 GHz	>90 dB, typ. >110 dB >70 dB, typ. >100 dB typ. 70 dB
Intermediate frequency	f ≤ 3.6 GHz 3.6 GHz < f ≤ 4.2 GHz f > 4.2 GHz	>90 dB, typ. >110 dB typ. 70 dB >70 dB, typ. >90 dB
Spurious response	f >1 MHz, without input signal, 0 dB RF attenuation	<–103 dBm
Other interfering signals	Δf >100 kHz mixer level <–10 dBm, f ≤ 2.3 GHz mixer level <–35 dBm, 2.3 GHz < f < 4 GHz mixer level <–10 dBm 4 GHz ≤ f < 8 GHz 8 GHz ≤ f < 16 GHz 16 GHz ≤ f < 26 GHz 26.5 GHz ≤ f < 40 GHz f ≥ 40 GHz	 <–80 dBc <–70 dBc <–70 dBc <–64 dBc <–58 dBc <–52 dBc <–52 dBc, nominal

Level display		
Screen		625 x 500 pixel (one diagram), max. 2 diagrams with independent settings
Logarithmic level axis		1 dB to 200 dB, in steps of 1/2/5
Linear level axis		10% of reference level per level division, 10 divisions or logarithmic scaling
Number of traces	1 measurement diagram 2 measurement diagrams	3 6
Trace detector		Max Peak, Min Peak, Auto Peak (Normal), Sample, RMS, Average, Quasi Peak
Number of measurement points	default value range	625 155 to 10001 in steps of about a factor of 2
Trace functions		Clear/Write, Max Hold, Min Hold, Average
Trace update rate	local measurement, display update rate, 625 points, zero span remote measurement, display off: zero span / sweep time 1 ms span = 10 MHz, sweep time 2.5 ms	80 per second 70 per second 50 per second
Setting range of reference level	logarithmic level display	–130 dBm to (+5 dBm + RF attenuation), max. 30 dBm, in steps of 0.1 dB
	linear level display	7.0 nV to 7.07 V in steps of 1%
Units of level axis	logarithmic level display linear level display	dBm, dBµV, dBmV, dBµA, dBpW µV, mV, µA, mA, pW, nW

Level measurement uncertainty		
Absolute level uncertainty at 128 MHz	RBW = 10 kHz, level –30 dBm, reference level –30 dBm, RF attenuation 10 dB	<0.2 dB (σ = 0.07 dB)
Frequency response referenced to 128 MHz	DC coupling, RF attenuation ≥10 dB, +20 °C to +30 °C 10 MHz ≤ f < 3.6 GHz 3.6 GHz ≤ f < 8 GHz, span < 1 GHz 8 GHz ≤ f < 22 GHz, span < 1 GHz 22 GHz ≤ f < 26.5 GHz, span < 1 GHz 26.5 GHz ≤ f < 40 GHz, span < 1 GHz 40 GHz ≤ f < 50 GHz, span < 1 GHz, RF attenuation ≤ 40 dB f ≥ 3.6 GHz, span ≥ 1 GHz +5 °C to +45 °C 10 MHz ≤ f <3.6 GHz 3.6 GHz ≤ f < 26.5 GHz f ≥ 26.5 GHz	 <0.3 dB (σ = 0.1 dB) <1.5 dB (σ = 0.5 dB) <2 dB (σ = 0.7 dB) <2.5 dB (σ = 0.8 dB) <2.5 dB (σ = 0.8 dB) <3 dB (σ = 1.0 dB) add 0.5 dB to above values <0.6 dB (σ = 0.2 dB) add 0.5 dB to above values add 1.0 dB to above values
Attenuator switching uncertainty	f = 128 MHz 0 dB to 70 dB, referenced to 10 dB attenuation	<0.2 dB (σ = 0.07 dB)
Uncertainty of reference level setting	RF attenuation 10 dB, referenced to –10 dBm reference level setting	<0.15 dB (σ = 0.05 dB)

Display nonlinearity	+20 °C to +30 °C, mixer level ≤–10 dBm)	
Logarithmic level display	RBW ≤ 100 kHz or channel filters, S/N >20 dB 0 dB to –70 dB –70 dB to –90 dB	 <0.1 dB (σ = 0.03 dB) <0.3 dB (σ =0.1 dB)
	200 kHz ≤ RBW ≤10 MHz, S/N >16 dB 0 dB to –50 dB –50 dB to –70 dB	 <0.2 dB (σ =0.07 dB) <0.5 dB (σ =0.17 dB)
	RBW >10 MHz, S/N >16 dB 0 dB to –50 dB	 <0.5 dB (σ =0.17 dB)
Linear level display		5% of reference level
Bandwidth switching error	referenced to RBW = 10 kHz 1 Hz to 100 kHz 200 kHz to 3 MHz 5 MHz to 50 MHz FFT filter 1 Hz to 3 kHz	 <0.1 dB (σ =0.03 dB) <0.2 dB (σ =0.07 dB) <0.5 dB (σ =0.15 dB) <0.2 dB (σ =0.07 dB)

Total measurement uncertainty		
	0 dB to –70 dB, S/N >20 dB, span/RBW <100, 95% confidence level, 20 °C to 30 °C, mixer level ≤–10 dBm f < 3.6 GHz, RBW ≤100 kHz f < 3.6 GHz, RBW >100 kHz 3.6 GHz ≤ f <8 GHz 8 GHz ≤ f <18 GHz 18 GHz ≤ f <26.5 GHz 26.5 GHz ≤ f < 40 GHz 40 GHz ≤ f < 50 GHz	 0.3 dB 0.5 dB 2.0 dB 2.5 dB 3.0 dB 3.0 dB 3.5 dB

I/Q data

Interface		GPIB or LAN interface
Memory length		max. 512 k samples I and Q
Sample length		24 bit, each I and Q
Sample rate	settable in steps of 0.5 (32 MHz x 2–n, n = 0 to 11)	15.625 kHz to 32 MHz
Max. signal bandwidth	sample rate ≤2 MHz 4 MHz 8 MHz 16 MHz 32 MHz	0.8 x sample rate 2.8 MHz 4.8 MHz 7 MHz 9 MHz
IF pre-filter bandwidth		300 kHz to 10 MHz, 1/2/3/5 steps

Audio demodulation

AF demodulation types		AM and FM
Audio output		loudspeaker and phone jack
Marker stop time in spectrum mode		100 ms to 60 s

Trigger functions

Trigger		
Trigger source		free run, video, external, IF level (mixer level 10 dBm to –50 dBm)
Trigger offset	span ≥10 Hz	125 ns to 100 s, resolution 125 ns min. (or 1% of offset)
	span = 0 Hz	± (125 ns to 100 s), resolution 125 ns min., dependent on sweep time
Max. deviation of trigger offset		± (31.25 ns + (0.1% × trigger offset))
Gated sweep		
Gate source		external, IF level, video
Gate delay		1 µs to 100 s
Gate length		125 ns to 100 s, resolution min. 125 ns or 1% of gate length
Max. deviation of gate length		±(31.25 ns + (0.05% × gate length))

Inputs and outputs (front panel)

RF input		
Impedance		50 Ω
Connector	R&S FSU3, R&S FSU8 R&S FSU26 R&S FSU46 R&S FSU50	N female test port adapter APC 3.5 mm/N female test port adapter 2.92 mm (K)/N female test port adapter 2.4 mm/N female
VSWR	RF attenuation ≥10 dB, DC coupled f < 3.6 GHz R&S FSU8: 3.6 GHz ≤ f <8 GHz R&S FSU26, R&S FSU46, R&S FSU50: 3.6 GHz ≤ f < 18 GHz 18 GHz ≤ f < 26.5 GHz 26.5 GHz ≤ f < 40 GHz 40 GHz ≤ f ≤ 50 GHz	 <1.5 <2 <1.8 <2.0 <2.5 <3, nominal
	RF attenuation <10 dB or AC coupling	1.5, typical
Setting range of attenuator		0 dB to 75 dB, in 5 dB steps

Probe power supply		
Supply voltages		+15 V DC, –12.6 V DC and ground, max. 150 mA, nominal

Power supply for antennas etc		5-pin connector
Supply voltages		± 10 V and ground, max. 100 mA, nominal

Keyboard connector		PS/2 female for MF-2 keyboard
AF output		
Connector		3.5 mm mini jack
Output impedance		10 Ω
Open-circuit voltage		up to 1.5 V, adjustable
Power supply for noise source		BNC female
Output voltage		0 V and 28 V, switchable, nominal

Inputs and outputs (rear panel)

IF 20.4 MHz		BNC female
Impedance		50 Ω
Bandwidth	RBW ≤30 kHz	1.67 x resolution bandwidth, min. 2.6 kHz
	RBW = 50 kHz, 100 kHz	400 kHz
	200 kHz ≤ RBW ≤10 MHz	equal to resolution bandwidth
Level	RBW ≤ 100 kHz, FFT filter, mixer level >–70 dBm	–20 dBm at reference level
	RBW = 200 kHz to 10 MHz, mixer level >–50 dBm	0 dBm at reference level

IF 404.4 MHz	active only if RBW >10 MHz	BNC female
Impedance		50 Ω
Bandwidth	RBW >10 MHz	equal to resolution bandwidth
Level	mixer level ≤0 dBm	mixer level typ. –10 dB

Video output		BNC female
Impedance		50 Ω
Output voltage	RBW ≥200 kHz, logarithmic scaling, full scale	0 V to 1 V (EMF)

Reference output		BNC female
Impedance		50 Ω
Output frequency		10 MHz
Level		>0 dBm, nominal

Reference input		BNC female
Impedance		50 Ω
Input frequency range		1 MHz ≤ f_{in} ≤ 20 MHz, in 1 Hz steps
Required level		>0 dBm from 50 Ω

Sweep output		BNC female
Output voltage		0 V to 5 V, proportional to displayed frequency

External trigger/gate input		BNC female
Trigger voltage		1.4 V (TTL)
Input impedance		≥10 kΩ

IEC/IEEE bus control		interface to IEC 625-2 (IEEE 488.2)
Command set		SCPI 1997.0 or HP8566 compatible
Connector		24-pin Amphenol female
Interface functions		SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0
LAN interface		10/100 BaseT, RJ45
USB interface		type A plug, version 1.1
Serial interface		RS-232-C (COM), 9-pin female connectors
Printer interface		parallel (Centronics compatible)
Mouse interface		PS/2 compatible

Connector for external monitor		15-pin sub-D (VGA)

General specifications

Display		21 cm LC TFT colour display (8.4")
Resolution		800 x 600 pixel (SVGA resolution)
Pixel failure rate		<1 x 10^{-5}

Mass memory		
Mass memory		1.44 Mbyte 3 ½" disk drive, hard disk, USB flash disk (not supplied)
Data storage		>500 instrument settings and traces
Mass memory	option R&S FSU -B20	hard disk replaced by a flash disk

Temperature		
Temperature	operating temperature range permissible temperature range storage temperature range option R&S FSU -B20: operating temperature range permissible temperature range	+5° C to +40 °C +0° C to +50 °C –40°C to +70 °C 0 °C to +50 °C 0 °C to +55 °C
Climatic loading		+40 °C at 95% relative humidity (DIN EN 60068-2-30: 2000-02)

Mechanical resistance		
	sinusoidal vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz; 0.5 g from 55 Hz to 150 Hz; meets DIN EN 60068-2-6: 1996-05, DIN EN 60068-2-30: 2000-02, DIN EN 61010-1, MIL-T-28800D, class 5
	random vibration	10 Hz to 100 Hz, acceleration 1 g (RMS)
	shock	40 g shock spectrum, meets MIL-STD-810C and MIL-T-28800D, classes 3 and 5
	option R&S FSU -B20: random vibration	10 Hz to 300 Hz, acceleration 1.9 g (RMS)
Recommended calibration interval	operation with external reference operation with internal reference	2 years 1 year
RFI suppression		meets EMC directive of EU (89/336/EEC) and German EMC legislation

Power supply		
AC supply		100 V to 240 V, 3.1 A to 1.3 A; 50 Hz to 400 Hz, class of protection I to VDE 411
Power consumption	R&S FSU 3, R&S FSU 8 R&S FSU26, R&S FSU46, R&S FSU50	typ. 130 VA typ. 150 VA
Safety		meets EN 61010-1, UL 3111-1, CSA C22.2 No. 1010-1, DIN EN 61010-1
Test mark		VDE, GS, CSA, CSA-NRTL
Dimensions	W x H x D in mm	435 x 192 x 460
Weight	R&S FSU 3 R&S FSU 8 R&S FSU 26 R&S FSU46 R&S FSU50	14.6 kg 15.4 kg 16.5 kg 16.8 kg 16.8 kg

Tracking Generator R&S FSU-B9,
Attenuator R&S FSU-B12 for Tracking Generator

Unless specified otherwise, specifications not valid for frequency range from –3 x RBW to +3 x RBW, however at least not valid from –100 kHz to +100 kHz. Maximum output level +5 dBm (peak modulation in the case of amplitude-modulated signals).

Frequency		
Frequency range		100 kHz to 3.6 GHz
Resolution		1 Hz
Frequency offset		
Setting range		±200 MHz
Resolution		1 Hz

Spectral purity		
SSB phase noise	f = 500 MHz, carrier offset 10 kHz normal mode with frequency offset with FM modulation on	 typ. –120 dBc (1 Hz) typ. –110 dBc (1 Hz) typ. –110 dBc (1 Hz)

Level		
Level setting range	 with option R&S FSU-B12	–30 dBm to +5 dBm in steps of 0.1 dB –100 dBm to +5 dBm in steps of 0.1 dB

Max. deviation of output level		
Absolute	f = 128 MHz, output level –20 dBm to 0 dBm	<1 dB (σ = 0.34 dB)
Frequency response	referenced to level at 128 MHz, sweep time >100 ms, +5 °C to +45 °C	
	output level –20 dBm to 0 dBm, 100 kHz to 3.6 GHz output level –30 dBm to –20 dBm, f= 100 kHz to 3.6 GHz additional deviation with R&S FSU-B12, 100 kHz to 3.6 GHz	 <3 dB, typ. 1.9 dB 3 dB <1 dB

Dynamic range		
Attenuation measurement range	RBW = 1 kHz, f >10 MHz	100 dB
Harmonics Spurious, nonharmonics	output level –10 dBm output level 0 dBm	typ. –30 dBc typ. –30 dBc

Modulation		
Modulation format	external	I/Q, AM, FM
Input voltage	full scale AM, FM, V_{pp} I/Q	 1 V $\sqrt{U_i^2 + U_q^2}$ = 0.5 V
AM	$f_{Center} > f_{Mod}$, span = 0 Hz	
Modulation depth		0% to 99%
Modulation frequency response	0 Hz to 5 MHz 0 Hz to 30 MHz	1 dB 3 dB
FM	$f_{Center} > f_{Mod}$, span = 0 Hz	
Frequency deviation		full range: 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Modulation frequency range	deviation ≤10 MHz deviation ≤1 MHz	0 Hz to 1 kHz 0 Hz to 100 kHz
Modulation frequency response	0 kHz to 100 kHz	1 dB
I/Q modulation	$f_{Center} > f_{Mod}$, span = 0 Hz	
Modulation frequency response	0 Hz to 5 MHz 0 Hz to 30 MHz	1 dB 3 dB
Modulation deviation of tracking generator	I/Q modulation, typical values, baseband signals generated by the R&S AMIQ	
EVM	NADC/TETRA/PDC	
	RMS	2%
	peak	4%
	PHS	
	RMS	2%
	peak	5%
Phase error	GSM/DCS1800/PCS1900	
	RMS	1.5°
	peak	5°
Rho factor	IS-95 CDMA	0.997

Inputs and outputs (front panel)		
RF output		N female, 50 Ω
VSWR	100 kHz ≤ f ≤ 2 GHz 2 GHz ≤ f ≤ 3.6 GHz	1.2 1.5

Inputs and outputs (rear panel)		
TG I/AM IN		BNC female
Impedance		50 Ω
Input voltage	V_{pp}	1 V
TG Q/FM IN		BNC female
Impedance		50 Ω,
Input voltage	V_{pp}	1 V

LO/IF Ports for External Mixers R&S FSU-B21 (for R&S FSU26, R&S FSU46 and R&S FSU50 only)

LO signal		
Frequency range		7.0 GHz to 15.5 GHz
Level	+20 °C to +30 °C +5 °C to +45 °C	+15.0 dBm ±1 dB +15.0 dBm ±3 dB

IF input		
IF frequency		404.4 MHz
Full scale level	2-port mixer (LO output / IF input, front panel) 3-port mixer (IF input, front panel)	–20 dBm –20 dBm
Level uncertainty	IF input level –30 dBm, RBW 30 kHz, 2-port mixer, LO output / IF input (front panel) +20 °C to +30 °C +5 °C to +45 °C 3-port mixer, IF input (front panel) +20 °C to +30 °C +5 °C to +45 °C	 <1 dB <3 dB <1 dB <3 dB

Inputs and outputs (front panel)

Option R&S FSU-B21		
LO output / IF input		SMA female, 50 Ω
IF input		SMA female, 50 Ω

RF Preamplifier R&S FSU -B23 (for R&S FSU 26 only, requires option R&S FSU-B25)

Level measurement uncertainty		
Frequency response	preamplifier = on 3.6 GHz to 8 GHz 8 GHz to 22 GHz 22 GHz to 26.5 GHz	 <2.0 dB (σ = 0.7 dB) <2.5 dB (σ = 0.8 dB) <3.0 dB (σ = 1 dB)

Displayed average noise level		
	0 dB RF attenuation, termination 50 Ω, RBW = 1 kHz, VBW = 3 kHz, zero span, sweep time 50 ms, trace average, sweep count = 20, mean marker, normalized to 10 Hz RBW	
	preamplifier = off	
	3.6 GHz to 8 GHz 8 GHz to 26.5 GHz	R&S 26 specifications + 2 dB R&S 26 specifications + 3 dB
	preamplifier = on	
	3.6 GHz to 8 GHz	<–152 dBm, typ. –155 dBm
	8 GHz to 13 GHz	<–149 dBm, typ. –152 dBm
	13 GHz to 18 GHz	<–147 dBm, typ. –150 dBm
	18 GHz to 22 GHz	<–144 dBm, typ. –149 dBm
	22 GHz to 26.5 GHz	<–140 dBm, typ. –145 dBm

Electronic Attenuator R&S FSU-B25

Frequency		
Frequency range	R&S FSU 3	10 MHz to 3.6 GHz
	R&S FSU 8	10 MHz to 8 GHz
	R&S FSU 26	10 MHz to 3.6 GHz
	R&S FSU46	10 MHz to 3.6 GHz
	R&S FSU50	10 MHz to 3.6 GHz

Setting range		
Electronic attenuator		0 dB to 30 dB, in 5 dB steps
Preamplifier		20 dB, switchable

Level measurement uncertainty		
Frequency response	with preamplifier or electronic attenuator	
	10 MHz to 50 MHz	<1 dB (σ = 0.34 dB)
	50 MHz to 3.6 GHz	<0.6 dB (σ = 0.2 dB)
	3.6 MHz to 8 GHz	<2.0 dB (σ = 0.7 dB)
Reference error	at 128 MHz, RBW ≤100 kHz, reference level –30 dBm, RF attenuation 10 dB	
	electronic attenuator	<0.3 dB (σ = 0.1 dB)
	preamplifier	<0.3 dB (σ = 0.1 dB)

Displayed average noise level		
	0 dB RF attenuation, termination 50 Ω, RBW = 1 KHz, VBW = 3 KHz, zero span, sweep time 50 ms, trace average, sweep count = 20, mean marker, normalized to 10 Hz RBW	
	preamplifier on	
	R&S FSU3, R&S FSU8, R&S FSU26 10 MHz to 2.0 GHz 2.0 GHz to 3.6 GHz	 <–152 dBm <–150 dBm
	R&S FSU8 3.6 GHz to 8 GHz	 <–147 dBm
	R&S FSU46, R&S FSU50 10 MHz to 40 MHz 40 MHz to 2 GHz 2 GHz to 3.6 GHz	 <–150 dBm <–152 dBm <–150 dBm
	with the R&S FSU-B25 built in, the average noise level values displayed by the base units degrade by (R&S FSU-B25 off):	
	20 Hz to 3.6 GHz	1 dB
	R&S FSU 8, 3.6 GHz to 8 GHz	2 dB
	preamplifier off, electronic attenuator 0 dB	
	20 Hz to 3.6 GHz	typ. 2.5 dB
	R&S FSU 8, 3.6 GHz to 8 GHz	typ. 3.5 dB

Intermodulation		
Third-order intercept point (TOI)	electronic attenuator on, Δf >5 x RBW or 10 kHz	
	10 MHz to 300 MHz	>17 dBm
	300 MHz to 3.6 GHz	>20 dBm
	3.6 GHz to 8 GHz	>18 dBm

Ordering information

Order designation	Type	Order No.
Spectrum Analyzer 20 Hz to 3.6 GHz	R&S FSU3	1166.1660.03
Spectrum Analyzer 20 Hz to 8 GHz	R&S FSU8	1166.1660.08
Spectrum Analyzer 20 Hz to 26.5 GHz	R&S FSU26	1166.1660.26
Spectrum Analyzer 20 Hz to 46 GHz	R&S FSU46	1166.1660.46
Spectrum Analyzer 20 Hz to 50 GHz	R&S FSU50	1166.1660.50
Accessories supplied		
Power cable, operating manual, service manual, R&S FSU26: test port adapter with 3.5 mm female (1021.0512.00) and N female (1021.0535.00) connector R&S FSU46: test port adapter with K female (1036.4790.00) and N female (1036.4777.00) connector R&S FSU50: test port adapter with 2.4 mm female (1088.1627.02) and N female (1036.4777.00) connector		

Options

Order designation	Type	Order No.	Retrofittable	Remarks
Options				
OCXO, low aging / improved phase noise at 10 Hz carrier offset	R&S FSU-B4	1144.9000.02	yes	
Tracking Generator, 100 kHz to 3.6 GHz	R&S FSU-B9	1142.8994.02	yes	
External Generator Control	R&S FSP-B10	1129.7246.02	yes	
Output Attenuator, 0 dB to 70 dB, for R&S FSU-B9	R&S FSU-B12	1142.9349.02	yes	requires R&S FSU-B9
Removable Hard Disk	R&S FSU-B18	1145.0242.0x	no	excludes R&S FSU-B20
Second Hard Disk for R&S FSU-B18	R&S FSU-B19	1145.0394.0x		requires R&S FSU-B18
Extended Environmental Specifications	R&S FSU-B20	1155.1606.08	no	
LO/IF Ports for External Mixers	R&S FSU-B21	1157.1090.02	yes	only for R&S FSU26, R&S FSU46 and R&S FSU50
20 dB Preamplifier, 3.6 GHz to 26.5 GHz, for R&S FSU26	R&S FSU-B23	1157.0907.02	no	only for R&S FSU26, requires R&S FSU-B25
Electronic Attenuator, 0 dB to 30 dB, and 20 dB Preamplifier (3.6 GHz)	R&S FSU-B25	1044.9298.02	yes	
Firmware / Software				
Noise Measurement Software	R&S FS-K3	1057.3028.02		preamplifier (e.g. R&S FSU-B25) recommended
Phase Noise Measurement Software	R&S FS-K4	1108.0088.02		
GSM/EDGE Application Firmware	R&S FS-K5	1141.1496.02		
FM Measurement Demodulator	R&S FS-K7	1141.1796.02		
Bluetooth Application Firmware	R&S FS-K8	1157.2568.02		
Power Sensor Measurements	R&S FS-K9	1157.3006.02		
Application Firmware for Noise Figure and Gain Measurements	R&S FS-K30	1300.6508.02		preamplifier (e.g. R&S FSU-B25) recommended
3GPP BTS/Node B FDD Application Firmware	R&S FS-K72	1154.7000.02		
3GPP UE FDD Application Firmware	R&S FS-K73	1154.7252.02		
3 GPP HSDPA BTS Application Firmware	R&S FS-K74	1300.7156.02		requires R&S FS-K72
3 GPP TD-SCDMA BTS Application Firmware	R&S FS-K76	1300.7291.02		
3 GPP TD-SCDMA UE Application Firmware	R&S FS-K77	1300.8100.02		
cdma2000 BTS Application Firmware	R&S FS-K82	1157.2316.02		
cdma2000 MS Application Firmware (incl. 1xEV-DV)	R&S FS-K83	1157.2416.02		
cdma2000 1xEV-DO BTS Application Firmware	R&S FS-K84	1157.2851.02		
cdma2000 1xEV-DO MS Application Firmware	R&S FS-K85	1300.6689.02		

Recommended extras

Order designation	Type	Order No.
Headphones		0708.9010.00
US Keyboard with trackball	R&S PSP-Z2	1091.4100.02
IEC/IEEE Bus Cable, 1 m	R&S PCK	0292.2013.10
IEC/IEEE Bus Cable, 2 m	R&S PCK	0292.2013.20
19” Rack Adapter	R&S ZZA-411	1096.3283.00
Adapter for mounting on telescopic rails (only with 19” Adapter R&S ZZA-411)	R&S ZZA-T45	1109.3774.00
Matching pads, 50/75 Ω		
L Section, matching at both ends	R&S RAM	0358.5414.02
Series Resistor, 25 Ω, matching at one end (taken into account in instrument function RF INPUT 75 Ω)	R&S RAZ	0358.5714.02
SWR bridges, 50 Ω		
SWR Bridge, 5 MHz to 3 GHz	R&S ZRB2	0373.9017.5X
SWR Bridge, 40 kHz to 4 GHz	R&S ZRC	1039.9492.5X
High power attenuators		
100 W, 3/6/10/20/30 dB, 1 GHz	R&S RBU100	1073.8495.XX (XX = 03/06/10/20/30)
50 W, 3/6/10/20/30 dB, 2 GHz	R&S RBU50	1073.8695.XX (XX = 03/06/10/20/30)
50 W, 20 dB, 6 GHz	R&S RDL50	1035.1700.52
Connectors and cables		
Probe power connector, 3 pin		1065.9480.02
DC blocks		
DC Block, 10 kHz to 18 GHz (type N)	R&S FSE-Z4	1084.7443.02
External harmonic mixers (for R&S FSU26, R&S FSU46, R&S FSU50 with option R&S FSU-B21)		
Harmonic Mixer 40 GHz to 60 GHz	R&S FS-Z60	1089.0799.02
Harmonic Mixer 50 GHz to 75 GHz	R&S FS-Z75	1089.0847.02
Harmonic Mixer 60 GHz to 90 GHz	R&S FS-Z90	1089.0899.02
Harmonic Mixer 90 GHz to 110 GHz	R&S FS-Z110	1089.0976.02
For R&S FSU 26 only:		
Test port adapter N male		1021.0541.00
Test port adapter 3.5 mm male		1021.0529.00
Microwave Measurement Cable with test port adapter set N male and 3.5 mm male	R&S FSE-Z15	1046.2002.02
For R&S FSU46 only:		
Test port adapter N male		1036.4783.00
Test port adapter K male		1036.4802.00
Test port adapter 2.4 mm female	R&S FSE-Z5	1088.1627.02
For R&S FSU50 only:		
Test port adapter N male		1036.4783.00
Test port adapter K female		1036.4790.00
Test port adapter K male		1036.4802.00

ROHDE&SCHWARZ

www.rohde-schwarz.com

PD 0758.0016.22 · Spectrum Analyzer R&S®FSU · Version 08.00 · April 2004 · Data without tolerance limits is not binding · Subject to change