Specifications

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Universal Radio Communication Tester R&S®CMU 300

Specifications

ROHDE&SCHWARZ

CONTENTS

The specifications for the R&S CMU300 (Order No. 1100.0008.03) refer to a fully equipped unit with all options installed.

Base unit specifications

Time base 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

Time base OCXO – option R&S CMU-B11

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
Warmup time	at +25 °C	approx. 5 min

Time base OCXO – option R&S CMU-B12

Max. frequency drift		
	in temperature range +5°C to +45 °C, referred to +25 °C	$\pm 5 \times 10^{-9}$
	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	after 30 days of operation	$\pm 3.5 \times 10^{-8}$/year $\pm 5 \times 10^{-10}$/day
Warmup time	at +25 °C	approx. 10 min

Reference frequency inputs/outputs

Synchronization input		BNC connector REF IN
Frequency	sinewave squarewave (TTL level)	1 MHz to 52 MHz, step 1 kHz 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 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 ∆f < 1 kHz

Output level range		
RF 1	100 kHz to 2200 MHz 2200 MHz to 2700 MHz	–130 dBm to –27 dBm –130 dBm to –33 dBm
RF 2	100 kHz to 2200 MHz 2200 MHz to 2700 MHz	–130 dBm to –10 dBm –130 dBm to –16 dBm
RF 3 OUT	100 kHz to 2200 MHz 2200 MHz to 2700 MHz	–90 dBm to +13 dBm –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 450 MHz to 2200 MHz 2200 MHz to 2700 MHz output level >–117 dBm 450 MHz to 2200 MHz 2200 MHz to 2700 MHz output level –117 dBm to –130 dBm 450 MHz to 2200 MHz 2200 MHz to 2700 MHz	 <0.6 dB <0.6 dB <0.8 dB <0.6 dB[1] <0.8 dB[1] <1.5 dB[1, 2] <1.5 dB[1, 2]
RF 3 OUT	10 MHz to 450 MHz output level –80 dBm to +10 dBm 450 MHz to 2200 MHz output level –90 dBm to +10 dBm 2200 MHz to 2700 MHz output level –90 dBm to +5 dBm	 <0.8 dB <0.8 dB <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 450 MHz to 2200 MHz 2200 MHz to 2700 MHz output level >–117 dBm 450 MHz to 2200 MHz 2200 MHz to 2700 MHz output level –117 dBm to –130 dBm 450 MHz to 2200 MHz 2200 MHz to 2700 MHz	 <1.0 dB <1.0 dB <1.5 dB <1.0 dB[1] <1.5 dB[1] <1.5 dB[1, 2] <1.5 dB[1, 2]
RF 3 OUT	10 MHz to 450 MHz output level –80 dBm to +10 dBm 450 MHz to 2200 MHz output level –90 dBm to +10 dBm 2200 MHz to 2700 MHz output level –90 dBm to +5 dBm	 <1.0 dB <1.0 dB <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 RF1 only.

Generator RF level repeatability	typical values after 1 h warmup time output level ≥–80 dBm output level <–80 dBm	 <0.01 dB <0.1 dB

VSWR		
RF 1	10 MHz to 2000 MHz 2000 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.2 <1.3 <1.6
RF 2	10 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.2 <1.6
RF 3 OUT	10 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.5 <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 ≥250 kHz	<–100 dBc, 1 Hz <–110 dBc, 1 Hz

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

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

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

RF analyzer

VSWR		
RF 1	10 MHz to 2000 MHz 2000 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.2 <1.3 <1.6
RF 2	10 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.2 <1.6
RF 4 IN	10 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.5 <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 250 kHz to 400 kHz ≥400 kHz	<–100 dBc, 1 Hz <–110 dBc, 1 Hz <–118 dBc, 1 Hz

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

Residual AM	ITU–T (formerly CCITT)	<0.02%, rms

Power meter (wideband)

Frequency range		100 kHz to 2700 MHz

Level range		
RF 1	continuous power[3] 100 kHz to 2200 MHz 2200 MHz to 2700 MHz peak envelope power[4] (PEP)	 +6 dBm to +47 dBm (50 W) +10 dBm to +47 dBm (50 W) +53 dBm (200 W)
RF 2	continuous power 100 kHz to 2200 MHz 2200 MHz to 2700 MHz peak envelope power[4] (PEP)	 –8 dBm to +33 dBm (2 W) –4 dBm to +33 dBm (2 W) +39 dBm (8 W)
RF 4 IN	continuous power and PEP 100 kHz to 2200 MHz 2200 MHz to 2700 MHz	 –33 dBm to 0 dBm –29 dBm to 0 dBm

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

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

[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 to or less than allowed 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.

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

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

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

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

RF level measurement repeatability	typical values after 1 h warmup input level ≥–40 dBm input level <–40 dBm	 <0.01 dB <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		10/20/30/50/80/100 dB

Level range		
RF 1	continuous power[3] peak envelope power[4] (PEP)	up to +47 dBm (50 W) up to +53 dBm (200 W)
RF 2	continuous power peak envelope power[4] (PEP)	up to +33 dBm (2 W) 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 2200 MHz to 2700 MHz	<0.5 dB <0.7 dB
RF 4 IN	50 MHz to 2200 MHz 2200 MHz to 2700 MHz	<0.7 dB <0.9 dB

Level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2	50 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.0 dB <1.0 dB
RF 4 IN	50 MHz to 2200 MHz 2200 MHz to 2700 MHz	<1.0 dB <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 2200 MHz to 2700 MHz	 <–100 dBc <–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 specifications

Operating temperature range		+5 °C to +45 °C, meets EN60068-2-1 and -2
Storage temperature range		–25 °C to +60 °C, meets EN60068-2-1 and -2
Humidity	+40 °C, non-condensing	80 % relative humidity, meets EN 60068-2-3

Electromagnetic compatibility		meets 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	meets 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	meets EN 60068-2-64 10 Hz to 300 Hz, acceleration 1.2 g rms
Shock		meets EN 60068-2-27, MIL-STD-810D 40 g shock spectrum

Power supply		power factor correction, meets EN61000-3-2
Input		100 V to 240 V ±10 % (AC), max. 500 VA, 50 Hz to 400 Hz –5 % to +10 %
Power consumption	base unit with typical options	approx. 130 W approx. 180 W

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

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

Weight	base unit with typical options	approx. 14 kg approx. 18 kg

Inputs and outputs (rear panel)

IF 3 RX CH1		BNC female
Frequency	WCDMA other networks/RF	7.68 MHz/10 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 sub-D connector

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

Keyboard		PS/2 connector

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

GSM specifications – base station test

RF generator

Modulation		GMSK, B x T = 0.3 8PSK

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

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

RF analyzer

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

Power meter (frequency-selective)

Level range		
RF 1	continuous power[3] peak envelope power[4] (PEP)	–40 dBm to +47 dBm (50 W) +53 dBm (200 W)
RF 2	continuous power peak envelope power[4] (PEP)	–54 dBm to +33 dBm (2 W) +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 in temperature range +5 °C to +45 °C	<0.5 dB <0.7 dB

Level resolution	in manual mode in remote control mode	0.1 dB 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	–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[7]

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 pole

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

Dynamic range	*Noise Correction → On,* with offset ≥1200 kHz	>80 dB

Spectrum due to switching[7]

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, max. hold over several measurements

Filter bandwidth		30 kHz resolution filter, 5 pole

Measurement	at an offset of	400, 600, 800, 1200, 1800 kHz

Dynamic range	*Noise Correction → On,* with offset ≥1200 kHz	>80 dB

[7] 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.

WCDMA specifications – base station test

Standard		3GPP FDD
Symbol rate		3.84 MHz
Trigger input	15 pin sub-D connector AUX 3, pin 6	TTL level
Required trigger signals	physical channel mode reference channel mode	10 ms frame trigger TTI trigger (20 ms, 40 ms, 80 ms)

RF generator (3GPP FDD, release 99, uplink signal)

Physical channels	1 x DPCCH, 1 to 6 x DPDCH	15 kbps, 30 kbps, 60 kbps, 120 kbps, 480 kbps, 1 x 960 kbps, 2 x 960 kbps, 3 x 960 kbps, 4 x 960 kbps, 5 x 960 kbps, 6 x 960 kbps
Amplitude ratio of ßc to ßd		15/15, 14/15, 13/15, 12/15, 11/15, 10/15, 9/15, 8/15, 7/15, 6/15, 5/15, 4/15, 3/15, 2/15, 1/15, DPDCH off
Reference measurement channel	3GPP TS 25.141	12.2 kbps, 64 kbps, 144 kbps, 384 kbps, 2048 kbps

Frequency range		1850 MHz to 1910 MHz 1920 MHz to 1980 MHz

Frequency resolution		0.1 Hz

Output level range		
RF 1		–130 dBm to –40 dBm
RF 2		–130 dBm to –23 dBm
RF 3 OUT		–90 dBm to 0 dBm

Output level uncertainty	in temperature range +20 °C to +35 °C	
RF 1, RF 2	output level ≥–125 dBm	<0.6 dB
RF 3 OUT	output level ≥–80 dBm	<0.8 dB

Output level uncertainty	in temperature range +5 °C to +45 °C	
RF 1, RF 2	output level ≥–125 dBm	<0.9 dB
RF 3 OUT	output level ≥–80 dBm	<1.0 dB

Signal quality		
Error vector magnitude (EVM)		<8 %[8], rms

[8] Global EVM for UL 3GPP reference measurement channels.

RF analyzer (TX measurements)

Frequency range		1930 MHz to 1990 MHz 2110 MHz to 2170 MHz

Frequency resolution		1 Hz

Modulation analysis[9,10]

Measurement filter	receiver filter according to standard	3.84 MHz, RRC, α = 0.22
Analysis modes		WCDMA downlink

Reference level for full dynamic range		
RF 1	continuous power[3] peak envelope power[4] (PEP)	0 dBm to +47 dBm 0 dBm to +53 dBm
RF 2	continuous power peak envelope power[4] (PEP)	–14 dBm to +33 dBm –14 dBm to +39 dBm
RF 4 IN	continuous power and PEP	–37 dBm to 0 dBm

Error vector magnitude (EVM)		
Measurement range		up to 25 %
Inherent EVM		<2.5 %[11] rms
Resolution		0.1 %

Frequency error		
Measurement range		±1 kHz
Uncertainty		<5 Hz[12] + drift of timebase
Resolution		1 Hz

I/Q offset		
Inherent I/Q offset		<–50 dB
Resolution		0.01 dB

I/Q imbalance		
Inherent I/Q imbalance		<–50 dB
Resolution		0.01 dB

Peak code domain error (PCDE)		
Inherent PCDE		<–40 dB
Resolution		0.01 dB

Spectrum measurements

Reference level for full dynamic range	test model 1	
RF 1	rms peak envelope power[4](PEP)	+19 dBm to +41 dBm +31 dBm to +53 dBm
RF 2	rms peak envelope power [4](PEP)	+5 dBm to +27 dBm +17 dBm to +39 dBm
RF 4 IN	for ACLR/OBW application	
	rms peak envelope power (PEP)	–18 dBm to –12 dBm –6 dBm to 0 dBm
RF 4 IN	for SEM application	
	rms peak envelope power (PEP)	–22 dBm to –14 dBm –10 dBm to -2 dBm

[9] The specified data is valid for *RF Attenuation* set to *Normal*.

[10] With 3GPP TS 25.141 test model 04 inclusive CPICH.

[11] With R&S CMU-Z6 <1.5 %, rms typ.

[12] Specified for average value of ≥10 slots.

Adjacent channel leakage ratio (ACLR)		
Measurement filter	receiver filter according to standard	3.84 MHz, RRC, α = 0.22
Frequency offsets	first adjacent channel second adjacent channel	±5 MHz ±10 MHz
Dynamic range *(ACLR Scanning → Off)*	first adjacent channel second adjacent channel	>54 dB >62 dB
Dynamic range (*ACLR Scanning → On*)	first adjacent channel second adjacent channel	>60 dB[13] >70 dB[13]
Uncertainty	relative	<0.8 dB[14] typ.
Resolution		0.1 dB

Occupied bandwidth (OBW)		
Range		1 MHz to 6 MHz
Uncertainty		<100 kHz
Resolution		20 kHz

Spectrum emission mask[13] (SEM)		
Measurement filter	±2.515 MHz to ±2.715 MHz ±2.715 MHz to ±3.515 MHz ±3.515 MHz to ±4.0 MHz ±4.0 MHz to ±8.0 MHz ±8.0 MHz to ±12.0 MHz	30 kHz Gaussian 30 kHz Gaussian 30 kHz Gaussian 1 MHz Gaussian 1 MHz Gaussian
Dynamic range	±2.515 MHz to ±2.715 MHz ±2.715 MHz to ±3.515 MHz ±3.515 MHz to ±4.0 MHz ±4.0 MHz to ±8.0 MHz ±8.0 MHz to ±12.0 MHz	>72 dB >72 dB + 6.25 x (f_{Offset} – 2.715 MHz) >77 dB >65 dB >70 dB
Uncertainty	typically	<1.5 dB
Resolution		0.1 dB

Power meter (wideband)

See base unit specifications		

Power meter (frequency-selective)[15]

Maximum output power	wideband filter receiver filter according to standard	bandwidth approx. 7 MHz 3.84 MHz, RRC, α = 0.22

Level range		
RF 1	continuous power[3] peak envelope power[4] (PEP)	–52 dBm to +47 dBm –42 dBm to +53 dBm
RF 2	continuous power peak envelope power[4] (PEP)	–66 dBm to +33 dBm –56 dBm to +39 dBm
RF 4 IN	continuous power[16] peak envelope power (PEP)	–89 dBm to 0 dBm –79 dBm to 0 dBm

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

[13] The specified data is valid for units delivered since 08/2003 or with R&S CMU-U74.

[14] For power difference <50 dB and full range carrier power level.

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

[16] Upper limit depends on crest factor.

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

Level resolution		0.01 dB

Code domain power[15]

Measurement filter	receiver filter according to standard	3.84 MHz, RRC, α = 0.22

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

Option I/Q/IF Interface R&S CMU-B17

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 %
Offset voltage	in temperature range +20 °C to +35 °C in temperature range +5 °C to +45 °C	<4 mV <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 in temperature range +5 °C to +45 °C	>40 dB >35 dB
Sideband suppression	$f_{I/Q}$ < 1 MHz 1MHz < $f_{I/Q}$ < 2.5 MHz	>45 dB >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 in temperature range +5 °C to +45 °C	>35 dB[17] >35 dB[17]
Sideband suppression	$f_{I/Q}$ < 1 MHz 1 MHz < $f_{I/Q}$ < 2.5 MHz	>45 dB >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

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 CMU300 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 CMU300 base unit specifications

[17] 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)	13.85 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)	10.7 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)	13.85 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)	10.7 MHz

Remarks

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

The RF frequency of the R&S CMU300 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 CMU300 generator or analyzer RF frequency	
	100 kHz to 1200.0999999 MHz	1200.1 MHz to 2700.0 MHz
R&S CMU300 I/Q output vector	inverted rotation swap I output with Q output for proper operation	normal rotation
R&S CMU300 I/Q input vector	inverted rotation swap I input with Q input for proper operation	normal rotation

The rotating direction must be considered if the R&S CMU300 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 CMU300 block after external handling.

Examples:

- The rotating direction must **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 CMU300 I/Q input (the R&S CMU300 in combination with the Fading Simulator R&S ABFS or R&S SMIQ/SMIQB14, the R&S CMU300 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 CMU300 (the R&S CMU300 in combination with the R&S SMIQ, 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 CMU300 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 CMU300 RF interface (RF 1, RF 2, RF 4 IN) have to be considered additionally (*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 mentioned 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 specifications for the R&S CMU300 (Order No. 1100.0008.03) refer to a fully equipped unit with all options installed.

Specifications are valid under the following conditions:

Data without tolerance limits is not binding.

In compliance with the 3GPP 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.

For more general information about the R&S CMU300 please refer to the product brochure PD 0758.0000.12, version ≥01.00.

For product brochure, see PD 0758.0000.12
and www.rohde-schwarz.com
(search term: CMU300)

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