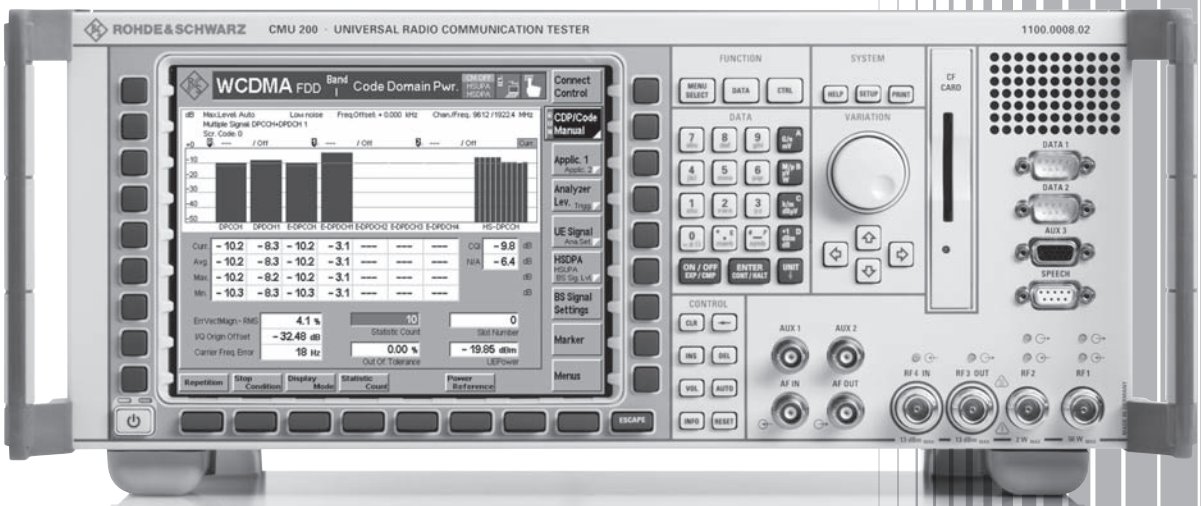
R&S®CMU200
Universal Radio Communication Tester
Specifications



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CONTENTS

Base unit specifications **5**
Timebase TCXO 5
Timebase OCXO – R&S®CMU-B11 option 5
Timebase OCXO – R&S®CMU-B12 option 5
Reference frequency inputs/outputs 5
RF generator 6
RF analyzer 7
Power meter (wideband) *8*
Power meter (frequency-selective) *9*
Spectrum analyzer 10
General data 11
Inputs and outputs (rear panel) 12
GSM specifications – mobile station test **13**
RF generator 13
R&S®CMU-B95 additional RF generator option 14
R&S®CMU-B96 additional RF generator option 14
Path 1 for GSM *14*
Influence on RF interface *15*
RF analyzer 15
Power meter (frequency-selective) *15*
Modulation analysis *16*
Burst power measurement *16*
Spectrum due to modulation *16*
Spectrum due to switching *17*
R&S®CMU-B52 speech codec option 17
TDMA specifications – mobile station test **18**
RF generator 18
RF analyzer 18
Modulation analysis *18*
Power meter (frequency-selective) *19*
Power versus time measurement *19*
Adjacent channel power measurement *19*
AMPS specifications – mobile station test **20**
RF generator 20
RF analyzer 20
Power meter (frequency-selective) *20*
FM measurement *21*
AF generator 21
AF analyzer 21
CDMA2000® specifications – mobile station test **22**
RF generator 22
RF analyzer 24

Power meter (frequency-selective) *24*
Modulation analyzer *25*
R&S®CMU-B85 speech codec option 25
1xEV-DO specifications – access terminal test 26
RF generator 26
RF analyzer 28
Power meter (frequency-selective) *28*
Modulation analyzer *29*
WCDMA specifications – mobile station (UE) test 30
RF generator 30
R&S®CMU-B96 additional RF generator option 33
Path 2 for WCDMA *33*
Influence on RF interface *34*
RF analyzer (TX measurements) 34
Modulation analysis *35*
Spectrum measurements *36*
Power meter (frequency-selective) *37*
Code domain power [7] *38*
Receiver quality (bit error rate measurements) *38*
R&S®CMU-B52 speech codec option 38
Bluetooth® specifications 39
RF generator 39
RF analyzer 39
Power meter (frequency-selective) and power versus time *40*
Modulation analyzer *40*
Timing measurement *40*
R&S®CMU-B52 speech codec option 41
R&S®CMU-B17 I/Q/IF interface option 42
I/Q interface 42
Influence on RF interface 42
IF interface 43
Remarks 44
Additional information for GSM: *44*
Aspects to be considered if TX or RX signal paths are interrupted: *44*
Notes for measuring I/Q/IF signals applied to inputs of the R&S®CMU-B17 option on the R&S®CMU200 RX path: *44*
R&S®CMU-B41 audio generator/analyzer option 45
AF generator 45
AF analyzer 45
R&S®CMU-U99/B99 RF1 level range identical to RF2 option 45

Specifications apply under the following conditions: "Typical values" are designated with the abbreviation "typ." These values are verified during the final test but are not assured by Rohde & Schwarz. "Nominal values" are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production.

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in kbps (thousand bits per second) or ksps (thousand symbols per second). Mcps, kbps, and ksps are not SI units.

The specifications for the R&S®CMU200 (Order No. 1100.0008.02/10/30/53) refer to a fully equipped unit with all relevant options installed.

Data without tolerance limits is not binding.

For more general information about the R&S®CMU200, refer to the product brochure PD 0758.0039.12.

Base unit specifications

Timebase TCXO

Max. frequency drift	in temperature range +5 °C to +45 °C	$\pm 1 \times 10^{-6}$
Max. aging		$\pm 1 \times 10^{-6}$/year

Timebase OCXO – R&S®CMU-B11 option

Max. frequency drift	in temperature range +5 °C to +45 °C	$\pm 1 \times 10^{-7}$
Max. aging	after 30 days of operation	$\pm 2 \times 10^{-7}$/year $\pm 5 \times 10^{-9}$/day
Warm-up time	at +25 °C	approx. 5 min

Timebase OCXO – R&S®CMU-B12 option

Max. frequency drift	in temperature range +5 °C to +45 °C, referenced to +25 °C	$\pm 5 \times 10^{-9}$
	with instrument orientation	$\pm 3 \times 10^{-9}$
	referenced to turn-off frequency after 2 h warm-up time following a 24 h off time at +25 °C	$\pm 5 \times 10^{-9}$

Max. aging	after 30 days of operation	$\pm 3.5 \times 10^{-8}$/year $\pm 5 \times 10^{-10}$/day
Warm-up time	at +25 °C	approx. 10 min

Reference frequency inputs/outputs

Synchronization input		BNC connector REF IN
Frequency	sinewave	1 MHz to 52 MHz, 1 kHz step
	squarewave (TTL level)	10 kHz to 52 MHz, 1 kHz step
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 REF OUT 1
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 REF OUT 2
Frequency		net-specific frequencies in range 100 kHz to 40 MHz
Output voltage	f ≤ 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 + frequency resolution
Frequency settling time		<400 µs to Δf < 1 kHz

Output level range		
RF 1	100 kHz to 2200 MHz	–130 dBm to –27 dBm
	2200 MHz to 2700 MHz	–130 dBm to –33 dBm
RF 2	100 kHz to 2200 MHz	–130 dBm to –10 dBm
	2200 MHz to 2700 MHz	–130 dBm to –16 dBm
RF 3 OUT	100 kHz to 2200 MHz	–90 dBm to +13 dBm
	2200 MHz to 2700 MHz	–90 dBm to +5 dBm

Output level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	output level ≥ –106 dBm	
	10 MHz to 450 MHz	<0.6 dB
	450 MHz to 2200 MHz	<0.6 dB
	2200 MHz to 2700 MHz	<0.8 dB
	output level > –117 dBm	
	450 MHz to 2200 MHz	<0.6 dB [1]
	2200 MHz to 2700 MHz	<0.8 dB [1]
	output level –117 dBm to –130 dBm	
	450 MHz to 2200 MHz	<1.5 dB [1, 2]
	2200 MHz to 2700 MHz	<1.5 dB [1, 2]
RF 3 OUT	10 MHz to 450 MHz	
	output level –80 dBm to +10 dBm	<0.8 dB
	450 MHz to 2200 MHz	
	output level –90 dBm to +10 dBm	<0.8 dB
	2200 MHz to 2700 MHz	
	output level –90 dBm to +5 dBm	<1.0 dB

Output level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2	output level ≥ –106 dBm	
	10 MHz to 450 MHz	<1.0 dB
	450 MHz to 2200 MHz	<1.0 dB
	2200 MHz to 2700 MHz	<1.5 dB
	output level > –117 dBm	
	450 MHz to 2200 MHz	<1.0 dB [1]
	2200 MHz to 2700 MHz	<1.5 dB [1]
	output level –117 dBm to –130 dBm	
	450 MHz to 2200 MHz	<1.5 dB [1, 2]
	2200 MHz to 2700 MHz	<1.5 dB [1, 2]
RF 3 OUT	10 MHz to 450 MHz	
	output level –80 dBm to +10 dBm	<1.0 dB
	450 MHz to 2200 MHz	
	output level –90 dBm to +10 dBm	<1.0 dB
	2200 MHz to 2700 MHz	
	output level –90 dBm to +5 dBm	<1.5 dB

Output level settling time		<4 µs

Output level resolution		0.1 dB

[1] Not valid at frequencies of net-clock harmonics.

[2] Valid for RF 1 only.

Generator RF level repeatability	typical values after 1 h warm-up time	
	output level ≥ –80 dBm	<0.01 dB
	output level < –80 dBm	<0.1 dB
VSWR		
RF 1	10 MHz to 2000 MHz	<1.2
	2000 MHz to 2200 MHz	<1.3
	2200 MHz to 2700 MHz	<1.6
RF 2	10 MHz to 2200 MHz	<1.2
	2200 MHz to 2700 MHz	<1.6
RF 3 OUT	10 MHz to 2200 MHz	<1.5
	2200 MHz to 2700 MHz	<1.7

Attenuation of harmonics	up to 7 GHz	
RF 1, RF 2	f_0 = 10 MHz to 200 MHz	>20 dB
RF 1, RF 2	f_0 = 200 MHz to 2200 MHz	>30 dB
RF 3 OUT	f_0 = 10 MHz to 2200 MHz output level ≤ +10 dBm	>20 dB

Attenuation of nonharmonics	10 MHz to 2200 MHz, at f > 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	f < 2.2 GHz	
	30 Hz to 15 kHz	<50 Hz, rms <200 Hz, peak
	ITU-T (formerly CCITT)	<5 Hz, rms

Residual AM	f < 2.2 GHz	
	ITU-T (formerly CCITT)	<0.02 %, rms

I/Q modulation		
Carrier suppression	data for frequency offset range 0 Hz to ±135 kHz	>40 dB

FM modulation		
Deviation range		10 kHz to 440 kHz
Deviation resolution		1 Hz
Modulation frequency range		100 Hz to 50 kHz
Modulation distortion	modulation frequency 1 kHz, deviation 80 kHz	<2 %
Deviation uncertainty		<5 % + resolution + residual FM

RF analyzer

VSWR		
RF 1	10 MHz to 2000 MHz	<1.2
	2000 MHz to 2200 MHz	<1.3
	2200 MHz to 2700 MHz	<1.6
RF 2	10 MHz to 2200 MHz	<1.2
	2200 MHz to 2700 MHz	<1.6
RF 4 IN	10 MHz to 2200 MHz	<1.5
	2200 MHz to 2700 MHz	<1.6

Inherent spurious response	*RF Attenuation → Low Distortion* 20 MHz to 2200 MHz, except 1816.115 MHz	<–50 dB

Inherent harmonics	f_{in} = 50 MHz to 1100 MHz, $f_{selected}$ = 100 MHz to 2200 MHz	
RF 1, RF 2		<–30 dB
RF 4 IN		<–20 dB

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, 1 Hz

Residual FM	f < 2.2 GHz	
	30 Hz to 15 kHz	<50 Hz, rms <200 Hz, peak
	ITU-T (formerly CCITT)	<5 Hz, rms

Residual AM	f < 2.2 GHz	
	ITU-T (formerly CCITT)	<0.02 %, rms

Power meter (wideband)

Frequency range		100 kHz to 2700 MHz

Level range		
RF 1	continuous power [3]	
	10 MHz to 2200 MHz	+6 dBm to +47 dBm (50 W)
	2200 MHz to 2700 MHz	+10 dBm to +47 dBm (50 W)
	peak envelope power [4] (PEP)	+53 dBm (200 W)
RF 2	continuous power	
	10 MHz to 2200 MHz	–8 dBm to +33 dBm (2 W)
	2200 MHz to 2700 MHz	–4 dBm to +33 dBm (2 W)
	peak envelope power [4] (PEP)	+39 dBm (8 W)
RF 4 IN	continuous power and PEP	
	10 MHz to 2200 MHz	–33 dBm to 0 dBm
	2200 MHz to 2700 MHz	–29 dBm to 0 dBm

Level uncertainty		
RF 1	input level +10 dBm to +20 dBm	
	50 MHz to 2700 MHz	<1.0 dB [5]
	input level +20 dBm to +47 dBm	
	50 MHz to 2700 MHz	<0.5 dB [5, 6]
RF 2	input level –4 dBm to +6 dBm	
	50 MHz to 2700 MHz	<1.0 dB [5]
	input level +6 dBm to +33 dBm	
	50 MHz to 2700 MHz	<0.5 dB [5]
RF 4 IN	input level –29 dBm to –19 dBm	
	50 MHz to 2700 MHz	<1.5 dB
	input level –19 dBm to 0 dBm	
	50 MHz to 2700 MHz	<0.8 dB

Level resolution	in manual mode	0.1 dB
	in remote control mode	0.01 dB

[3] 50 W in temperature range +5 °C to +30 °C, linear degradation down to 25 W at +45 °C.

[4] Mean value of power versus time must be equal to or less than permissible continuous power.

[5] Temperature range +5 °C to +20 °C or +35 °C to +45 °C and f > 2200 MHz: add 0.2 dB.

[6] Calibrated for input level > +33 dBm only in frequency range 800 MHz to 2000 MHz.

Power meter (frequency-selective)

Frequency range		10 MHz to 2700 MHz

Frequency resolution		0.1 Hz

Resolution bandwidths		10 Hz to 1 MHz in 1/2/3/5 steps

Level range		
RF 1	continuous power [3]	
	10 MHz to 2200 MHz	–40 dBm to +47 dBm (50 W)
	2200 MHz to 2700 MHz	–34 dBm to +47 dBm (50 W)
	peak envelope power [4] (PEP)	+53 dBm (200 W)
RF 2	continuous power	
	10 MHz to 2200 MHz	–54 dBm to +33 dBm (2 W)
	2200 MHz to 2700 MHz	–48 dBm to +33 dBm (2 W)
	peak envelope power [4] (PEP)	+39 dBm (8 W)
RF 4 IN	continuous power and PEP	
	10 MHz to 2200 MHz	–80 dBm to 0 dBm
	2200 MHz to 2700 MHz	–74 dBm to 0 dBm

Level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	50 MHz to 2200 MHz	<0.5 dB
	2200 MHz to 2700 MHz	<0.7 dB
RF 4 IN	50 MHz to 2200 MHz	<0.7 dB
	2200 MHz to 2700 MHz	<0.9 dB

Level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2	50 MHz to 2200 MHz	<1.0 dB
	2200 MHz to 2700 MHz	<1.0 dB
RF 4 IN	50 MHz to 2200 MHz	<1.0 dB
	2200 MHz to 2700 MHz	<1.1 dB

Level resolution	in manual mode	0.1 dB
	in remote control mode	0.01 dB

RF level measurement repeatability	typical values after 1 h warm-up time	
	input level ≥ –40 dBm	<0.01 dB
	input level < –40 dBm	<0.03 dB

Spectrum analyzer

Frequency range		10 MHz to 2.7 GHz
Span		zero span to full span
Frequency resolution		0.1 Hz
Resolution bandwidths		10 Hz to 1 MHz in 1/2/3/5 steps
Sweep time	depending on resolution bandwidth (RBW)	≥100 ms
Display		560 dots, horizontal
Marker		up to 3, absolute/relative
Display line		1
Display scale		10 dB/20 dB/30 dB/50 dB/80 dB/100 dB

Level range		
RF 1	continuous power [3]	up to +47 dBm (50 W)
	peak envelope power [4] (PEP)	up to +53 dBm (200 W)
RF 2	continuous power	up to +33 dBm (2 W)
	peak envelope power [4] (PEP)	up to +39 dBm (8 W)
RF 4 IN	continuous power and PEP	up to 0 dBm

Level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	50 MHz to 2200 MHz	<0.5 dB
	2200 MHz to 2700 MHz	<0.7 dB
RF 4 IN	50 MHz to 2200 MHz	<0.7 dB
	2200 MHz to 2700 MHz	<0.9 dB

Level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2	50 MHz to 2200 MHz	<1.0 dB
	2200 MHz to 2700 MHz	<1.0 dB
RF 4 IN	50 MHz to 2200 MHz	<1.0 dB
	2200 MHz to 2700 MHz	<1.1 dB

Reference level for full dynamic range	*RF Attenuation → Low Noise* logarithmic level display	
RF 1		+10 dBm to +47 dBm
RF 2		–4 dBm to +33 dBm
RF 4 IN		–22 dBm to 0 dBm

Displayed average noise level	*RF Attenuation → Low Noise* RBW → 1 kHz	
	10 MHz to 2200 MHz	<–100 dBc
	2200 MHz to 2700 MHz	<–95 dBc

Inherent spurious response	*RF Attenuation → Low Distortion*	
	20 MHz to 2200 MHz, except 1816.115 MHz	<–50 dB

Inherent harmonics	f_{in} = 50 MHz to 1100 MHz $f_{selected}$ = 100 MHz to 2200 MHz	
RF 1, RF 2		<–30 dB
RF 4 IN		<–20 dB

General data

Operating temperature range		+5 °C to +45 °C, in line with EN 60068-2-1 and -2
Storage temperature range		–25 °C to +60 °C, in line with EN 60068-2-1 and -2
Humidity	+40 °C, non-condensing	80 % relative humidity, in line with EN 60068-2-78

Electromagnetic compatibility		in line with EMC Directive 2004/108/EC, applied standard: EN 61326 (immunity for industrial environment; class B emissions)

Electrical safety		in line with IEC 61010-1: 2001 (ed. 2), EN 61010-1: 2001 (ed. 2), UL 61010-1 (ed. 2), CAN C22.2 No. 61010-1-04

Mechanical resistance	non-operating mode	
Vibration	sinusoidal	in line with EN 60068-2-6, MIL-PRF-28800 F classes 3 and 4, 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 MIL-STD-810D 40 g shock spectrum

Power supply		power factor correction, in line with EN 61000-3-2
Input		100 V to 240 V ±10 % (AC), max. 500 VA, 50 Hz to 400 Hz –5 % to +10 %
Power consumption	base unit	approx. 130 W
	with typical options	approx. 180 W

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

Dimensions	W × H × D	465.1 mm × 197.3 mm × 517.0 mm (18.31 in × 7.77 in × 20.35 in)
	for rackmounting	19” 1/1, 4 HU, 450

Weight	base unit	approx. 14 kg (approx. 31 lb)
	with typical options	approx. 18 kg (approx. 40 lb)

Inputs and outputs (rear panel)

IF 3 RX CH1		BNC female
Frequency	WCDMA other networks/RF	7.68 MHz 10.7 MHz
Max. output level		0 dBm
Impedance		50 Ω

Remote control interfaces		
IEC/IEEE bus	IEC 60625-2 (IEEE 488.2)	24-pin Amphenol connector
Serial interface COM 1, COM 2	RS-232-C (COM)	9-pin D-Sub connector

Printer interface LPT	parallel (Centronics compatible)	25-pin D-Sub connector

USB	keyboard only	2 × USB type A connector

External monitor (VGA)		15-pin D-Sub connector

GSM specifications – mobile station test

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	
RF 1		–130 dBm to –27 dBm
RF 2		–130 dBm to –10 dBm
RF 3 OUT		–90 dBm to +13 dBm

Output level range	8PSK	
RF 1		–130 dBm to –31 dBm
RF 2		–130 dBm to –14 dBm
RF 3 OUT		–90 dBm to +9 dBm

Output level resolution		0.1 dB

Output level uncertainty	in temperature range +20 °C to 35 °C	
RF 1, RF 2	output level > –117 dBm	<0.5 dB
RF 3 OUT	–90 dBm to +10 dBm (GMSK) –90 dBm to +6 dBm (8PSK)	<0.7 dB <0.7 dB

Output level uncertainty	in temperature range +5 °C to 45 °C	
RF 1, RF 2	output level > –117 dBm	<0.7 dB
RF 3 OUT	–90 dBm to +10 dBm (GMSK) –90 dBm to +6 dBm (8PSK)	<0.9 dB <0.9 dB

R&S®CMU-B95 additional RF generator option

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

Frequency resolution		200 kHz

Frequency uncertainty		same as timebase, see base unit specifications

Inherent phase error	GMSK	<5°, rms

Output level range	GMSK	
RF 1	without R&S®CMU-U99 with R&S®CMU-U99	–122 dBm to –72 dBm –110 dBm to –60 dBm
RF 2		–110 dBm to –60 dBm

Output level range	8PSK	
RF 1	without R&S®CMU-U99 with R&S®CMU-U99	–122 dBm to –76 dBm –110 dBm to –64 dBm
RF 2		–110 dBm to –64 dBm

Output level resolution		1 dB

Reduced input level range	if R&S®CMU-B95 is installed	
RF 1	continuous input power	max. 2 W

R&S®CMU-B96 additional RF generator option

Path 1 for GSM

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

Frequency resolution		2.5 kHz

Frequency uncertainty		same as timebase, see base unit specifications

Inherent phase error	GMSK	<5°, rms

Output level range	GMSK	
RF 1	without R&S®CMU-U99 with R&S®CMU-U99	–115 dBm to –72 dBm –103 dBm to –60 dBm
RF 2		–103 dBm to –60 dBm

Output level range	8PSK	
RF 1	without R&S®CMU-U99 with R&S®CMU-U99	–115 dBm to –76 dBm –103 dBm to –64 dBm
RF 2		–103 dBm to –64 dBm

Output level range	GMSK overrange mode	
RF 1	without R&S®CMU-U99 with R&S®CMU-U99	–110 dBm to –28 dBm –90 dBm to –14 dBm
RF 2		–90 dBm to –14 dBm
RF 3 OUT		–70 dBm to +9 dBm

Output level range	8PSK overrange mode	
RF 1	without R&S®CMU-U99 with R&S®CMU-U99	–110 dBm to –32 dBm –90 dBm to –18 dBm
RF 2		–90 dBm to –18 dBm
RF 3 OUT		–70 dBm to +5 dBm

Output level resolution		1 dB

Influence on RF interface

Reduced input level range	if R&S®CMU-B96 is installed	
RF 1	continuous input power	max. 2 W

RF level uncertainty	Use of the R&S®CMU-B96 in overrange mode may influence all RF signal levels and their quality.

RF analyzer

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

Power meter (frequency-selective)

Level range		
RF 1	continuous power [3]	–40 dBm to +47 dBm (50 W)
	peak envelope power [4] (PEP)	+53 dBm (200 W)
RF 2	continuous power	–54 dBm to +33 dBm (2 W)
	peak envelope power [4] (PEP)	+39 dBm (8 W)
RF 4 IN	continuous power and PEP	–80 dBm to 0 dBm

Level uncertainty	in temperature range +20 °C to +35 °C	<0.5 dB
	in temperature range +5 °C to +45 °C	<0.7 dB

Level resolution	in manual mode	0.1 dB
	in remote control mode	0.01 dB

Measurement bandwidth	selectable	500 kHz or 600 kHz

Modulation analysis

Level range	peak envelope power (PEP)	
RF 1	see footnote 4	–6 dBm to +53 dBm
RF 2	see footnote 4	–20 dBm to +39 dBm
RF 4 IN		–60 dBm to 0 dBm

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

Inherent EVM	8PSK	≤1.0 %, rms

Frequency measurement uncertainty		≤10 Hz + drift of timebase, see base unit specifications

Measurement bandwidth	selectable	500 kHz or 600 kHz

Burst power measurement

Reference level for full dynamic range	GMSK, *RF Attenuation → Low Noise*	
RF 1	see footnote 4	+10 dBm to +53 dBm
RF 2	see footnote 4	–4 dBm to +39 dBm
RF 4 IN		–22 dBm to 0 dBm

Reference level for full dynamic range	8PSK, *RF Attenuation → Low Noise*	
RF 1	see footnote 4	+6 dBm to +49 dBm
RF 2	see footnote 4	–8 dBm to +35 dBm
RF 4 IN		–26 dBm to –4 dBm

Dynamic range	*Filter → 500 kHz*, rms *RF Attenuation → Low Noise*	
	GMSK	>72 dB
	8PSK	>69 dB

Relative measurement uncertainty		
	result > –40 dB	<0.1 dB
	–60 dB ≤ result ≤ –40 dB	<0.5 dB

Resolution	in active part of burst	0.1 dB

Measurement bandwidth	selectable	500 kHz or 600 kHz

Spectrum due to modulation

Reference level for full dynamic range	GMSK, *RF Attenuation → Low Noise*	
RF 1		+10 dBm to +47 dBm
RF 2		–4 dBm to +33 dBm
RF 4 IN		–22 dBm to 0 dBm

Test method		relative measurement, averaging

Filter bandwidth		30 kHz resolution filter, 5 poles

Measurement	at an offset of ±	100/200/250/400/600/800/1000/1200/ 1400/1600/1800 kHz

Dynamic range	with offset ≥ 1200 kHz	>74 dB

Spectrum due to switching

Reference level for full dynamic range	GMSK, *RF Attenuation → Low Noise*	
RF 1		+10 dBm to +47 dBm
RF 2		–4 dBm to +33 dBm
RF 4 IN		–22 dBm to 0 dBm

Test method		absolute measurement, max. hold over several measurements

Filter bandwidth		30 kHz resolution filter, 5 poles

Measurement	at an offset of ±	400/600/1200/1800 kHz

Dynamic range	with offset ≥ 1200 kHz	>72 dB

R&S®CMU-B52 speech codec option

Speech decoder output	SPEECH HANDSET OUT	9-pin D-Sub connector
Output impedance		<10 Ω
Max. output current		20 mA, peak
Full-range output level		1 V, peak

Speech coder input	SPEECH HANDSET IN	9-pin D-Sub connector
Input impedance		100 kΩ
Full-range input level	low sensitivity high sensitivity	1.4 V, peak 0.1 V, peak

TDMA specifications – mobile station test

RF generator

Frequency range	signaling mode	
	US Cellular	869 MHz to 894 MHz
	PCS (US)	1930 MHz to 1990 MHz

Frequency range	non-signaling mode	10 MHz to 2200 MHz

Frequency resolution	non-signaling mode	1 Hz

Frequency uncertainty		same as timebase, see base unit specifications

Output level range		
RF 1		–130 dBm to –32 dBm
RF 2		–130 dBm to –15 dBm
RF 3 OUT		–90 dBm to +8 dBm

Output level resolution		0.1 dB

Output level uncertainty		see base unit specifications

Modulation	π/4 DQPSK or unmodulated (non-signaling mode)	
Uncertainty	EVM	<2.5 %, rms
Carrier suppression		>40 dB

RF analyzer

Frequency range	signaling mode	
	US Cellular	824 MHz to 849 MHz
	PCS (US)	1850 MHz to 1910 MHz

Frequency range	non-signaling mode	10 MHz to 2200 MHz

Frequency resolution	non-signaling mode	1 Hz

Frequency uncertainty		same as timebase, see base unit specifications

Modulation analysis

Frequency range	signaling mode	
	US Cellular	824 MHz to 849 MHz
	PCS (US)	1850 MHz to 1910 MHz

EVM	residual	<2.0 %, rms
		<4 %, peak

I/Q offset	residual	<–50 dB (0.3 %)

I/Q imbalance	residual	<–50 dB (0.3 %)

Frequency measurement range		–2 kHz to +2 kHz

Frequency measurement uncertainty		≤5 Hz + drift of timebase, see base unit specifications

Power meter (frequency-selective)

Level range		see base unit specifications

Level uncertainty		see base unit specifications

Power versus time measurement

Reference level for full dynamic range		
RF 1		+4 dBm to +47 dBm
RF 2		–10 dBm to +33 dBm
RF 4 IN		–28 dBm to –6 dBm

Dynamic range	*Filter → 100 kHz*, rms *RF Attenuation → Low Noise*	>74 dB

Relative measurement uncertainty	result > –40 dB	<0.1 dB
	–60 dB ≤ result ≤ –40 dB	<0.5 dB

Residual leakage power level		<–65 dBm

Adjacent channel power measurement

Dynamic range	first adjacent channel	>45 dB
	second and third adjacent channel	>55 dB

AMPS specifications – mobile station test

RF generator

Frequency range	signaling mode	
	US Cellular	869 MHz to 894 MHz

Frequency range	non-signaling mode	10 MHz to 2200 MHz

Frequency resolution	non-signaling mode	1 Hz

Frequency uncertainty		same as timebase, see base unit specifications

Output level range		
RF 1		–130 dBm to –27 dBm
RF 2		–130 dBm to –10 dBm
RF 3 OUT		–99 dBm to +13 dBm

Output level resolution		0.1 dB

Output level uncertainty		see base unit specifications and add 0.1 dB

FM modulation		
Deviation range		100 Hz to 20 kHz
Deviation resolution		1 Hz
Modulation frequency range		100 Hz to 15.999 kHz
Modulation distortion	SINAD, modulation frequency 1 kHz, deviation 8 kHz, bandwidth 30 Hz to 15 kHz	≥40 dB
Residual FM	bandwidth 300 Hz to 3 kHz	<10 Hz, rms
Deviation uncertainty	modulation frequency 1 kHz, deviation 8 kHz, bandwidth 30 Hz to 15 kHz	<2 % of setting + residual FM
Deviation frequency response	modulation frequency 300 Hz to 15.999 kHz	≤1 dB

RF analyzer

Frequency range	signaling mode	
	US Cellular	824 MHz to 849 MHz

Frequency range	non-signaling mode	10 MHz to 2200 MHz

Frequency resolution	non-signaling mode	1 Hz

Frequency uncertainty		same as timebase, see base unit specifications

Power meter (frequency-selective)

Max. level range		
RF 1		0 dBm to +53 dBm
RF 2		–14 dBm to +39 dBm
RF 4 IN		–37 dBm to +0 dBm

Level uncertainty		see base unit specifications

Level resolution		0.1 dB

FM measurement

Dynamic range		30 dB below max. level
RF bandwidth	2 × deviation + 4 × modulation frequency	136 kHz
Deviation range		0 Hz to 47 kHz
Resolution		1 Hz
Modulation frequency range		100 Hz to 18 kHz
Residual FM	bandwidth 300 Hz to 3 kHz	<5 Hz, rms
	bandwidth 6 Hz to 20 kHz	<18 Hz, rms
Deviation uncertainty	bandwidth 6 Hz to 20 kHz	<1 % of reading + residual FM
Carrier frequency error		
Measurement range		–47 kHz to +47 kHz
Measurement uncertainty		≤2 kHz + drift of timebase, see base unit specifications

AF generator

See specifications of R&S®CMU-B41 audio generator/analyzer option		

AF analyzer

See specifications of R&S®CMU-B41 audio generator/analyzer option		

CDMA2000® specifications – mobile station test

Standards	CDMA2000® standards	TIA/EIA IS-2000 Rev. 0
	CDMA2000® test standards	TIA/EIA IS-98-F

RF generator

Frequency range	US/Korean Cellular (band class 0)	860.025 MHz to 893.985 MHz
	North American PCS (band class 1)	1930.000 MHz to 1990.000 MHz
	TACS band (band class 2)	917.0125 MHz to 959.9875 MHz
	JTACS band (band class 3)	832.0125 MHz to 869.9875 MHz
	Korean PCS (band class 4)	1840.000 MHz to 1870.000 MHz
	NMT-450 (band class 5)	421.675 MHz to 493.480 MHz
	IMT-2000 (band class 6)	2110.000 MHz to 2169.950 MHz
	North American 700 MHz Cellular band (band class 7)	746.000 MHz to 764.000 MHz
	1800 MHz band (band class 8)	1805.000 MHz to 1879.950 MHz
	900 MHz band (band class 9)	925.000 MHz to 958.750 MHz
	secondary 800 MHz band (band class 10)	851.000 MHz to 939.975 MHz
	400 MHz European PAMR (band class 11)	421.675 MHz to 493.475 MHz
	800 MHz PAMR band (band class 12)	915.0125 MHz to 920.9875 MHz
	2.5 GHz IMT-2000 extension (band class 13)	2620.000 MHz to 2690 MHz
	US PCS 1.9 GHz band (band class 14)	1930.000 MHz to 1995.000 MHz
	AWS band (band class 15)	2110.000 MHz to 2155.000 MHz
	US 2.5 GHz band (band class 16)	2624.000 MHz to 2690.000 MHz
	US 2.5 GHz forward link only band (band class 17)	2624.000 MHz to 2690.000 MHz

Frequency resolution	channel spacing in line with standard	

Frequency uncertainty		same as timebase, see base unit specifications

Output level range	modulated signal	
RF 1	f < 2200 MHz	–120 dBm to –33 dBm
	f ≥ 2200 MHz	–120 dBm to –39 dBm
RF 2	f < 2200 MHz	–120 dBm to –16 dBm
	f ≥ 2200 MHz	–120 dBm to –22 dBm
RF 3 OUT	f < 2200 MHz	–99 dBm to +5 dBm
	f ≥ 2200 MHz	–99 dBm to –1 dBm

Output level resolution	modulated signal	0.1 dB

Output level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	output level ≥ –108 dBm	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
RF 3 OUT	–80 dBm to +4 dBm	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB
	in temperature range +5 °C to +45 °C	
RF 1, RF 2	output level ≥ –108 dBm	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<1.5 dB
RF 3 OUT	–80 dBm to +4 dBm	
	f < 2200 MHz	<0.9 dB
	f ≥ 2200 MHz	<1.5 dB

Modulation		
Dual BPSK, multiple QPSK		1.2288 Mcps
AWGN		see AWGN generator
Carrier suppression		>35 dB
Waveform quality (ρ) factor		>0.985
Code channel level uncertainty	relative to total CDMA output power F-PICH, F-PCH, F-FCH, F-SCH1, F-SCH2	approx. 0.1 dB
	all other channels	approx. 0.25 dB
Code channel resolution		0.1 dB
Code channel level range	relative to total CDMA output power	
	PICH, SYNC, FCH, SCH0, SCH1, PCH	–20 dB to –1 dB
	QPCH (relative to PICH level)	–5 dB to +2 dB

AWGN generator		
Bandwidth		>1.8 MHz
Output level resolution		0.1 dB
Output level uncertainty	bandwidth 1.23 MHz	approx. 0.2 dB
Output level range	relative to total CDMA output power	–20 dB to +4 dB

Supported service options	in signaling mode	
Loopback service options		SO 2, 9, 55
Speech service options		SO 1, 3, 17, 0x8000
Test data service option		SO 32
Packet data service option		SO 33
Messaging tele service option		SO 6, 14

RF analyzer

Frequency range	US/Korean Cellular (band class 0)	815.025 MHz to 848.985 MHz
	North American PCS (band class 1)	1850.000 MHz to 1910.000 MHz
	TACS band (band class 2)	872.0125 MHz to 914.9875 MHz
	JTACS band (band class 3)	887.0125 MHz to 924.9875 MHz
	Korean PCS (band class 4)	1750.000 MHz to 1780.000 MHz
	NMT-450 (band class 5)	411.675 MHz to 483.480 MHz
	IMT-2000 (band class 6)	1920.000 MHz to 1979.950 MHz
	North American 700 MHz Cellular band (band class 7)	776.000 MHz to 794.000 MHz
	1800 MHz band (band class 8)	1710.000 MHz to 1784.950 MHz
	900 MHz band (band class 9)	880.000 MHz to 913.750 MHz
	secondary 800 MHz band (band class 10)	806.000 MHz to 900.975 MHz
	400 MHz European PAMR (band class 11)	411.675 MHz to 483.475 MHz
	800 MHz PAMR band (band class 12)	870.0125 MHz to 875.9875 MHz
	2.5 GHz IMT-2000 extension (band class 13)	2500.000 MHz to 2570.000 MHz
	US PCS 1.9 GHz band (band class 14)	1850.000 MHz to 1915.000 MHz
	AWS band (band class 15)	1710.000 MHz to 1755.000 MHz
	US 2.5 GHz band (band class 16)	2502.000 MHz to 2568.000 MHz

Measurement filter	in line with standard	bandwidth 1.23 MHz

Frequency resolution	channel spacing in line with standard	

Frequency uncertainty		same as timebase, see base unit specifications

Power meter (frequency-selective)

Level range	HPSK, O-QPSK signal	
RF 1	f < 2200 MHz	–40 dBm to +44 dBm
	f ≥ 2200 MHz	–34 dBm to +44 dBm
RF 2	f < 2200 MHz	–54 dBm to +30 dBm
	f ≥ 2200 MHz	–48 dBm to +30 dBm
RF 4 IN	f < 2200 MHz	–80 dBm to –9 dBm
	f ≥ 2200 MHz	–74 dBm to –9 dBm

Level uncertainty		
RF 1, RF 2, RF 4 IN	in temperature range +20 °C to +35 °C	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
	in temperature range +5 °C to +45 °C	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB

Level resolution		0.1 dB

Modulation analyzer

Level range	HPSK, O-QPSK signal	
RF 1	f < 2200 MHz	–40 dBm to +44 dBm
	f ≥ 2200 MHz	–34 dBm to +44 dBm
RF 2	f < 2200 MHz	–54 dBm to +30 dBm
	f ≥ 2200 MHz	–48 dBm to +30 dBm
RF 4 IN	f < 2200 MHz	–80 dBm to –9 dBm
	f ≥ 2200 MHz	–74 dBm to –9 dBm

RC1, RC2 (O-QPSK)	waveform quality, error vector magnitude, magnitude error, phase error	
Waveform quality (ρ) uncertainty	for ρ 0.9 to 1	<0.003
Frequency measurement range		–3 kHz to +3 kHz
Frequency measurement uncertainty	f < 2200 MHz	<10 Hz + drift of timebase see base unit specifications
	f ≥ 2200 MHz	<15 Hz + drift of timebase see base unit specifications

RC3, RC4 (HPSK)	waveform quality, error vector magnitude, magnitude error, phase error, channel power, code domain power, peak code domain error power	
Waveform quality (ρ) uncertainty	for ρ 0.9 to 1	<0.003
Frequency measurement range		–3 kHz to +3 kHz
Frequency measurement uncertainty		<10 Hz + drift of timebase, see base unit specifications
Relative measurement uncertainty	result > –33 dB	<0.1 dB

Measurements		
Modulation		overview EVM versus time, graphical ME versus time, graphical PE versus time, graphical I/Q analyzer
Power		standby/access-probe power open loop time response gated output power max. output power min. output power power versus frame smart alignment narrowband power
Spectrum		adjacent channel power
Code domain power		code domain power code domain error power channel power time/phase offset relative to pilot
Receiver		FER for FCH, SCH RLP/throughput statistics forward power control

R&S®CMU-B85 speech codec option

Speech decoder output	SPEECH HANDSET OUT	9-pin D-Sub connector
Output impedance		<10 Ω
Max. output current		20 mA, peak
Full-range output level		1 V, peak

Speech coder input	SPEECH HANDSET IN	9-pin D-Sub connector
Input impedance		100 kΩ
Full-range input level	low sensitivity	1.4 V, peak
	high sensitivity	0.1 V, peak

1xEV-DO specifications – access terminal test

Standards	1xEV-DO standards	TIA/EIA IS-856-2
	1xEV-DO test standards (access terminal)	TIA/EIA IS-866-A

RF generator

Frequency range	US/Korean Cellular (band class 0)	860.025 MHz to 893.985 MHz
	North American PCS (band class 1)	1930.000 MHz to 1990.000 MHz
	public safety bands (PSB)	772.000 MHz to 802.000 MHz
	TACS band (band class 2)	917.0125 MHz to 959.9875 MHz
	JTACS band (band class 3)	832.0125 MHz to 869.9875 MHz
	Korean PCS (band class 4)	1840.000 MHz to 1870.000 MHz
	NMT-450 (band class 5)	421.675 MHz to 493.480 MHz
	IMT-2000 (band class 6)	2110.000 MHz to 2169.950 MHz
	North American 700 MHz Cellular band (band class 7)	746.000 MHz to 764.000 MHz
	1800 MHz band (band class 8)	1805.000 MHz to 1879.950 MHz
	900 MHz band (band class 9)	925.000 MHz to 958.750 MHz
	secondary 800 MHz band (band class 10)	851.000 MHz to 939.975 MHz
	400 MHz European PAMR (band class 11)	421.675 MHz to 493.475 MHz
	800 MHz PAMR band (band class 12)	915.0125 MHz to 920.9875 MHz
	2.5 GHz IMT-2000 extension (band class 13)	2620.000 MHz to 2690 MHz
	US PCS 1.9 GHz band (band class 14)	1930.000 MHz to 1995.000 MHz
	AWS band (band class 15)	2110.000 MHz to 2155.000 MHz
	US 2.5 GHz band (band class 16)	2624.000 MHz to 2690.000 MHz
	US 2.5 GHz forward link only band (band class 17)	2624.000 MHz to 2690.000 MHz

Frequency resolution	channel spacing in line with standard	

Frequency uncertainty		same as timebase, see base unit specifications

Statistics		
Statistic count		1 to 1000
Values		current, average, min./max.

Trigger		
Trigger sources		free run, internal, external, IF power, RF power
Trigger output	24-pin D-Sub connector AUX 3	super frame, power control frame, paging frame, sync frame, PP2S

Output level range	modulated signal	
RF 1	f < 2200 MHz	–120 dBm to –33 dBm
	f ≥ 2200 MHz	–120 dBm to –39 dBm
RF 2	f < 2200 MHz	–120 dBm to –16 dBm
	f ≥ 2200 MHz	–120 dBm to –22 dBm
RF 3 OUT	f < 2200 MHz	–99 dBm to +5 dBm
	f ≥ 2200 MHz	–99 dBm to –1 dBm

Output level resolution	modulated signal	0.1 dB

Output level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	output level ≥ –108 dBm	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
RF 3 OUT	–80 dBm to +4 dBm	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB

Output level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2	output level ≥ –108 dBm	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<1.5 dB
RF 3 OUT	–80 dBm to +4 dBm	
	f < 2200 MHz	<0.9 dB
	f ≥ 2200 MHz	<1.5 dB

Modulation		
Dual BPSK		1.2288 Mcps
AWGN		see AWGN generator
Carrier suppression		>35 dB
Waveform quality (ρ) factor		>0.985
Code channel level uncertainty	relative to total 1xEV-DO output power	approx. 0.1 dB
Code channel resolution		0.1 dB
Code channel level range	relative to total 1xEV-DO output power	
	PICH, SYNC, FCH, SCH0, SCH1, PCH	–20 dB to –1 dB
	QPCH (relative to PICH level)	–5 dB to +2 dB

AWGN generator		
Bandwidth		>1.8 MHz
Output level resolution		0.1 dB
Output level uncertainty	bandwidth 1.23 MHz	approx. 0.2 dB
Output level range	relative to total 1xEV-DO output power	–20 dB to +4 dB

Supported applications	in signaling mode	
Test applications		FTAP/RTAP, FETAP/RETAP
Default signaling application		
Default packet application		

RF analyzer

Frequency range	US/Korean Cellular (band class 0)	815.025 MHz to 848.985 MHz
	North American PCS (band class 1)	1850.000 MHz to 1910.000 MHz
	public safety bands (PSB)	742.000 MHz to 772.000 MHz
	TACS band (band class 2)	872.0125 MHz to 914.9875 MHz
	JTACS band (band class 3)	887.0125 MHz to 924.9875 MHz
	Korean PCS (band class 4)	1750.000 MHz to 1780.000 MHz
	NMT-450 (band class 5)	411.675 MHz to 483.480 MHz
	IMT-2000 (band class 6)	1920.000 MHz to 1979.950 MHz
	North American 700 MHz Cellular band (band class 7)	776.000 MHz to 794.000 MHz
	1800 MHz band (band class 8)	1710.000 MHz to 1784.950 MHz
	900 MHz band (band class 9)	880.000 MHz to 913.750 MHz
	secondary 800 MHz band (band class 10)	806.000 MHz to 900.975 MHz
	400 MHz European PAMR (band class 11)	411.675 MHz to 483.475 MHz
	800 MHz PAMR band (band class 12)	870.0125 MHz to 875.9875 MHz
	2.5 GHz IMT-2000 extension (band class 13)	2500.000 MHz to 2570.000 MHz
	US PCS 1.9 GHz band (band class 14)	1850.000 MHz to 1915.000 MHz
	AWS band (band class 15)	1710.000 MHz to 1755.000 MHz
	US 2.5 GHz band (band class 16)	2502.000 MHz to 2568.000 MHz

Measurement filter	in line with standard	bandwidth 1.23 MHz

Frequency resolution	channel spacing in line with standard	

Frequency uncertainty		same as timebase, see base unit specifications

Statistics		
Statistic count		1 to 1000
Values		current, average, min./max.

Trigger		
Trigger sources		free run, internal, external, IF power, RF power
Trigger output	24-pin D-Sub connector AUX 3	ControlSlot, ControlChannel, slot, PP2S

Power meter (frequency-selective)

Level range	modulated signal	
RF 1	f < 2200 MHz	–40 dBm to +44 dBm
	f ≥ 2200 MHz	–34 dBm to +44 dBm
RF 2	f < 2200 MHz	–54 dBm to +30 dBm
	f ≥ 2200 MHz	–48 dBm to +30 dBm
RF 4 IN	f < 2200 MHz	–80 dBm to –9 dBm
	f ≥ 2200 MHz	–74 dBm to –9 dBm

Level uncertainty		
RF 1, RF 2, RF 4 IN	in temperature range +20 °C to +35 °C	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
	in temperature range +5 °C to +45 °C	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB

Level resolution		0.1 dB

Modulation analyzer

Level range	modulated signal	
RF 1	f < 2200 MHz	–40 dBm to +44 dBm
	f ≥ 2200 MHz	–34 dBm to +44 dBm
RF 2	f < 2200 MHz	–54 dBm to +30 dBm
	f ≥ 2200 MHz	–48 dBm to +30 dBm
RF 4 IN	f < 2200 MHz	–80 dBm to –9 dBm
	f ≥ 2200 MHz	–74 dBm to –9 dBm

Waveform quality (ρ) uncertainty	for ρ 0.9 to 1	<0.003
Frequency measurement range		–3 kHz to +3 kHz
Frequency measurement uncertainty		<10 Hz + drift of timebase, see base unit specifications
Relative measurement uncertainty	result > –33 dB	<0.1 dB

Measurements		
Modulation		overview EVM versus time, graphical ME versus time, graphical PE versus time, graphical I/Q analyzer
Power		standby/access-probe power open loop time response narrowband power
Spectrum		adjacent channel power
Code domain power		code domain power code domain error power channel power
Receiver	in signaling mode	FTAP/RTAP, FETAP/RETAP

WCDMA specifications – mobile station (UE) test

Standard		3GPP FDD
Symbol rate		3.84 MHz

Synchronization output 2		BNC connector REF OUT 2
Frequency		30.72 MHz/n, n = 1 to 32

RF generator

Channels	non-signaling mode	
	P-CPICH, P-SCH, S-SCH, P-CCPCH, PICH, DPCH, up to 4 HS-SCCHs, HS-PDSCH, E-AGCH, E-RGCH/E-HICH	
	OCNS R99	16-channel orthogonal channel noise
	OCNS R5	6-channel orthogonal channel noise
	AWGN	bandwidth ≥ 5.76 MHz
	reference measurement channels (RMC) in line with 3GPP TS 34.121	12.2 kbit/s, 64 kbit/s, 144 kbit/s, 384 kbit/s

Channels	signaling mode; codes selectable until conflict in code space occurs	
	P-CPICH, P-SCH, S-SCH, P-CCPCH, S-CCPCH, AICH, PICH, up to 4 HS-SCCHs, HS-PDSCH, E-AGCH, E-RGCH/E-HICH	
	OCNS R99	16-channel orthogonal channel noise
	OCNS R5	6-channel orthogonal channel noise
	AWGN	bandwidth ≥ 5.76 MHz
	DPCH signaling radio bearer (SRB)	1.7 kbit/s, 2.5 kbit/s, 3.4 kbit/s, 13.6 kbit/s
	DPCH reference measurement channels (RMC) in line with 3GPP TS 34.121	
	DL and UL	12.2 kbit/s, 64 kbit/s, 144 kbit/s, 384 kbit/s
	DL/UL	144 kbit/s/64 kbit/s, 384 kbit/s/64 kbit/s, 384 kbit/s/144 kbit/s
	BTFD	1.95 kbit/s, 4.75 kbit/s, 5.15 kbit/s, 5.9 kbit/s, 6.7 kbit/s, 7.4 kbit/s, 7.95 kbit/s 10.2 kbit/s, 12.2 kbit/s
	DPCH voice (echo or speech codec) NB-AMR	4.75 kbit/s, 5.15 kbit/s, 5.9 kbit/s, 6.7 kbit/s, 7.4 kbit/s, 7.95 kbit/s 10.2 kbit/s, 12.2 kbit/s
	DPCH voice (echo or speech codec) WB-AMR	6.6 kbit/s, 8.85 kbit/s, 12.65 kbit/s, 14.25 kbit/s, 15.85 kbit/s, 18.25 kbit/s, 19.85 kbit/s, 23.05 kbit/s, 23.85 kbit/s

Frequency range	non-signaling mode	
		728 MHz to 768 MHz 869 MHz to 894 MHz 925 MHz to 960 MHz 1475.9 MHz to 1500.9 MHz 1805 MHz to 1880 MHz 1930 MHz to 1990 MHz 2110 MHz to 2170 MHz 2180 MHz to 2200 MHz 2620 MHz to 2690 MHz

Frequency range	signaling mode	
	band 1	2110 MHz to 2170 MHz
	band 2	1930 MHz to 1990 MHz
	band 3	1805 MHz to 1880 MHz
	band 4	2110 MHz to 2155 MHz
	band 5	869 MHz to 894 MHz
	band 6	875 MHz to 885 MHz
	band 7	2620 MHz to 2690 MHz
	band 8	925 MHz to 960 MHz
	band 9	1844.9 MHz to 1879.9 MHz
	band 10	2110 MHz to 2170 MHz
	band 11	1475.9 MHz to 1500.9 MHz
	band 12	728 MHz to 746 MHz
	band 13	746 MHz to 756 MHz
	band 14	758 MHz to 768 MHz
	band S	2180 MHz to 2200 MHz

Frequency offset		–100 kHz to +100 kHz

Frequency resolution		0.1 Hz

Frequency setting		by channel number or frequency

Output level range	depending on PAR	
RF 1	PAR ≤ 10 dB	–120 dBm to –37 dBm
RF 2	PAR ≤ 10 dB	–120 dBm to –20 dBm
	overranging	up to –15 dBm
RF 3 OUT	PAR ≤ 10 dB	–100 dBm to 0 dBm
	overranging	up to +3 dBm

Output level resolution	manual mode	0.1 dB
	remote mode	0.01 dB

Output level uncertainty	in temperature range +20 °C to +35 °C, no overranging	
RF 1, RF 2	output level ≥ –120 dBm	
	f < 2200 MHz	<0.6 dB
	f ≥ 2200 MHz	<0.8 dB
RF 3 OUT	output level ≥ –80 dBm	
	f < 2200 MHz	<0.8 dB
	f ≥ 2200 MHz	<1.0 dB

Output level uncertainty	in temperature range +5 °C to +45 °C, no overranging	
RF 1, RF 2	output level ≥ –120 dBm	
	f < 2200 MHz	<0.9 dB
	f ≥ 2200 MHz	<1.5 dB
RF 3 OUT	output level ≥ –80 dBm	
	f < 2200 MHz	<1.0 dB
	f ≥ 2200 MHz	<1.5 dB

Output level setting	setting reference	relative to CPICH or total output power

Channel levels	non-signaling mode	
	P-CPICH, P-SCH, S-SCH, P-CCPCH, PICH, DPCH, OCNS, HS-SCCH, HS-PDSCH, E-AGCH	–35 dB to +15 dB relative to CPICH
	E-RGCH/E-HICH	–35 dB to +12 dB relative to CPICH

Channel levels	signaling mode	
	P-CPICH, P-SCH, S-SCH, P-CCPCH, S-CCPCH, PICH, AICH, DPCH, OCNS, HS-SCCH, HS-PDSCH, E-AGCH	–35 dB to +15 dB relative to CPICH
	E-RGCH/E-HICH	–35 dB to +12 dB relative to CPICH

Signal quality		
Error vector magnitude (EVM)	global EVM for DL RMC in line with 3GPP TS 34.121 C3.1 to C3.4 with DPCH/CPICH = 0 dB	<8 %, rms

Signal quality	16QAM	
Error vector magnitude (EVM)	global EVM for 16QAM reference setup: 3GPP TS34.121 FRC H-Set3 for 16QAM	<8 %, rms

R&S®CMU-B96 additional RF generator option

Path 2 for WCDMA

Standard		3GPP FDD

Frequency range	non-signaling mode	
		728 MHz to 768 MHz 869 MHz to 894 MHz 925 MHz to 960 MHz 1475.9 MHz to 1500.9 MHz 1805 MHz to 1880 MHz 1930 MHz to 1990 MHz 2110 MHz to 2170 MHz 2180 MHz to 2200 MHz

Frequency range	WCDMA signaling mode	
	band 1	2110 MHz to 2170 MHz
	band 2	1930 MHz to 1990 MHz
	band 3	1805 MHz to 1880 MHz
	band 4	2110 MHz to 2155 MHz
	band 5	869 MHz to 894 MHz
	band 6	875 MHz to 885 MHz
	band 8	925 MHz to 960 MHz
	band 9	1844.9 MHz to 1879.9 MHz
	band 10	2110 MHz to 2170 MHz
	band 11	1475.9 MHz to 1500.9 MHz
	band 12	728 MHz to 746 MHz
	band 13	746 MHz to 756 MHz
	band 14	758 MHz to 768 MHz
	band S	2180 MHz to 2200 MHz

Frequency resolution		2.5 kHz

Frequency uncertainty		same as timebase, see base unit specifications

Error vector magnitude (EVM)	global EVM for DL RMC in line with 3GPP TS 34.121 C3.1 to C3.4 with DPCH/CPICH = 0 dB	<8 %, rms

Output level range		
RF 1	without R&S®CMU-U99	–115 dBm to –82 dBm
	with R&S®CMU-U99	–103 dBm to –70 dBm
RF 2		–103 dBm to –70 dBm

Output level resolution	RF 1 and RF 2	0.1 dB

Output level range	overrange mode	
RF 1	without R&S®CMU-U99	–110 dBm to –38 dBm
	with R&S®CMU-U99	–90 dBm to –24 dBm
RF 2		–90 dBm to –24 dBm
RF 3 OUT		–70 dBm to –1 dBm

Output level resolution	for overrange mode	1 dB

Influence on RF interface

Reduced input level range	if R&S®CMU-B96 is installed	
RF 1	continuous input power	max. 2 W

RF level uncertainty	Use of the R&S®CMU-B96 in overrange mode may influence all RF signal levels and quality.	

RF analyzer (TX measurements)

Frequency range	non-signaling mode	
		698 MHz to 716 MHz 777 MHz to 798 MHz 824 MHz to 849 MHz 880 MHz to 915 MHz 1427.9 MHz to 1452.9 MHz 1710 MHz to 1785 MHz 1850 MHz to 1910 MHz 1920 MHz to 1980 MHz 2000 MHz to 2020 MHz 2500 MHz to 2570 MHz

Frequency range	signaling mode	
	band 1	1920 MHz to 1980 MHz
	band 2	1850 MHz to 1910 MHz
	band 3	1710 MHz to 1785 MHz
	band 4	1710 MHz to 1755 MHz
	band 5	824 MHz to 849 MHz
	band 6	830 MHz to 840 MHz
	band 7	2500 MHz to 2570 MHz
	band 8	880 MHz to 915 MHz
	band 9	1749.9 MHz to 1784.9 MHz
	band 10	1710 MHz to 1770 MHz
	band 11	1427.9 MHz to 1452.9 MHz
	band 12	698 MHz to 716 MHz
	band 13	777 MHz to 787 MHz
	band 14	788 MHz to 798 MHz
	band S	2000 MHz to 2020 MHz

Frequency offset		–100 kHz to +100 kHz

Frequency resolution		1 Hz

Frequency setting		by channel number or frequency

Level setting		by autoranging or manual mode

Max. level setting range		
RF 1	peak envelope power [4] (PEP)	–38 dBm to +53 dBm
RF 2	peak envelope power [4] (PEP)	–52 dBm to +39 dBm
RF 4 IN	peak envelope power (PEP)	–77 dBm to +0 dBm

Statistics		
Statistic count		1 to 1000
Values		current, average, min./max.

Trigger	non-signaling mode	
Trigger sources		free run, internal, external, IF power, slot, frame, TPC, HSDPCCH, auto
Trigger input	15-pin D-Sub connector AUX 3, pin 8	external
Trigger slot delay		0 to 14 slots
Trigger delay offset		–10239 to + 10239 × 1/4 chip
Trigger output	15-pin D-Sub connector AUX 3, pins 2 to 5	frame, slot, TPC, HSDPCCH

Trigger	signaling mode	
Trigger sources		free run, external, slot, frame, signaling, IF power, TPC, preamble, PRACH-MSG part, compressed mode, change of TFC, HSDPCCH, auto
Trigger input	15-pin D-Sub connector AUX 3, pin 8	external
Trigger slot delay		0 to 14 slots
Trigger delay offset		–10239 to + 10239 × 1/4 chip
Trigger output	15-pin D-Sub connector AUX 3, pins 2 to 4 15-pin D-Sub connector AUX 3, pin 5, depending on signaling state and trigger source	frame, slot, TPC preamble, PRACH-MSG part, compressed mode, change of TFC, HSDPCCH

Modulation analysis

Measurement filter	receiver filter in line with standard	3.84 MHz, RRC, α = 0.22

Analysis modes		QPSK, WCDMA uplink

Input level range		
RF 1	continuous power [3]	–21 dBm to +47 dBm
	peak envelope power [4] (PEP)	–16 dBm to +53 dBm
RF 2	continuous power	–35 dBm to +33 dBm
	peak envelope power [4] (PEP)	–30 dBm to +39 dBm
RF 4 IN	continuous power and PEP	–50 dBm to 0 dBm

Error vector magnitude (EVM)		
Measurement range		up to 25 %
Applications		overview EVM versus time, graphical ME versus time, graphical PE versus time, graphical
	non-signaling mode	I/Q analyzer
Measured parameters		error vector magnitude magnitude error phase error I/Q origin offset I/Q imbalance peak code domain error waveform quality
Inherent EVM	*RF Attenuation → Low Noise*	<2.5 %, rms
	RF Attenuation → Low Noise with R&S®CMU-Z6 calibration and f < 2200 MHz	<1.5 %, rms
	RF Attenuation → Low Noise with R&S®CMU-Z6 calibration and f ≥ 2200 MHz	<2.5 %, rms
Resolution		0.1 %
Measurement length	QPSK mode	1 timeslot (2560 chips) 1/4 timeslot (640 chips)
	WCDMA mode	1 timeslot
Marker	in graphical menus	reference, Abs1, Abs2, D-line

Frequency error		
Measurement range		±3 kHz
Uncertainty	f < 2200 MHz and max. value of 10 slots	<10 Hz + drift of timebase, see base unit specifications
	f ≥ 2200 MHz and average value of 10 slots	<10 Hz + drift of timebase, see base unit specifications
Resolution		1 Hz

I/Q offset		
Inherent I/Q offset		<–55 dB
Resolution		0.01 dB

I/Q imbalance		
Inherent I/Q imbalance		<–30 dB
Resolution		0.01 dB

Peak code domain error (PCDE)		
Inherent PCDE	for SF = 4	<–40 dB
Resolution		0.01 dB

I/Q analyzer	non-signaling mode	
Display	QPSK mode and WCDMA mode	graphical display
	waveform type	constellation diagram, vector diagram, eye diagram I, Q, I/Q
	zoom	1, 2, 5, 10, 20
	rotation	0°, 45°
	measurement length	1 timeslot (2560 chips) 1/4 timeslot (640 chips)

Spectrum measurements

Reference level for full dynamic range		
RF 1	rms	+14 dBm to +47 dBm
	peak envelope power [4](PEP)	up to +53 dBm
RF 2	rms	+0 dBm to +33 dBm
	peak envelope power [4](PEP)	up to +39 dBm
RF 4 IN	rms	–18 dBm to 0 dBm
	peak envelope power (PEP)	up to 0 dBm

Adjacent channel leakage ratio (ACLR filter application)		
Measurement filter	receiver filter in line with standard	3.84 MHz, RRC, α = 0.22
Display		bargraphs of rms and peak values, numeric values rms and peak of current, average and max. values
Frequency offsets	first adjacent channel second adjacent channel	±5 MHz ±10 MHz
Uncertainty	for –33 dBc first adjacent channel level for –43 dBc second adjacent channel level	<0.5 dB <0.5 dB
Dynamic range *(High Dynamic Mode → On)*	first adjacent channel second adjacent channel	>54 dB >64 dB
Resolution		0.1 dB
Measurement length		1 timeslot (2560 chips) 1/2 timeslot (1280 chips) 1/4 timeslot (640 chips) 1/8 timeslot (320 chips)

Adjacent channel leakage ratio (ACLR FFT/OBW application)		
Measurement filter	receiver filter in line with standard	3.84 MHz, RRC, α = 0.22
Display		continuous spectrum with 25 MHz bandwidth, numeric values rms and peak of current, average and max. values
Frequency offsets	first adjacent channel	±5 MHz
	second adjacent channel	±10 MHz
Resolution bandwidth		20 kHz 3.84 MHz
Dynamic range *(High Dynamic Mode → On)*	first adjacent channel	>54 dB
	second adjacent channel	>64 dB
Occupied bandwidth	measurement range	1 MHz to 6 MHz
	measurement uncertainty	<50 kHz
	measurement resolution	20 kHz
Measurement length		≥1 timeslot (2560 chips) ≥1/2 timeslot (1280 chips) ≥1/4 timeslot (640 chips) ≥1/8 timeslot (320 chips)

Spectrum emission mask (SEM application)		
Measurement filter	receiver filter in line with standard	3.84 MHz, RRC, α = 0.22
Display		graphical and numeric values of current, average and max. values
Resolution bandwidth	frequency offset	
	2.5 MHz to 3.5 MHz	30 kHz
	3.5 MHz to 7.5 MHz	1 MHz
	7.5 MHz to 8.5 MHz	1 MHz
	8.5 MHz to 12.5 MHz	1 MHz
Measurement interval		≥1 timeslot (2560 chips) ≥1/2 timeslot (1280 chips) ≥1/4 timeslot (640 chips) ≥1/8 timeslot (320 chips)

Power meter (frequency-selective) [7]

Measurement applications	max. power, min. power	bandwidth approx. 7 MHz
	off power	3.84 MHz, RRC, α = 0.22
	power versus slot	bandwidth approx. 7 MHz
	inner loop power	3.84 MHz, RRC, α = 0.22

Power versus slot	measurement width	0.25, 0.5, 1 slot
	step width	1 slot to 30 slots
	step count	1 to 100
	step delay	0 to 100

Level range		
RF 1	continuous power [3]	–52 dBm to +47 dBm
	peak envelope power [4] (PEP)	–42 dBm to +53 dBm
RF 2	continuous power	–66 dBm to +33 dBm
	peak envelope power [4] (PEP)	–56 dBm to +39 dBm
RF 4 IN	continuous power [8]	–89 dBm to 0 dBm
	peak envelope power (PEP)	–79 dBm to 0 dBm

Level uncertainty	in temperature range +20 °C to +35 °C	
RF 1	–10 dBm to +47 dBm, rms	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
	–44 dBm to –10 dBm, rms	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB
RF 2	–24 dBm to +33 dBm, rms	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
	–60 dBm to –24 dBm, rms	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB
RF 4 IN	–24 dBm to 0 dBm, rms	
	f < 2200 MHz	<0.5 dB
	f ≥ 2200 MHz	<0.7 dB
	–85 dBm to –24 dBm, rms	
	f < 2200 MHz	<0.7 dB
	–83 dBm to –24 dBm, rms	
	f ≥ 2200 MHz	<0.9 dB

[7] The specified data is valid for *RF Attenuation* set to *Low Noise*.

[8] Upper limit depends on crest factor.

Level uncertainty	in temperature range +5 °C to +45 °C	
RF 1	–10 dBm to +47 dBm, rms	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB
	–44 dBm to –10 dBm, rms	
	f < 2200 MHz	<0.9 dB
	f ≥ 2200 MHz	<1.1 dB
RF 2	–24 dBm to +33 dBm, rms	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB
	–60 dBm to –24 dBm, rms	
	f < 2200 MHz	<0.9 dB
	f ≥ 2200 MHz	<1.1 dB
RF 4 IN	–24 dBm to 0 dBm, rms	
	f < 2200 MHz	<0.7 dB
	f ≥ 2200 MHz	<0.9 dB
	–85 dBm to –24 dBm, rms	
	f < 2200 MHz	<0.9 dB
	–83 dBm to –24 dBm, rms	
	f ≥ 2200 MHz	<1.1 dB

Level resolution		0.01 dB

Code domain power [7]

Measurement filter	receiver filter in line with standard	3.84 MHz, RRC, α = 0.22

Display modes		CDP/code auto
		CDP/code manual
		CDP/code Rho auto
		CDP/code Rho manual

Spreading factor (SF)	auto mode	
	manual setting	4, 8, 16, 32, 64, 128, 256

Level range		
RF 1		–8 dBm to +47 dBm
RF 2		–22 dBm to +33 dBm
RF 4 IN		–45 dBm to 0 dBm

Level uncertainty		<0.5 dB

Level resolution		0.01 dB

Receiver quality (bit error rate measurements)

Measurement types		BER, BLER, DBLER, FDR
Measurement method		loopback mode 2, loopback mode 1 with RLC transparent
Number of transport blocks		1 to 50000
DL/UL transport block size		symmetric, asymmetric
DL/UL timing		876 chips to 1172 chips

R&S®CMU-B52 speech codec option

Speech decoder output	SPEECH HANDSET OUT	9-pin D-Sub connector
Output impedance		<10 Ω
Max. output current		20 mA, peak
Full-range output level		1 V, peak

Speech coder input	SPEECH HANDSET IN	9-pin D-Sub connector
Input impedance		100 kΩ
Full-range input level	low sensitivity	1.4 V, peak
	high sensitivity	0.1 V, peak

Bluetooth® specifications

Standards		Bluetooth® Core Specifications Version 1.1

RF generator

RF channel definition		2402 MHz + k × 1 MHz, k = 0 to 93
Frequency range		2402 MHz to 2495 MHz
Frequency resolution	channel spacing in line with standard	1 MHz
Frequency offset range		±500 kHz
Frequency offset resolution		1 kHz
Frequency uncertainty		±1 Hz + drift of timebase, see base unit specifications
Hopping scheme	modes in line with standard	Europe (except France), USA
		France
		RX/TX single frequency
		reduced hopping

Output level range	modulated signal	
RF 1		–106 dBm to –33 dBm
RF 2		–106 dBm to –12 dBm
RF 3 OUT		–90 dBm to +5 dBm

Output level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2		<0.9 dB
RF 3 OUT		<1.1 dB

Output level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2		<1.6 dB
RF 3 OUT		<1.6 dB

Output level resolution		0.1 dB

Modulation		
GFSK	AC coupling cut-off frequency 100 Hz	1 Mbps, B × T = 0.5
Modulation index	11110000 pattern, frequency deviation 160 kHz	0.32
Modulation index range	frequency deviation 100 kHz to 220 kHz	0.20 to 0.44
Modulation index resolution		0.01
Modulation index uncertainty	11110000 pattern, frequency deviation 160 kHz	±5 %

RF analyzer

RF channel definition		2402 MHz + k × 1 MHz, k = 0 to 93
Frequency range		2402 MHz to 2495 MHz
Frequency resolution	channel spacing in line with standard	1 MHz
Frequency uncertainty		±1 Hz + drift of timebase, see base unit specifications
Hopping scheme	modes in line with standard	Europe (except France), USA
		France
		RX/TX single frequency
		reduced hopping

Power meter (frequency-selective) and power versus time

Measurement bandwidth	filter definition: passband	
	Filter Bandwidth → wide	2.0 MHz
	Filter Bandwidth → narrow	1.3 MHz

Reference level for full dynamic range	GFSK signal	
RF 1		0 dBm to +41 dBm
RF 2		–14 dBm to +33 dBm
RF 4 IN		–32 dBm to 0 dBm

Dynamic range	*Filter Bandwidth → wide*	>55 dB, rms

Level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	from full scale setting down to –25 dB	<0.7 dB
RF 4 IN	from full scale setting down to –25 dB	<0.9 dB

Level uncertainty	in temperature range +5 °C to +45 °C	
RF1, RF2	from full scale setting down to –25 dB	<1.0 dB
RF4IN	from full scale setting down to –25 dB	<1.1 dB

Level resolution	in manual mode	0.1 dB
	in remote control mode	0.01 dB

Modulation analyzer

Measurement bandwidth	filter definition: passband	
	Filter Bandwidth → wide	2.0 MHz
	Filter Bandwidth → narrow	1.3 MHz

Level range	GFSK signal	
RF 1, RF 2, RF 4 IN		from full scale setting down to –25 dB

Total measurement range for frequency offset and frequency deviation		–250 kHz to +250 kHz

Frequency offset uncertainty in preamble	for deviation ≤ 160 kHz	≤2 kHz

Frequency deviation uncertainty in payload	for 100 kHz < deviation ≤ 200 kHz	
	11110000 pattern	≤2 %
	10101010 pattern	≤4 %

Frequency drift uncertainty	measured in burst related to frequency offset value in preamble	
	10101010 pattern	
	max.	≤2 kHz
	typ.	≤1 kHz

Frequency resolution	in manual mode	1 kHz
	in remote control mode	1 Hz

Timing measurement

Range		±20 µs
Resolution		≤0.25 µs
Uncertainty		≤0.25 µs + resolution

R&S®CMU-B52 speech codec option

Speech decoder output	SPEECH HANDSET OUT	9-pin D-Sub connector
Output impedance		<10 Ω
Max. output current		20 mA, peak
Full-range output level		1 V, peak

Speech coder input	SPEECH HANDSET IN	9-pin D-Sub connector
Input impedance		100 kΩ
Full-range input level	low sensitivity	1.4 V, peak
	high sensitivity	0.1 V, peak

R&S®CMU-B17 I/Q/IF interface option

I/Q interface

Analog I/Q outputs	IF → I/Q; TX and RX paths, analog I/Q output	connector I/Q CH1
I/Q bandwidth		0 MHz 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		<2 %
	for WCDMA function group	<2.5 %
Offset voltage	in temperature range +20 °C to +35 °C	<4 mV
	in temperature range +20 °C to +35 °C for WCDMA function group	<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
I/Q bandwidth		0 MHz 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
I/Q bandwidth		0 MHz 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	>35 dB [9]
	in temperature range +5 °C to +45 °C	>35 dB [9]
Sideband suppression	$f_{I/Q}$ < 1 MHz	>45 dB
	1 MHz < $f_{I/Q}$ < 2.5 MHz	>40 dB

Influence on RF interface

GSM/EDGE measurements		
Additional influence on signal quality	analog I/Q input and output considered; for TX and RX paths	
Phase error	GMSK	<3°, peak <1°, rms
EVM	8PSK	<5 %, rms

WCDMA measurements	3GPP FDD, UE test	
Additional influence on signal quality	analog I/Q input and output considered; for TX and RX paths	
EVM		<5 %, rms

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®CMU200 base unit specifications
Input level uncertainty of frequency-selective power meter	at RF 1, RF 2, RF 4 IN	add 0.3 dB to R&S®CMU200 base unit specifications

[9] For GSMK modulation and max. input voltage at I/Q inputs.

IF interface

IF inputs, TX path		connector IF3 TX CH1 IN
IF level range		up to –5 dBm, PEP
Standard IF frequencies	RF/GSM (GMSK and 8PSK)/ TDMA/CDMA2000®	13.85 MHz
	WCDMA	15.36 MHz

IF inputs, RX path		connector IF3 RX CH1 IN
IF level range		up to +2 dBm, PEP
Standard IF frequencies	RF/GSM (GMSK and 8PSK)/ TDMA/CDMA2000®	10.7 MHz
	WCDMA	7.68 MHz

IF outputs, TX path		connector IF3 TX CH1 OUT
IF level range		up to –5 dBm, PEP
Standard IF frequencies	RF/GSM (GMSK and 8PSK)/ TDMA/CDMA2000®	13.85 MHz
	WCDMA	15.36 MHz

IF outputs, RX path		connector IF3 RX CH1 OUT
IF level range		up to +6 dBm, PEP
Standard IF frequencies	RF/GSM (GMSK and 8PSK)/ TDMA/CDMA2000®	10.7 MHz
	WCDMA	7.68 MHz

Remarks

- Due to the modulation schemes used Bluetooth® and AMPS standards will not be supported.
- The R&S®CMU-B17 and R&S®CMU-B73 options use the same mainboard connector of the R&S®CMU200. Therefore, either the R&S®CMU-B17 or the R&S®CMU-B73 can be ordered for a single instrument.

Additional information for GSM:

To avoid influences on the fading profile, the following is highly recommended:

- To set all timeslots to the same level.
- To use for the TX signal of the R&S®CMU200 the same RF frequencies and RF levels for both TCH and BCCH.
- To switch off hopping.

Aspects to be considered if TX or RX signal paths are interrupted:

The RF frequency of the R&S®CMU200 influences the rotating direction of the I/Q vector.
The direction is inverted for f < 1200.1 MHz; this can be compensated for by changing I and Q.

	R&S®CMU200 generator or analyzer RF frequency	
	100 kHz to 1200.0999999 MHz	1200.1 MHz to 2700.0 MHz
R&S®CMU200 I/Q output vector	inverted rotation swap I output for Q output for proper operation	normal rotation
R&S®CMU200 I/Q input vector	inverted rotation swap I input for Q input for proper operation	normal rotation

The rotating direction must be considered if the R&S®CMU200 signal path from the link handler board to the frontend and vice versa is interrupted, i.e. if the signal is not returned to the same R&S®CMU200 block after external handling.

Examples:

- The rotating direction need **not** be taken into account if the transmitted signal is routed from the I/Q output of the R&S®CMU-B17 to an external fading simulator and then returned to the R&S®CMU200 I/Q input (the R&S®CMU200 in combination with the R&S®ABFS fading simulator or the R&S®SMIQ/SMIQB14, with the R&S®CMU200 providing the faded RF signal).
- The rotating direction must be considered if the transmitted signal is forwarded to an external fading simulator and is not returned to the I/Q input of the R&S®CMU200 (the R&S®CMU200 in combination with the R&S®SMIQ, with the R&S®SMIQ providing the faded RF signal).

Notes for measuring I/Q/IF signals applied to inputs of the R&S®CMU-B17 option on the R&S®CMU200 RX path:

- The RF spectrum analyzer function (RF function group) cannot be used.
- The displayed RF power levels are not related directly to the applied I/Q/IF voltages. The analyzer settings of the R&S®CMU200 RF interface (RF 1, RF 2, RF 4 IN) must also be considered (*Analyzer Level → RF Max. Level*).
- I/Q inputs have a fixed attenuation of 2 dB, e.g. the RF power meter readout for an applied 500 mV I/Q peak voltage will be 2 dB below the value set in *RF Max. Level*.
- IF inputs do not have a fixed attenuation. The max. IF input level is 2 dBm. The RF power meter readout for the specified max. IF signal level (2 dBm) will be 2 dB below the value set in *RF Max. Level*.
- We recommend switching off the autoranging function.
- RF and IF trigger functions are not possible.
- The WCDMA RF compensation filter is switched off (I/Q IN/OUT, IF IN/OUT, IFIN_I/Q IN/OUT).
- WCDMA UE test: ACLR/SEM measurement is not applicable.

R&S®CMU-B41 audio generator/analyzer option

AF generator

Output impedance		<4 Ω

Max. output current		20 mA, peak

AF sine generator		
Frequency range		20 Hz to 20 kHz
Frequency uncertainty		same as timebase + half resolution, see base unit specifications
Frequency resolution		0.1 Hz
Output level range		10 µV to 5 V
Output level resolution	level < 10 mV	10 µV
	level ≥ 10 mV	0.1 %
Output level uncertainty	level ≥ 1 mV and frequency ≤ 10 kHz	≤1.5 % + resolution
THD+N [10]	level ≥ 100 mV into load ≥ 600 Ω	≤0.05 %
THD [10]	level ≥ 100 mV into load ≥ 600 Ω	≤0.025 %

AF analyzer

Input impedance		1 MΩ ‖ 100 pF

AF voltmeter		
Frequency range		50 Hz to 20 kHz
Level range		50 µV to 30 V
Level resolution	level < 1 mV	1 µV
	level ≥ 1 mV	0.1 %
Level uncertainty	1 mV ≤ level ≤ 2 V	<1 % + resolution
	2 V < level ≤ 20 V	<2 % + resolution

THD+N meter		
Measurement bandwidth		21 kHz
Frequency range		100 Hz to 10 kHz
Level range		10 mV to 30 V
Resolution		0.01 % THD+N
Inherent distortion	100 mV ≤ level ≤ 20 V	<0.05 % THD+N
Uncertainty	100 mV ≤ level ≤ 2 V	<1 % + inherent resolution
	2 V < level ≤ 20 V	<2 % + inherent resolution

R&S®CMU-U99/B99 RF1 level range identical to RF2 option

With the R&S®CMU-U99/B99 option installed, the input/output level range and the input/output level uncertainty for RF 1 are the same as for RF 2.

With the R&S®CMU-U99/B99 option installed, the VSWR of the RF generator and analyzer at RF 1 is as follows:

VSWR	RF generator and RF analyzer	
RF1	10 MHz to 2000 MHz	<1.2
	2000 MHz to 2200 MHz	<1.4
	2200 MHz to 2700 MHz	<1.6

[10] Measurement bandwidth 21.9 kHz.

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*0.14 €/min within German wireline network; rates may vary in other networks (wireline and mobile) and countries.