



**ROHDE & SCHWARZ**

Test and Measurement  
Division

## **Release Notes**

# **R&S FSQ-K70**

## **Vector Signal Analysis Application Firmware**

### **Release 4.40**

for R&S FSU, FSQ, FSG, FMU, FSUP  
Analyzer Firmware 4.4x

#### **New Features:**

- Export and Import of I/Q RAW data.

**Release Note Revision: 3**

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## History

Date	Rel Note Rev	Changes
August 18, 2008	1	First revision for Vector Analysis Application Firmware 4.40.
March 09, 2009	2	Description of remote command “:SENS:DDEM:UQAM:FORM” corrected and extended.
March 26, 2009	3	Example added, how to create a pattern.

## General Topics

### Hardware Requirements

The option R&S FSQ-K70 requires certain minimum board revisions of the Wideband Detector Board.

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 is required at least:

Model	Revision	Sub Revision	
3	4	$\geq 8$	for
3	$\geq 5$		R&S FSQ (with CPU-Board 1091.2520) <b>or</b>
5			R&S FSQ (with CPU-Board 1091.2520), R&S FSU (with CPU-Board 1091.2520) <b>or</b>
8			R&S FSU (with CPU-Board 1091.3104), R&S FSQ (with CPU-Board 1091.3104), R&S FSUP, R&S FSG, R&S FMU

## 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
4.40	4.41	4.45	-	-	-	4.49
4.30 SP1	4.31 SP1	4.35 SP1	-	-	4.38	4.39 SP2
4.30	4.31	4.35	-	-	-	4.39
4.20 SP2	4.21 SP1	4.25 SP1	-	4.27	-	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	-	-	-	-

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
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.**

## New Functions in Version 4.40

- Export and Import of I/Q RAW data.

## 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  $1.5 \cdot \text{Symbol Rate}$ .**
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.**

**15. (V4.30) Softkeys Signal Source Type (I+J\*Q, I Only, Q Only) are only available if baseband input is selected.**

**16. (V4.30) Multi Mode: Changing the Zoom Start window has no effect.**

The Capture Buffer Trace is not updated according to the new zoom window position, if the zoom start position is changed at the current zoom window is located at the end of the I/Q capture buffer.

**17. (V4.30) Statistics measurement: New function field indicates voltage/level interval**

The interval used for the statistics evaluation is indicated with a new function field at the left top corner of the grid replacing the reference level indication.

**18. (V4.30) New windows dialogs available for File Import/Export functions**

New dialog with browser functions are now available to export traces or configure the import / export path for Standards, Pattern, Filters, Equalizers..

**19. (V4.40) Export and Import of I/Q RAW data**

## Problems Eliminated with 4.40

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

**1. (V4.20) ADJUST REF LVL restores wrong measurement result if AM &PM Conversion is selected.**

Note: This problem is already fixed in V4.30 SP1.

**2. (V4.30) Remote command SYSTem:DISPlay:UPDate ON | OFF resets measurement results.**

Measurement results are marked as invalid, when the command SYST:DISP:UPD is sent after performing a single sweep. No result query is possible in that case.

Note: This problem is already fixed in V4.30 SP1.

**3. (V4.20) The application crashes if one of the TETRA standards is selected and the cursor wraps around in the generic standard list.**

**4. (V4.30) Command CALCulate1:MARK1:X? MIN returns a wrong value for result format Constellation.**

The actual result length is returned instead of Result Length – 1/Points\_per\_Symbol.

**5. (V4.30) Application crashes with summary marker on Screen B.**

**6. (V4.20) B25: No frequency range limitation with electronic attenuator switched on.**

For instruments with a maximum frequency > 8 GHz (e.g. FSU26, FSQ 26, FSQ40) the allowed frequency is limited to ≤ 3.6GHz if the electronic attenuator (R&S FSU-B25) is switched on. This limitation is not taken into account. This is now corrected.

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

None.

# 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:

- 1161.8073.42-09 (English)
- 1161.8073.41-09 (German)

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

## Last minute changes to the operating manual

### Menu MEAS RESULT - NEXT

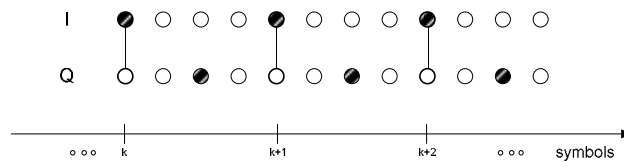


The “*OFFSET EVM ON/OFF*” softkey influences the calculation of the error vector magnitude trace for Offset-QPSK only. It has no effect for all other modulations. It has no effect on results based on the MEAS or the REF signal.

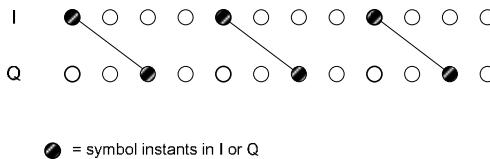
At which samples will the difference between MEAS and REF signal be measured:

- *OFFSET EVM ON*: The error vector magnitude is calculated at the symbol instants of the I-part and the symbol instants of the Q-part of the Offset-QPSK signal.  
In other words: The half symbol duration delay of the Q-part is compensated.  
In firmware versions prior to the introduction of this softkey, this was method was always used for Offset-QPSK.
- *OFFSET EVM OFF*: The error vector magnitude is calculated at the symbol instants of the I-part and the corresponding sample of the Q-part of the signal. But the latter is not a symbol instant.  
In other words: The Offset-QPSK signal is treated like a QPSK signal for the error vector magnitude calculation, the Q-delay is not compensated.

OFFSET EVM OFF



OFFSET EVM ON



Example how samples are selected depending on “OFFSET EVM ON/OFF” (shown for oversampling 4).

This softkey does not only influence the way how the difference between the MEAS and the REF signal is calculated (Numerator of the EVM formula). If the softkey “EVM CALC” is not set to “MAX SYMBOL”, but to “SIGNAL MEAN POWER”, the calculation of the normalization factor C (denominator of the EVM formula) is also switched to work in the same fashion. So the half symbol duration delay of the Q-part of the REF signal is either compensated or not.

This normalization factor C is not only used for EVM-based results, but also in the SNR (MER) calculation.

So in the case of Offset-QPSK this softkey “OFFSET EVM ON/OFF” has an effect on all these results:

- Error vector magnitude (EVM) trace
- All the numerical EVM results in the *Modulation Accuracy* table. Therefore the EVM in the table is either titled “EVM offset” or “EVM no offset”.
- The SNR (MER) in the *Modulation Accuracy* table, because of the changing normalization factor C.

Note: The EVM result in the Modulation Accuracy table is listed as “EVM Offset” and “EVM No Offset” respectively.

#### Remote command:

```
:SENS:DDEM_ECAL:OFFS ON | OFF
```

## Menu TRACE - NEXT

Export of all active traces is selected as follows:

### FILE EXPORT

All active traces are stored.

#### Remote command:

`M MEM:STOR:TRAC 1, 'D:\rawdat'` exports I/Q RAW data

### DATA RAW

The data type RAW DATA is selected. The formats ASCII, WAVEFORM and BINARY are supported.

- ASCII Exports the selected data (TRACE / RAW) in ASCII file format.
- WAVEFORM Files saved with format are loadable by R&S SMU signal generator R&S SMU signal generator.
- BINARY Exports the I/Q RAW data and the VSA user parameter settings in a binary format. The VSA settings are stored in <file\_name>.VAV, the RAW data are stored in <file\_name>.BIN. Files saved with this format are loadable by function FILE IMPORT.  
**Note:** The required disk space to store the I/Q RAW data depends on the specified RECORD LENGTH and might exceed the available disk space.

#### Remote command:

`FORMat:DEXPort:RAW:FORMat ASCii || BINary || WAVEform'`

### HEADER

A file header is created or not

### DECIM SEP

The decimal separator is selected.



Softkey "FILE IMPORT" imports I/Q RAW data previously stored with FILE EXPORT (DATA RAW, format binary).

This softkey is only available, if DATA RAW is selected with format BINARY.

The import of the I/Q RAW data requires the MULTI mode to be active. This mode is automatically switched on with start of the load process. For more details refer to HOME VSA → MEAS RESULT → CAPTURE BUFFER → ZOOM → MULTI.

The VSA base settings (<file\_name>.VAV) are loaded first. The I/Q RAW data <file\_name>.BIN are loaded in a second step.

#### Remote command:

`M MEM:LOAD:TRAC 1, 'D:\rawdat'`

## Trace-based Evaluations

Test parameter	Formula
Error Vector Magnitude = EVM	$EVM(t) = \frac{ EV(t) }{C}$ ; In case of Offset-QPSK please observe the influence of the softkey "Offset EVM ON/OFF" on nominator and denominator.

## 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>
---------------------------------------	---

Normalization constant C (not VSB)	$C = \sqrt{\frac{1}{K} \sum_K  REF(k) ^2} = \text{sqrt( mean power of the symbol decision instants)}$ <p>But if the softkey "EVM CALC" is set to "MAX SYMBOL POWER", the factor C is not calculated as given above, but set to the constant ideal value of the maximum symbol magnitude.</p> <p>In case of Offset-QPSK please observe the additional influence of the softkey "OFFSET EVM ON/OFF" on the determination of the symbol instants in the I- and Q-part of the REF signal.</p>
Normalization constant C (VSB only)	$C = \sqrt{\frac{1}{K} \sum_K  \text{Re}\{REF(k)\} ^2} = \text{sqrt( mean power of the symbol decision instants)}.$

	But if the softkey "EVM CALC" is set to "MAX SYMBOL POWER", the factor C is not calculated as given above, but set to the constant ideal value of the maximum symbol magnitude.
RMS_EVM (not VSB)	$RMS\_EVM = \sqrt{\frac{1}{K} \sum EVM(k)^2}$ <p>In case of Offset-QPSK please observe the influence of the softkey "Offset EVM" on the EVM trace.</p>
RMS_EVM (VSB only)	$RMS\_EVM = \sqrt{\frac{1}{K} \sum \operatorname{Re}\{EVM(k)\}^2}$
Origin_Offset (logarithmic measure for IQ_Offset)	$OriginOffset = 10 \log_{10} \left( \frac{ IQ\_Offset ^2}{C^2} \right)$ <p>Note: For the normalization of the "Origin Offset" the denominator C does not depend on the softkey "EVM CALC" and "OFFSET EVM". The calculation assumes that they are set to "MEAN SIGNAL POWER" respectively "OFFSET EVM OFF".</p>

## Remote Control Commands

### FORMat:DEXPort:RAW:FORMat ASCII | WAVeform | BINary

This command defines the output format of the RAW data file export function.

<b>Parameter:</b>	ASCII	ASCII file format
	WAVeform	Format WAV can be read e.g. by signal generator R&S SMU.
	BINary	Exports the I/Q RAW data and the VSA user parameter settings in a binary format. Files saved with this format are loadable by function MMEM:LOAD:TRAC. Note: The required harddisk space to store the I/Q RAW data depends on the RECORD LENGTH specified.
<b>Example:</b>	<pre>"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</pre>	
<b>Characteristics:</b>	*RST value:	ASCII
	SCPI:	device-specific

### MMEMory: LOAD:TRACe 1,<file\_name>

This command loads I/Q RAW data files. The file name includes indication of the path and the drive name. The path name complies with DOS conventions. This command is only available if RAW data with binary format is selected (":FORM:DEXP:MODE RAW", ":FORM:DEXP:RAW:FORM BIN"). The command needs two different files, created with the MMEM:STOR:TRAC command.

- <file\_name>.VAV VSA settings
- <file\_name>.bin I/Q RAW data

The import of the I/Q RAW data requires the MULTI mode to be active (refer to HOME VSA → MEAS RESULT → CAPTURE BUFFER → ZOOM → MULTI for more details). This mode is automatically switched on with start of the load process.

**Parameter:** <file\_name> ::= DOS file name

<b>Example:</b>	<pre>INST:SEL DDEM ... ...  :FORM:DEXP:MODE RAW :FORM:DEXP:RAW:FORM BIN :MMEM:STOR:TRAC 1, 'D:\vsa_raw'</pre>	<pre>' enter VSA option ' additional commands to ' configure the measurement ' and perform a measurement ' select RAW data to export ' select binary format ' exports I/Q RAW data into ' two files: ' vsa_raw.vav (VSA settings) ' vsa_raw.bin (I/Q RAW data)</pre>
	<pre>*RST INST:SEL DDEM :FORM:DEXP:MODE RAW :FORM:DEXP:RAW:FORM BIN :MMEM:LOAD:TRAC 1, 'D:\vsa_raw'</pre>	<pre>' ' enter VSA ' select RAW data to import ' select binary format ' import the I/Q RAW data files</pre>

' vsa\_raw.vav (VSA settings)  
' vsa\_raw.bin (I/Q RAW data)

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

This command is an event and therefore has no \*RST value and no query.

### MMEMory: STORE:TRACe 1,<file\_name>

This command stores I/Q RAW data files. The file name includes indication of path and drive name. The path name complies with DOS conventions. This command is only available if RAW data with binary format is selected ( ":FORM:DEXP:MODE RAW", ":FORM:DEXP:RAW:FORM BIN" ).

The import of the I/Q RAW data requires the MULTI mode to be active (refer to HOME VSA → MEAS RESULT → CAPTURE BUFFER → ZOOM → MULTI for more details). This mode is automatically switched on with start of the load process.

**Parameter:** <file\_name> ::= DOS file name

<b>Example:</b>	:INST:SEL DDEM ... ...  :FORM:DEXP:MODE RAW :FORM:DEXP:RAW:FORM BIN :MMEM:STOR:TRAC 1, 'D:\vsa_raw'	' ' enter VSA option ' additional commands to ' configure the measurement ' and perform a measurement ' select RAW data to export ' select binary format ' exports I/Q RAW data into ' two files: ' vsa_raw.vav (VSA settings) ' vsa_raw.bin (I/Q RAW data)  ' ' enter VSA ' select RAW data to import ' select binary format ' import the I/Q RAW data file
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**Characteristics:** \*RST value: -  
SCPI: device-specific

This command is an event and therefore has no \*RST value and no query.

### :[SENSe<1|2>:]DDEMod:ECALc:OFFSet ON | OFF

This command controls the calculation of the error vector magnitude trace for Offset-QPSK only. It has . It has no effect for all other modulations. It has no effect on results based on the MEAS or the REF signal.

**Parameter:** ON: The error vector magnitude is calculated at the symbol instants of the I-part and the symbol instants of the Q-part of the Offset-QPSK signal.  
In other words: The half symbol duration delay of the Q-part is compensated.  
In firmware versions prior to the introduction of this softkey, this was method was always used for Offset-QPSK.

OFF: The error vector magnitude is calculated at the symbol instants of the I-part and the corresponding sample of the Q-part of the signal. But the latter is not a symbol instant.

In other words: The Offset-QPSK signal is treated like a QPSK signal for the error vector magnitude calculation, the Q-delay is not compensated.

Refer to the manual operation section for additional details.

This command is only available for Offset-QPSK-Modulation.

**Example:** "DDEM:QPSK:FORM OFFS" 'select Offset-QPSK demodulation  
"DDEM:ECAL:OFFS OFF" 'set offset EVM calc to OFF

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

**:[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

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

This command selects the specific demodulation mode for User QAM.

The available User QAM demodulation modes are listed in the column USER-QAM of table MODULATION & MAPPING and depend on the contents of the available User QAM mapping files.

If several mappings are available for selected demodulation mode, it is additionally required to select the mapping to be used.

**Note:** ".SENS:DDEM:MAPP:CAT?" returns the available mappings for the currently selected demodulation mode.

This command is only available for User QAM demodulation.

**Parameter:** < UQAM\_demod\_mode > ' User QAM demodulation mode

**Example:** "DDEM:FORM UQAM" ' Switch User QAM demodulation  
' on.  
"DDEM:UQAM:FORM 'UQAM\_demod\_mode'" ' Select the UQAM  
' demodulation mode  
"DDEM:MAPP 'UQAM\_mapping\_file'" ' Select the User QAM mapping  
' if needed (see above)

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

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

This command returns the specific modulation level for User QAM.

This command is only available for User QAM demodulation.

**Parameter:** -

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

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

**Remote Control Commands - Programming Examples**

The examples below show command sequences to be sent to the instrument or query commands to read data from the instrument. // indicates a comment and gives additional hints to the command used.

**Perform a Measurement with OPC Synchronization**

```
*RST                                // reset instrument and enter VSA
INST:SEL DDEM                       // option
//
// Select a standard, change ConfigurePattern definition
//

:SENS:DDEMod:PRES FW3G              // select standard 3G_WCDMA_FWD
:INIT:CONT OFF                      // Set to Single Sweep
                                    // required for OPC Sync and
                                    // improves configuration speed

:SENS:FREQ:CENT 1GHz                // Center Frequency 1GHz
:DISP:WIND:TRAC:Y:SCAL:RLEV -30.0   // Reference Level -30 dBm
//
// additional/other commands to configure the measurement
// ...
// ...
// Perform the measurement

:INIT:IMM;*OPC?                     // returns 1 when the sweep is
                                    // finished

// no results can be read from the instrument, e.g. marker, modulation
// summary, a.s.o.
```

**Create a Search Pattern**

The following command sequence defines a pattern "MY\_PAT" for a modulation with 16 states with bit sequence "111100001111000011110000".

The pattern is added to the standard NONE pattern list to be selectable in the Burst&Pattern selection dialog.

In addition, the QAM16 modulation is configured and the new pattern is selected to be used for the pattern search function and the pattern search is switched on.

The command "SENS:DDEM:SEAR:SYNC:CAT? ALL" lists all available pattern. The command "SENS:DDEM:SEAR:SYNC:CAT?" lists all pattern compatible to the current settings.

How to define the symbol sequence:

The bits has to be arranged as symbols. This depend on the number of states of the modulation, e.g. QAM16 has 16 possible states = 4bits/symbol:

Symbol sequence for a modulation with 16 states of the bit sequence above is:

```
"1111" = 000F hex
"0000" = 0000 hex
"1111" = 000F hex
"0000" = 0000 hex
"1111" = 000F hex
"0000" = 0000 hex
```

The command "SENS:DDEM:SEAR:SYNC:DATA" always expected a 4 character hex value for every symbol.

```
*RST                                // reset instrument and enter VSA
INST:SEL DDEM                       // option
//
// Pattern definition
//
SENS:DDEM:SEAR:SYNC:NAME 'MY_PAT'   // Select pattern name MY_PAT
SENS:DDEM:SEAR:SYNC:DEL          // delete old pattern, if it
                                // exists
SENS:DDEM:SEAR:SYNC:DATA '000f0000000F0000000F0000' // always 4
                                // characters/symbol in HEX format
                                // 0000 ... 000F for QAM16 possible
SENS:DDEM:SEAR:SYNC:NST 16         // QAM16 has 16 states
SENS:DDEM:SEAR:SYNC:TEXT 'MY_PAT Selection' // This text will be visible
                                // after pressing SELECT PATTERN,
                                // dialog PATTERN SELECT (right
                                // column)
SENS:DDEM:SEAR:SYNC:COMM 'My Comment' // Additional comment
//
// The pattern is now created and has to be added to the standard
// the pattern will be used for (Standard NONE here).
//
//      Select QAM16 modulation (-> Standard NONE)
//
:SENS:DDEM:FORM QAM
:SENSe1:DDEMod:QAM:NState 16
```

```
//  
// This command queries all available patter, it is not required to  
// define the pattern  
SENS:DDEM:SEAR:SYNC:CAT? ALL           // returns all available pattern,  
                                         // just to see the new pattern  
                                         // exists now  
:SENSe1:DDEMod:SEARch:SYNC:PATtern:ADD 'MY_PAT' // add the pattern MY_PAT  
                                         // to standard NONE  
                                         // now the new pattern is visible on  
                                         // the pattern selection list for  
                                         // standard NONE  
  
:SENSe1:DDEMod:SEARch:SYNC:SEL 'MY_PAT' // select pattern MY_PAT for  
                                         // pattern search  
  
// switch pattern search ON  
:SENSe1:DDEMod:SEARch:SYNC:STATe ON    // activate the pattern search with  
                                         // previously selected pattern
```

## 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)