ROHDE&SCHWARZ

Test and Measurement
Division

Release Notes

3G FDD UE

Application Firmware R&S FS-K73

Release 4.40

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

New Features:

- Support for variable length of analysis (slot length 1280 / 2560 chips) according to 3GPP specification.

Release Note Revision: **1**

Printed in the Federal Republic of Germany

Contents

History

Date	Rel Note Rev	Changes
November 20, 2008	1	First revision for R&S FS-K73 version 4.40.

General Topics

Hardware Requirements

Please note that R&S FS-K73 requires option R&S FSP-B15 in order to run on an R&S FSP.
If the required hardware option is not installed the unit will not accept the license key for the corresponding application firmware.

Additionally please note that FRAME based analysis with R&S FS-K73 on an R&S FSP is only possible if R&S FSP-B70 is installed; otherwise only SLOT based analysis will be available on the R&S FSP.

Compatibility of the R&S FS-K73 3G FDD UE Application Firmware

The following table shows the compatible versions of the basic analyzer firmware and the 3G FDD UE Application Firmware:

Table of compatible versions:

R&S FS-K73 Application Firmware	R&S FSP Basic 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	4.40	4.41	4.45	-	-	-	4.49
4.30	4.30	4.31	4.35	-	4.37	4.38	4.39
4.20 SP1	4.20	4.21	4.25	-	4.27	-	4.29
4.20	4.20	4.21	4.25	-	-	-	4.29
4.17			-	-	4.17	-	-
4.10	4.10	4.11	4.15	-	-	-	-
4.01	-	-	-	-	-	4.08	-
4.00	4.00	4.01	4.05	-	-	-	-
3.90 SP1	3.90	3.91	3.95	3.96	3.99	-	-
3.90	3.90	3.91	3.95	3.96	-	-	-
3.80	3.80	3.81	3.85	3.86	-	-	-
3.70	3.70	3.71	3.75	-	-	-	-
3.60 SP1	3.60	3.61	3.65	3.66 SP1	-	-	-
3.60	3.60	3.61	3.65	-	-	-	-
3.50	3.50	3.51	3.55	-	-	-	-
3.40	3.40	3.41	3.45	-	-	-	-
3.35	-	-	3.35	-	-	-	-
3.30	3.30	3.31	-	-	-	-	-
3.28	3.20	3.21	3.25	-	-	-	-
3.24	3.10	3.11	3.15	-	-	-	-
3.20	3.00	-	3.05	-	-	-	-
2.80	2.80	2.81	-	-	-	-	-
2.60	2.60	2.61	-	-	-	-	-
2.40	2.40	2.41	2.45	-	-	-	-
2.35	-	-	2.35	-	-	-	-
2.30	2.30	2.31	-	-	-	-	-
2.28	2.20	2.21	2.25	-	-	-	-
2.24	2.10	2.11	2.15	-	-	-	-
1.21	-	-	2.05	-	-	-	-
1.20	1.80	1.81	1.85	-	-	-	-

Application firmware versions 3.xx/4.xx running on FSPs with order # 1164.4391.xx or FSU with order # 1166.1660.xx are adequate to version 2.xx for FSPs with order # 1093.4495.xx or FSU with order # 1129.9003.xx. (Version 3.20 is adequate to 1.20)

On the FSQ application firmware versions 3.xx requires the Windows-XP upgrade kit FSQ-U2, order # 1162.9696.02.

Note:

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

Firmware Update of the R&S FS-K73 3G FDD UE 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 instrument or delivered as a part of the R&S FS-K73 3G FDD UE 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 <u>and</u> the application firmware package is installed prior to entering the license key code.

New Functions in version 4.40

- **New key code for HSPA+ functionality**
  With firmware version 4.40 the HSPA+ functionality is supported in uplink 3GPP. All topics that are described in the following are available after installing a K73+ key.
- **New HSPA+ functionality**
  After having installed the K73+ key code, the following new or changed functions are available:

  - Support of modulation type 4PAM
  HSPA+ signals can contain channels with modulation type 4PAM. With the K73+ key, this modulation format will be detected properly and channels with 4PAM modulation will therefore be analyzed correctly within the graphics of K73.

  - Residual code domain error (RCDE)
  The measurement of RCDE can be done for all channels within the signal. The measurement result consists of one RCDE value per slot and is given in *RESULT SUMMARY*, see chapter “Modifications to the Operating Manual”.

  - Average Residual Code Domain Error (Average RCDE)
  3GPP specifies an average of the RCDE values of all channels with 4PAM modulation that belong to the signal. This measurement is done slot-wise as well as RCDE. The result is given in *RESULT SUMMARY*. The Average RCDE is only specified for signals that contain channels with 4PAM modulation. If the analyzed signal has no 4PAM channels, the entry of Average RCDE will be “-.—“.

  - Measurement of IQ origin offset together with all other relevant parameters of the signal
  For HSPA+, 3GPP specifies the measurement of IQ origin offset together with the measurement of all relevant parameters that describe the in-channel quality of the output signal of the Tx under test in a single measurement process. The IQ offset can be choosen to be eliminated by softkey *NORMALIZE ON | OFF*.
- **Power versus Slot for inactive channels**
  With firmware version 4.40 the display of Power versus Slot can also be drawn for inactive channels.

Modified Functions

The version numbers in brackets indicate the version in which the function was modified.

1. [V1.12] New result display type Power vs. Symbol

2. [V3.24/V2.24] Code Domain Error Power measurement is now available

3. [V3.24/V2.24] Improved Resolution of Trigger to Frame measurement

4. [V3.24/V2.24] Improved absolute accuracy of Trigger to Frame measurement

5. [V3.24/V2.24] Trace statistic available on result summary parameters (MIN Hold, MAX Hold, Averaging)

6. [V3.28/V2.28] Unit circle display in constellation diagrams

7. [V3.28] Option FS-K9 power sensor support for RF measurements

8. [V3.30/V2.30] Multi-Frame Measurement supported

9. [V3.30/V2.30] Read out of spectrum emission mask worst fail position

10. [V3.35/V2.35] Detecting of incorrect pilot symbols of the DPCCH

11. [V3.40/V2.40] Detection of HS-DPCCH in HSDPA signal (TM5)

12. [V3.40/V2.40] Remote readout of frame bit-stream available

13. [V3.50/V2.60] Full Support of Uplink HSDPA signals (TM5)

14. [V3.50/V2.60] Eliminate 25us of each slot for EVM calculation:
According to 3GPP specification Release 5 the measurement interval for error vector magnitude (EVM) is one slot (4096 chips) less 25 µs at each end of the burst (3904 chips). This requirement depends on the expected power changes of the channel. The consideration of eliminating the tail of a slot can be switched ON or OFF.

15. [V3.50/V2.60] Absolute and relative slot power display for Power vs Slot

16. [V3.50/V2.60] Disable/Enable root raised cosine (RRC) receiver filter

17. [V3.50/V2.60] Extended trigger range:

In external trigger mode, the trigger event is expected in a time range of a half slot (333us) before and a half slot (-333us) after the start of the frame

18. [V3.60/V2.60] Display of frequency error versus slot, phase discontinuity versus slot, symbol magnitude error, symbol phase error

22. [V3.60/V2.60] Result Summary: added value RHO and timing offset

23. [V3.60/V2.60] Scrambling code input in hexadecimal and in decimal format

24**. [V3.60/V2.60] HSDPA mode channel detection can be switched ON or OFF**

25. [V3.60/V2.60] SEM: Adjustable transition frequency (30 kHz/1 MHz RBW)

26. [V3.60/V2.60] External trigger level adjustable from 0.5 to 3.5

27. [V3.60/V2.60] Carrier frequency step size softkey available

28. [V3.70] Remote command to read out total power versus slot

29. [V3.70] ACP/MCACP: number of adjacent channels increased to 12

30. [V3.70] ACP/MCACP: power mode to max hold the power results

31. [V3.80/V2.80] Support of enhanced channels (HSUPA)

32. [V3.80/V2.80] Trace view available within code domain analyzer

33. [V4.00] Vector error of Error Vector Magnitude (EVM) versus chip, Magnitude error of Error Vector Magnitude (EVM) versus chip, Phase error of Error Vector Magnitude (EVM) versus chip, Composite constellation diagram of scrambled chip buffer available

33. [V4.00] Spectrum emission mask: List evaluation in lower screen now supported

34. [V4.00SP1] Error Vector Magnitude (EVM) versus chip for composite signal
In the vector error, magnitude error and phase error display the averaging interval for RMS values is shown.

35. [V4.00SP1] Automatic determination of measurement interval for EVM (RMS) versus slot measurement according to 3GPP specification 34.121.

36. [V4.10] New remote command CALC:MARK:FUNC:WCDP:RES? MTYPe | ACHannels

37. [V4.20] Support for instrument R&S FSG.

38. [V4.20] Soft key REF VALUE Y AXIS available for CDP measurements.

39. [V4.30] Support for variable length of analysis (variable time slot length 1280 / 2560 chips) according to 3GPP specification.

A new Half Slot mode is available for all graphical displays.

Hint: The command SENSe:CDPower:ETCHips ON | OFF is no longer supported.

40. [V4.30] New remote command CALC:MARK:FUNC:WCDP:RES? MPIC returns the average power of the inactive codes for the selected slot.

41. [V4.40] Result Summary: added value RCDE and Avarage RCDE

42. [V4.40] New remote command CALC:MARK:FUNC:WCDP:RES? MTYPe | ACHannels RCD | ARCD

43. [V4.40] Support for HSPA+ with new key code K73+

Problems Eliminated with 4.40

1. [V4.30] Short scrambling code synchronisation.

The synchronisation algorithms for short scrambling code signals have been largely improved. Signals that use short scrambling code can now be analyzed in a better way.

2. [V4.30] Power versus Slot in case of relative display.

Up to version 4.30 the R&S FS-K73 used for relative display of Power versus Slot always the total power of the slot currently being analyzed. For this leads to incorrect behaviour in case of signals with changing total power the reference value has been changed to the total power of each individual slot. That means that the power of one slot of the channel currently analyzed will now be referenced to the total power of the same slot.

Modifications to the Operating Manual

The R&S FS-K73 3G FDD UE analyzer functions are included in a separate manual set. Please refer to the following order numbers:

- 1154.7275.42-04 (English)
- 1154.7275.44-04 (German)

Modified Chapters for manual operation

The *RESULT SUMMARY* softkey selects the numerical display of all results. The display is subdivided as follows:

Result Summary
SR 960 ksps
Chan 2 / Q
CF 1.935 GHz Slot # 4 Meas Int Slot

GLOBAL RESULTS FOR FRAME 0:		Carrier Freq Error	-58.45 Hz
Total Power	-0.06 dBm	Trigger to Frame	640.021536 µs
Chip Rate Error	0.06 ppm	Avg Pow Ina Chan	-71.78 dB
IQ Offset / Imb	1.03 / 0.13 %	Pk CDE (15 ksps)	-53.21 dB
Composite EVM	2.67 %	Avg RCDE (4PAM)	-.-- dB
Rho	0.99930	No of Active Chan	7
CHANNEL RESULTS		RCDE	-48.24 dB
Symbol Rate	960.00 ksps	Timing Offset	0 Chips
Channel Code	2	Channel Mapping	Q
No of Pilot Bits	0	Modulation Type	BPSK Q
Channel Power Rel	-8.44 dB	Channel Power Abs	-8.50 dBm
Symbol EVM	2.39 % rms	Symbol EVM	6.34 % Pk

Ref 0.00 dBm
Att* 5 dB
1 CLRWR
B
3DB

Fig. 1 Display of Result Summary

The upper part contains the results relating to the total signal:

Carrier Freq Error:

Outputs the frequency error referred to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error.

Differences of more than 1 kHz between transmitter and receiver

frequency impair the synchronization of the CDP measurement. For this reason, the transmitter and receiver should be synchronized (see chapter Getting Started).

Total Power: Outputs the total signal power (average power of total evaluated 3GPP FDD frame).

Trigger to Frame:

This result outputs the timing offset from the beginning of the recorded signal section to the start of the analyzed 3GPP FDD frame. In the case of triggered data collection, this timing offset is identical with the timing offset of frame trigger (+ trigger offset) – frame start. In the case of failure of the synchronization of analyzer and 3GPP FDD signal, the value of Trigger to Frame is not significant.

Chip Rate Error:

Outputs the chip rate error in ppm

As a result of a high chip rate error symbol errors arise and the CDP measurement is possibly not synchronized to the 3GPP FDD signal. The result is valid even if the synchronization of analyzer and signal failed.

Av Pow Ina Chan: The power in the code domain of all inactive channels is averaged to give the user an overview on the difference between active and inactive channels.

IQ Offs / Imb: DC offset and IQ imbalance of the signal in % (see "**Fehler! Verweisquelle konnte nicht gefunden werden.**"). If K73+ key is installed, the IQ offset is measured together with all other relevant parameters that describe the in-channel quality of the signal in a single measurement process. If K73+ key is not installed IQ offset is measured together with IQ imbalance after the in-channel measurement has been done.

Pk CDE: The *Pk CDE* measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor (see *PEAK CODE DOMAIN ERR* softkey). The Pk CDE value for the selected slot is indicated in the *RESULT SUMMARY*. The spreading factor onto which projection is made is shown beneath the measurement result.

Composite EVM: The composite EVM is the difference between the test signal and the ideal reference signal (see *COMPOSITE EVM* softkey). The composite EVM value for the selected slot is given in the *RESULT SUMMARY*.

Avg RCDE: Average of residual code domain errors of all channels that use 4PAM modulation. The entry is valid only if K73+ key is installed, otherwise "-.—" is used. If the signal does not contain channels with 4PAM modulation, "-.—" is used too.

Rho: Quality paramter rho for every slot.

No of Active Chan:

Indicates the number of active channels detected in the signal. Both the detected data channels and the control channels are considered active channels.

The results of measurements on the selected channel (red in the CDP diagram) are displayed in the lower part of the *RESULT SUMMARY*.

RCDE: Residual code domain error of the channel according to 3GPP.

Symbol Rate: Symbol rate at which the channel is transmitted.

Timing Offset: Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD frame.

Channel Code: Number of the spreading code of the selected channel.

Chan Mapping: Component onto which the channel is mapped (I or Q)

No of Pilot Bits: Indicates the number of pilot bits detected in the control channel.

Modulation Type: Indicates the modulation type of the selected channel. Valid entries are BPSK I for channels on branch I, BPSK Q for channels on branch Q and NONE for inactive channels. If FS-K73+ key is installed, additional valid entries are 4PAM_I and 4PAM_Q for channels that use 4PAM modulation.

Chan Pow rel. / abs.:

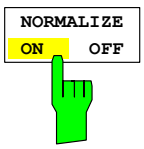
Channel relative (referred to the total power of the signal) and absolute.

Symbol EVM Pk / rms:

Peak or average of the results of the error vector magnitude measurement (see SYMBOL EVM softkey). The measurement provides information on the EVM of the channel (marked red) in the CDP diagram in the slot (marked red) of the power-versus-slot diagram at symbol level.

IEC/IEEE bus command:

```
:CALC2:FEED "XTIM:CDP:ERR:SUMM"
:CALC1:MARK1:FUNC:WCDP:RES?
                          PTOT | FERR | TFR | TOFF | MACC |
                          PCD | EVMR | EVMP | CERR |
                          SRAT | CHAN | CDP | CDPR |
                          IQOF | IQIM | PSYM | RHO | TOFF|
                          MTYP | ACH | MPIC | RCD | ARCD
```



The NORMALIZE ON / OFF softkey eliminates the DC offset of the signal (see entry “IQ offset” of RESULT SUMMARY) display. In case K73+ key is installed on the analyzer, the DC offset is measured together with all other relevant parameters that describe the in-channel quality of the signal in a single measurement process. If the key is not installed, the DC offset is measured together with IQ imbalance beside the in-channel measurement.

IEC/IEEE bus commandSENS:CDP:NORM OFF

Modified Chapters for remote operation

CALCulate:MARKer – Subsystem

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2> :MARKer<1...4> :FUNCtion :WCDPower		1.	
:MS :RESult?	PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance | CMAPping | PSYMbol | RHO | TOFFset | MTYPe | ACHannels| MPIC | RCDerror | ARCDerror		Query only
:POWer		2.	
:RESult?	ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0		
:PHZ	ON|OFF		

:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:MS:RESult?
PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance | CMAPping | PSYMbol | RHO | TOFFset | MPIC | MTYPe | ACHannels | RCDerror | ARCDerror

This command queries the measured and calculated results of the 3GPP FDD code domain power measurement.

PTOTal	total power
FERRor	frequency error in Hz
TFRame	trigger to frame
MACCuracy	composite EVM
PCDerror	peak code domain error
EVMRms	error vector magnitude RMS
EVMPeak	error vector magnitude peak
CERRor	chip rate error
SRATe	symbol rate
CHANnel	channel number
CDPabsolute	channel power absolute
CDPRelative	channel power relative
IQOFfset	IQ offset
IQIMbalance	IQ imbalance
CMAPping	Channel component

PSYMbol	Number of pilot bits
RHO	Quality parameter RHO for every slot
TOFFset	Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD frame.
MPIC	average power of the inactive codes for the selected slot
MTYPe	modulation type of the selected channel
ACHannels	number of active channels
RCDerror	residual code domain error for selected channel
ARCDerror	average of residual code domain errors of channels that use 4PAM modulation

Example: `":CALC:MARK:FUNC:WCDP:RES? PTOT"`

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

TRACe Subsystem

:TRACe[:DATA] TRACE1 | TRACE2 | ABITstream | CTABle | CWCDp | TPVSlot | LIST | CEVM

This command transfers trace data from the controller to the instrument, the query reads trace data out of the instrument.

ABITstream can be set only if `CALC2:FEED "XTIM:CDP:BSTReam"` is selected (in the lower bitstream window). This command returns the bit streams of all 15 slots one after the other, the output format may be REAL, UINT or ASCII. The results of ABITstream are valid only if the analysis of one complete frame is selected. In slot mode the query always yields characters '9' to mark bits that are invalid.

The output format is equal to that of the ":TRACe1:DATa? TRACE2" command in case of an activated bitstream display. The only difference is the number of symbols which are evaluated. The ABITstream command evaluates all symbols of one frame. One value is transferred per bit (range 0,1,). Each symbol contains of one bit in case of BPSK modulation or two consecutive bits in case of 4PAM modulation. If the modulation type of the channel the bits are given for changes within the frame, always two consecutive bits are transferred for each symbol to provide an equal length of the string. At symbols with only one bit per symbol the second (unused) bit is marked with '9'.. The number of symbols is not constant and may vary depending on the spreading factor of the selected channel. The bit stream may contain invalid bits(symbols without power). In this case the character '9' is transferred.

Unit:	[]
Range:	{0, 1, 7, 9}
Bits per symbol:	$N_{BitPerSymb}$ = 2
Number of symbols:	N_{Symb} = $150*2^{(8-Code\ Class)}$
Number of bits:	N_{Bit} = N_{Symb} * $N_{BitPerSymb}$
Format:	Bit_{00},Bit_{01},Bit_{10},Bit_{11},Bit_{20},Bit_{21},.... , $Bit_{NSymb\ 0}$,$Bit_{NSymb\ 1}$
Explanation:	0 – Low state of a transmitted bit 1 – High state of a transmitted bit 7 – Suppressed symbol of a HS-DPCCH slot 9 – Bit of an inactive channel

CTABle reads out the channel table: Seven values are transmitted for each channel, the sixth value (reserved for pilot length) being constantly 0:
< class>,<cannel number>,<absolute level>,<relative level>, <I/Q component>,0,<state>...

CWCDp can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length, channel state, channel type, modulation type and a reserved value are transmitted in addition to the values transmitted for trace 1. For each channel, 11 values are transmitted

<code class>, <channel number>, <IQ component>, <absolute level>, <relative level>, <timing offset>, <pilot length>, <active flag>, <channel type>, <modulation type>, <reserved>...

No.	Parameter	Range	Unit	Explanation
1)	<code class>	{2 to 8}	[1]	Code class of the channel.
2)	<channel number>	{0 to 255}	[1]	Code number of the channel.
3)	<IQ component>	{0, 1}	[1]	IQ component of the channel.
		0 - Q component	Channel symbols (S_n) sent from **q**uadrate component; only imaginary part of S_n is used. [Re {S_n} = 0 Im {S_n} ≠ 0]	
		1 - I component	Channel symbols (S_n) sent from **I**n phase component; only real part of S_n is used. [Re {S_n} ≠ 0 Im {S_n} = 0]	
4)	<absolute level>	{-∞ to ∞}	[dBm]	Absolute level of the code channel at the selected channel slot. (The channel slot can be marked by the SELECTED CPICH slot.)
5)	< relative level >	{-∞to ∞}	[dB]	Relative level of the code channel at the selected channel slot referenced to CPICH or total power. (The channel slot can be marked by the SELECTED CPICH slot.)
6)	<timing offset>	{0 to 2560}	[chips]	Timing offset of the HS-DPCCH to the frame start. The value is measured in chips. The step width is 256 chips. For all other data channels, the timing offset is zero.
7)	<pilot length>	{0 to 8}	[symbols]	Pilot length of the DPCCH.
8)	<active flag>	{0,1}	[1]	Flag to indicate whether a channel is active 0 - channel not active 1 - channel active
9)	<channel type>	{0 ... 2}	[1]	Channel type indication
		0 – DPDCH	**D**edicated **P**hysical **D**ata **Ch**annel	
		1 – DPCCH	**D**edicated **P**hysical **C**ontrol **Ch**annel	
		2 – HS-DPCCH	**H**igh-**S**peed **D**edicated **P**hysical **C**ontrol **Ch**annel	
		3 – E-DPCCH	**E**nhanced **D**edicated **P**hysical **C**ontrol **Ch**annel	
		4 - E-DPDCH	**E**nhanced **D**edicated **P**hysical **D**ata **Ch**annel	
10)	<modulation type>	{2}	[1]	Modulation type of the code channel
11)	<reserved>	{0}	[1]	Reserved for future functionality.

For TRACE1 or TRACE2 the following measured values are transferred depending on the display mode:

CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE (TRACE1)

Each channel is defined by the class, the channel number, the absolute level, the relative level and the timing offset. The class denotes the spreading factor of the channel.

Class 8 corresponds to the highest spreading factor (256, symbol rate 15 ksps), class 2 to the lowest admissible spreading factor (4, symbol rate 960 ksps).

Five values are transmitted for each channel.

<class>,<cannel number>,<absolute level>,<relative level>,<I/Q component>, ...

For CODE PWR ABSOLUTE / RELATIVE, the channels are output in ascending order sorted according to the code numbers, i.e. in the same sequence as they are displayed on the screen. For CHANNEL TABLE, the channels are sorted according to the code classes, i.e. the unassigned channels are transmitted last.

The units are:

Absolute level dBm,
Relative level dB referred to the total power of the signal.

The example shows the results of a query for three channels with the following configuration:
1st channel: spreading factor 256, channel number 0, component Q
2nd channel: spreading factor 4, channel number 1, component I
3rd channel: spreading factor 4, channel number 1, component Q

This yields the following result: 8,0,-20.0,0.0,0,2,-20.0,0.0,1,2,1,-20.0,0.0,0

The channels come in the same order as in the CDP diagram, i.e. depending on their position in the code domain of spreading factor 256.

CODE DOMAIN ERROR POWER (TRACE1 [Overview OFF] TRACE1 / TRACE2 [Overview ON])

Output: Five values are transmitted for each code class 8 channel. The channels are sorted according to the code numbers

Format: <code class>$_1$, <code number>$_1$, <CDEP>$_1$, <channel flag>$_1$, <code class>$_2$, <code number>$_2$, <CDEP>$_2$, <channel flag>$_2$, …
<code class>$_{256}$, <code number>$_{256}$, <CDEP>$_{256}$, <channel flag>$_{256}$

Unit: < [1] >, < [1] >, < [dB] >,< [1] >

Range: < 8 > , < 0...256 >, < -∞ ... ∞ >, < 0 ; 1 >

Quantity**:** 256

Explanation:

code class: [1] Highest code class of an uplink signal. It is always set to 8 (CC8).

code number: [1] Code number of the evaluated CC8 channel.

CDEP: [dB] Code domain error power value of the CC8 channel.

channel flag: [1] Indicates if the CC8 channel belongs to an assigned code channel:
Range: 0b00 0d0 - CC8 is inactive
0b01 0d1 - CC8 channel belongs to an active code channel

RESULT SUMMARY (TRACE2)

The results of the RESULT SUMMARY are output in the following order:
<composite EVM>,<peak CDE>,<carr freq error>,<chip rate error>,
<total power>,<trg to frame>,<EVM peak channel>,<EVM mean channel>, <class>, <channel number>,<power abs. channel>,<power rel. channel>,<I/Q component>,
<pilot length>,<IQ offset>,<IQ imbalance>

The units are:
EVM peak channel/mean channel, composite EVM, IQ offset/imbalance : %,
peak CDE, total power and power abs. channel: dB,
power rel. channel: dB referred to the total power of the signal,
carr freq error: Hz,
chip rate error: ppm,
trg to frame: µs,
pilot length: bits,
I/Q component: absolute.

POWER VS SLOT (TPVSlot)

15 pairs of CPICH slot numbers and level values are always transferred. The query is only possible in frame mode and not in slot mode. But it is possible no matter which evaluation screen is selected in the code domain analyzer.
<slot number>, <level value in dBm>,<slot number>,<level value in dBm>,.....

POWER VS SLOT (TRACE2)

15 pairs of slot (slot number of CPICH) and level values (for 15 slots) are always transferred.
<slot number>, <level value in dB>,<slot number>,<level value in dB>,.....

SYMBOL EVM (TRACE2)

The number of level values depends on the spreading factor:

Spreading factor 256	10 values	Spreading factor 128	20 values
Spreading factor 64	40 values	Spreading factor 32	80 values
Spreading factor 16	160 values	Spreading factor 8	320 values
Spreading factor 4	640 values		

PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2)

15 pairs of slot (slot number of CPICH) and values are always transferred.
PEAK CODE DOMAIN ERR: <slot number>, <level value in dB>,.....
COMPOSITE EVM: <slot number>, <value in %>, ...

SYMBOL CONST(TRACE2)

The real and the imaginary part are transferred as a pair:
<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

For the channels have exclusively I or Q components in R&S FS-K73, the <re> or <im> values are 0, depending on the selected component.

The number of level values depends on the spreading factor:

Spreading factor 256	10 values	Spreading factor 128	20 values
Spreading factor 64	40 values	Spreading factor 32	80 values
Spreading factor 16	160 values	Spreading factor 8	320 values
Spreading factor 4	640 values		

BITSTREAM (TRACE2)

The bitstream of one slot is transferred. One value is transferred per bit (range 0,1,). The number of symbols is not constant and may vary for each sweep. Specific symbols in the bitstream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by "9".

EVM VS CHIP (TRACe2)

The square root of square difference between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:.

Output:	List of vector error values of all chips at the selected slot
Format:	$VectError_0$, $VectError_1$, ..., $VectError_{2559}$
Unit:	[%]
Quantity:	2560

MAGNITUDE ERROR VS CHIP (TRACe2)

The magnitude difference between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

Output:	List of magnitude error values of all chips at the selected slot
Format:	$MagError_0$, $MagError_1$, ..., $MagError_{2559}$
Unit:	[%]
Quantity:	2560

PHASE ERROR VS CHIP (TRACe2)

The phase differences between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

Output:	List of magnitude error values of all chips at the selected slot
Format:	$PhaseError_0$, $PhaseError_1$, ..., $PhaseError_{2559}$
Unit:	[°]
Quantity:	2560

Example:
```
":TRAC TRACE1,"+A$    (A$: data list in current format)
":TRAC? TRACE1"
```

Features: *RST value: -
SCPI: conforming

LIST With this command the list evaluation results are queried in the following order:

<no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2>

All results are float values.

no	: range number
start	: start frequency
stop	: stop frequency
rbw	: resolution bandwidth of range
freq	: frequency of peak
power abs	: absolut power in dBm of peak
power rel	: relative power in dBc (related to the channel power) of peak
delta	: distance to the limit line in dB (positive indicates value above the limit, fail)
limit check	: limit fail (pass = 0, fail =1)
unused1	: reserved (0.0)
unused2	: reserved (0.0)

READ OUT RESULTS OF PEAK LIST EVALUATION

This command reads the peak list of the spectrum emission mask measurement list evaluation (refer to CALC:PEAK:AUTO ON | OFF). An array of values is returned for each range of the limit line. The arrays for each limit line range are following sequentially.

<value array of range 1>, <value array of range 2>, ..., <value array of range n>

The array of each range contains the following value list:

<No>, <Start>, <Stop>, <Rbw>, <Freq>, <Levelabs>, <Levelrel>, <Delta>, <Limitcheck>, <unused1>, <unused2>

where:

No	[]	: number of the limit line range
Start	[Hz]	: start frequency of the limit line range
Stop	[Hz]	: stop frequency of the limit line range
Rbw	[Hz]	: resolution band width of the limit line range
Freq	[Hz]	: frequency of the power peak with in the range
Levelabs	[dBm]	: absolute power of the peak with in the range
Levelrel	[dB]	: relative power of the peak with in the range related to channel power.
Delta	[dB]	: power difference to margin power
Limitcheck	[0 | 1]	: decision whether the power is below [0] or above [1] the limit line
Unused1	[]	: reserved (0.0)
Unused2	[]	: reserved (0.0)

Example: `"TRAC:DATA? LIST"` Reads the value list of automatic peaks search

CEVM This command reads the root mean square (RMS) value of the error vector magnitude (EVM_{rms}). The measurement interval of the RMS value depends on analyzer settings and the channel configuration of the applied signal (refer to ":[SENSe:]CDPower:EINTerval" and ":[SENSe:]CDPower:ETCHips"). The information of the chip limits of the used measurement interval are given for each slot.
Fifteen (15) groups of 6 values are always transferred.

Example: `:TRAC:DATA? CEVM`

Result: 15 groups with 6 values per group are returned:

<slot$_0$>,<EVM$_0$>, <BeginMeas$_0$>,<EndMeas$_0$>,<Reserved_A$_0$>,<Reserved_B$_0$>
<slot$_1$>,<EVM$_1$>, <BeginMeas$_1$>,<EndMeas$_1$>,<Reserved_A$_1$>,<Reserved_B$_1$>
| | | | | |
<slot$_{14}$>,<EVM$_{14}$>, <BeginMeas$_{14}$>,<EndMeas$_{14}$>,<Reserved_A$_{14}$>,<Reserved_B$_{14}$>

where:	<field>	[unitf]	{range}	-	explanation
	<slot$_n$>	[1]	{0 to 14}	-	slot nummer
	<EVM$_n$>	[%]	{0 to 100}	-	RMS value of error vector magnitude
	<BeginMeas$_n$>	[chip]	{0 to 1278}	-	Begin of the measurement interval for EVM_{rms} value
	<EndMeas$_n$>	[chip]	{0 to 2559}	-	End of the measurement interval for EVM_{rms} value
	< Reserved_A$_n$>	[]	{0}	-	Reserved for possible additional information in future FW versions
	< Reserved_B$_n$>	[]	{0}	-	Reserved for possible additional information in future FW versions

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

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

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