R&S®FS-K72/-K73/-K73+/-K74/-K74+
WCDMA 3GPP
Application Firmware

Years of
Driving
Innovation

ROHDE & SCHWARZ

R&S®FS-K72/-K73/ -K73+/-K74/-K74+
At a glance

The application firmware adds measurement functions in line with the 3GPP specifications for the FDD mode to the Rohde & Schwarz signal and spectrum analyzers.

The R&S®FS-K72/R&S®FS-K73 application firmware can be installed on all models of the R&S®FSQ, R&S®FSU, R&S®FSG, R&S®FSUP, R&S®FSMR, R&S®FMU and R&S®FSP signal and spectrum analyzers, enhancing the range of applications to include code domain power and modulation measurements on 3GPP FDD signals.

R&S®FS-K74 integrates into R&S®FS-K72 and extends the modulation measurement capabilities to HSDPA and HSUPA signals in the downlink. HSDPA and HSUPA signals in the uplink are covered by R&S®FS-K73.

R&S®FS-K74+ allows extended measurements in line with 3GPP Release 7, i.e. relative code domain error with 64QAM modulation.

R&S®FS-K73+ adds the capabilities to measure HSPA+ signals in the uplink. The 4PAM modulation format is automatically detected and the residual code domain error calculated in line with the standard.

Featuring wide dynamic range for adjacent channel power, the R&S®FSG, R&S®FSU and R&S®FSQ are ideal tools for WCDMA base station transmitter measurements in development and production.

The R&S®FSP is the ideal development tool with easy-to-use measurement functions integrated into a cost-effective analyzer, especially in mobile radio development.

R&S®FS-K72/-K73/-K73+/-K74/-K74+ Benefits and key features

R&S®FS-K72

The R&S®FS-K72 application firmware provides the functionality needed for base station testing.

R&S®FS-K73/R&S®FS-K74

The R&S®FS-K73/R&S®FS-K74 application firmware extends the capabilities of R&S®FS-K72 to encompass HSPA (high speed packet access) for base station testing (R&S®FS-K74) and user equipment testing (R&S®FS-K73).

R&S®FS-K73+

The R&S®FS-K73+ application firmware adds HSPA+ capabilities to the R&S®FS-K73.

R&S®FS-K74+

The R&S®FS-K74+ application firmware provides additional functionality for HSPA+ testing in line with 3GPP Release 7:
❙ 64QAM
❙ Relative code domain error

Code domain power measurements

Code domain power measurements are the main task of the application firmware.
❙ Measurement of modulation quality: EVM, peak code domain error and relative code domain error
❙ Automatic detection of active channels and their data rate
❙ Scrambling code search
❙ Automatic detection of modulation formats in HSDPA and HSPA+
❙ Spectrum emission mask
❙ Spectrum measurements over wide dynamic range
❙ Remote control
❙ Other standards
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Code domain power measurements

The main application of R&S®K72/-K73/-K73+/-K74/-K74+ is the determination of the power in the individual code channels referred to as code domain power measurement. The power ratios between the individual channels, for instance, can be checked for compliance with the nominal values. Moreover, this measurement is a very efficient tool for detecting impairments such as clipping or intermodulation that are not obvious from the spectrum alone. The power of the different codes is shown versus the code number.

To investigate power control, the power characteristic in a code channel can be displayed versus all slots of a frame (10 ms).

The R&S®FSU and R&S®FSP can capture and analyze up to three frames (30 ms) of consecutive data. The R&S®FSQ can handle up to 100 frames (1 s). By using the R&S®FSQ-B100 and R&S®FSQ-B102 options the capture length can be extended to up to 3000 frames.

The R&S®FSP requires the R&S®FSP-B70 option to perform measurements over more than one slot in the code domain.

Measurement of modulation quality: EVM, peak code domain error and relative code domain error
Three different measurements are stipulated in the 3GPP specifications for determining the modulation quality:
▪ EVM (error vector magnitude)
▪ Peak code domain error
▪ Relative code domain error

The code domain power measurement offers an in-depth analysis for a WCDMA signal with several active channels. The composite EVM measurement returns a modulation error value for the total signal, whereas the symbol EVM function yields the individual vector errors of the active channels.

To obtain the peak code domain error (PCDE), the vector error between the measured signal and the ideal reference signal is determined and projected to the codes of a specific spreading factor. With R&S®FS-K72, the spreading factor for the PCDE measurement can be selected by the user.

R&S®FS-K73+ and R&S®FS-K74+ provide relative code domain error (RCDE) measurements, i.e. they determine the ratio of the mean power of the error vector projection onto a selectable code to the code's mean power in the composite reference waveform.

Scrambling code search
R&S®FS-K72 has a built-in function to find and list the scrambling codes used.

Measurement	Base station	Base station with R&S®FS-K72 application firmware	User equipment with R&S®FS-K73 application firmware
	R&S®FSQ/R&S®FSU/R&S®FSP/ R&S®FSUP/R&S®FSMR/R&S®FSG	R&S®FSQ/R&S®FSU/R&S®FSG/ R&S®FSUP/R&S®FSMR/R&S®FSP	R&S®FSQ/R&S®FSU/R&S®FSG/ R&S®FSUP/R&S®FSMR/R&S®FSP
Maximum output power	✔	–	–
CPICH power accuracy	–	✔	N/A
Frequency error	–	✔	✔ [1]
Power control dynamic range	–	✔	–
Total power dynamic range	–	✔	N/A
Occupied bandwidth	✔	–	–
Spectrum emission mask	✔	✔	✔
ACLR	✔	–	–
Spurious emissions	✔	–	–
Error vector magnitude	–	✔ [2]	✔
Peak code domain error	–	✔	✔
Residual code domain error	–	✔ [3]	✔ [4]

[1] Frequency relative to frequency received from base station.
[2] R&S®FS-K74 is required for HSDPA capable base stations.
[3] Requires R&S®FS-K74+.
[4] Requires R&S®FS-K73+.

Automatic detection of active channels and their data rate

The scrambling code, which is user-selectable in the application firmware, must be known for the code domain power measurement. 3GPP FDD signals may use different spreading factors and data rates in the various channels. The data rates are automatically detected by the firmware packages and need not be known beforehand.

Automatic detection of modulation formats in HSDPA and HSPA+

R&S®FS-K74 and R&S®FS-K74+ extend the capabilities by automatically demodulating QPSK, 16QAM and 64QAM codes, which are subsequently included into the code domain analysis.

The R&S®FS-K73+ automatically finds the codes with BPSK or 4PAM modulation.

Spectrum emission mask

To perform the spectrum emission mask measurement in line with the 3GPP specifications, R&S®FS-K72/-K73 provide an automatic function that gives a pass/fail result.

Spectrum measurements over wide dynamic range

The RMS detector integrated as standard allows precise transmitter power measurements irrespective of the waveform.

Owing to their extremely wide dynamic range, the R&S®FSU and the R&S®FSQ are the ideal analyzers for out-of-band emissions that have to be detected for instance by means of adjacent-channel power measurements. Noise correction yields a value of 84 dB in the adjacent channel which exceeds by far the values prescribed by the specification.

Measurements can be performed on systems as well as on individual components such as amplifiers that have to meet more stringent requirements.

Remote control

All measurements can be remote-controlled. The results and demodulated data bits can be transferred via Ethernet LAN (100 Mbps) or via the IEEE bus – an ideal solution in production.

Other standards

Additional application packages transform the R&S®FSP/R&S®FSG/R&S®FSU/R&S®FSQ into multistandard signal and spectrum analyzers for base stations as well as for mobile phones.

- GSM and EDGE (R&S®FS-K5)
- TD-SCDMA base station (R&S®FS-K76)
- TD-SCDMA user equipment (R&S®FS-K77)
- CDMA2000® [1], cdmaOne and 1×EV-DV forward link (R&S®FS-K82)
- CDMA2000® and 1×EV-DV reverse link (R&S®FS-K83)
- 1×EV-DO forward link (R&S®FS-K84)
- 1×EV-DO reverse link (R&S®FS-K85)
- EUTRA/LTE FDD downlink (R&S®FSQ-K100)
- EUTRA/LTE FDD uplink (R&S®FSQ-K101)
- EUTRA/LTE downlink MIMO (R&S®FSQ-K102)
- EUTRA/LTE TDD downlink (R&S®FSQ-K104)
- EUTRA/LTE TDD uplink (R&S®FSQ-K105)

[1] CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA USA).

Applications and examples

**Code domain power measurement on a signal with 44 active codes**

Active and inactive channels are marked in different colors. Inactive channels (noise, interference) are displayed with the highest spreading factor.

The table also shows the main parameters of the total signal at a glance, e.g. total power, frequency error and error of chip rate, as well as the parameters of the marked code channel such as timing offset, code power and relative code domain error.
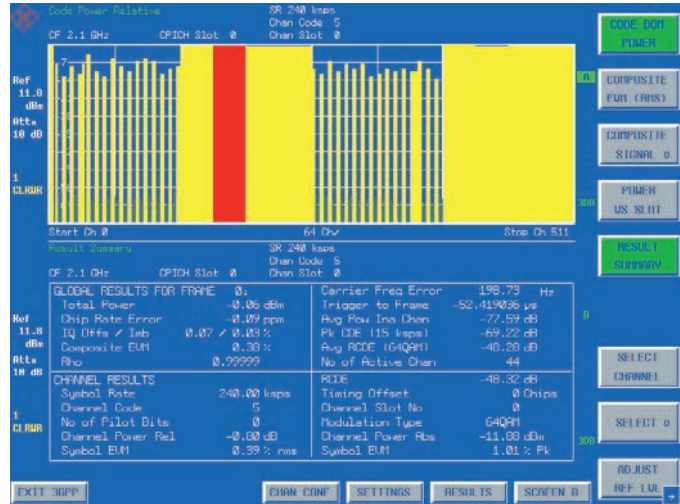


Peak code domain error measurement

The peak code domain error is projected to the codes of the highest spreading factors. The maximum value of all codes per slot is displayed.
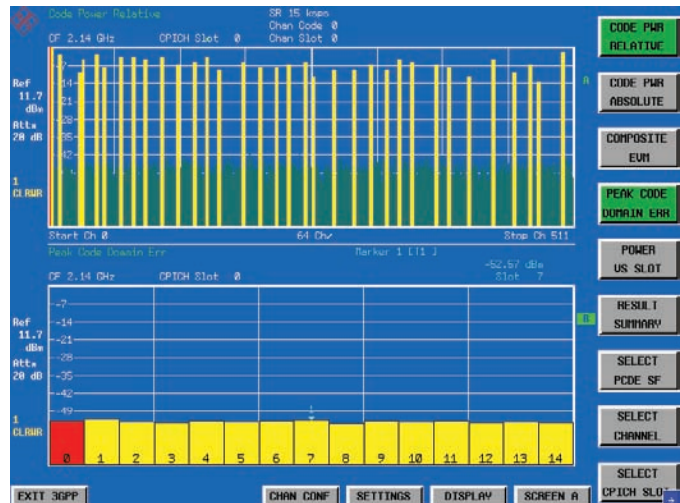

Automatic detection of channels and decoding of information

Information about the active channels is presented in a list. In addition, the user data transmitted on each physical channel can be analyzed.
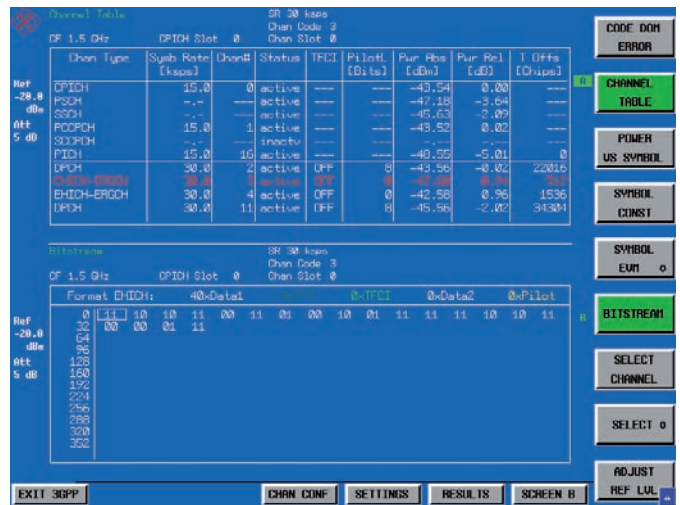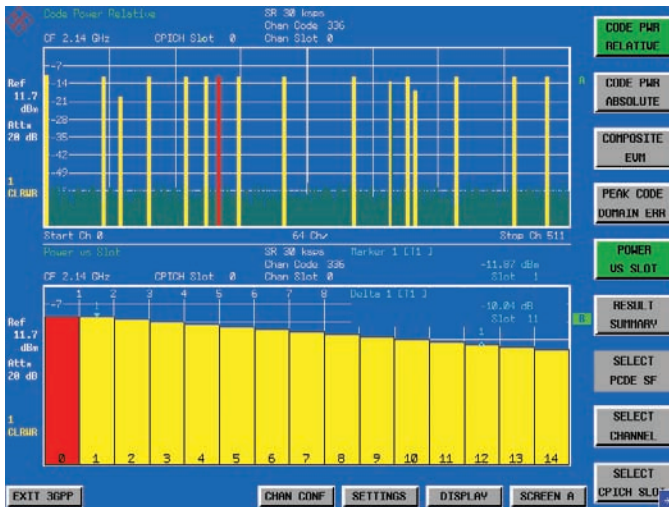
Measurement of code domain power versus time

The code power can additionally be displayed versus the 15 slots of a frame to determine the accuracy of power control.
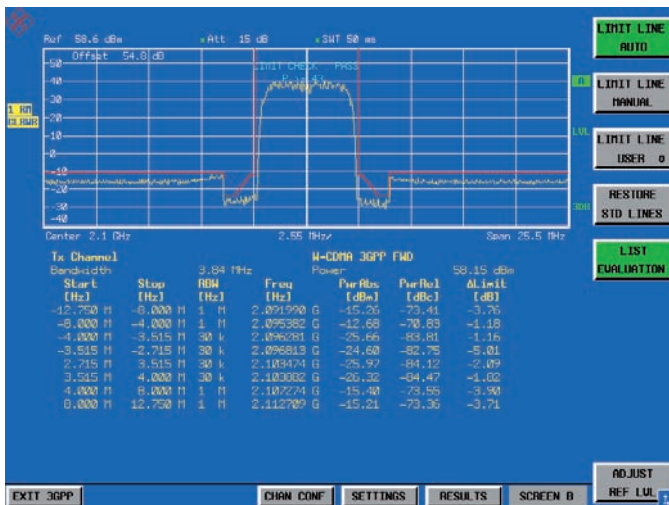

Spectrum emission mask measurement

The measurement is defined with a 30 kHz measurement bandwidth at 2.5 MHz to 3.5 MHz offset from the carrier. From 3.5 MHz to 12.5 MHz, the measurement is performed in a 1 MHz measurement bandwidth. The limit values are in line with 3GPP specifications TS 25.141.
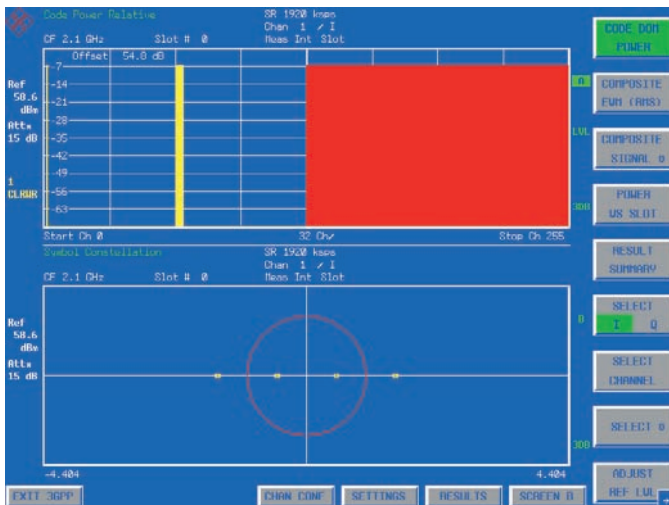
Multicode UE HSPA+ transmission

The mapping of the active channels on the I/Q branches is automatically detected and displayed together with the PAM constellation diagram of the red-marked HSPA+ code.

Symbol constellation diagram

The 64QAM constellation diagram of the HSDPA code marked in red in the code domain is displayed.
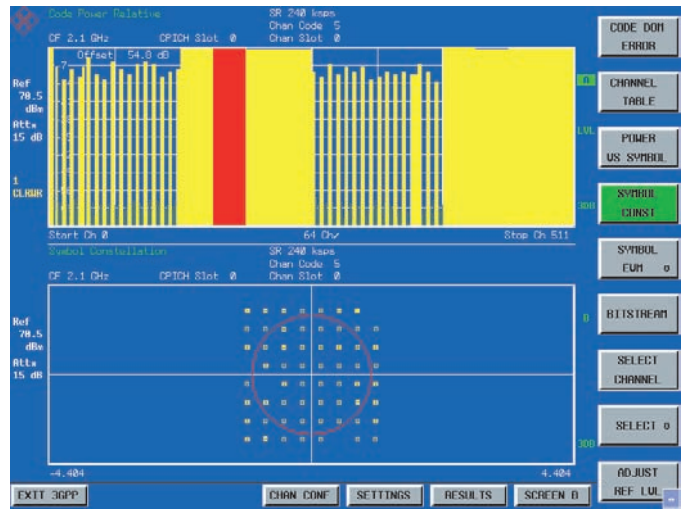
Configuration overview

	Base station		HSDPA and HSUPA capable base station		HSPA+ capable base station		HSDPA and HSUPA capable user equipment		HSPA+ capable user equipment	
	R&S®FSQ/ R&S®FSU/ R&S®FSG	R&S®FSP	R&S®FSQ/ R&S®FSU/ R&S®FSG	R&S®FSP	R&S®FSQ/ R&S®FSU/ R&S®FSG	R&S®FSP	R&S®FSQ/ R&S®FSU/ R&S®FSG	R&S®FSP	R&S®FSQ/ R&S®FSU/ R&S®FSG	R&S®FSP
R&S®FS-K72	✔	✔	✔	✔	✔	✔	–	–	–	–
R&S®FS-K73	–	–	–	–	–	–	✔	✔	✔	✔
R&S®FS-K73+	–	–	–	–	–	–	–	–	✔	✔
R&S®FS-K74	–	–	✔	✔	✔	✔	–	–	–	–
R&S®FS-K74+	–	–	–	–	✔	✔	–	–	–	–
R&S®FSP-B15	–	✔	–	✔	–	✔	–	✔	–	✔
R&S®FSP-B70	–	✔	–	✔	–	✔	–	✔ [1]	–	✔ [1]

[1] Extends the measurement range from one slot to one frame.

Ordering information

Designation	Type	Order No.
WCDMA 3GPP Application Firmware The R&S®FS-K72 application firmware can be integrated into any member of the R&S®FSU, R&S®FSQ and R&S®FSG families. The R&S®FSP-B70 and R&S®FSP-B15 options are prerequisites for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.	R&S®FS-K72	1154.7000.02
WCDMA 3GPP Application Firmware The R&S®FS-K73 application firmware can be integrated into any member of the R&S®FSU, R&S®FSQ and R&S®FSG families. The R&S®FSP-B15 option is a prerequisite for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.	R&S®FS-K73	1154.7252.02
HSPA+ Application Firmware The R&S®FS-K73+ application firmware can be integrated into any member of the R&S®FSU, R&S®FSQ and R&S®FSG families. R&S®FS-K73 is required. The R&S®FSP-B15 option is a prerequisite for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.	R&S®FS-K73+	1309.9274.02
HSDPA Application Firmware The R&S®FS-K74 application firmware can be integrated into any member of the R&S®FSU, R&S®FSQ and R&S®FSG families. The R&S®FS-K72 option must first be installed. The R&S®FSP-B15 and R&S®FSP-B70 options are prerequisites for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.	R&S®FS-K74	1300.7156.02
HSPA+ Application Firmware The R&S®FS-K74+ application firmware can be integrated into any member of the R&S®FSU, R&S®FSQ and R&S®FSG families. The R&S®FS-K72 and R&S®FS-K74 options must first be installed. The R&S®FSP-B15 and R&S®FSP-B70 options are prerequisites for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.	R&S®FS-K74+	1309.9180.02
Pulse Calibrator for the R&S®FSP	R&S®FSP-B15	1155.1006.02
Demodulator Hardware for the R&S®FSP The R&S®FSP-B70 option extends the measurement range of the R&S®FS-K73 application firmware for the R&S®FSP spectrum analyzer from one slot to one frame.	R&S®FSP-B70	1157.0559.02

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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