



**ROHDE & SCHWARZ**

Test and Measurement  
Division

## **Release Notes**

# **R&S FSQ-K70**

## **Vector Signal Analysis Application Firmware**

### **Release 4.20**

### **with Service Pack 2**

for R&S FSU, FSQ, FSG, FMU, FSUP  
Analyzer Firmware 4.2x

#### **New Features:**

- Support for instrument R&S FSG.
- Trace Export of I/Q Data in WAVEFORM format.

**Release Note Revision:**      **7**

Printed in the Federal  
Republic of Germany

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## History

Date	Rel Note Rev	Changes
19 July 2007	1	First revision for Vector Analysis Application Firmware 4.20.
16 August 2007	2	FSP, FSU and FSQ added.
12 October 2007	3	Problems eliminated with Service Pack 1.
08 November 2007	4	Description of the update procedure adjusted to new update ZIP file.
22 November 2007	5	FMU added.
18 December 2007	6	Problems eliminated with Service Pack 2 added.
08 October 2008	7	FSUP detector board minimum version added

## General Topics

### Hardware Requirements

Please note at least revision 04.08 of Wideband Detector Board is required for R&S FSQ-K70. This can be checked in the SETUP SYSTEM INFO menu with softkey HARDWARE INFO.

For component WB DETECTOR is required:

<b>revision</b>	<b>sub revision</b>	
4	$\geq 8$	<b>or</b>
> 5		

For R&S FSUP at least model 08 of Wideband Detector Board is required for R&S FSQ-K70: This can be checked in the SPECTRUM -> SETUP -> SYSTEM INFO menu with softkey HARDWARE INFO. For component WBDET with order number 1130.3086 the model  $\geq 08$  is required.

## Compatibility of the R&S FSQ-K70 Vector Analysis Application Firmware with other Firmware Releases

The following table shows the compatible versions of the basic analyzer firmware and the Vector Analysis Application Firmware:

**Table of compatible versions:**

R&S FSQ-K70 Application Firmware	R&S FSU Basic Firmware	R&S FSQ Basic Firmware	R&S FSMR Basic Firmware	R&S FSUP Basic Firmware	R&S FMU Basic Firmware	R&S FSG Basic Firmware
4.20 SP2	4.21 SP1	4.25 SP1	-	4.27	4.28	4.29 SP3
4.20 SP1	4.21	4.25	-	-	-	4.29
4.20	4.21	4.25	-	-	-	4.29
4.10	4.11	4.15	-	4.17	-	-
4.01	-	-	-	-	4.08	-
4.00 SP2	4.01 SP3	4.05 SP3	-	-	-	-
4.00 SP1	-	-	4.06	-	-	-
4.00	4.01	4.05	-	-	-	-
3.90 SP1	-	3.95 SP2	-	-	-	-
3.90	-	3.95	3.96	-	-	-
3.80	-	3.85				
3.70	-	3.75	-	-	-	-
3.60	-	3.65	-	-	-	-
3.50 SP1	-	3.55 SP2	-	-	-	-
3.50	-	3.55	-	-	-	-
3.40	-	3.45	-	-	-	-
3.30	-	3.35	-	-	-	-
3.28	-	3.25	-	-	-	-
3.24	-	3.15	-	-	-	-
3.21	-	3.05 SP1	-	-	-	-
3.20	-	3.05	-	-	-	-
2.30	-	2.35	-	-	-	-
2.28	-	2.25	-	-	-	-
2.24	-	2.15	-	-	-	-
1.21	-	2.05	-	-	-	-
1.00	-	1.85	-	-	-	-
-	-	1.65	-	-	-	-
-	-	1.55	-	-	-	-

The FSQ-K70 application firmware versions 3.xx or 4.xx requires Windows XP. For NT based instruments a Windows-XP upgrade kit FSQ-U2, order # 1162.9696.02 is available.

**Note:**

*Applications with version number 3.xx or 4.xx are only compatible with basic firmware 3.yy or 4.yy (see table above). Do not install them on basic firmware versions below 3.00!*

## **Firmware Update of the R&S FSQ-K70 Vector Analysis Application Firmware**

Since basic firmware version 4.2x a ZIP file with the update sets of the basic system firmware and all available applications is provided. This ZIP file is available in the instruments FIRMWARE section, e.g. R&S FSU of the Service Board on GLORIS.

Please follow the steps described in the instrument's basic firmware release note to perform a complete firmware update.

## **Enabling the Application Firmware via License Key Code Entry**

This section can be skipped if the option key was entered once.

After installing the application firmware package a license key for validation must be entered. The license key is printed either on a label on the rear panel of the R&S FSQ or delivered as a part of the R&S FS-K70 Vector Analysis Application Firmware package.

The key sequence for entering the license key is:

SETUP - GENERAL SETUP – OPTIONS - INSTALL OPTION

Use the numeric keypad to input the license key number and press ENTER.

- On a successful validation the message 'option key valid' will appear.
- If the validation failed, the application firmware is not installed.

The most probable reason will be that the instrument is not equipped with the correct basic firmware version. Therefore a message box will appear asking for installation of the correct basic firmware version.

If the application firmware package was not installed prior to entering the license key code, a message will appear asking for installation of the application firmware package.

**In any case please make sure that the correct basic firmware version and the application firmware package is installed prior to entering the license key code.**

## Modified Functions

The behaviour of the following functions changed compared to earlier versions [the number in brackets indicates the firmware version that introduced the individual change]:

1. (V3.60) **EXPORT STANDARD**: Query before overwriting existing file in manual operation.
2. (V3.60) Menu **HOME VSA - FACTORY DEFAULTS** now support **PATTERNS**, too.
3. (V3.60) Expanded range for **Symbol Rate**. The lower limit is now 100 Hz.
4. (V3.60) A trace in **VIEW** state in analyzer mode is set to **CLR/WRITE** when leaving the vector analysis mode.
5. (V3.80) Expanded range for **FSK Ref. Deviation**. The upper limit is now  $1.5 * \text{Symbol Rate}$ .
6. (V3.80) Measurements at low frequencies using baseband inputs of option **FSQ-B71** by a digital down conversion are now supported.
7. (V3.80) Absolute marker position for marker 1 added for measurement result **AM/AM - AM/PM** conversion.
8. (V3.80) **SAVE AS STANDARD** additionally stores statistics parameter settings (**X-AXIS QUANTIZE**, **X-axis** and **Y-axis** scaling).
9. (V3.80) Default focus for **NEW PATTERN** dialog is change to pattern name.
10. (V3.90) Support of option **FSQ-B100: Extended Record Length**.
11. (V4.00) External trigger level in steps 0.1V over the complete range of 0.5V to 3.5V.
12. (V4.20) Support for instrument **R&S FSG**.
13. (V4.20) **Result SYMBOLS & MOD ACC: Calculation of SNR (signal-to-noise ratio) changed**.  
Before version 4.20, the SNR calculation is dependent on the **EVM CALC** setting (**MAX SYMBOL / SIGNAL MEAN POWER**). Since version 4.20 the SNR value is only referenced to the mean power. **EVM CALC** setting is ignored for SNR calculation.
14. (V4.20) **Trace Export of I/Q Data (RAW DATA) in WAVEFORM format**.

## Problems Eliminated with 4.20

The version numbers in brackets indicate the version in which the problem was observed for the first time.

1. (V4.00) **Vertikal display lines (e.g. Eval Lines) are visible in I/Q display and modulation accuracy result**.
2. (V4.00) **X UNIT TIME** is not disabled for measurement result **EQUALIZER** but the setting is ignored.
3. (V4.00) **Changing the symbol numbering by SET SYMB# (menu FIT TRACE) has no influence on the grid scaling**.

This problem only occurs if **FIT OFFSET** was changed before.

## Problems Eliminated with Service Pack 1

Service Pack 1 fixes the following problems.

**1. (V4.10) Wrong input signal power indication in analyzer mode after leaving VSA mode.**

An incorrect internal level setting leads to a wrong signal power indication after following settings:

- Enter Vector Signal Analysis mode (VSA)
- Set Reference Level to 0 dBm
- Exit VSA

Changing the Reference Level in Analyzer Mode to the same value corrects the internal setting and the power indication is correct now.

## Problems eliminated with Service Pack 2

Service Pack 2 fixes the following problems. All previous service packs are included. The version numbers in brackets indicate the version in which the problem was observed for the first time.

**1. (V4.20) The I/Q data capturing does not work after the export of trace data in the wave form format is done.**

**2. (V4.10) Missing EXTREF indication for measurement Result Signal - REAL/IMAG combined with SPLIT SCREEN.**

An "EXTREF" enhancement label indicates an UNLOCK condition due to a missing external reference. If SPLIT SCREEN is active and one of the screens is using a REAL/IMAG measurement format, the update of this indication is erroneously suppressed. The remote control status information (Status Questionable Frequency register) is not affected and returns the correct status information.

Note: An update of the instrument's base system firmware is required:

FSU: V4.21 SP1  
FSQ: V4.25 SP1  
FSG: V4.29 SP3

**3. (V4.10) Unstable demodulation of USER-QAM for TX filters with narrow bandwidth.**

This problem only occurs with TX filters designed for EDGE Evolution signals (for "higher symbol rate" and the "narrow pulse shape").

**4. (V4.20) Option FSU-B24 is not supported.**

## Known problems with option R&S FSQ-K70 Vector Analysis

The version numbers in brackets indicate the version in which the error was observed for the first time.

**1. (K70 V2.24/V3.24) Export trace functions available in the FILE menu.**

The trace export function of menu FILE is not supported in FSQ-K70, but the soft keys are not disabled.

**Workaround:** Use functions of menu TRACE.

**2. (V4.10) VSA uses a wrong frequency setting when VSA is entered.**

After following manual operation sequence the VSA application works with a wrong internal frequency setting:

- Enter VSA, set Center Frequency and Digital Standard according to the input signal.
- Exit VSA and change Center Frequency without changing the input signal frequency
- Enter VSA again.

The Center Frequency enhancement label shows the new frequency, taken from the analyzer mode.

Measuring at the wrong frequency the VSA should not be able to demodulate the signal, but the application measures at the previous frequency.

If the frequency is changed after activation of the VSA mode this problem does not occur.

## Modifications to the Operating Manual and Supplements

The R&S FSQ-K70 analyzer functions are included in a separate new manual set. Please refer to the following order numbers:

- 1161.8073.42-07 (German and English)

The corresponding PDF-Files are separately available on the service board.

## Last minute changes to the operating manual

### Setting Demodulation - DEMOD SETTINGS Softkey

RECORD LEN  
( 8 kSym ) ↕

RECORD LEN  
( AUTO )

RECORD LEN  
( 8 kSYM )

RECORD LEN  
( 1.234 ms )

The *RECORD LEN* softkey opens a submenu for setting the size of the IQ buffer for data recording.

Time entries are internally converted into the unit symbol and are rounded to integer symbols.

The screen display range of the MAG CAP BUFFERS is exclusively determined by the setting of the RECORD LEN.

The upper limit of the record length is 4194104 symbols.

### Selection of Error Display - ERROR SIGNAL Softkey

AM & PM  
CONVERSION

The *AM & PM CONVERSION* softkey displays the amplitude or phase error of the measurement signal relative to the reference signal level (i.e. of an ideal, undistorted transmission signal). The test points are used to calculate the distortion characteristic, on which the markers move.

The result window is divided into two parts:

The *AM/AM* display shows the logarithm level of the reference signal horizontally and the logarithm level of the measurement signal vertically.



Nonlinear level distortion causes trace deviations from the 0 dB line.

The AM/PM display shows the logarithm level of the reference signal horizontally, and the linear phase error vertically. Phase distortion also causes trace deviations from the 0° line.

This measurement is only available with PSK and QAM modulation.

**Note:** If a MEAS filter in the demodulation path has been switched on, the setting MEAS RESULT -> RESULT = RAW must be selected, otherwise the characteristic will be falsified by the MEAS filtering.

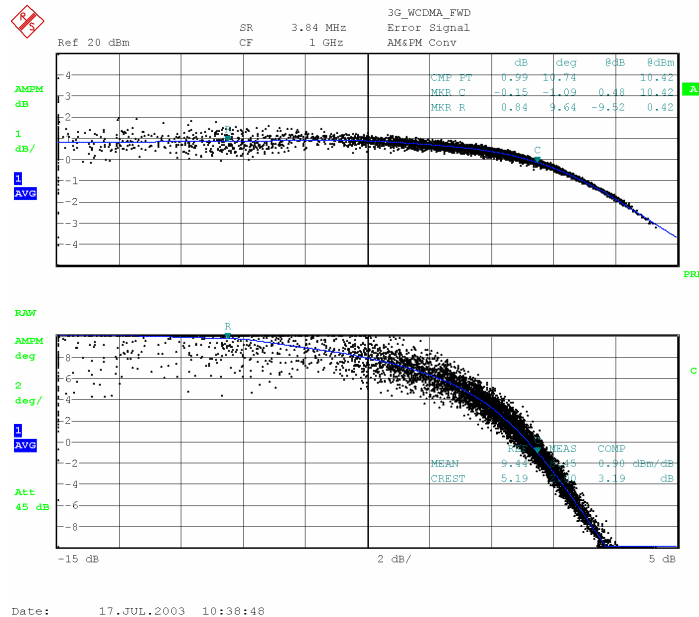


Fig. 5-58 AM & PM CONVERSION result display (AM-AM upper diagram, AM-PM lower diagram)

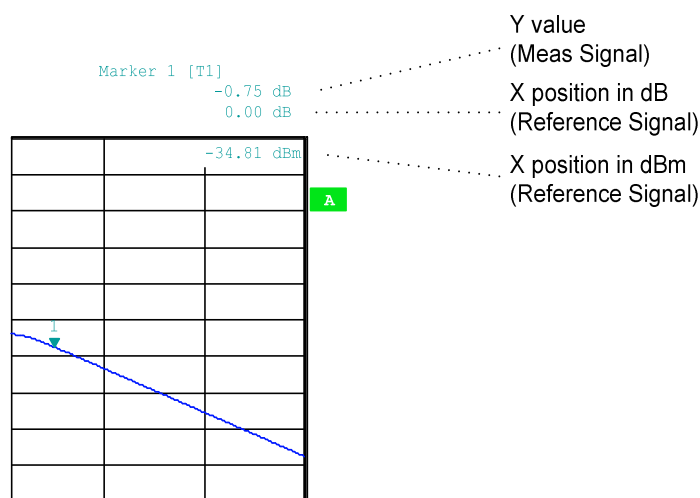


Fig. 5-59 AM & PM CONVERSION result display, marker field

The MKR FCT -> COMP PT marker functions are used to calculate the compression point from the trace and the input power upper diagram). The difference between the mean powers or crest factors of the measurement and reference signals is used to calculate the results for the power compression at the current modulation of the DUT. The results (power compression and reduction of the crest factor) are shown in the lower diagram. These values are determined by using two markers which are automatically positioned on the interpolated distortion characteristic. If one of the two markers leaves the display area, these numeric values will not be displayed.

IEC/IEEE bus command

```
:CALC:FEED 'XTIM:DDEM:ERR:MPH'
:CALC:FORM CONV

:CALC:MARK1:X:CONV:ABS?
```

## Trace Functions - TRACE Key

<b>TRACE</b>	SELECT TRACE	MIN HOLD	The <i>TRACE</i> key opens a menu for setting the trace functions.
	CLEAR / WRITE		<i>SELECT TRACE</i> selects the trace of the active measurement screen.
	MAX HOLD	AVG MODE LIN LOG	The trace <b>display mode</b> can be selected as follows:
	AVERAGE	FILE EXPORT	<i>CLEAR WRITE</i> Overwrite mode; the old trace is deleted after each measurement and overwritten by the new trace.
	VIEW	<b>DATA TRACE</b>	<i>VIEW</i> The current trace is frozen.
	BLANK	DATA RAW (ASCII)	<i>BLANK</i> The selected trace is blanked.
	SWEEP COUNT	HEADER ON OFF	<b>Weighting</b> of the complete trace is selected as follows:
	RMS	DECIM SEP .,	<i>AVERAGE</i> The average value is determined.
			<i>MAX HOLD</i> The maximum value is determined.
			<i>MIN HOLD</i> The minimum value is determined.

**Export** of all active traces is selected as follows:

<i>FILE EXPORT</i>	All active traces are stored
<i>DATA TRACE</i>	The data type TRACE is selected.
<i>DATA RAW</i>	The data type RAW DATA is selected. The formats ASCII and WAVEFORM are supported. <b>Note:</b> Files saved with format WAVEFORM are loadable by R&S SMU signal generator.
<i>HEADER</i>	A file header is created or not.
<i>DECIM SEP</i>	The decimal separator is selected.

## Summary - Evaluations

SNR ( MER) (Signal-to-noise ratio)	$SNR = 10 \log_{10} \left( \frac{\text{signal power}}{\text{noise power}} \right) = \frac{\frac{1}{N} \sum_{n=0}^{N-1}  REF(n \cdot T_{symbol}) ^2}{\frac{1}{N} \sum_{n=0}^{N-1}  MEAS(n \cdot T_{symbol}) - REF(n \cdot T_{symbol}) ^2}$ <p>The <b>SNR</b> (signal-to-noise ratio) is the quotient of the <b>signal power</b> of the ideal signal (REF signal) and the <b>noise power</b>. The signal power is calculated as the mean power of the ideal signal (REF signal) at symbol decision points. The noise power is calculated as the mean power of the error signal, i.e. the difference of the measured signal and the corresponding ideal signal (MEAS-REF signal), at symbol decision points. For VSB, only the power of the real part is considered.</p> <p>The definition of the SNR has been changed with firmware version 4.20. In older versions the SNR was calculated in the same way as the EVM and did depend on the softkey "EVM CALC".</p> <p>The parameter "EVM calc" does always influence the calculation of EVM.</p>
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## Remote Control Commands

### :CALCulate<1|2>:MARKer<1 to 4>:X:CONVersion:ABSolute?

This command returns the absolute X marker position for AM & PM conversion measurement. The value is returned in dBm. This function is only available for marker 1.

**Example:** "CALC1:MARK1:X:CONV?" 'Returns the absolute horizontal marker position.

**Characteristics:** \*RST value: -  
SCPI: device-specific

**Operating mode:** VSA

### :FORMat:DEXPort:RAW:FORMat ASCII | WAVEform

This command defines the output format of the RAW data file export function. Format WAV can be read e.g. by signal generator R&S SMIQ or R&S SMU.

**Example:** :FORM:DEXP:MODE RAW 'select RAW data export  
:FORM:DEXP:RAW:FORM WAV 'select format waveform  
:MMEM:STOR:TRAC 1,'D:\rawdat.wv' 'start data export to file  
D:\rawdat.wv

**Characteristics:** \*RST value: ASCII  
SCPI: device-specific

**Operating mode:** VSA

### :[SENSe<1|2>:]DDEMod:FORMat QPSK | PSK | MSK | QAM | FSK | VSB | UQAM

This command selects the digital demodulation mode.

<b>Parameter:</b>	QPSK	Quad Phase Shift Key
	PSK	Phase Shift Key
	MSK	Minimum Shift Key
	QAM	Quadrature Amplitude Modulation
	FSK	Frequency Shift Key
	VSB	Vestigial Sideband
	UQAM	User QAM, only available with user mapping files

**Example:** "DDEM:FORM QPSK" 'Switch QPSK demodulation on.

**Characteristics:** \*RST value: Depends on the demodulation standard.  
SCPI: device-specific

**Operating mode:** VSA

**:[SENSe<1|2>:]DDEMod:UQAM:FORMat '<UQAM\_Mapping>'**

This command selects the specific demodulation mapping for UQAM .

**Parameter:** <UQAM\_Mapping> 'Mapping name

**Example:** "DDEM:FORM UQAM" 'Switch UQAM demodulation on.  
 "DDEM:MSK:FORM TYPE2" 'Switch DMSK demodulation on.

**Characteristics:** \*RST value: -  
 SCPI: device-specific

**Operating mode:** VSA

This command is only available for UQAM demodulation. Related mapping files have to be imported.

**:[SENSe<1|2>:]DDEMod:UQAM:NState?**

This command returns the specific modulation level for UQAM. .

**Parameter:** -

**Example:** "DDEM:FORM UQAM" 'Switch User QAM demodulation on.  
 "DDEM:UQAM:FORM 'special'" 'Selects user mapping 'special'.  
 "DDEM: UQAM:NState?" 'returns the modulation level.

**Characteristics:** \*RST value: -  
 SCPI: device-specific.

**Operating mode:** VSA

This command is only available for UQAM demodulation.

## Appendix: Contact to our hotline

Any questions or ideas concerning the instrument are welcome by our hotline:

### USA & Canada

Monday to Friday (except US public holidays)

8:00 AM – 8:00 PM Eastern Standard Time (EST)

Tel. from USA 888-test-rsa (888-837-8772) (opt 2)

From outside USA +1 410 910 7800 (opt 2)

Fax +1 410 910 7801

E-mail [Customer.Support@rsa.rohde-schwarz.com](mailto:Customer.Support@rsa.rohde-schwarz.com)

### East Asia

Monday to Friday (except Singaporean public holidays)

8:30 AM – 6:00 PM Singapore Time (SGT)

Tel. +65 6 513 0488

Fax + 65 6 846 1090

E-mail [Customersupport.asia@rohde-schwarz.com](mailto:Customersupport.asia@rohde-schwarz.com)

### Rest of the World

Monday to Friday (except German public holidays)

08:00 – 17:00 Central European Time (CET)

Tel. from Europe +49 (0) 180 512 42 42

From outside Europe +49 89 4129 13776

Fax +49 (0) 89 41 29 637 78

E-mail [CustomerSupport@rohde-schwarz.com](mailto:CustomerSupport@rohde-schwarz.com)