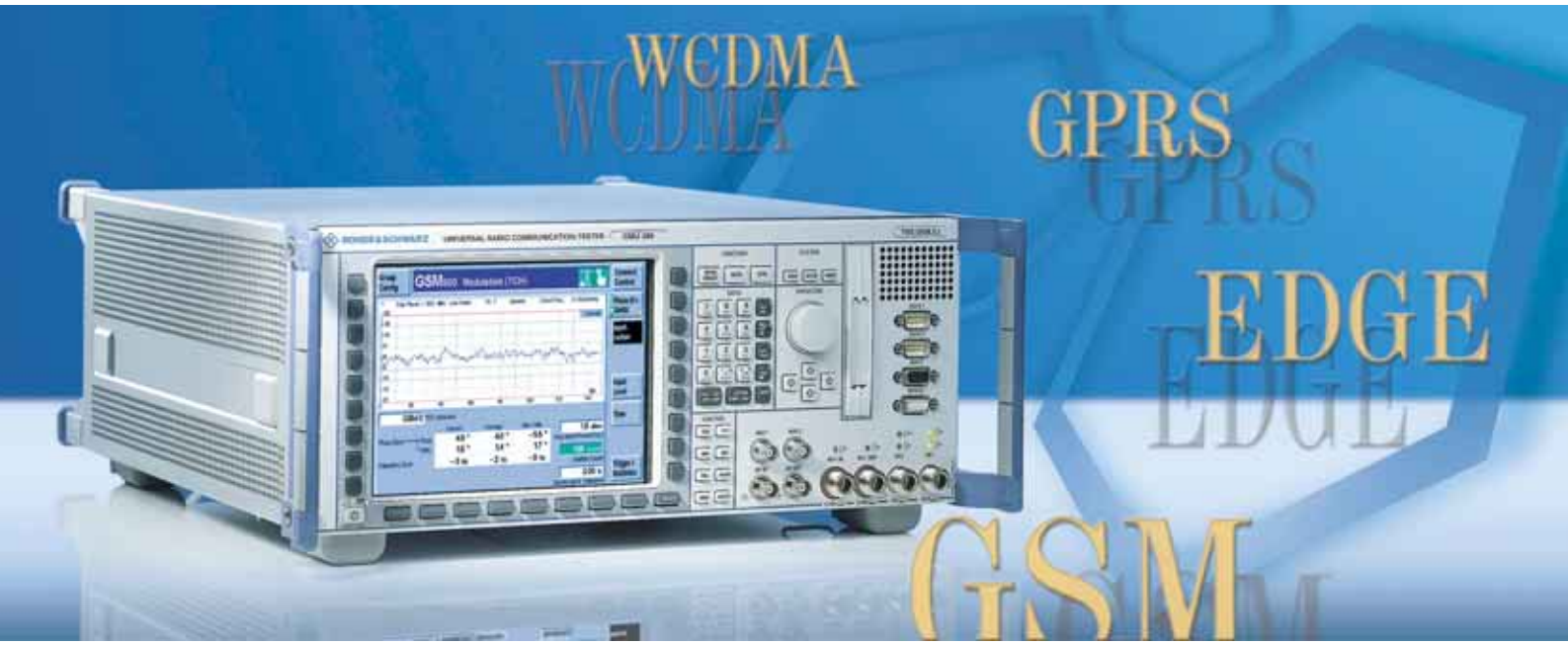

Universal Radio Communication Tester CMU300

Technical Information

ROHDE&SCHWARZ

Base unit specifications

Timebase TCXO

Max. frequency drift in temperature range +5 °C to +45 °C	±1 x 10^{-6}
Max. aging	±1 x 10^{-6}/year

Timebase OCXO – option CMU-B12

Max. frequency drift in temperature range +5 °C to +45 °C	±5 x 10^{-9}, referred to +25 °C
with instrument orientation referred to turn-off frequency after 2 h warmup time following a 24 h off time at +25 °C	±3 x 10^{-9} ±5 x 10^{-9}
Max. aging	±3.5 x 10^{-8}/year, ±5 x 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	±5 x 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 ≤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 µs to Δf <1kHz

Output level range

RF1	
100 kHz to 2200 MHz	–130 dBm to –27 dBm
2200 MHz to 2700MHz	–130 dBm to –33 dBm
RF2	
100 kHz to 2200 MHz	–130 dBm to –10 dBm
2200 MHz to 2700MHz	–130 dBm to –16 dBm
RF3OUT	
100 kHz to 2200 MHz	–90 dBm to +13 dBm
2200 MHz to 2700MHz	–90 dBm to +5 dBm

Output level uncertainty

RF1, RF2 (temperature range +23 °C to +35 °C)

	≥–106 dBm	**>–117 dBm**	**–117 to –130dBm**
10 MHz to 450 MHz	<0.6 dB		
450 MHz to 2200 MHz	<0.6 dB	<0.6 dB[2]	<1.5 dB[1][2]
2200 MHz to 2700 MHz	<0.8 dB	<0.8 dB[2]	<1.5 dB[1][2]

RF1, RF2 (temperature range +5 °C to +45 °C)

	≥–106 dBm	**>–117 dBm**	**–117 to –130 dBm**
10 MHz to 450 MHz	<1.0 dB		
450 MHz to 2200 MHz	<1.0 dB	<1.0 dB[2]	<1.5 dB[1][2]
2200 MHz to 2700 MHz	<1.5 dB	<1.5 dB[2]	<1.5 dB[1][2]

RF3OUT (temperature range +23 °C to +35 °C)	
10 MHz to 450 MHz	<0.8 dB P=–80 dBm to +10 dBm
450 MHz to 2200 MHz	<0.8 dB P=–90 dBm to +10 dBm
2200 MHz to 2700 MHz	<1.0 dB P=–90 dBm to +5 dBm
RF3OUT (temperature range +5 °C to +45 °C	
10 MHz to 450 MHz	<1.0 dB P=–80 dBm to +10 dBm
450 MHz to 2200 MHz	<1.0 dB P=–90 dBm to +10 dBm
2200 MHz to 2700 MHz	<1.5 dB P=–90 dBm to +5 dBm

Output level settling time <4 µs

[1] Valid for RF1 only.

[2] Not valid at frequencies of netclock harmonics.

Output level resolution 0.1 dB

Generator RF level repeatability

(RF1, RF2, RF3OUT, typical values after 1h warm-up):

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≤ +10 dBm)	>20 dB

Attenuation of nonharmonics

10 MHz to 2200 MHz	>40 dB at >5 kHz from carrier

Spectral purity

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)
CCITT	<5 Hz (rms)
Residual AM	
CCITT	<0.02% (rms)

IQ modulation

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

RF analyzer

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

Power meter (wideband)

Frequency range 100 kHz to 2700 MHz

Level range

RF1	
continuous power[3]	
100 kHz 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)
RF2	
continuous power	
100 kHz to 2200 MHz	–8 dBm to +33 dBm (2 W)
2200 MHz to 2700 MHz	–4 dBm to +33 dBm
Peak Envelope Power [4] (PEP)	+39 dBm (8 W)
RF4IN (continuous power and PEP)	
100 kHz to 2200 MHz	–33 dBm to 0 dBm
2200 MHz to 2700 MHz	–29 dBm to 0 dBm

Level uncertainty

RF1	10 dBm to 20 dBm	20 dBm to 47 dBm
50 MHz to 2700 MHz	<1.0 dB[6]	<0.5 dB[5][6]
RF2	–4 dBm to +6 dBm	+6 dBm to +33 dBm
50 MHz to 2700 MHz	<1.0 dB[6]	<0.5 dB[6]
RF4IN	–29 dBm to –19dBm	–19 dBm to 0 dBm
50 MHz to 2700 MHz	<1.5 dB	<0.8 dB

Level resolution 0.1 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 vs time must be equal or less than allowed continuous power.

[5] Calibrated for P>33 dBm only in frequency range 800 MHz to 2000 MHz.

[6] Temperature range +5°C to +23 °C or +35 °C to +45 °C and f>2200 MHz: add 0.2 dB.

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

RF1	
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)
RF2	
continuous power	
10 MHz to 2200 MHz	–54 dBm to +33 dBm (2 W)
2200 MHz to 2700 MHz	–48 dBm to +33 dBm
Peak Envelope Power [4] (PEP)	+39 dBm (8 W)
RF4IN (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

RF1, RF2	
in temperature range +23 °C to +35 °C	
50 MHz to 2200 MHz	<0.5 dB
2200 MHz to 2700 MHz	<0.7 dB
in temperature range +5 °C to +45 °C	
50 MHz to 2200 MHz	<1.0 dB
2200 MHz to 2700 MHz	<1.0 dB
RF4IN	
in temperature range +23 °C to +35 °C	
50 MHz to 2200 MHz	<0.7 dB
2200 MHz to 2700 MHz	<0.9 dB
in temperature range +5 °C to +45 °C	
50 MHz to 2200 MHz	<1.0 dB
2200 MHz to 2700 MHz	<1.1 dB

RF level measurement repeatability

(RF1, RF2, RF4IN, typical values after 1h warm-up):	
Input ≥–40 dBm	<0.01 dB
Input <–40 dBm	<0.03 dB

Level resolution 0.1 dB

Demodulation (data of hardware paths)

Spectral purity

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	
30 Hz to 15 kHz	<50 Hz (rms), <200 Hz (peak)
CCITT	<5 Hz (rms)
Residual AM	
CCITT	<0.02% (rms)

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	≥100 ms, depending on RBW
Display	560 dots, horizontal
Marker	up to 3, absolute/relative
Display line	1
Display scale	10/20/30/50/80/100 dB

Level range

RF1	
continuous power[3]	up to +47 dBm (50 W)
max. peak power[4] (PEP)	up to +53 dBm (200 W)
RF2	
continuous power	up to +33 dBm (2 W)
max. peak power[4] (PEP)	up to +39 dBm (8 W)
RF4IN (continuous power and PEP)	up to 0 dBm

Level uncertainty

RF1, RF2	
in temperature range +23 °C to +35 °C	
50 MHz to 2200 MHz	<0.5 dB
2200 MHz to 2700 MHz	<0.7 dB
in temperature range +5 °C to +45 °C	
50 MHz to 2200 MHz	<1.0 dB
2200 MHz to 2700 MHz	<1.0 dB
RF4IN	
in temperature range +23 °C to +35 °C	
50 MHz to 2200 MHz	<0.7 dB
2200 MHz to 2700 MHz	<0.9 dB
in temperature range +5 °C to +45 °C	
50 MHz to 2200 MHz	<1.0 dB
2200 MHz to 2700 MHz	<1.1 dB

Reference level for full dynamic range (low noise mode)

Logarithmic level display	
RF1	+10 dBm to +47 dBm
RF2	–4 dBm to +33 dBm
RF4IN	–22 dBm to 0 dBm

Displayed average noise level (RBW 1 kHz, low noise mode)

RF1/RF2/RF4IN	
10 MHz to 2200 MHz	<–100 dBc
2200 MHz to 2700 MHz	<–95 dBc

Inherent spurious response <–50 dB
Low distortion mode, 20 MHz to 2200 MHz, except 1816.115 MHz

Inherent harmonics

(f_0 = 50 MHz to 2200 MHz, up to 7 GHz)	
RF1, RF2	<–30 dB
RF4IN	<–20 dB

GSM specifications – Base station test

RF generator

Modulation	GMSK, BxT = 0.3
	8PSK[7]
Frequency range	
GSM 400 band	450 MHz to 458 MHz / 478 MHz to 486 MHz
GSM 850 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

Attenuation of inband spurious emissions >50 dB

Inherent phase error (GMSK)	<1°, rms
	<4°, peak
Inherent EVM (8PSK)[7]	<2%, rms

Frequency settling time <500 µs to res. phase of 4°

Output level range (GMSK)

RF1	–130 dBm to –27 dBm
RF2	–130 dBm to –10 dBm
RF3OUT	–90 dBm to +13 dBm

Output level range (8PSK)[7]

RF1	–130 dBm to –31 dBm
RF2	–130 dBm to –14 dBm
RF3OUT	–90 dBm to +9 dBm

Output level resolution 0.1 dB

Level uncertainty

RF1, RF2	P >–117 dBm
in temperature range	
+23 °C to +35 °C	<0.5 dB
+5 °C to +45 °C	<0.7 dB
RF3OUT	P >–90 dBm to +10 dBm (GMSK)
	P >–90 dBm to +6 dBm (8PSK)[7]
in temperature range	
+23 °C to +35 °C	<0.7 dB
+5 °C to +45 °C	<0.9 dB

RF analyzer

Frequency range

GSM 400 band	460 MHz to 468 MHz / 488 MHz to 496 MHz
GSM 850 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

[7] with option CMU-K41.

Measurement bandwidth
in measurement menus 500 kHz

Power meter

Level range
RF1
continuous power[8] –40 dBm to +47 dBm (50 W)
Peak Envelope Power[9] (PEP) +53 dBm (200 W)
RF2
continuous power –54 dBm to +33 dBm (2 W)
Peak Envelope Power[9] (PEP) +39 dBm (8 W)
RF4IN (continuous power and PEP) –80 dBm to 0 dBm

Level uncertainty
RF1, RF2, RF4IN
in temperature range
+23 °C to +35 °C <0.5 dB
+5 °C to +45 °C <0.7 dB

Level resolution 0.1 dB (0.01 dB via remote control)

Modulation Analysis

Level range (PEP)
RF1 –6 dBm to +53 dBm
RF2 –20 dBm to +39 dBm
RF4IN –60 dBm to 0 dBm

Inherent phase error (GMSK) <0.6°, rms
<2°, peak
Inherent EVM (8PSK)[7] <1,0%, rms

Frequency measurement uncertainty ≤10 Hz + drift of time base

Burst power measurement

Reference level for full dynamic range (GMSK, low noise mode)
RF1 +10 dBm to +53 dBm
RF2 –4 dBm to +39 dBm
RF4IN –22 dBm to 0 dBm
Dynamic range (GMSK) >72 dB (BW= 500 kHz, rms)

Reference level for full dynamic range (8PSK, low noise mode)[7]
RF1 +6 dBm to +49 dBm
RF2 –8 dBm to +35 dBm
RF4IN –26 dBm to –4 dBm
Dynamic range >69 dB (BW= 500 kHz, rms)

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

Resolution 0.1 dB in active part of burst

Spectrum due to modulation [10]

Level range for full dynamic range
RF1 +10 dBm to +47 dBm
RF2 –4 dBm to +33 dBm
RF4IN –22 dBm to 0 dBm
Test method relative measurement, averaging
Filter bandwidth 30 kHz resolution filter (5 pole)
Measurement at an offset of 100, 200, 250, 400, 600, 800, 1000, 1200, 1400, 1600, 1800 kHz
Dynamic range (noise correction mode)
with offset ≥ 1200 kHz >80 dB

Spectrum due to switching [10]

Level range for full dynamic range
RF1 +10 dBm to +47 dBm
RF2 –4 dBm to +33 dBm
RF4IN –22 dBm to 0 dBm
Test method absolute measurement, max hold over several measurements
Filter bandwidth 30 kHz resolution filter (5 pole)
Measurement at an offset of 100, 200, 250, 400, 600, 800, 1000, 1200, 1400, 1600, 1800 kHz
Dynamic range (noise correction mode)
with offset ≥ 1200 kHz >80 dB

General data

Rated 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 68-2-3

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

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

Mechanical resistance (non operating mode)
Vibration, sinusoidal meets IEC68-2-6, IEC1010-1, EN61010-1, 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 68-2-36, DIN 40046 T24 10 Hz to 300 Hz, acceleration 1.2 g rms
Shock meets DIN IEC 68-2-27, MIL-STD-810D 40 g shock spectrum

Electrical safety IEC1010-1, DIN EN61010-1, UL3111-1, CSA22.2 No. 1010-1

Power supply 100 V to 240 V ± 10% (AC), 3.1 A to 1.3 A, 50 Hz to 400 Hz –5% to +10% power factor correction, EN61000-3-2

Power consumption
Base unit 130 W
With typical options 180 W

Dimensions (W x H x D) 465 mm x 193 mm x 517 mm (19"; 4 height units)

Weight
Base unit 14 kg
With typical options 18 kg

[8] 50 W from +5 °C to +30 °C, linear degradation down to 25 W at 45 °C.
[9] Mean value of power vs time must be equal or less than allowed continuous power.
[10] The specifications apply to all cases, in which interfering carriers (up to the same level as the measured carrier) are more than 50 GSM channels away.

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