

Version  
01.00

November  
2003

## Application Firmware for Noise Figure and Gain Measurements R&S® FS-K30 for R&S® FSP/FSU/FSQ

### Outperforming any conventional noise measurement system

The Spectrum Analyzers R&S®FSP and R&S®FSU as well as the Signal Analyzers R&S®FSQ feature high sensitivity and level accuracy – in conjunction with switchable, calibrated noise sources – are thus ideal for automatic measurement of noise figure and gain.

Application Firmware R&S®FS-K30 provides the high-grade analyzers with features otherwise only provided by special noise measurement systems. At a specified frequency or in a selectable frequency range the following parameters can be measured:

- ◆ Noise figure in dB
- ◆ Noise temperature in K
- ◆ Gain in dB

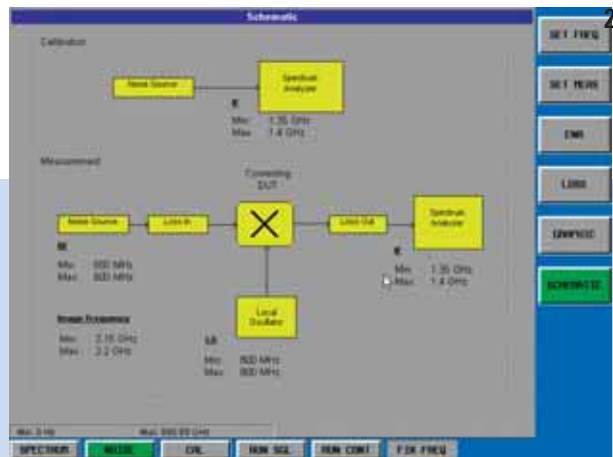
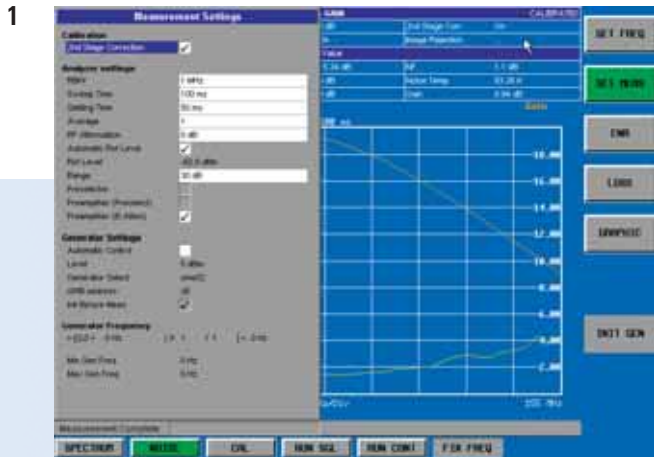
Compared to conventional noise measurement systems, R&S®FS-K30 used with the Analyzers R&S®FSP/FSU or R&S®FSQ has the advantage that a large variety of further RF measurements can also be performed.

The measurement results are output as a graph or a list. Up to four measurements can be represented in a diagram. All functions can be remote-controlled.



**ROHDE & SCHWARZ**

# Application Firmware R&S®FS-K30 ...



EM Table	Min	Max
EM Table 1	10 MHz	10.00 GHz
EM Table 2	10 MHz	10.17 GHz
EM Table 3	10 MHz	10.34 GHz
EM Table 4	10 MHz	10.51 GHz
EM Table 5	10 MHz	10.68 GHz
EM Table 6	10 MHz	10.85 GHz
EM Table 7	10 MHz	11.02 GHz
EM Table 8	10 MHz	11.19 GHz
EM Table 9	10 MHz	11.36 GHz
EM Table 10	10 MHz	11.53 GHz
EM Table 11	10 MHz	11.70 GHz
EM Table 12	10 MHz	11.87 GHz
EM Table 13	10 MHz	12.04 GHz
EM Table 14	10 MHz	12.21 GHz
EM Table 15	10 MHz	12.38 GHz
EM Table 16	10 MHz	12.55 GHz
EM Table 17	10 MHz	12.72 GHz
EM Table 18	10 MHz	12.89 GHz
EM Table 19	10 MHz	13.06 GHz



The combination of Application Firmware R&S®FS-K30 and Analyzers R&S®FSP/FSU or R&S®FSQ offers the following advantages over conventional noise measurement systems:

- ◆ Frequency range up to 46 GHz (depending on analyzer model) for noise measurements in the microwave range without requiring an additional downconverter
- ◆ Resolution bandwidths variable in steps of 1/2/3/5 (R&S®FSP: only 1/3) for optimum matching to narrowband DUTs

While conventional noise measurement systems are only suitable for determining the noise and gain characteristics of the DUT, the R&S®FSP/FSU or R&S®FSQ also

allows the highly sensitive measurement of the following parameters:

- ◆ Harmonics
- ◆ Intermodulation
- ◆ Spurious responses and many other RF-relevant criteria.

The versatility of this R&S®FSP/FSU/FSQ-based noise measurement set is not at the expense of the measurement accuracy, which is essentially determined by the accuracy of the noise source calibration and the mismatch. The largest error affecting the measuring instrument, i.e. the linearity of its log characteristic, is minimized in the R&S®FSP/FSU and R&S®FSQ analyzers by individual calibration.

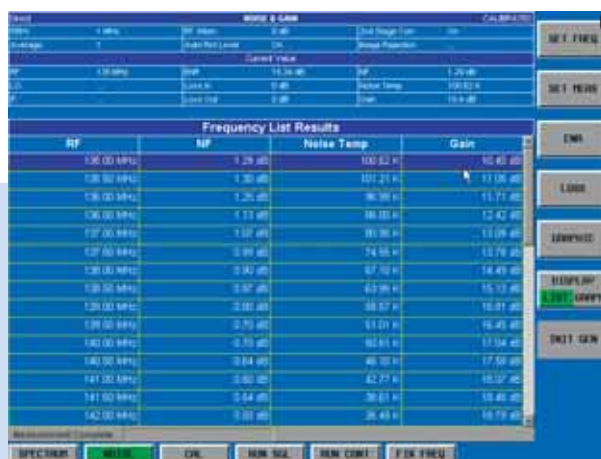
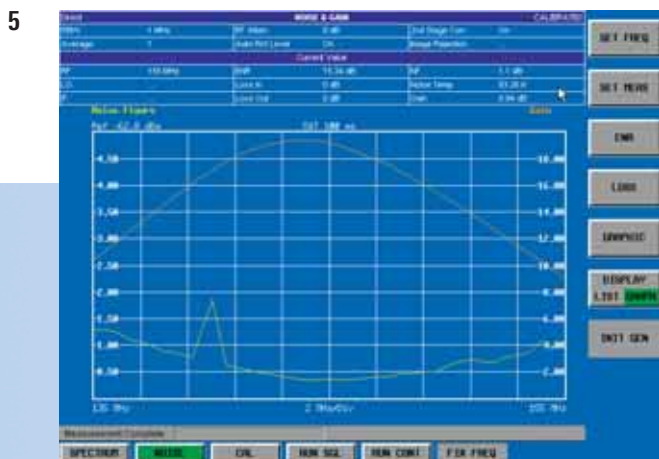
## Easy to operate

The firmware runs on the R&S®FSP/FSU and R&S®FSQ analyzers that operate under Windows XP. The measurement results can be further processed, e.g. for documentation or presentation, using Windows standard software.

A practically unlimited number of complete measurement routines can be stored. They facilitate reproducible and error-free measurements and include:

- ◆ Frequency range
- ◆ Noise source characteristics
- ◆ Type of DUT (amplifier, mixer, low-noise converter)
- ◆ Analyzer settings
- ◆ Measurement results

# ... outperforming conventional noise measurement systems



1 to 3 The user interface makes for convenient settings

4 The Spectrum Analyzer R&S®FSP and the power supply for the DUT: this is all you need to set up an extremely convenient system for measuring noise and many other parameters

5 Measurements on a GaAs preamplifier show an anomaly at 140 MHz, whose cause is easily traceable in the spectrum analyzer mode

6 Tabular representation of measurement results

## Applications

### Highly sensitive measurements on amplifiers

Noise figure measurements respond even to very small disturbances. In figure 5 measurements are carried out on a GaAs preamplifier showing an irregularity at 140 MHz.

The interference source can be evaluated with the highly sensitive Analyzer R&S®FSP/FSU or R&S®FSQ. The analysis of the disturbed frequency range is easily made by switching to the spectrum analyzer mode.

### Measurements on frequency-converting DUTs, e.g. low-noise converters

R&S®FS-K30 allows the noise figure and the gain for instance of LNCs for direct satellite reception to be measured without any problems despite the great frequency difference of typ. 10 GHz between the input and output. A particular asset in these measurements is the extremely wide dynamic range, allowing the direct determination of gain values up to 60 dB. Even higher values can be measured when the DUT

is followed by an attenuator, which is taken into account automatically. The firmware supports measurements on frequency-converting DUTs using a fixed LO frequency or a fixed IF. It enables the user to select the sidebands to be measured and controls external generators for mixer measurements via the IEC/IEEE bus by means of the optional External Generator Control R&S®FSP-B10.

## Specifications

<b>Frequency range</b>	100 kHz to 26.5 GHz (depending on analyzer model)
Measurement bandwidth R&S®FSP R&S®FSU/FSQ	1 kHz to 10 MHz 1 kHz to 50 MHz
<b>Noise measurements</b>	
Level range	0 dB to 25 dB
Resolution	0.01 dB
Measurement accuracy	±0.2 dB (measurement with preamplifier (gain 20 dB, noise figure 5 dB) and 1 MHz bandwidth, valid for DUTs with noise figure 1 dB to 10 dB and gain >10 dB)
<b>Gain measurements</b>	
Level range	0 dB to 60 dB
Resolution	0.01 dB
Measurement accuracy	±0.2 dB (preamplification 20 dB, noise figure 5 dB, bandwidth 1 MHz)

## Required hardware and software

<b>Analyzers</b>	R&S®FSP3/FSP7/FSP13, R&S®FSP30/FSP40, R&S®FSQ3/FSQ8/FSQ26, R&S®FSU3/FSU8, R&S®FSU26/FSU46
Recommended noise source	NoiseCom 346 (see table at right)
Power supply	via 28 V connector for R&S®FSP/ FSU/FSQ (BNC)
Preamplifier	gain approx. 20 dB, noise figure max. 5 dB

## Ordering information

Order designation	Type	Order number
Application Firmware for Noise Figure and Gain Measurement for R&S®FSP/FSU/FSQ	R&S®FS-K30	1300.6508.02
<b>Options</b>		
External Generator Control	R&S®FSP-B10	1129.7246.02
Electronic Attenuator, 0 dB to 30 dB, and 20 dB Preamplifier	R&S®FSU-B25	1144.9298.02
Electronic Attenuator, 0 dB to 30 dB, 5 dB steps, integrated preamplifier	R&S®FSP-B25	1129.7746.02
3.6 GHz to 26.5 GHz RF preamplifier for R&S®FSU26 <sup>1) 2) 3)</sup>	R&S®FSU-B23	1157.0907.02
3.6 GHz to 26.5 GHz RF preamplifier for R&S®FSQ26 <sup>1) 2) 3)</sup>	R&S®FSQ-B23	1157.0907.03
Noise source	<b>see table at right</b>	

<sup>1)</sup> Factory installation only.

<sup>2)</sup> Not for retrofit.

<sup>3)</sup> R&S®FSU-B25 required.

**Note:** Application Firmware R&S®FS-K30 can only be installed on analyzers that run under the Windows XP operating system.

Noise source <sup>1)</sup>	RF connector	Frequency range in GHz	Output level in dB
NC 346 A	SMA male	0.01 to 18	5 to 7
NC 346 A Precision	APC 3.5 male	0.01 to 18	5 to 7
NC 346 A Option1	N male	0.01 to 18	5 to 7
NC 346 A Option 2	APC 7	0.01 to 18	5 to 7
NC 346 A Option 4	N female	0.01 to 18	5 to 7
NC 346 B	SMA male	0.01 to 18	14 to 16
NC 346 B Precision	APC 3.5 male	0.01 to 18	14 to 16
NC 346 B Option 1	N male	0.01 to 18	14 to 16
NC 346 B Option 2	APC 7	0.01 to 18	14 to 16
NC 346 B Option 4	N female	0.01 to 18	14 to 16
NC 346 C	APC 3.5 male	0.01 to 26.5	13 to 17
NC 346 D	SMA male	0.01 to 18	19 to 25
NC 346 D Precision	APC 3.5 male	0.01 to 18	19 to 25
NC 346 D Option 1	N male	0.01 to 18	19 to 25
NC 346 D Option 2	APC 7	0.01 to 18	19 to 25
NC 346 D Option 3	N female	0.01 to 18	19 to 25
NC 346 E	APC 3.5 male	0.01 to 26.5	19 to 25
NC 346 Ka	K male	0.10 to 40	10 to 17
NC 346 V	V male	0.10 to 55	7 to 21

<sup>1)</sup>Noise sources supplied by NoiseCom; specifications from NoiseCom.





**ROHDE & SCHWARZ**

Rohde & Schwarz GmbH & Co. KG · Mühlhofstraße 15 · 81671 München · Germany · P.O.B. 801469 · 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

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG · Trade names are trademarks of the owners  
PD 07568.0839.32 · Application Firmware for Noise Figure and Gain Measurement R&S®FS-K30 for R&S®FSP/FSU/FSQ · Version 01.00 · November 2003

· Data without tolerance limits is not binding · Subject to change

Printed in Germany (Pe bb)