Specifications

Version 02.00

October 2006

Universal Protocol Test Platform R&S®CRTU

Specifications

ROHDE&SCHWARZ

Contents

The specifications refer to fully equipped testers with all hardware and software options installed!

Specifications are valid under following conditions:

Data without tolerance limit is not binding.
In compliance with the 3GPP/2GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in kbps (thousand bit per second) or ksps (thousand symbol per second).
MCPS, kbps and ksps are not SI units.

For more general information about R&S®CRTU please refer to the product brochure PD 5213.5574.12, version ≥01.00

Specifications of Radio Unit R&S®CRTU-RU

Timebase OCXO

Max. frequency drift	in temperature range +5 °C to +45 °C	±5 × 10^{-9}, referred to +25 °C
	with instrument orientation	±3 × 10^{-9}
	referred to turn-off frequency after 2 h warm-up time following a 24 h off time at +25 °C	±5 × 10^{-9}
Max. aging		±3.5 × 10^{-8}/year
		±5 × 10^{-10}/day after 30 days of operation
Warm-up time	at +25 °C	approx. 10 min

Reference frequency inputs/outputs

Synchronization input		BNC connector REFIN
Frequency	sinewave signal	1 MHz to 52 MHz, step 1 kHz
	squarewave signal (TTL level)	10 kHz to 52 MHz, step 1 kHz
Max. frequency variation		±5 × 10^{-6}
Input voltage range	sinewave signal	0.5 V to 2 V (rms)
Impedance		50 Ω

Synchronization output 1		BNC connector REFOUT1
Frequency	in internal reference mode	10 MHz from internal reference
	in external reference mode	frequency of synchronization input
Output voltage		>1.4 V (peak-peak)
Impedance		50 Ω

Synchronization output 2		BNC connector REFOUT2
Frequency	in WCDMA mode	30.72 MHz
	in GSM mode	39 MHz
Impedance		50 Ω

Synchronization output 3		BNC connector REFOUT3
Frequency	in WCDMA mode	15.36 MHz
Impedance		50 Ω

RF generator (CW signals)

Frequency range		100 kHz to 2700 MHz
Frequency resolution		0.1 Hz
Frequency uncertainty		same as timebase + frequency resolution
Frequency settling time		<400 µs to Δf < 1 kHz

Output level uncertainty RF1, RF2		
In temperature range +20 °C to +35 °C	10 MHz to 450 MHz, level ≥–106 dBm	<0.8 dB
	450 MHz to 2200 MHz	
	level ≥–106 dBm	<0.8 dB
	level >–117 dBm (see note 2)	<0.8 dB
	level –130 dBm to –117 dBm (see note 2 and note 3)	<1.7 dB
	2200 MHz to 2700 MHz	
	level ≥–106 dBm	<1.0 dB
	level >–117 dBm (see note 2)	<1.0 dB
	level –130 dBm to –117 dBm (see note 2 and note 3)	<1.7 dB

In temperature range +5 °C to +45 °C	10 MHz to 450 MHz, level ≥–106 dBm	<1.2 dB
	450 MHz to 2200 MHz	
	level ≥–106 dBm	<1.2 dB
	level >–117 dBm (see note 2)	<1.2 dB
	level –130 dBm to –117 dBm (see note 2 and note 3)	<1.7 dB
	2200 MHz to 2700 MHz	
	level ≥–106 dBm	
	level >–117 dBm (see note 2)	<1.7 dB
	level –130 dBm to –117 dBm (see note 2 and note 3)	<1.7 dB
	10 MHz to 450 MHz, level ≥–106 dBm	<1.7 dB

Output level uncertainty RF3OUT		
In temperature range +20 °C to +35 °C	10 MHz to 450 MHz	
	level –80 dBm to +10 dBm	<1.0 dB
	450 MHz to 2200 MHz	
	level –90 dBm to +10 dBm	<1.0 dB
	2200 MHz to 2700 MHz	
	level –90 dBm to +5 dBm	<1.2 dB
In temperature range +5 °C to +45 °C	10 MHz to 450 MHz	
	level –80 dBm to +10 dBm	<1.2 dB
	450 MHz to 2200 MHz	
	level –90 dBm to +10 dBm	<1.2 dB
	2200 MHz to 2700 MHz	
	level –90 dBm to +5 dBm	<1.7 dB

Output level settling time		<4 µs
Output level resolution		0.1 dB
Generator RF level repeatability	typical values after 1h warm-up time	
	output level ≥–80 dBm	<0.01 dB
	output level <–80 dBm	<0.1 dB

Note 2: Not valid at frequencies of netclock harmonics.

Note 3: Valid for RF1 only.

Spectral purity	CW signals	
Attenuation of harmonics	f_0 = 10 MHz to 2200 MHz, measured up to 7 GHz	
	RF1, RF2	>30 dB
	RF3OUT (level ≤+10 dBm)	>20 dB
Attenuation of nonharmonics	10 MHz to 2000 MHz at > 5 kHz from carrier	>40 dB
Phase noise	single sideband, f < 2.2 GHz	
	carrier offset 20 kHz to 250 kHz	<–100 dBc (1 Hz)
	carrier offset ≤250 kHz	<–110 dBc (1 Hz)
Residual FM	30 Hz to 15 kHz	<50 Hz (rms), <200 Hz (peak)
	ITU-T (formerly CCITT)	<5 Hz
Residual AM	ITU-T (formerly CCITT)	<0.02% (rms)
I/Q modulation	for frequency offset range 0 kHz to ±135 kHz	
	carrier suppression	>40 dB

VSWR of RF input and output connectors

VSWR of RF1	10 MHz to 2000 MHz	<1.2
	2000 MHz to 2200 MHz	<1.3
	2200 MHz to 2700 MHz	<1.6
VSWR of RF2	10 MHz to 2200 MHz	<1.2
	2200 MHz to 2700 MHz	<1.6
VSWR of RF3OUT	10 MHz to 2200 MHz	<1.5
	2200 MHz to 2700 MHz	<1.7
VSWR of RF4IN	10 MHz to 2200 MHz	<1.5
	2200 MHz to 2700 MHz	<1.6

RF receiver

Spectral purity		
Phase noise	single sideband, f < 2.2 GHz	
	carrier offset 20 kHz to 250 kHz	<–100 dBc (1 Hz)
	carrier offset 250 kHz to 400 kHz	<–110 dBc (1 Hz)
	carrier offset ≥400 kHz	<–118 dBc (1 Hz)
Residual FM	30 Hz to 15 kHz	<50 Hz (rms), <200 Hz (peak)
	ITU-T (formerly CCITT)	<5 Hz (rms)
Residual AM	ITU-T (formerly CCITT)	<0.02 % (rms)

Power splitter

Insertion loss (SC/S1 or SC/S2)	400 MHz to 2200 MHz	<7 dB
	2200 MHz to 2700 MHz	<8 dB
VSWR (SC)	400 MHz to 2200 MHz	<1.3
	2200 MHz to 2700 MHz	<1.6
VSWR (S1, S2)	400 MHz to 2700 MHz	<1.5
Isolation (S1/S2)	400 MHz to 2200 MHz	>17 dB
	2200 MHz to 2700 MHz	>10 dB
Max. continuous power	SC	4 W
	S1, S2	21 dBm

Interfaces of Radio Unit R&S®CRTU-RU

USB		double connector on rear and front panel
Ethernet 1		RJ-45
Connector for external monitor (VGA)		15-pin D-Sub
Serial interface COM1, COM2		RS-232-C, 9-pin D-Sub
Printer interface LPT		parallel (centronics-compatible), 25-pin
Control A (for connection to PU or for R&S®CRTU interconnection)		68-pin high-density connector
Control B (for connection to PU or for R&S®CRTU interconnection)		68-pin high-density connector
IF (RX and TX, CH1 and CH2) (four connections to PU)		BNC
Clock (for connection to PU)		BNC
IEC/IEEE bus remote control interface (for connection to PU)		24-pin Amphenol

General specifications of Radio Unit R&S®CRTU-RU

Power supply		power factor correction, in line with EN 61000-3-2
Input		100 V to 240 V ±10 % (AC), 500 VA, 50 Hz to 400 Hz –5 % to +10 %
Power consumption	without GSM configuration	approx. 160 W
	with GSM configuration	approx. 200 W

Radio Unit R&S®CRTU-RU		
Dimensions	W × H × D	465.1 mm × 196.5 mm × 517.0 mm (19” 1/1, 4 HU, 450)
Weight	without options	approx. 18 kg/ 39.6 lb

Specifications of Protocol Unit R&S®CRTU-PU

Interfaces of Protocol Unit R&S®CRTU-PU

USB		double connector on rear and front panel
Ethernet 1, 2, 3		RJ-45
Ethernet HUB		5 ports, 10/100 Mbps (auto detection), RJ-45
Connector for external monitor (VGA)		15-pin D-Sub
Connector for external monitor (DVI)		24-pin + 4-pin
Serial interface COM1		RS-232-C, 9-pin D-Sub
Printer interface LPT		parallel (centronics-compatible), 25-pin
Control A (for connection to RU)		68-pin high-density connector
Control B (for connection to RU)		68-pin high-density connector
Chain IN (for R&S®CRTU interconnection)		68-pin high-density connector
Chain OUT (for R&S®CRTU interconnection)		68-pin high-density connector
IF (RX and TX, CH1 and CH2) (four connections to RU)		BNC
Clock (for connection to RU)		BNC
IEC/IEEE bus remote control interface (for connection to RU)		24-pin Amphenol

General specifications of Protocol Unit R&S®CRTU-PU

Power supply		power factor correction, in line with EN 61000-3-2
Input		100 V to 120 V ±10 % (AC) or 220 V to 240 V ±10 % (AC), 600 VA, 50 Hz to 60 Hz –5 % to +10 %
Power consumption		approx. 180 W

Protocol Unit R&S®CRTU-PU		
Dimensions	W × H × D	465.1 mm × 241.0 mm × 595.0 mm, (19” 1/1, 5 HU, 550)
Weight		approx. 21 kg/ 46.3 lb

General specifications (of R&S®CRTU-RU and R&S®CRTU-PU)

Operating temperature range		+5 °C to +45 °C, in line with EN 60068-2-1 or -2
Storage temperature range		–25 °C to +60 °C, in line with EN 60068-2-1 or -2
Humidity	+40 °C, non-condensing	80 % relative humidity, in line with EN 60068-2-30
Electromagnetic compatibility		in line with EMC Directive 89/336/EEC, applied standard: EN 61326 (immunity for industrial environment; class B emissions)
Electrical safety		IEC 61010-1, EN 61010-1, UL3111-1, CAN/CSA-C22.2 No. 1010.1

Mechanical resistance	non-operating mode	
Vibration	sinusoidal	in line with EN 60068-2-6, EN 61010-1, MIL-T-28800 D class 5, 5 Hz to 150 Hz, max. 2 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g const.
Vibration	random	in line with EN 60068-2-64, 10 Hz to 300 Hz, acceleration 1.2 g rms
Shock		in line with EN 60068-2-27, MIL-STD-810D 40 g shock spectrum

GSM specifications

RF generator

Modulation		GMSK, B×T = 0.3
		8PSK

Frequency range		
	GSM400 band	460 MHz to 468 MHz
		488 MHz to 496 MHz
	GSM850 band	869 MHz to 894 MHz
	GSM900 band	921 MHz to 960 MHz
	GSM1800 band	1805 MHz to 1880 MHz
	GSM1900 band	1930 MHz to 1990 MHz

Attenuation of inband spurious emissions		>50 dB

Inherent phase error	GMSK	<1°, rms
		<4°, peak

Inherent EVM	8PSK	<2 %, rms

Frequency settling time	to residual phase of 4°	<500 µs

Output level range	GMSK	
RF1		–130 dBm to –33 dBm
RF2		–130 dBm to –16 dBm
RF3OUT		–90 dBm to +5 dBm

Output level range	8PSK	
RF1		–130 dBm to –37 dBm
RF2		–130 dBm to –20 dBm
RF3OUT		–90 dBm to +1 dBm

Output level uncertainty	GSM bands	
RF1, RF2	at >–117 dBm	
	in temperature range +20 °C to +35 °C	<0.7 dB
	in temperature range +5 °C to +45 °C	<0.9 dB
RF3OUT		
	–90 dBm to +5 dBm for GMSK	
	–90 dBm to +1 dBm for 8PSK	
	in temperature range +20 °C to +35 °C	<0.9 dB
	in temperature range +5 °C to +45 °C	<1.1 dB

RF receiver

Frequency range		
GSM400 band		450 MHz to 458 MHz
		478 MHz to 486 MHz
GSM850 band		824 MHz to 849 MHz
GSM900 band		876 MHz to 915 MHz
GSM1800 band		1710 MHz to 1785 MHz
GSM1900 band		1850 MHz to 1910 MHz

Inherent phase error	GMSK	<0.6°, rms
		<2°, peak

Inherent EVM	8PSK	<1.0 %, rms

Reference level for full dynamic range	GMSK	
RF1	max. continuous input power 50 W	+10 dBm to +53 dBm
RF2	max. continuous input power 2 W	–4 dBm to +39 dBm
RF4IN		–22 dBm to 0 dBm

Reference level for full dynamic range	8PSK	
RF1	max. continuous input power 50 W	+6 dBm to +49 dBm
RF2	max. continuous input power 2 W	–8 dBm to +35 dBm
RF4IN		–26 dBm to –4 dB

Audio

Input connector AUX1 (BNC)	speech coder input	
Full range input level	low sensitivity	1.40 V (peak)
	high sensitivity	0.10 V (peak)
Input impedance		100 kΩ

Output connector AUX2 (BNC)	speech decoder output	
Full range output level		1.00 V (peak)
Output impedance		<10 Ω
Maximum output current		20 mA (peak)

Trigger/clock signals

Input (BNC) connectors	Trig In A, Trig In B	
	nominal input level	TTL
	input impedance	1 kΩ

Output (BNC) connectors	Trig Out A, Trig Out B, SLOT CLK, BIT CLK	
Nominal output level		TTL
Output impedance		50 Ω

Display

Display size		21 cm TFT colour display (8.4”)
Resolution		640 x 480 pixels (VGA resolution)
Pixel failure rate		$<2 \times 10^{-5}$

WCDMA specifications

Standard

Standard		3GPP-FDD, 3.84 Mcps, R99, Rel-5, Rel-6

RF Generator

Modulation		according to standard
Frequency range	band I	2110 MHz to 2170 MHz
	band II	1930 MHz to 1990 MHz
	band III	1805 MHz to 1880 MHz
	band IV	2110 MHz to 2155 MHz
	band V	869 MHz to 894 MHz
	band VI	875 MHz to 885 MHz
	band VII	2620 MHz to 2690 MHz
	band VIII	925 MHz to 960 MHz
	band IX	1844.9 MHz to 1874.9 MHz

Output level range (rms value)	max. value depends on channel configuration	
RF1		–120 dBm to –37 dBm
RF2		–120 dBm to –20 dBm
RF3OUT		–100 dBm to +0 dBm

Output level uncertainty	in temperature range +20 °C to +35 °C	
RF1, RF2	output level ≥–120 dBm	
	f < 2200 MHz	<0.8 dB
	f ≥ 2200 MHz	<1.0 dB
RF3OUT	output level ≥–80 dBm	
	f < 2200 MHz	<1.0 dB
	f ≥ 2200 MHz	<1.2 dB

Output level uncertainty	in temperature range +5 °C to +45 °C	
RF1, RF2	output level ≥–120 dBm	
	f < 2200 MHz	<1.1 dB
	f ≥ 2200 MHz	<1.7 dB
RF3OUT	output level ≥–80 dBm	
	f < 2200 MHz	<1.2 dB
	f ≥ 2200 MHz	<1.7 dB

RF receiver

Frequency range	band I	1920 MHz to 1980 MHz
	band II	1850 MHz to 1910 MHz
	band III	1710 MHz to 1785 MHz
	band IV	1710 MHz to 1755 MHz
	band V	824 MHz to 849 MHz
	band VI	830 MHz to 840 MHz
	band VII	2500 MHz to 2570 MHz
	band VIII	880 MHz to 915 MHz
	band IX	1749.9 MHz to 1784.9 MHz

Max. level setting range peak envelope power (PEP)		
RF1	max. continuous power +47 dBm (note 1)	–38 dBm to +53 dBm
RF2	max. continuous power +33 dBm	–52 dBm to +39 dBm
RF4IN	max. continuous power +0 dBm	–77 dBm to +0 dBm

Trigger/clock signals

Output (BNC) connectors	Trig Out A, Trig Out B	
Nominal output level		TTL
Output impedance		50 Ω

Note 1: 50 W in temperature range +5 °C to +30 °C, linear degradation down to 25 W at +45 °C.

Option 2-channel IQ/IF Interface Card R&S®CRTU-B7

The R&S®CRTU-B7 is a 2-channel option. Each channel can be setup independent from each other.

Note for I/Q chip connections:
If standard signaling tests or test cases are used, it is required to combine both channels. See application note for details.

I/Q interface

Analog I/Q outputs	IF → I/Q; TX and RX paths, analog I/Q output	connector I/Q CH1/CH2
I/Q bandwidth		0 Hz to 2.5 MHz
Max. output voltage range	EMF	–1 V to +1 V, peak
		$\sqrt{I^2+Q^2}$ = 1 V, peak
Output impedance		50 Ω
I and Q amplitude imbalance	for GSM	<2 %
	for WCDMA	<2.5 %
Offset voltage	in temperature range +20 °C to +35 °C for GSM	<4 mV
	in temperature range +20 °C to +35 °C for WCDMA	<5 mV
	in temperature range +5 °C to +45 °C	<8 mV

Analog I/Q inputs	I/Q → IF; TX–path, analog I/Q input	connector I/Q CH1/CH2
I/Q bandwidth		0 Hz to 2.5 MHz
Max. input voltage range		–0.5 V to +0.5 V, peak
		$\sqrt{I^2+Q^2}$ = 0.5 V, peak
Input impedance		50 Ω
Carrier suppression	in temperature range +20 °C to +35 °C	>40 dB
	in temperature range +5 °C to +45 °C	>35 dB
Sideband suppression	$f_{I/Q}$ < 1 MHz	>45 dB
	1 MHz < $f_{I/Q}$ < 2.5 MHz	>40 dB

Analog I/Q inputs	I/Q → IF; RX path, analog I/Q input	connector I/Q CH1/CH2
I/Q bandwidth		0 Hz to 2.5 MHz
Max. input voltage range		–0.5 V to +0.5 V, peak
		$\sqrt{I^2+Q^2}$ = 0.5 V, peak
Input impedance		50 Ω
Carrier suppression		>35 dB
Sideband suppression	$f_{I/Q}$ < 1 MHz	>45 dB
	1 MHz < $f_{I/Q}$ < 2.5 MHz	>40 dB

Influence on RF interface

RF level uncertainty	bypass with I/Q IF OUT, I/Q IN/OUT, IF IN/OUT	
Output level uncertainty	at RF 1, RF 2, RF 3 OUT	add 0.3 dB to R&S® CRTU-RU specifications

IF interface

IF outputs, TX path		connector IF TX CH1/CH2 OUT
IF level range		up to –5 dBm, PEP
Standard IF frequencies	for GSM	13.85 MHz
	for WCDMA	15.36 MHz

IF outputs, RX path		connector IF RX CH1/CH2 OUT
IF level range		up to +6 dBm, PEP
Standard IF frequencies	for GSM	10.7 MHz
	for WCDMA	7.68 MHz

Ordering information

GSM

Designation	Type	Order number
Protocol Tester for GSM	R&S®CRTU-G	1140.0009K02
Protocol Tester for GSM (extension unit)	R&S®CRTU-S	1140.1705K02
2-channel IQ/IF Interface Card for R&S®CRTU-G	R&S®CRTU-B7	1139.0009.02
Upgrade R&S®GRTU-G to R&S®CRTU-GW	R&S®CRTU-U01	1140.1105.02
Upgrade R&S®GRTU-S to R&S®CRTU-G	R&S®CRTU-U03	1140.0209.02
Upgrade R&S®GRTU-G hardisk to 120 Gbyte	R&S®CRTU-U05	1139.1105.04
Upgrade of PC module to 933 MHz/512 Mbyte	R&S®CRTU-U06	1139.1940.02
Upgrade of R&S®CRTU-S to R&S®CRTU-MS	R&S®CRTU-U10	1139.2401.02
Equipment supplied with R&S®CRTU-G/CRTU-S		
Included in the scope of delivery: hardlock, test SIMs R&S®CRT-Z2 and R&S®CRT-Z12 (for US and rest-of-world), all RF-, control- and Ethernet-cables for a multibox setup		

WCDMA

Designation	Type	Order number
Protocol Tester for WCDMA	R&S®CRTU-W	1140.0509K02
Multi-cell Extension (2 WCDMA channels) for CRTU-W	R&S®CRTU-M	1140.2101K02
Upgrade R&S®CRTU-W to R&S®CRTU-GW	R&S®CRTU-U04	1140.0309.02
Upgrade R&S®CRTU-M to R&S®CRTU-W	R&S®CRTU-U07	1139.2102.02
Upgrade R&S®CRTU-M to R&S®CRTU-MS	R&S®CRTU-U11	1139.3108.03
PPC Upgrade	R&S®CRTU-U13	1139.3008.02
Equipment supplied with R&S®CRTU-W/CRTU-M		
Included in the scope of delivery: R&S®CRTU-B7, hardlock, test SIM R&S®CRT-Z3, all RF-, control- and Ethernet-cables for a multibox setup, Microsoft VisualStudio .Net 2005 Compiler, spare fuses (two for Protocol Unit)		

Combined

Designation	Type	Order number
Protocol Tester for WCDMA and GSM	R&S®CRTU-GW	1140.0709K02
Protocol Tester for WCDMA and GSM (extension unit)	R&S®CRTU-MS	1140.2401K02
Upgrade of R&S®CRTU-MS to R&S®CRTU-GW	R&S®CRTU-U12	1139.3208.02
Equipment supplied with R&S®CRTU-GW/CRTU-MS		
Included in the scope of delivery: R&S®CRTU-B7, hardlocks, test SIMs CRT-Z2, CRT-Z12 and R&S®CRT-Z3, all RF-, control- and Ethernet-cables for a multibox setup, Microsoft VisualStudio .Net 2005 Compiler, spare fuses (two for Protocol Unit)		

Recommended number of required accessories

	Mouse	Keyboard	Monitor	DVD Drive
R&S®CRTU-G	1	1	1	1
R&S®CRTU-W	1	1	1	0
R&S®CRTU-GW	1 or 2**	1 or 2**	1	1
R&S®CRTU-S	1	1	1*	1
R&S®CRTU-M	1	1	1	0
R&S®CRTU-MS	1 or 2**	1 or 2**	1	1

Notes:

* If used in standalone mode, e.g. for data testing.

** With one mouse and keyboard only, user have to change USB connectors between RU and PU when changing operation modes between GSM and WCDMA.

Important information:

Monitor, keyboard, mouse and external DVD drive are absolutely necessary for the proper operation of the protocol testers R&S®CRTU.

We strongly recommend using only the original PC components of Rohde & Schwarz specified below in connection with a Protocol Tester R&S®CRTU. The interaction of all components is continuously tested and adjusted. The proper operation with other commercially available PC components cannot be warranted.

Recommended accessories

USB-Mouse optical mouse	R&S®PSL-Z10	1157.7060.03
USB-Keyboard	R&S®PSL-Z2	1157.6870.04
Monitor 17“ TFT	R&S®PMC3	1082.6004.12
USB DVD±RW Drive	R&S®PSP-B6	1134.8201.22

Antenna Coupler for Handheld Telephones	R&S®CMU-Z10	1150.0801.02
Shielded Chamber for R&S®CMU-Z10	R&S®CMU-Z11	1150.1008.02
19" Rack Adapter (for Radio Unit)	R&S®ZZA-411	1096.3283.00
19" Rack Adapter (for Protocol Unit)	R&S®ZZA-511	1096.3290.00
Additional test SIMs		
Test SIM GSM 900/1800	R&S®CRT-Z2	1039.9005.02
Test SIM GSM 850/1900	R&S®CRT-Z12	1139.1205.02
UICC/USIM Test Card	R&S®CRT-Z3	1139.1005.02

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

For product brochure, see PD 5213.5574.12
and www.rohde-schwarz.com
(search term: CRTU)

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