



Protocol Tester R&S CRTU-S

Cost-effective multibox and data application testing

- ◆ Enhancement for multichannel tests on R&S CRTU-G
- ◆ Platform for data application testing
- ◆ Simulation of a GSM cell with two independent channels
- ◆ Detailed analysis of messages at various protocol layers
- ◆ Fit for future mobile radio standards
- ◆ Compact single supplier solution with Windows 2000 operating system
- ◆ Upgradeable to R&S CRTU-G



ROHDE & SCHWARZ

R&S CRTU-S for GSM

The R&S CRTU-S enhances the R&S CRTU-G by another R&S CRTU radio unit with two additional RF channels. The R&S CRTU-S is also suitable as a cost-effective stand-alone unit for data tests. Our service centers can easily upgrade any R&S CRTU-S to an R&S CRTU-G, if required.

Conformance testing of GSM mobiles

The conformance test of GSM mobiles is based on the test cases defined by 3GPP in specification 51.010. Using an R&S CRTU-G/R&S CRTU-S multichannel solution, the test cases can be expanded to handover, cell selection and cell reselection as well as to other multichannel tests. A large number of these test cases have been validated for Rohde & Schwarz by independent test houses and are available for the R&S CRTU-G. Easy-to-use tools, automated testing and detailed log files speed up conformance testing and error elimination. The R&S CRTU-S can also be used in Rohde & Schwarz system solutions.

Multibox scenarios

In conjunction with the R&S CRTU-G, the R&S CRTU-S is a cost-effective test solution for up to eight RF channels. The R&S CRTU-G simulates a GSM base station and records all messages sent to and received from a mobile station. This allows detailed analysis of the protocol stack in the mobile station even under complex multichannel conditions. The R&S CRTU-S is entirely controlled by the R&S CRTU-G and needs no additional control. One R&S CRTU-G unit can control up to three R&S CRTU-S units. The testers are interconnected via the integrated and calibrated RF combiners and TCP/IP

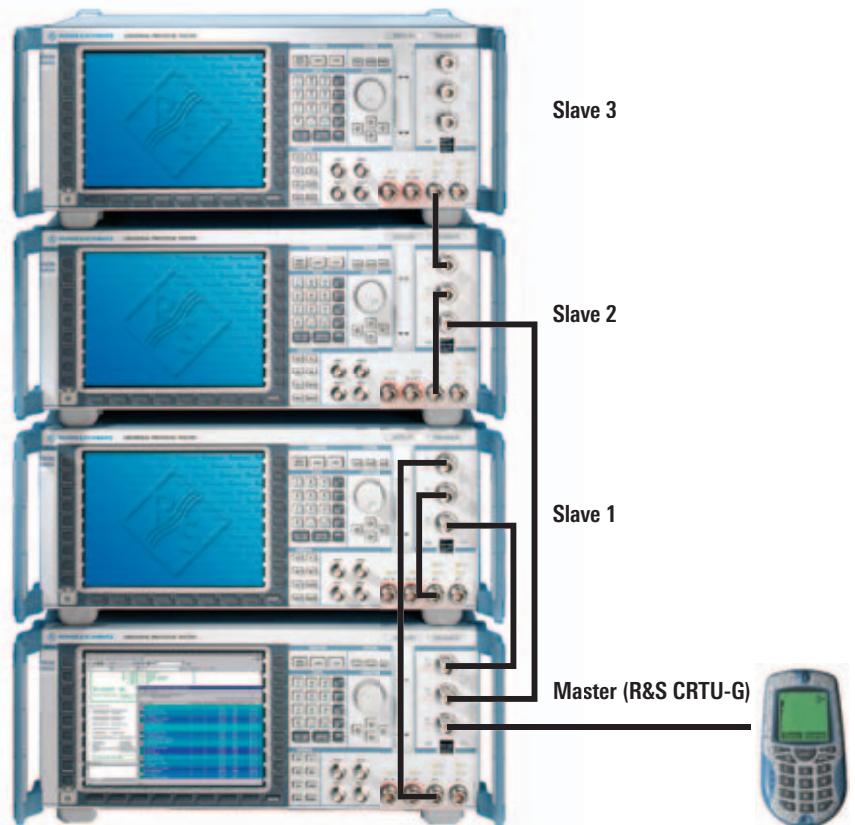
cables. There is no need to use external RF components. The messages of the protocol stack can be modified by the user. It is possible, for example, to simulate network errors and analyze a mobile station's response. To test partially implemented protocol stacks in the mobile, the R&S CRTU-G allows sections of the stack to be bypassed.

R&S CRTU-S highlights

- ◆ Cost-effective solution for multichannel tests
- ◆ Platform for reproducible data tests
- ◆ User-friendly network simulation for cost-saving application tests
- ◆ Upgradeable to R&S CRTU-G and generation of user-specific test cases possible

R&S CRTU-S basic functionality

- ◆ GSM 850, 900, 1800, 1900
- ◆ GPRS functionality
- ◆ EGPRS functionality
- ◆ FTP server
- ◆ Message viewer for analysis of layer 1, 2 and 3
- ◆ Layer 1 EDGE tool supporting all EDGE coding schemes

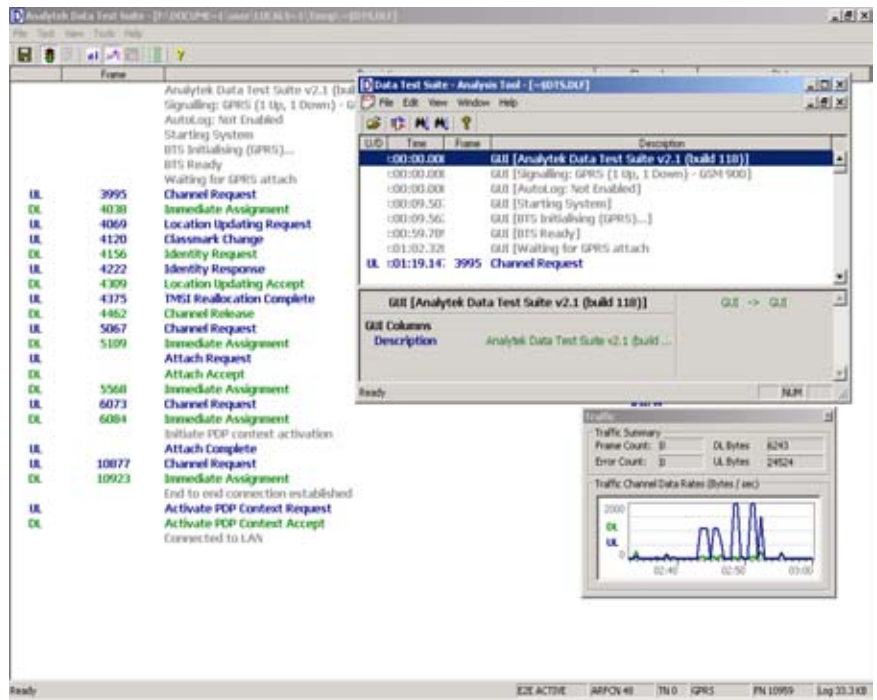


8 multichannel configuration with 1 R&S CRTU-G and 3 slave units (R&S CRTU-S or -G).

The application photo on the front page shows the 2-box application with 1 R&S CRTU-G and 1 R&S CRTU-S.

Data application testing

The R&S CRTU-S is a cost-effective platform for application testing. Through the use of additional software modules (R&S CRTU GD01 und R&S CRTU GD02) the R&S CRTU-S becomes a network simulator that is able to provide services such as I-Mode, WAP, MMS, SMS and Internet access requested by mobile phone. Neither mobile radio nor programming knowledge are thus required to test applications and their performance in the mobile phone. The reproducible conditions under which the mobile phone can be tested are the only crucial factor. This application eliminates the need for dialling into a real network and thus the associated costs.



Data test suite desktop

Specifications

Inband GSM specifications

RF generator

Modulation	GMSK, BxT = 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 <500 µs to res. phase of 4°

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

Inband output level uncertainty

RF1, RF2 at >-117 dBm
in temperature range +23°C to +35°C <0.7 dB
in temperature range +5°C to +45°C <0.9 dB

RF3OUT
-90 dBm to +5 dBm (GMSK)
-90 dBm to +1 dBm (8PSK)
in temperature range +23°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	+10 dBm to +53 dBm, max. continuous input power 50 W ¹⁾
RF2	-4 dBm to +39 dBm, max. continuous input power 2 W
RF4IN	-22 dBm to 0 dBm
8PSK	
RF1	+6 dBm to +49 dBm, max. continuous input power 50 W ¹⁾
RF2	-8 dBm to +35 dBm, max. continuous input power 2 W
RF4IN	-26 dBm to -4 dBm

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

Base unit specifications

Timebase OCXO

Max. frequency drift	
in temperature range +5°C to +45°C	$\pm 5 \times 10^{-9}$ referred to +25°C
with instrument orientation	$\pm 3 \times 10^{-9}$
referred to turn-off frequency	
after 2 h warmup time following	
a 24 h off time at +25°C	$\pm 5 \times 10^{-9}$
Max. aging	$\pm 3.5 \times 10^{-8}$ /year, $\pm 5 \times 10^{-10}$ /day
	after 30 days of operation
Warmup time (at +25°C)	approx. 10 min

Reference frequency inputs/outputs

Synchronization input	BNC connector REFIN
Frequency	
Sinewave	1 MHz to 52 MHz, step 1 kHz
Squarewave (TTL level)	10 kHz to 52 MHz, step 1 kHz
Max. frequency variation	$\pm 5 \times 10^{-6}$
Input voltage range	0.5 V to 2 V (rms)
Impedance	50 Ω
Synchronization output 1	BNC connector REFOUT1
Frequency	10 MHz from internal reference or frequency at synchronization input
Output voltage	>1.4 V (peak-peak)
Impedance	50 Ω
Synchronization output 2	BNC connector REFOUT2
Frequency	net-specific frequencies in range 100 kHz to 40 MHz
Output voltage ($f \leq 13$ MHz)	>1.0 V (peak-peak)
Impedance	50 Ω

RF generator

Frequency range	100 kHz to 2700 MHz
Frequency resolution	0.1 Hz
Frequency uncertainty	same as timebase + resolution
Frequency settling time	<400 μ s to $\Delta f < 1$ kHz

Output level uncertainty

RF1, RF2 in temperature range +23°C to +35°C			
	>-106 dBm	>-117 dBm	-117 to -130 dBm
10 MHz to 450 MHz	<0.8 dB		
450 MHz to 2200 MHz	<0.8 dB	<0.8 dB	<1.7 dB
2200 MHz to 2700 MHz	<1.0 dB	<1.0 dB	<1.7 dB

RF1, RF2 in temperature range +5°C to +45°C			
	≥ -106 dBm	>-117 dBm	-117 to -130 dBm
10 MHz to 450 MHz	<1.2 dB		
450 MHz to 2200 MHz	<1.2 dB	<1.2 dB	<1.7 dB
2200 MHz to 2700 MHz	<1.7 dB	<1.7 dB	<1.7 dB

RF3OUT in temperature range +23°C to +35°C	
10 MHz to 450 MHz: -80 dBm to +10 dBm	<1.0 dB
450 MHz to 2200 MHz: -90 dBm to +10 dBm	<1.0 dB
2200 MHz to 2700 MHz: -90 dBm to +5 dBm	<1.2 dB

RF3OUT in temperature range +5°C to +45°C	
10 MHz to 450 MHz: -80 dBm to +10 dBm	<1.2 dB
450 MHz to 2200 MHz: -90 dBm to +10 dBm	<1.2 dB
2200 MHz to 2700 MHz: -90 dBm to +5 dBm	<1.7 dB

Output level settling time	<4 μ s
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Output level resolution	0.1 dB
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Generator RF level repeatability

(RF1, RF2, RF3OUT, typical values after 1 h warmup)	
Output ≥ -80 dBm	<0.01 dB
Output < -80 dBm	<0.1 dB

VSWR

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

Attenuation of harmonics ($f_0 = 10$ MHz to 2200 MHz, up to 7 GHz)

RF1, RF2	>30 dB
RF3OUT ($P \leq +10$ dBm)	>20 dB

Attenuation of nonharmonics

10 MHz to 2200 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)
≥ 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 (rms)

Residual AM

ITU-T (formerly CCITT)	<0.02% (rms)
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I/Q modulation

Data for frequency offset range 0 kHz to ± 135 kHz	
Carrier suppression	>40 dB

RF receiver

VSWR

RF1	
10 MHz to 2000 MHz	<1.2
2000 MHz to 2200 MHz	<1.3
2200 MHz to 2700 MHz	<1.6
RF2	
10 MHz to 2200 MHz	<1.2
2200 MHz to 2700 MHz	<1.6
RF4IN	
10 MHz to 2200 MHz	<1.5
2200 MHz to 2700 MHz	<1.6

Phase noise (single sideband, $f < 2.2$ GHz)

Carrier offset	
20 kHz to 250 kHz	<-100 dBc (1 Hz)
250 kHz to 400 kHz	<-110 dBc (1 Hz)
≥ 400 kHz	<-118 dBc (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)
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Power splitter

Insertion loss

SC/S1, 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
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

Audio

Input connector AUX1 (BNC)

Full range input level	0.79 V (rms)
Input impedance	100 k Ω

Output connector AUX2 (BNC)

Full range output level	0.79 V (rms)
Output impedance	<2 Ω

Inputs and outputs (rear panel)

IEC/IEEE bus remote-control interface according to IEC 625-2 (IEEE 488.2)

Connector	24-pin Amphenol
Serial interface COM1, COM2	RS-232-C (COM), 9-pin sub-D connector
Printer interface LPT	parallel (Centronics-compatible)
Connector for ext. monitor (VGA)	15-pin sub-D connector
USB	double connector
Ethernet	RJ45

Trigger/clock signals

Input (BNC) connectors: Trig In A, Trig In B	
Nominal input level	TTL
Input impedance	1 k Ω
Output (BNC) connectors: Trig Out A, Trig Out B, SLOT CLK, BIT CLK	
Nominal output level	TTL
Output impedance	50 Ω

General data for R&S CRTU-RU

Operating temperature range	+5°C to +45°C
Storage temperature range	-25°C to +60°C
Humidity	+40°C, 80% rh, non-condensing; complies with IEC 60068

Display

21 cm TFT colour display (8.4")	
Resolution	640 x 480 pixels (VGA resolution)
Pixel failure rate	<2 x 10 ⁻⁵

Electromagnetic compatibility

meets requirements of European EMC Directive 89/336/EEC (EN50081-1 and EN50082-2)

Mechanical resistance (non-operating mode)

Vibration, sinusoidal meets IEC 60068, IEC 61010, 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 meets DIN IEC 60068, DIN 40046 T24, 10 Hz to 300 Hz, acceleration 1.2 g (rms)

Shock meets DIN IEC 60068, MIL-STD-810D, 40 g shock spectrum

Electrical safety IEC 61010, DIN EN61010-1

Power supply

100 V to 240 V \pm 10% (AC), 500 VA, 50 Hz to 400 Hz -5% to +10% power factor correction, EN61000-3-2, power consumption max. 500 VA, base unit 200 W typ.

Dimensions

W x H x D	665 mm x 193 mm x 517 mm (19"; 4 height units)
Weight	19 kg

Ordering information

Protocol Tester	R&S CRTU-S	1140.1705.02
2 channel IQ/IF Interface Board	R&S CRTU-B7	1139.0009.02
Upgrade R&S CRTU-S to R&S CRTU-G	R&S CRTU U03	1140.0209.02

For information about software options, please contact the nearest Rohde & Schwarz sales agency.

Equipment supplied with R&S CRTU-S

Radio Unit	R&S CRTU-RU
Link Handler (2 pieces)	R&S CRTU-B5
MAC/Speech Board	R&S CRTU-B6
Test SIM phase 2+	R&S CRT-Z2
Operational Software	R&S CR02P2P
Additional Operational Software	R&S CRGPRS1
Additional Operational Software	R&S CRGPRS2
Additional Operational Software	R&S CRGPRS3
Additional Operational Software	R&S CU-GA85

Keyboard, mouse, CD-RW drive, hardlock, all RF and control cables required for cascading of 2 boxes

Recommended extras

19" Rack Adapter	R&S ZAA-411	1096.3283.00
Antenna Coupler	R&S CMU-Z10	1150.0801.02
RF Shielding Cover for R&S CMU-Z10	R&S CMU-Z11	1150.1008.02
RF cable N-N connector for cascading of more than 2 boxes (1 cable for each additional box)		1119.3619.00
Data Test Suite Software for Circuit Switched Tests	R&S CRTU GD01	1141.0702.02
Data Test Suite Software for Packet Switched Tests ¹⁾	R&S CRTU GD02	1141.0754.02

¹⁾ Only in combination with R&S CRTU GD01.



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