



**ROHDE & SCHWARZ**

Test and Measurement  
Division

## **Release Notes**

# **TD-SCDMA Base Station Test Application Firmware R&S FS-K76**

## **Release 4.50**

for R&S FSP, FSU, FSQ, FSG, FSMR, FSUP  
Analyzer Firmware 4.5x

### **New Features:**

- Relative Code Domain Error (RCDE) in result summary
- Support for High Speed Physical Downlink Shared Channel (HS-PDSCH) using 64QAM modulation symbols.
- New midamble based synchronization mode

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## Contents

History .....	3
General Topics .....	3
Compatibility of R&S FS-K76 TD-SCDMA BTS Application Firmware .....	3
Firmware Update of R&S FS-K76 TD-SCDMA BTS Application Firmware.....	4
Enabling the Application Firmware via License Key Code Entry .....	4
New Functions in Version 4.50 .....	5
Improvements .....	5
Known Issues with R&S FS-K76 .....	5
Modified Functions.....	5
Modifications to the Operating Manual and Supplements .....	7
Modified Chapters .....	8
Menu CHAN CONF .....	8
Menu RESULTS .....	8
Menu SETTINGS - NEXT .....	9
Remote Control Commands .....	10
Appendix: Contact to our hotline.....	15

## History

Date	Rel Note Rev	Changes
19 August 2009	1	First revision for R&S FS-K76 Firmware 4.50.

## General Topics

### Compatibility of R&S FS-K76 TD-SCDMA BTS Application Firmware

The following table shows the compatible versions of the basic analyzer firmware version and the TD-SCDMA BTS application firmware:

Table of compatible versions:

R&S FS-K76 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 FSG Basic Firmware
4.50	4.50	4.51	4.55	-	-	4.59
4.40	4.40	4.41	4.45	-	-	4.49
4.30	4.30	4.31	4.35	-	-	4.39
4.20	4.20	4.21	4.25	-	4.27	4.29
4.10	4.10	4.11	4.15	-	4.17	.-
4.00	4.00	4.01	4.05	-	-	-
3.90	3.90	3.91	3.95	3.96	3.99	-
3.80	3.80	3.81	3.85	3.86	-	-
3.70	3.70	3.71	3.75	-	-	-
3.60	3.60	3.61	3.65	3.66 SP1	-	-
3.50	3.50	3.51	3.55	-	-	-
3.40	3.40	3.41	3.45	-	-	-
3.30	3.30	3.31	3.35	-	-	-
3.28	3.20	3.21	3.25	-	-	-
2.80	2.80	2.81	-	-	-	-
2.60	2.60	2.61	-	-	-	-
2.40	2.40	2.41	2.45	-	-	-
2.30	2.30	2.31	2.35	-	-	-
2.28	2.20	2.21	2.25	-	-	-

Application firmware versions 3.xx are running on R&S FSPs with order # 1164.4391.xx or R&S FSU with order # 1166.1660.xx or R&S FSQ with operating system XP.

Application firmware version 2.xx are running on R&S FSPs with order # 1093.4495.xx or R&S FSU with order # 1129.9003.xx or R&S FSQ with operating system NT.

## Firmware Update of R&S FS-K76 TD-SCDMA BTS 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 analyzer or delivered as a part of the R&S FS-K76 TD-SCDMA BTS 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 likely reason will be that the instrument is not equipped with the correct basic firmware version. In this case 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 4.50

- **Relative Code Domain Error (RCDE) in result summary.**  
The average relative code domain error in dB for all active channels in the selected slot is calculated according to release 8 of the standard. This value is displayed in the result summary.
- **Support for High Speed Physical Downlink Shared Channel (HS-PDSCH) using 64QAM modulation symbols.**  
64QAM constellations are fully supported as code channel modulation. An improved robust channel search algorithm classifies the modulation automatically from QPSK up to 64QAM. For bad SNR environments the automatic search can optionally be limited to lower constellations.
- **New midamble based synchronization mode.**  
By default the R&S FS-K76 determines the phase reference for all downlink data slots from the downlink pilot channel (DwPCH). For e.g. beamforming or repeater measurements it might be necessary to apply different phase offsets to each time slot. Using the DwPCH as phase reference leads to rotated constellation diagrams and bad EVM values in these time slots.  
  
Since version 4.30 the R&S FS-K76 provides the optional synchronization on the selected slot. This synchronization needed at least one code channel with QPSK or 8PSK modulation within the slot. The new midamble based synchronization mode is independent of the code channel modulation and thus allows synchronization on slots with arbitrary code channel modulation.

## Improvements

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

**1. [V4.40] No independent sweeptime settings supported for ACLR and SEM measurement.**

Changing the sweeptime for ACLR measurement also changes the sweeptime for SEM measurement and vice versa.

## Known Issues with R&S FS-K76

None

## Modified Functions

1. [V3.30/V2.30] “Signal Statistics” measurements CCDF and APD are supported.
2. [V3.30/V2.30] For all code domain analyzer measurements, the maximum capture length has been extended from 35 to 63 slots.
3. [V3.30/V2.30] “Composite Constellation” is available within the code domain analyzer.
4. [V3.30/V2.30] The China Wireless Telecommunication Standard “TSM” is supported.
5. [V3.30/V2.30] Unit circle display in constellation diagrams is shown.

**6. [V3.50/V2.60] Change of default node for CALC2:FEED 'XTIM:CDP:PVSL'**

For compatibility reason with other 3G applications the default node for the IEC/IEEE bus command

CALC2:FEED 'XTIM:CDP:PVSL[:ABS]' is changed to

CALC2:FEED 'XTIM:CDP:PVSL[:RAT]'.

**7. [V3.60/V2.60] External trigger level adjustable from 0.5 to 3.5V .****8. [V3.60/V2.60] Center Frequency Stepsize softkey available.****9. [V3.60/V2.60] Changed SCPI commands.**

In order to limit to 12 chars the :CALCulate2:FEED 'XTIME:CDPower:SYMBOL:CONStellation' and

:CALCulate2:FEED 'XTIME:CDPower:COMPosite:CONStellation' are changed to

:CALCulate2:FEED 'XTIME:CDPower:SYMBOL:CONSt' and

:CALCulate2:FEED 'XTIME:CDPower:COMPosite:CONSt'.

**10. [V3.70/V2.80] ACP: number of adjacent channels increased to 12.****11. [V3.70/V2.80] ACP: power mode to max holds the power results.****12. [V3.80/V2.80] Trace view available within code domain analyzer.****13. [V3.90] Support for noise correction in ACLR measurement with power trigger.****14. [V4.00] High Dynamic Mode for Power vs. Time Measurement.****15. [V4.00] Support for High Speed Physical Downlink Shared Channel (HS-PDSCH) using 16QAM modulation symbols.****16. [V4.00] Spectrum emission mask: List evaluation in lower screen now supported.****17. [V4.00] Multicarrier ACP measurement support.****18. [V4.20] Support for instrument R&S FSG.****19. [V4.20] Softkey REF VALUE Y AXIS available for CDP measurements.****20. [V4.20] Power vs Time: Sweep Mode SINGLE/CONTINUOUS is now restored to it's previous state, when HIGH DYNAMIC is switched off.****21. [V4.30] Softkey AC / DC Coupling available.****22. [V4.30] New Ref Value Y Axis / Reference Level coupling simplifies grid scaling configuration for Code Domain measurments.**

Since version 4.20 the Reference Level and the grid scaling (REF VALUE Y AXIS) with unit dBm can be independently set for Code Domain measurements. In previous versions changing the Reference Level and changing the Ref Value Y Axis were independent. If the Reference Level value is changed the Ref Value Y Axis is now automatically adjusted to keep the difference between Reference Level and Ref Value Y axis constant.

Example:

Ref Level set to 0 dBm

Ref Value Y axis set to -10 dBm (at Y Axis Position 100%)

► The upper Y limit of the grid scaling is now at 10 dB below reference level.

Change Reference Level to -10dBm

The Ref Value Y Axis is now adjusted to -20 dB

► The upper Y limit of the grid scaling is at 10 dB below reference level as before.

**Note:** The internal reference level change with function ADJUST REF LEVEL is treated in the same way.

**23. [V4.30] Selectable Phase Reference (softkey SYNC TO SLOT) for repeater measurements.****24. [V4.50] The Relative Code Domain Error (RCDE) is displayed in the result summary.****25. [V4.50] Support for High Speed Physical Downlink Shared Channel (HS-PDSCH) using 64QAM modulation symbols.**

64QAM constellations are fully supported as code channel modulation. An improved robust channel search algorithm classifies the modulation automatically from QPSK up to 64QAM. For bad SNR environments the automatic search can optionally be limited to lower constellations.

**26. [V4.50 New midamble based synchronization mode.**

By default the R&S FS-K76 determines the phase reference for all downlink data slots from the downlink pilot channel (DwPCH). For e.g. beamforming or repeater measurements it might be necessary to apply different phase offsets to each time slot. Using the DwPCH as phase reference leads to rotated constellation diagrams and bad EVM values in these time slots.

Since version 4.30 the R&S FS-K76 provides the optional synchronization on the selected slot. This synchronization needed at least one code channel with QPSK or 8PSK modulation within the slot. The new midamble based synchronization mode is independent of the code channel modulation and thus allows synchronization on slots with arbitrary code channel modulation.

## **Modifications to the Operating Manual and Supplements**

For the R&S FS-K76 TD-SCDMA Base Station Test Application Firmware manuals please refer to the following order numbers:

- 1300.7304.44-04 (German/English)

They can be downloaded from R&S internet – search: FS-K76:

<http://www.rohde-schwarz.com>

## Modified Chapters

### Menu CHAN CONF

HEADER  
VALUES

#### MODULATION TYPE:

Modulation type of the channel. You can choose between QPSK, 8PSK, 16QAM and 64 QAM

#### IEC-Bus-command:

```
:CONFigure:CDPower[:BTS]:CTABLE:DATA 1..6, 0..4,
1..16, 0..3, 1..16, 0 | 1, 0, 0...
```

< Channel type >, <Code class>, <Code number>, <Modulation type>,  
<Midamble shift>, <Status>, <Reserved 1>, <Reserved 2>, ....

Modulation type: 0 = invalid (for midamble)  
1 = QPSK  
2 = 8PSK  
3 = 16QAM  
4 = 64QAM

MAX MOD  
<64QAM>

The MAX MOD setting defines the highest modulation to be considered in the automatic channel search. In low SNR environments it may be necessary to limit the channel search to lower modulations than 64QAM.

#### IEC/IEEE-bus command:

```
SENSe:CDPower:MMAx QPSK | PSK8 | QAM16 | QAM64
```

### Menu RESULTS

RESULT  
SUMMARY



The RESULT SUMMARY softkey selects numeric evaluation of all measured results. Evaluation is subdivided as follows:

RESULT SUMMARY TABLE				DR	52.8 kbps
CF 1 GHz				Chan	1.16
				Slot	4
GLOBAL RESULTS FOR SET 0:					
Ref	Chip Rate Error	0.05 ppm	Trg to Frame	59 ns	
-6.00 dBm	P Data	-10.75 dBm	Carr Freq Err	-38.40 Hz	
Att	P D1	-11.30 dBm	IQ Imbal/Offs	0.03/0.05 %	
20 dB	P D2	-10.27 dBm	RHO	1.0000	
	P Midamble	-10.19 dBm	Composite EVM	0.18 %	
	Active Channels	2	Pk CDE(SF 16)	-62.68 dB	
			Average RCDE	-59.75 dB	
CHANNEL RESULTS					
1	Channel.SF	1.16	Data Rate	52.8 kbps	
CLRR	ChannelPwr Rel	-3.01 dB	ChannelPwr Abs	-13.76 dBm	
	Symbol EVM	0.10 %rms	Symbol EVM	0.31 %Pk	

Fig. 1 Result summary



The second part shows measured results relating to all channels for the slot selected with the SELECT SLOT softkey:

Average RCDE: Average relative code domain error of the active channels

**IEC/IEEE bus command:**

```
:CALC2:FEED "XTIM:CDP:ERR:SUMM"
:CALC2:MARK1:FUNC:CDP:BTS:RES? SLOT | PDAT | PD1 | PD2 |
                                PMID | RHO | MACC | PCD |
                                FERR | CERR | TFR | IQIMB |
                                IQOF | ACT | SRAT | CHAN |
                                SFAC | CDPR | CDP | EVMR |
                                EVMP | ARCD
```

## Menu SETTINGS - NEXT

SYNC  
TO SLOT

By default the R&S FS-K76 determines the phase reference for all downlink data slots from the downlink pilot channel (DwPCH). For e.g. beamforming or repeater measurements it might be necessary to apply different phase offsets to each time slot. Using the DwPCH as phase reference leads to rotated constellation diagrams and bad EVM values in these time slots.

By activating the setting 'SYNC TO SLOT' the R&S FS-K76 determines the phase reference within the selected slot. Thus the data slots can be phase rotated to each other without degrading the EVM results. The actual part of the selected slot used as phase reference is determined by the SYNC TO CODE | MA softkey.

**IEC/IEEE-bus command:**

```
:SENSe:CDPower:STSlot ON | OFF
```

SYNC TO  
CODE MA

This softkey selects the slot synchronization mode. It is effective only if SYNC TO SLOT is activated.

If CODE is selected, the phase reference is determined by a multi-stage algorithm involving code channels and midambles. At least one code channel within the selected slot must be QPSK or 8PSK modulated.

If MA is selected, the phase reference is determined by the midamble area of the selected slot. Hence there is no requirement about the code channel modulation.

**IEC/IEEE-bus command:**

```
:SENSe:CDPower:STSlot:MODE CODE | MA
```

## Remote Control Commands

### :**[SENSe<1|2>]:CDPower:STSLot** ON | OFF

This command selects the phase reference to be used.

By default the R&S FS-K76 determines the phase reference for all downlink data slots from the downlink pilot channel (DwPCH). For e.g. beamforming or repeater measurements it might be necessary to apply different phase offsets to each time slot. Using the DwPCH as phase reference leads to rotated constellation diagrams and bad EVM values in these time slots.

By activating the setting 'SYNC TO SLOT' the R&S FS-K76 determines the phase reference within the selected slot. Thus the data slots can be phase rotated to each other without degrading the EVM results. The actual part of the selected slot used as phase reference is determined by the SENS:CDP:STS:MODE command.

**Parameter:** ON: Uses the selected slot as phase reference.  
OFF: Uses the downlink pilot channel (DwPCH) as phase reference.

**Example:** "SENS:CDP:STSL ON" 'use selected slot as phase reference

**Characteristics:** \*RST value: OFF  
SCPI: instrument-specific

### :**[SENSe<1|2>]:CDPower:STSLot:MODE** CODE | MA

This command selects the slot synchronization mode. It is effective only if SYNC TO SLOT is activated.

If CODE is selected, the phase reference is determined by a multi-stage algorithm involving code channels and midambles. At least one code channel within the selected slot must be QPSK or 8PSK modulated.

If MA is selected, the phase reference is determined by the midamble area of the selected slot. Hence there is no requirement about the code channel modulation.

**Parameter:** CODE: Uses code channels and midamble of the selected slot as phase reference  
MA: Uses the midamble of the selected slot as phase reference.

**Example:** "SENS:CDP:STSL:MODE MA" 'use midamble in selected slot as  
' phase reference

**Characteristics:** \*RST value: CODE  
SCPI: instrument-specific

### :**[SENSe<1|2>]:CDPower:MMA**X QPSK | PSK8 | QAM16 | QAM64

This command defines the highest modulation to be considered in the automatic channel search. In low SNR environments it may be necessary to limit the channel search to lower modulations than 64QAM.

**Parameter:** QPSK: Consider QPSK modulation only  
PSK8: Consider QPSK and 8PSK modulation.  
QAM16: Consider QPSK, 8PSK and 16QAM modulation  
QAM64: Consider QPSK, 8PSK, 16QAM and 64QAM modulation

**Example:** "SENS:CDP:MMA PSK8" 'assume QPSK and 8PSK modulations  
' only for the automatic channel search

**Characteristics:** \*RST value: QAM64  
 SCPI: instrument-specific

**:CALCulate<1|2>:MARKer<1>:FUNCTION:CDPower[:BTS]:RESult?** SLOT | PDATa | PD1 | PD2 |  
 PMIDamble | RHO | MACCuracy | PCDError | FERRor | CERRor | TFRame |  
 IQOFFset | IQIMbalance | ACTive | SRATe | CHANnel | SFACtor | CDPabsolute |  
 CDPRelative | EVMRms | EVMPeak | ARCDError

This command polls the measured and calculated values of code domain power analysis. The results are provided for the channel to which the code selected by the `CDPower:CODE` command belongs.

**Parameters:**

Global results of selected slot:

SLOT	Slot number		
PDATa	Power data fields in dBm	FERRor	Frequency error in Hz
PD1	Power data field 1 in dBm	CERRor	Chip rate error in ppm
PD2	Power data field 2 in dBm	TFRame	Trigger to frame
PMIDamble	Power midamble in dBm	IQIMbalance	IQ imbalance in %
RHO	RHO	IQOFFset	IQ offset in %
MACCuracy	Composite EVM in %	ACTive	Number of active channels
PCDError	Peak code domain error in dB	ARCDError	Average RCDE of active channels

Channel results:

SRATe	Data rate in kbps
CHANnel	Channel number
SFACtor	Spreading factor of channel
CDPRelative	Channel power relative in dB
CDPabsolute	Channel power absolute in dBm
EVMRms	Error vector magnitude RMS in %
EVMPeak	Error vector magnitude Peak in %

**Note:** The trigger to frame (*TFRame*) value produces a "9" if the trigger is set to *FREE RUN*.

**Example:** "INST:SEL BTDS" ' Activate TD-SCDMA BTS meaning  
 ' CDP relative on screen A and  
 ' Result Summary active on screen B  
 "INIT:CONT OFF" ' Select single sweep  
 "INIT;\*WAI" ' Start measurement with  
 ' synchronization  
 "CALC:MARK:FUNC:CDP:RES? PDAT" ' Read out power of data fields  
 "CDP:SLOT 5" ' Selects slot 5  
 "CDP:CODE 11" ' Select code number 11  
 "CALC:MARK:FUNC:CDP:RES? EVMR" ' Read out EVM RMS of code with  
 ' number 11 in slot 5

**Characteristics:** \*RST value: –  
 SCPI: instrument-specific

**:CALCulate<1|2>:MARKer<1 to 4>:FUNCTION:POWER:RESult?** ACPower | AOBandwidth | AOBWidth |  
CPOWer | MCACpower | OBANDwidth |  
OBANDwidth

This command queries the result of the power measurement performed in the selected window. If necessary, the measurement is switched on prior to the query.

The channel spacings and channel bandwidths are configured in the `SENSe:POWer:ACHannel` subsystem.

To obtain a valid result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single-sweep mode.

**Note:** The parameters AOBandwidth and AOBWidth are available only from firmware version 4.5x

### Parameters:

ACPower: adjacent channel power measurement

Results are output in the following sequence, separated by commas:

1. Power of transmission channel
2. Power of lower adjacent channel
3. Power of upper adjacent channel
4. Power of lower alternate channel 1
5. Power of upper alternate channel 1
6. Power of lower alternate channel 2
7. Power of upper alternate channel 2

The number of measured values returned depends on the number of adjacent/alternate channels selected with `SENSe:POWer:ACHannel:ACPairs`.

With logarithmic scaling (`RANGE LOG`), the power is output in the currently selected level unit; with linear scaling (`RANGE LIN dB` or `LIN %`), the power is output in W. If `SENSe:POWer:ACHannel:MODE REL` is selected, the adjacent/alternate-channel power is output in dB.

AOBandwidth	Measurement of occupied bandwidth, all results
AOBWidth	<p>The results include the left and right frequency/level information</p> <p>Results are output in the following sequence, separated by commas:</p> <ol style="list-style-type: none"><li>1. Occupied bandwidth in Hz</li><li>2. T1 marker position in Hz (left marker)</li><li>3. T1 marker level</li><li>4. T2 marker position in Hz (right marker)</li><li>5. T2 marker level</li></ol> <p><b>Note:</b> The Occupied Bandwidth is marker position T2 – T1</p>
CPOWER:	<p>Channel power measurement</p> <p>With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.</p>
MCACpower:	<p>Channel/adjacent channel power measurement with several carrier signals</p> <p>Results are output in the following sequence, separated by commas:</p> <ol style="list-style-type: none"><li>1. Power of carrier signal 1</li><li>2. Power of carrier signal 2</li><li>3. Power of carrier signal 3</li><li>4. Power of carrier signal 4</li><li>5. Power of carrier signal 5</li><li>6. Power of carrier signal 6</li><li>7. Power of carrier signal 7</li><li>8. Power of carrier signal 8</li><li>9. Power of carrier signal 9</li><li>10. Power of carrier signal 10</li><li>11. Power of carrier signal 11</li><li>12. Power of carrier signal 12</li><li>13. Total power of all carrier signals</li><li>14. Power of lower adjacent channel</li></ol>

- 15. Power of upper adjacent channel
- 16. Power of lower alternate channel 1
- 17. Power of upper alternate channel 1
- 18. Power of lower alternate channel 2
- 19. Power of upper alternate channel 2

The number of measured values returned depends on the number of carrier signals and adjacent/alternate channels selected with `SENSe:POWer:ACHannel:TXChannel:COUNT` and `SENSe:POWer:ACHannel:ACPairs`.

If only one carrier signal is measured, the total value of all carrier signals will not be output.

With logarithmic scaling (`RANGE LOG`), the power is output in dBm; with linear scaling (`RANGE LIN dB` or `LIN %`), the power is output in W. If `SENSe:POWer:ACHannel:MODE REL` is selected, the adjacent/alternate-channel power is output in dB.

**OBANdwidth |** Measurement of occupied bandwidth  
**OBWidth:** The occupied bandwidth in Hz is returned.

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

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

## 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)