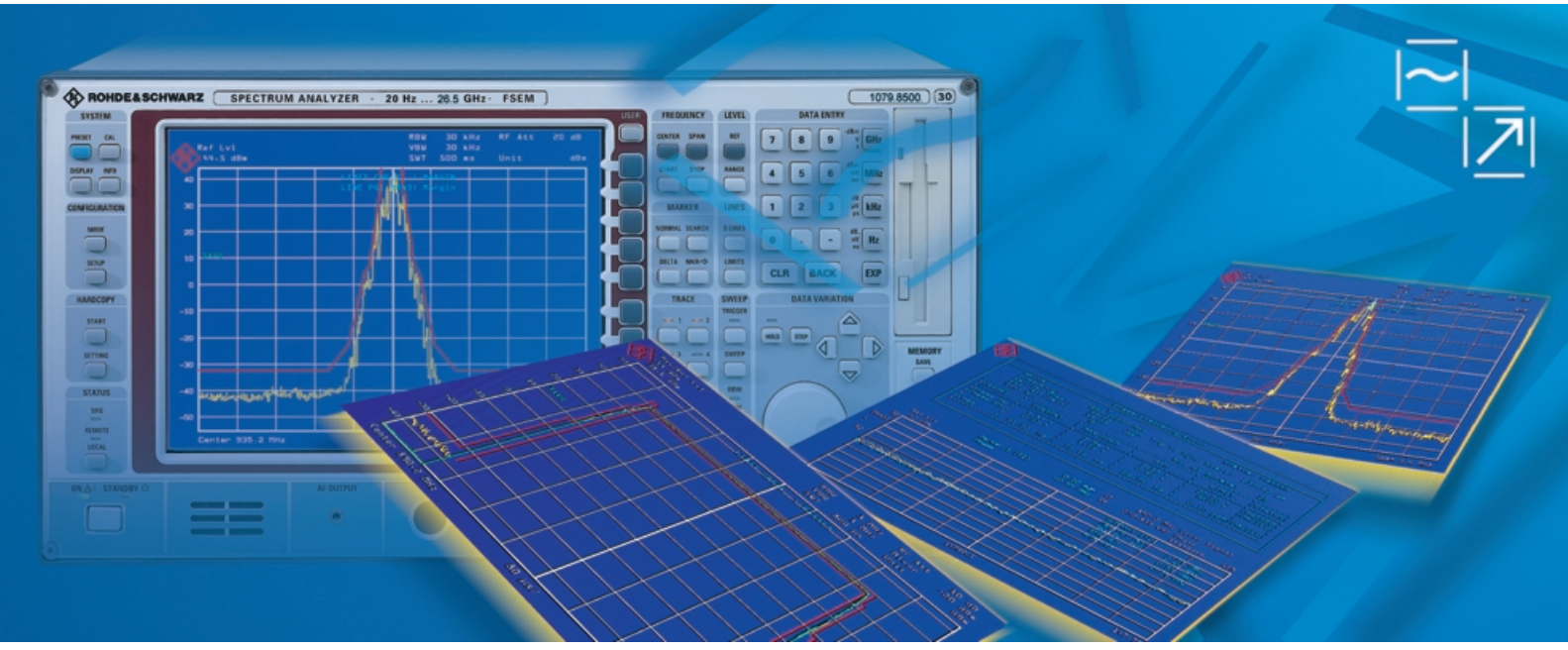

Application Firmware FSE-K10/-K11

for Spectrum Analyzers FSE and Signal Analyzers FSIQ

- GSM transmitter measurements conforming to standards:
  - FSE-K10 for mobile phones
  - FSE-K11 for base stations
- Measurement of RF parameters for GSM900, GSM1800 and GSM1900 in line with:
  - GSM 11.10
  - GSM 11.10-1
  - GSM 11.20
  - GSM 11.21
  - J-STD 007 Air Interface
  - R-GSM
- The firmware modules can be fitted to all models of the FSE and FSIQ family

NEW
- **Extended frequency range**
- **Improved menu structure**
- **Higher flexibility and speed**

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Characteristics

Standards	FSE-K11 (for base stations)	FSE-K10 (for mobile stations)
P-GSM900, Phase I	GSM 11.20	GSM 11.10
GSM1800	GSM 11.20-DCS	ETS 300 020-3
GSM900/1800, Phase II	GSM 11.21	ETS 300 067-1/GSM 11.10-1
GSM1900	J-STD-007 Air Interface	J-STD-007 Air Interface
R-GSM, GSM 1800, Phase II+	GSM 11.21	GSM 11.10-1

Standards covered by Firmware Modules FSE-K10/-K11

Measurements	Possible trigger sources		Synchronization to midamble
	FSE-K10	FSE-K11	With FSIQ and FSE fitted with FSE-B7
Phase/frequency error	External, video, RF power, free run	External, free run	Yes
Mean carrier power	External, video, RF power, free run	External, free run	Yes/switch-selected
Carrier power versus time	External, video, RF power, free run	External, free run	Yes/switch-selected
Spectrum due to modulation	External, RF power	External	–
Spectrum due to transients	External, RF power, free run	External, free run	–
Spurious	External, free run	External, free run	–

Selection of trigger sources

RF power: only for ARFCN ±1.8 MHz

Convenient add-on to analyzers

Analyzers FSE and FSIQ with their wide dynamic range and high accuracy are ideal for GSM transmitter measurements in development and production. Application Firmware Modules FSE-K10 and FSE-K11 further simplify operation: complex measurements exactly in line with standards can be performed at a keystroke. The modules take into account all requirements and settings for GSM900, GSM1800 (Phase I and Phase II), GSM1900 and R-GSM. Operation follows the sequence of measurements as specified in the standards.

Fitted with the application firmware, Analyzer FSE or FSIQ automatically sets the frequency limits, measurement bandwidths, sweep times and detectors required for a given standard and the associated measurements. The analyzer compares results with specified limit values and verifies their compliance.

Fast and easy measurements to GSM specifications

Automatic test routines speed up measurements in acceptance testing, development and production and do away with incorrect settings. The user can concentrate on results rather than on test procedures – in the simplest case on pass/fail information. This increases measurement throughput and reduces error rates.

FSEM and FSIQ26 cover the frequency range up to 27 GHz, which allows the measurement of spurious through to 12.75 GHz.

Flexible in development and final testing through:

- User-definable limit values and limit lines (except for mean carrier power measurement)
- Free carrier-frequency selection independent of channel numbers, for example for measurements at intermediate frequencies or at 450 MHz
- Improved menu structure: frequency setting, trigger, power and limit lines accessible directly from each measurement menu
- Number of bursts user-selectable deviating from standard for optimized test times

Measurements	FSIQ	FSEx	
		with FSE-B7	without FSE-B7
Phase/frequency error	✓	✓	–
Mean carrier power – with synchronization to midamble	✓	✓	–
Mean carrier power – without synchronization to midamble	✓	✓	✓
Transmitted power versus time (burst timing) – with synchronization to midamble	✓	✓	–
Transmitted power versus time (burst timing) – without synchronization to midamble	✓	✓	✓
Spectrum due to modulation	✓	✓	✓
Spectrum due to transients	✓	✓	✓
Spurious	✓	✓	✓

Measurement functions with and without Vector Signal Analyzer FSE-B7 (option)

High-precision time reference

FSIQ, or FSE with optional Vector Signal Analyzer FSE-B7, establishes the time reference to the midamble of the signal under test. In addition to spectrum measurements, this allows phase and frequency error measurements and provides for correct synchronization in TDMA power ramp measurements without an external trigger being required.

Unparalleled dynamic range

The analyzers of the FSE and FSIQ families feature low inherent and phase noise as well as high overload capability, thus offering a dynamic range that meets even the stringent requirements of BTS transmitter measurements, for example power ramp measurements at 1 MHz measurement bandwidth with MAX HOLD over 70 dB. Featuring low phase noise also far off the carrier, FSE and FSIQ allow the measurement of spurious emissions in the transmit band with an output power of up to 39 dBm without the use of complex notch filters. This simplifies test setups and considerably speeds up measurements.

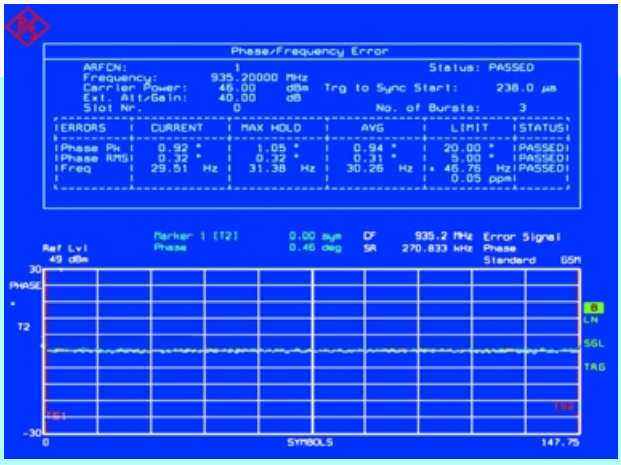
High level measurement accuracy

The small absolute level measurement error of <0.6 dB up to 2 GHz achieved with optional Increased Level Accuracy FSE-B22 allows higher tolerances for the DUT. In many cases, this eliminates the need for elaborate calibration methods or an additional power meter, thus reducing investment costs as well as measurement time.

Automatic measurements

All measurements can of course be remotely controlled. The required analyzer settings are performed automatically by FSE-K10 and FSE-K11, relieving the operator from extensive programming. After a measurement has been started, only the associated results or PASS/FAIL information are transmitted via the bus, so that the bus remains free for other tasks.

Applications



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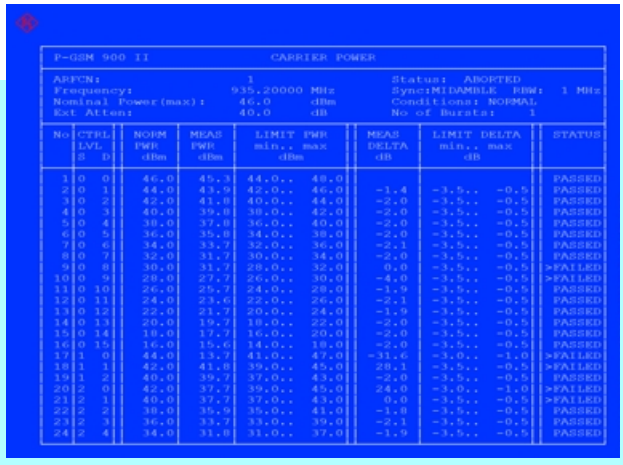

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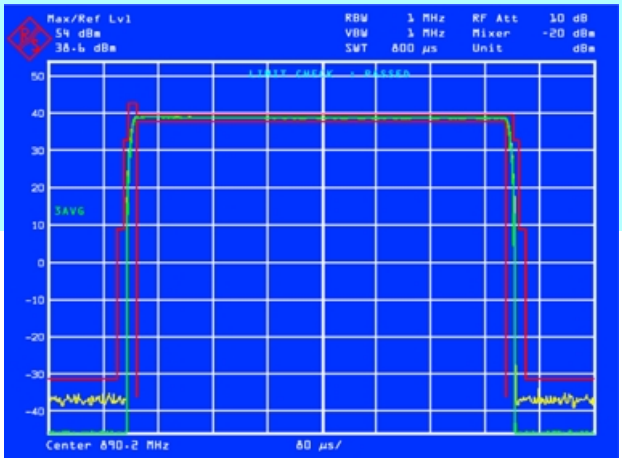


3

1 Measurement of phase/frequency error

2 Measurement of mean carrier power for various power control levels

3 Measurement of power ramp in FULL BURST mode

Phase/frequency error (1)
FSIQ, or FSE with the optional vector signal analyzer, determines the phase and frequency error (rms and peak value) over an adjustable number of bursts. Numerical results as well as the phase error versus time are displayed. The latter is represented by three traces for the instantaneous, maximum and minimum error over the selected number of bursts.

Mean carrier power (2)
In the carrier power mode, FSE and FSIQ measure the absolute output power and the relative power for the selected power class and the different power control levels (static power control level and dynamic power control level). Results are output in tabular form. The measurement may cover the complete power control range with all power control levels, or a specific nominal power may be measured.

High reliability of the measurements is ensured through the low absolute and relative power measurement uncertainty:

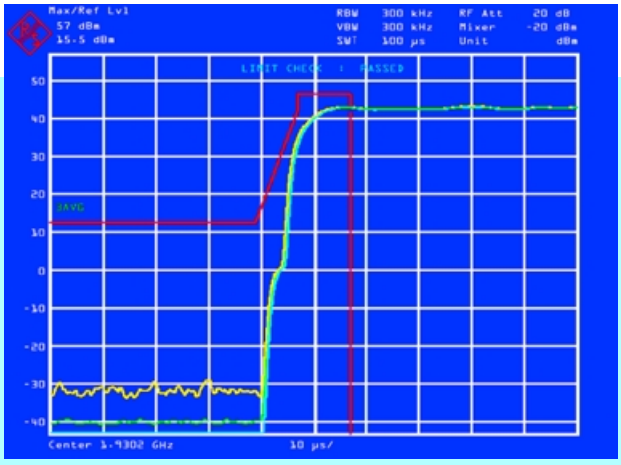
- Absolute measurement uncertainty: <0.6 dB (FSIQ or FSE with option FSE-B22)
- Relative measurement error: <0.3 dB

A separate power meter is therefore not needed in most cases .

Transmitted power versus time (3 and 4)
For power ramp measurements, FSE and FSIQ offer a dynamic range better than 70 dB at 1 MHz measurement bandwidth with MAX HOLD. Three traces are displayed at the same time: MAX HOLD, MIN HOLD and AVERAGE over an adjustable number of bursts.

Bursts can be analyzed in detail at a selectable measurement bandwidth of 300 kHz or 1 MHz:

- FULL BURST displays the complete burst
- RISING measures the rising edge
- FALLING measures the falling edge
- BURST HIGH RESOLUTION measures the useful part of the burst with high resolution



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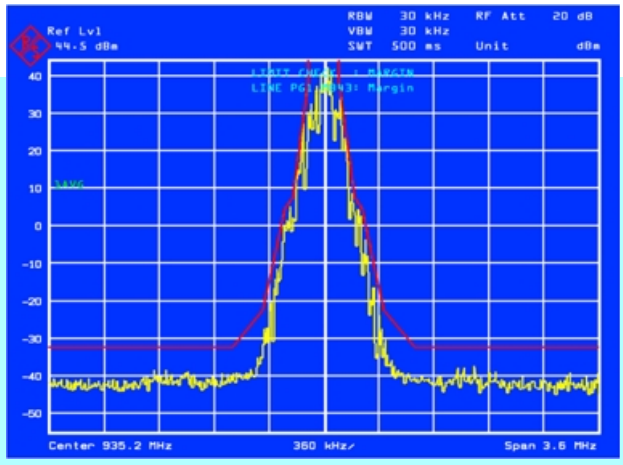
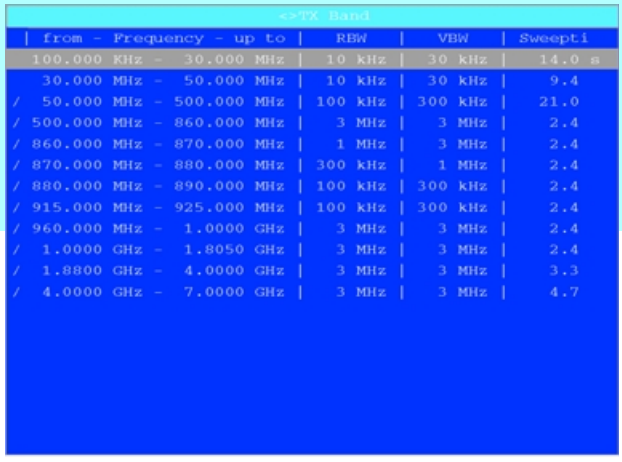


5

4 Measurement of power ramp, rising edge

5 Measurement of spectrum due to modulation with frequency sweep

6 Selection of bands for spurious emission measurement



6

Depending on the selected standard and carrier power measured, limit lines are inserted and compliance with these limit lines is checked automatically.

Spectrum due to modulation (5)

This measurement determines the power in the adjacent channels caused by modulation. The power can be measured in compliance with standard specifications either in the zero span or gated sweep (frequency sweep) mode. Since only the stipulated part of the burst is analyzed, an external trigger or the RF power trigger is required for this measurement.

Spectrum due to transients (no illustration)

This measurement is made in the zero span mode. The analyzer is automatically tuned to the required offsets. FSE and FSIQ output the maximum level measured at each frequency in the form of a table.

Spurious emissions (6)

Depending on the basic unit used, spurious emissions can be measured up to 3.5 GHz, 7 GHz or 12.75 GHz in the following bands:

- in the receive band
- in the transmit band and
- outside the receive and transmit bands.

The following can be taken into account:

- SFH (slow frequency hopping)
- Cositing (GSM and DCS), measurements also in the receive band of the other system
- External preamplifier for achieving the required sensitivity in the receive band
- Notch filter for carrier suppression in transmit band measurements

The correct frequency ranges, resolution and video bandwidths are selected automatically. The single-step mode enables step-by-step measurement of the various frequency bands. The band currently measured is displayed, overall results are output as a list with PASS/FAIL information. Individual bands can be selected from a table.

Specifications

The specifications below apply to FSE-K10 and FSE-K11. They are based on data sheet specifications of Spectrum Analyzers FSE and optional Vector Signal Analyzer FSE-B7 as well as Signal Analyzers FSIQ and have not been checked separately.

Level measurement errors given with a tolerance are measurement uncertainties with a confidence level of 95%. Values in [ ] apply to FSE with Increased Level Accuracy FSE-B22 (option) fitted.

Data without tolerances are typical values.

The stated level measurement errors do not take into account systematic errors resulting from the reduced S/N ratio. This is critical in particular in measurements with the peak detector (spectrum due to transients and spurious emissions outside the receive band).

Measurements	**FSEA30 with FSE-B7**	**FSEB30, FSEM30, FSEK30 with FSE-B7**	**FSIQ3**	**FSIQ7, FSIQ26, FSIQ40**	**Test specifications and permissible measurement uncertainty for measuring equipment to I-ETS 300 609-1**
Phase/frequency error					11.21, 6.2/ 11.10-1, 13.1
Phase error					
rms value	≤0.5°	≤0.7°	≤0.5°	≤0.7°	≤1.5°
peak value	≤1.5°	≤2.1°	≤1.5°	≤2.1°	≤5°
Frequency error	±(1.45 Hz + error of reference frequency relative to carrier)				±10 Hz
Mean carrier power versus time (CPW)					11.21, 6.3/ 11.10-1, 13.3
Measurement error absolute	≤0.9 dB [≤0.6 dB]		≤0.6 dB		±1 dB
relative	≤0.55 dB [≤0.3 dB]		≤0.3 dB		±0.7 dB
Transmitted power versus time					11.21, 6.4/ 11.10-1, 13.3
Error of reference level	≤0.9 dB [≤ 0.6 dB] (0 to 50 dB below reference level)		≤0.6 dB (0 to 70 dB below reference level)		±1 dB
Relative error of reference level	≤0.3 dB (0 to 50 dB below reference level) ≤0.5 dB (50 to 70 dB below reference level)		≤0.2 dB (0 to 70 dB below reference level)		±1 dB
Trigger error	±0.25 µs [±1/16 bit]				
Dynamic range (resolution bandwidth 300 kHz, MAX HOLD)	75 dB				
Spectrum due to modulation					11.21, 6.5.1/ 11.10-1, 13.4
Level measurement error					±1 dB
absolute	≤0.9 dB [≤0.6 dB] (0 to 50 dB below reference level) ≤1 dB (50 to 70 dB below reference level) ≤1.4 dB (70 to 95 dB below reference level)		≤0.6 dB (0 to 70 dB below reference level) ≤1.4 dB (70 to 95 dB below reference level)		
relative, frequency offset:					
≤100 kHz	≤0.3 dB				±0.5 dB
100 kHz to 1.8 MHz, level difference <50 dB	≤0.45 dB				±0.7 dB
1.8 MHz to 6 MHz, level difference ≥50 dB	≤1.3 dB				±1.5 dB
≥6 MHz	≤1.3 dB				±2.0 dB
Dynamic range (carrier power 46 dBm)					
Frequency offset 200 kHz	82 dB	78 dB	82 dB	78 dB	
250 kHz	83 dB	79 dB	83 dB	79 dB	
400 kHz	87 dB	82 dB	87 dB	82 dB	
600 kHz	90 dB	84 dB	90 dB	84 dB	
1200 kHz	93 dB	86 dB	93 dB	86 dB	
1800 kHz	94 dB	86 dB	94 dB	86 dB	
1800 kHz to 6000 kHz (resolution bandwidth 100 kHz)	90 dB	85 dB	90 dB	89 dB	
>6 MHz (resolution bandwidth 100 kHz), transmit band	91 dB	86 dB	91 dB	90 dB	

Measurements	FSEA30 with FSE-B7	FSEB30, FSEM30, FSEK30 with FSE-B7	FSIQ3	FSIQ7, FSIQ26, FSIQ40	Test specifications and permissible measurement uncertainty for measuring equipment to I-ETS 300 609-1
Spectrum due to transients					11.21, 6.5.2/ 11.10-1, 13.4
Level measurement error					
absolute	≤0.9 dB [0,6 dB]		≤0.6 dB		±1.5 dB
relative, level difference <50 dB	≤0.45 dB		≤0.45 dB		±0.7 dB
relative, level difference >50 dB	≤1.2 dB		≤1.2 dB		±1.5 dB
Dynamic range (carrier power 46 dBm)					
Frequency offset 400 kHz	76 dB	71 dB	76 dB	71 dB	
600 kHz	81 dB	75 dB	81 dB	75 dB	
1200 kHz	87 dB	81 dB	87 dB	81 dB	
1800 kHz	91 dB	85 dB	91 dB	85 dB	

The specifications stated above apply to the following basic units:

FSEA30	1065.6000.35	FSIQ3	1119.5005.13
FSEB30	1066.3010.35	FSIQ7	1119.5005.17
FSEM30	1079.8500.35	FSIQ26	1119.6001.27
FSEK30 with option FSE-B7	1088.3494.35	FSIQ40	1119.6001.40

For basic units FSEx, model .30, and FSIQ, models .03, .07, .26, the following specifications differ from those above:

Measurements	FSEA30 with FSE-B7	FSEB30, FSEM30, FSEK30 with FSE-B7	FSIQ3	FSIQ7, FSIQ26, FSIQ40	Test specifications and permissible measurement uncertainty for measuring equipment to I-ETS 300 609-1
Spectrum due to modulation					
Dynamic range (carrier power 46 dBm)					
Frequency offset 200 kHz	78 dB	72 dB	78 dB	78 dB	
250 kHz	78 dB	72 dB	78 dB	79 dB	
400 kHz	82 dB	76 dB	82 dB	82 dB	
600 kHz	87 dB	81 dB	87 dB	84 dB	
1200 kHz	93 dB	87 dB	93 dB	86 dB	
1800 kHz	94 dB	88 dB	94 dB	86 dB	
1800 kHz to 6000 kHz (resolution bandwidth 100 kHz)	90 dB	84 dB	90 dB	89 dB	
>6 MHz (resolution bandwidth 100 kHz), transmit band	91 dB	87 dB	91 dB	90 dB	
Spectrum due to transients					
Dynamic range (carrier power 46 dBm)					
Frequency offset 400 kHz	76 dB	70 dB	76 dB	70 dB	

Ordering information

Application Firmware FSE-K10 and FSE-K11 can be fitted to all models of the FSE and FSIQ families (also both modules at the same time). The 5-pole resolution filters stipulated by standards are included in all FSE30 and FSIQ models; FSE models .20 are equipped with 4-pole resolution filters.

Order designations

Application Firmware for tests on GSM/DCS/PCS mobile phones	FSE-K10	1057.3092.02
Application Firmware for tests on GSM/DCS/PCS base stations	FSE-K11	1057.3392.02

Recommended extras and options for FSE

Increased Level Accuracy up to 2 GHz (factory-fitted)	FSE-B22	1106.3480.02
Vector Signal Analyzer	FSE-B7	1066.4317.02
Windows NT Computer Function English	FSE-B15	1073.5696.03

The above options are included in Signal Analyzers FSIQ as standard.

For further options and recommended extras see FSE and FSIQ data sheets.

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ROHDE&SCHWARZ GmbH & Co. KG · Muehldorfstrasse 15 · 81671 Munich, Germany · P.O.B. 801469 · 81614 Munich, Germany
Telephone +4989 4129-0 · www.rohde-schwarz.com · CustomerSupport: Tel. +491805124242, Fax +4989 4129-3777, E-mail: CustomerSupport@rsd.rsd.de