R&S®SMU200A Vector Signal Generator

Data sheet

ROHDE&SCHWARZ

CONTENTS

Introduction

The R&S®SMU200A vector signal generator has been designed to meet all requirements encountered in the research and development of modern communications systems as well as in their production. The R&S®SMU200A not only combines up to two independent signal generators in one cabinet of only four height units, but also offers unrivaled RF and baseband characteristics.

Due to its modular design, the R&S®SMU200A can be optimally adapted to the requirements of different applications. The first RF path can be equipped with one of the four available frequency options. The upper frequency limit of 2.2 GHz, 3 GHz, 4 GHz, or 6 GHz is user-selectable. In addition, a second RF path can be installed with an upper frequency limit of 2.2 GHz or 3 GHz. The lower frequency limit of all frequency options is 100 kHz.

Two generators can also be installed in the baseband section. They generate complex signals in realtime and are equipped with an arbitrary waveform generator with 16 Msample, 64 Msample, or 128 Msample memory. The signals generated in the different basebands can be added, even with frequency offset.

The modern, intuitive concept of the R&S®SMU200A ensures fast and easy operation.

Key features

Two signal generators in one

- Frequency options from 100 kHz to 2.2/3/4/6 GHz for the first RF path
- Optional second RF path up to 2.2 GHz or 3 GHz
- Up to two complete baseband paths
- Lossless combination of baseband signals in the digital domain (e.g. for testing multistandard base stations)

Intuitive operation

- Color display with 800 × 600 pixels (SVGA format)
- Intuitive user interface with graphical display of signal flow (block diagram)
- Graphical display of baseband signals through built-in transient recorder
- Context-sensitive help system

Outstanding signal quality

- I/Q modulator with 200 MHz RF bandwidth
- Very low SSB phase noise of typ. −135 dBc (f = 1 GHz, 20 kHz carrier offset, 1 Hz measurement bandwidth), typ. −139 dBc with the enhanced phase noise performance option
- Wideband noise of typ. −153 dBc (CW, f = 1 GHz, >10 MHz carrier offset, 1 Hz measurement bandwidth)
- Excellent ACLR performance of typ. +70 dB with 3GPP FDD (test model 1, 64 DPCH)
- Very high level repeatability of 0.05 dB
- High output power of up to +19 dBm (PEP), overrange +26 dBm
- High-stability reference oscillator as standard

Unrivaled flexibility

- 2 x 2 MIMO with realtime fading possible
- Optional fading simulator with up to 40 fading paths
- Support of EUTRA/LTE signal generation
- Support of WiMAX IEEE 802.16-2004/Corr1-2005, 802.16e-2005, and WiBro
- Four code channels in realtime for 3GPP FDD, support of HSDPA and HSUPA
- Support of WLAN IEEE 802.11a, b, g and n
- Change of modulation from slot to slot for GSM/EDGE
- Baseband generator with universal coder for realtime signal generation
- Arbitrary waveform generator with 16 Msample, 64 Msample, or 128 Msample
- Arbitrary waveform generator supported by R&S®WinIQSIM2™ and R&S®WinIQSIM™ simulation software

Ideal for production

- Very short frequency and level setting times (<2 ms); only 450 µs in List mode
- Electronic attenuator with overvoltage protection up to 6 GHz over full level range
- Flexible high speed measurements with RF List mode and multisegment waveforms
- Minimum space required as two complete generators are accommodated in one instrument of only four height units

Connectivity

- Remote control via LAN (Gigabit Ethernet, VXI11) and GPIB
- Remote operation via Windows Remote Desktop or VNC
- User-selectable trigger and marker signals
- USB connectors for keyboard, mouse, and memory stick
- LXI class C compliance

Frequency and enhancement options

Frequency options

One of the following frequency options must be installed in RF path A:

R&S®SMU-B102	100 kHz to 2.2 GHz
R&S®SMU-B103	100 kHz to 3 GHz
R&S®SMU-B104	100 kHz to 4 GHz
R&S®SMU-B106	100 kHz to 6 GHz

One of the following frequency options can be installed in RF path B:

(If R&S®SMU-B104 or R&S®SMU-B106 and one of the R&S®SMU-B20 or R&S®SMU-B22 options are installed in RF path A, no options can be installed in RF path B.)

R&S®SMU-B202	100 kHz to 2.2 GHz
R&S®SMU-B203	100 kHz to 3 GHz

Enhancement options

Enhanced phase noise performance and FM/φM modulator

One of the following options can be installed in RF path A:

R&S®SMU-B20	FM/φM Modulator
R&S®SMU-B22	FM/φM Modulator and Enhanced Phase Noise Performance

These options cannot be installed in RF path B.

High-power output

The following options can be installed

R&S®SMU-B31	High-Power Output (RF path A)
R&S®SMU-B36	High-Power Output (RF path B)

Modulation

Possible modulation types

RF path A
Amplitude modulation, frequency/phase modulation (optional), vector modulation, digital modulation via internal baseband section (optional), vector modulation via baseband inputs (optional), pulse modulation, wideband amplitude modulation

RF path B
Amplitude modulation, digital modulation via internal baseband section (optional), vector modulation via baseband inputs (optional), pulse modulation

Simultaneous modulation

In the same RF path

	AM	FM	φM	Pulse	BB-AM	I/Q	DM	ARB
Amplitude modulation (AM)	/	+	+	+	–	–	–	–
Frequency modulation (FM)	+	/	–	+	+	+	+	+
Phase modulation (φM)	+	–	/	+	+	+	+	+
Pulse modulation	+	+	+	/	+	+	+	+
Broadband AM (BB-AM)	–	+	+	+	/	–	–	–
Vector modulation (I/Q)	–	+	+	+	–	/	–	–
Digital modulation (DM)	–	+	+	+	–	–	/	–
ARB	–	+	+	+	–	–	–	/

+ = compatible, – = not compatible, switch off each other

RF characteristics

Frequency

Range	underrange	100 kHz to <300 kHz
	R&S®SMU-B102, R&S®SMU-B202	up to 2.2 GHz
	R&S®SMU-B103, R&S®SMU-B203	up to 3 GHz
	R&S®SMU-B104	up to 4 GHz
	R&S®SMU-B106	up to 6 GHz
Resolution of setting		0.01 Hz
Resolution of synthesis	standard, fundamental frequency range 750 MHz to 1500 MHz	5 µHz
	with R&S®SMU-B22 option	0.2 µHz
Setting time[1]	to within $<1 \times 10^{-7}$ for f > 200 MHz or <124 Hz for f < 200 MHz, with GUI update stopped, after IEC/IEEE bus delimiter	<2 ms, typ. 1.5 ms
	in ALC OFF MODE S&H	<4 ms, typ. 2.5 ms
	after trigger pulse in List mode	<450 µs, typ. 300 µs
Phase offset		adjustable in 0.1° steps

Frequency sweep

Operating modes	digital sweep in discrete steps	automatic, step, single, external single, external step, manual or external trigger, spacing linear or logarithmic
Sweep range		full frequency range
Step width	linear	full frequency range
	logarithmic	0.01 % to 100 % per step
Dwell time	range	10 ms to 10 s
	resolution	0.1 ms

Reference frequency

Aging	after 30 days of uninterrupted operation	$<1 \times 10^{-9}$/day, $<1 \times 10^{-7}$/year
	with R&S®SMU-B22 option	$<5 \times 10^{-10}$/day, $<3 \times 10^{-8}$/year
Maximum temperature effect	in operating temperature range	$\pm6 \times 10^{-8}$
	with R&S®SMU-B22 option	$\pm6 \times 10^{-9}$
Warm-up time	to nominal thermostat temperature	≤10 min
Output for internal reference signal	frequency (approx. sinewave)	10 MHz or external input frequency
	level	typ. 5 dBm
	source impedance	50 Ω
Input for external reference	frequency	5 MHz, 10 MHz or 13 MHz
	maximum deviation	3×10^{-6}
	input level, limits	≥–6 dBm, ≤19 dBm
	recommended	0 dBm to 19 dBm
	input impedance	50 Ω
Electronic tuning from input AUX I/O	sensitivity	typ. 1×10^{-8}/V to 3×10^{-8}/V
	with R&S®SMU-B22 option	typ. 4×10^{-9}/V to 1.2×10^{-8}/V
	input voltage	–10 V to +10 V
	input impedance	10 kΩ

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[1] Installation of software that is not authorized by Rohde & Schwarz for use on the R&S®SMU200A or installation of antivirus software can deteriorate the setting time performance.

Level

Setting range	standard	−145 dBm to +20 dBm
	with R&S®SMU-B31 or R&S®SMU-B36 option	to +30 dBm
Maximum level	standard	
	f ≤ 3 GHz	+13 dBm (PEP)[2]
	f > 3 GHz	+11 dBm (PEP)
	with R&S®SMU-B31 or R&S®SMU-B36 option	
	f ≤ 3 GHz	+19 dBm (PEP)
	f > 3 GHz	+17 dBm (PEP)
Resolution		0.01 dB
Level uncertainty	for levels >−120 dBm, attenuator mode Auto, temperature range +18 °C to +28 °C	
	1 MHz ≤ f ≤ 3 GHz	<0.5 dB
	f > 3 GHz	<0.9 dB
Additional uncertainty with ALC OFF, S&H	This function is needed only for some special applications.	<0.2 dB
Output impedance VSWR in 50 Ω system	ALC state ON, standard	
	f ≤ 3 GHz	<1.6, typ. <1.4
	f > 3 GHz	<1.85, typ. <1.6
	ALC state ON, with R&S®SMU-B31 or R&S®SMU-B36 option	
	attenuator mode Normal	
	f ≤ 3 GHz	<1.65, typ. <1.45
	f > 3 GHz	<1.9, typ. <1.65
	attenuator mode High Power	
	f ≤ 3 GHz	<1.7, typ. <1.5
	f > 3 GHz	<1.9, typ. <1.65
Setting time[3]	after IEC/IEEE bus delimiter, to <0.1 dB deviation from final value, with GUI update stopped, temperature range +18 °C to +28 °C	
	ALC state ON	<2 ms, typ. 1.5 ms
	ALC state OFF	<4 ms, typ. 2.5 ms
	in List mode after trigger impulse to 0.3 dB deviation from final value	<450 µs, typ. 300 µs
	range switchover with R&S®SMU-B31 or R&S®SMU-B36 option	<10 ms
Uninterrupted level setting	with attenuator mode fixed, ALC state ON	
	setting range	>20 dB
Back-feed (from ≥50 Ω source)	maximum permissible RF power in output frequency range for f > 1 MHz	
	1 MHz ≤ f ≤ 3 GHz	50 W
	f > 3 GHz	10 W
	maximum permissible DC voltage	50 V

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[2] PEP = peak envelope power.

[3] Installation of software that is not authorized by Rohde & Schwarz for use on the R&S®SMU200A or installation of antivirus software can deteriorate the setting time performance.
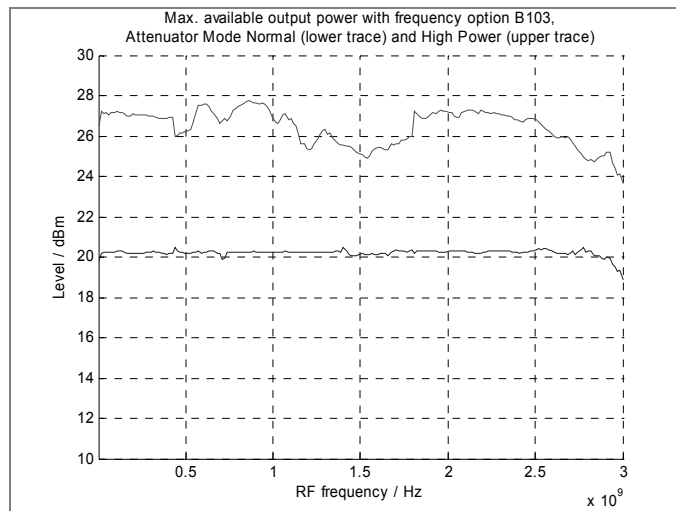
Measured level data

Max. available output power with frequency option B106,
Attenuator Mode Normal (lower trace) and High Power (upper trace)

Max. available output power with frequency option B103,
Attenuator Mode Normal (lower trace) and High Power (upper trace)
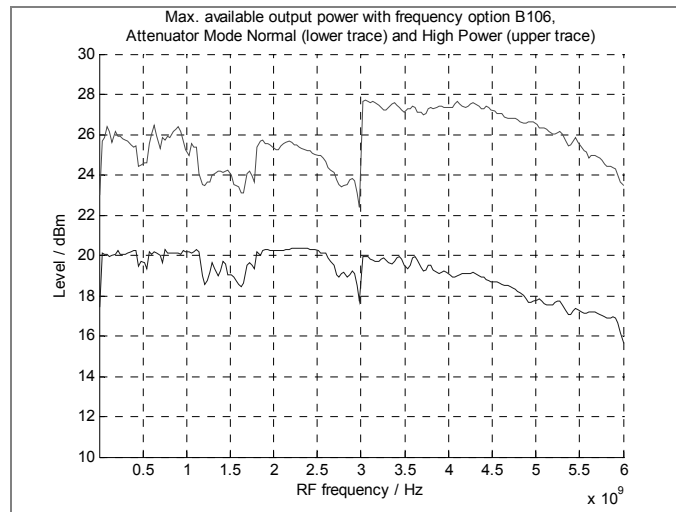
Measured maximum available output level versus frequency

Level = (Pmax – 2.5)dBm, CW, ALC On
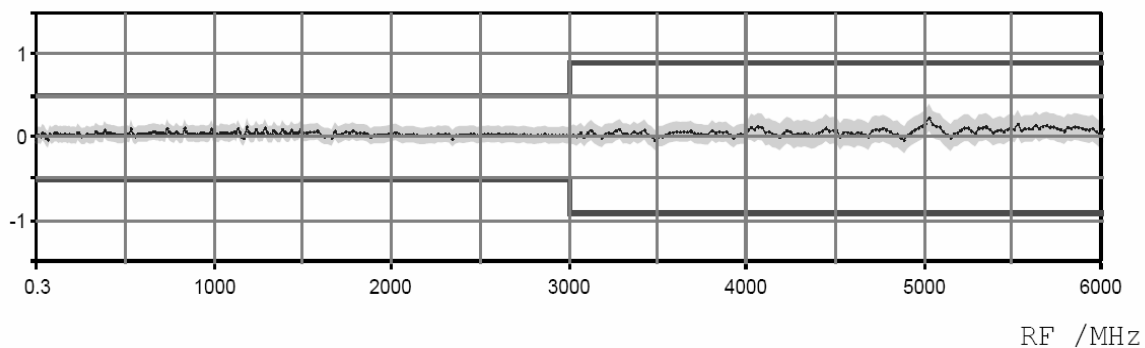
Measured level uncertainty versus frequency
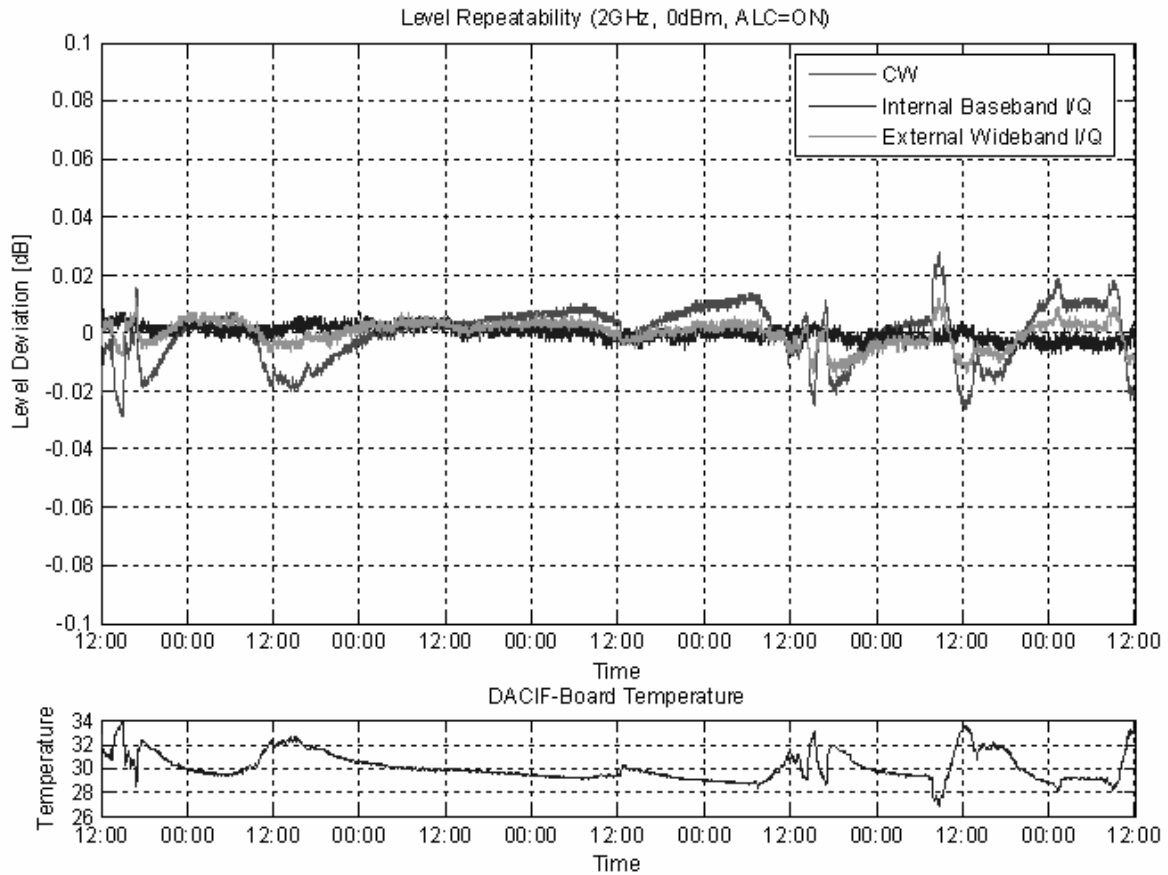
Level repeatability over 6 days with random settings between measurements
(DACIF board temperature: internal temperature test point, variations caused by changes of ambient temperature)

Level sweep

Operating modes	digital sweep in discrete steps	auto, single, step, external single, external step, manual, or external trigger
Sweep range		level range of attenuator modes Normal or High Power
Step width	logarithmic	0.1 dB to 20 dB per step
Dwell time	range	10 ms to 10 s
	resolution	0.1 ms

Spectral purity

Harmonics	standard, unmodulated	
	level <8 dBm	<–30 dBc
	level <13 dBm	typ. <–30 dBc
	with R&S®SMU-B31 or R&S®SMU-B36 option, level <12 dBm	<–30 dBc
Nonharmonics	level >–50 dBm, CW, vector modulation (full-scale DC input), >10 kHz offset from carrier and outside the modulation spectrum	
	0.3 MHz ≤ f ≤ 200 MHz	<–77 dBc
	200 MHz < f ≤ 1500 MHz	<–80 dBc
	1500 MHz < f ≤ 3000 MHz	<–74 dBc
	f > 3000 MHz	<–68 dBc
	>850 kHz offset from carrier and outside the modulation spectrum	
	0.3 MHz ≤ f ≤ 200 MHz	<–77 dBc
	200 MHz < f ≤ 1500 MHz	<–86 dBc
	1500 MHz < f ≤ 3000 MHz	<–80 dBc
	f > 3000 MHz	<–74 dBc
Nonharmonics with R&S®SMU-B22 option	level >–50 dBm, CW, vector modulation (full-scale DC input), >10 kHz offset from carrier and outside the modulation spectrum	
	0.3 MHz ≤ f ≤ 200 MHz	<–77 dBc (typ. –87 dBc)
	200 MHz < f ≤ 1500 MHz	<–90 dBc
	1500 MHz < f ≤ 3000 MHz	<–84 dBc
	f > 3000 MHz	<–78 dBc
Power supply and mechanically related nonharmonics	at RF = 1 GHz, 50 Hz to 10 kHz from carrier	<–70 dBc
Subharmonics	1500 MHz < f ≤ 3000 MHz	<–74 dBc
	f > 3000 MHz	<–50 dBc
Wideband noise	carrier offset >10 MHz, measurement bandwidth 1 Hz, CW	
	20 MHz ≤ f ≤ 200 MHz	<–146 dBc (typ. –149 dBc)
	200 MHz < f ≤ 1500 MHz	<–150 dBc (typ. –153 dBc)
	1.5 GHz < f ≤ 3 GHz	<–148 dBc (typ. –151 dBc)
	f > 3 GHz	<–146 dBc (typ. –149 dBc)
	vector modulation with full-scale DC input, I/Q input gain 3 dB	
	20 MHz ≤ f ≤ 200 MHz	<–143 dBc (typ. –146 dBc)
	200 MHz < f ≤ 1500 MHz	<–146 dBc (typ. –149 dBc)
	1.5 GHz < f ≤ 3 GHz	<–145 dBc (typ. –148 dBc)
	f > 3 GHz	<–143 dBc (typ. –146 dBc)
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz, CW	
	20 MHz ≤ f ≤ 200 MHz	<–128 dBc (typ. –132 dBc)
	f = 1 GHz	<–131 dBc (typ. –135 dBc)
	f = 2 GHz	<–125 dBc (typ. –129 dBc)
	f = 3 GHz	<–121 dBc (typ. –125 dBc)
	f = 4 GHz	<–119 dBc (typ. –123 dBc)
	f = 6 GHz	<–115 dBc (typ. –119 dBc)

SSB phase noise with R&S®SMU-B22 option	carrier offset 20 kHz, measurement bandwidth 1 Hz, CW	
	20 MHz ≤ f ≤ 200 MHz	<−135 dBc (typ. −138 dBc)
	f = 1 GHz	<−136 dBc (typ. −139 dBc)
	f = 2 GHz	<−130 dBc (typ. −133 dBc)
	f = 3 GHz	<−126 dBc (typ. −129 dBc)
	f = 4 GHz	<−124 dBc (typ. −127 dBc)
	f = 6 GHz	<−120 dBc (typ. −123 dBc)
Residual FM	rms value at f = 1 GHz	
	300 Hz to 3 kHz	<1 Hz
	20 Hz to 23 kHz	<4 Hz
Residual AM	rms value 20 Hz to 23 kHz	<0.02 %

Measured SSB phase noise, I/Q modulated (typical values)
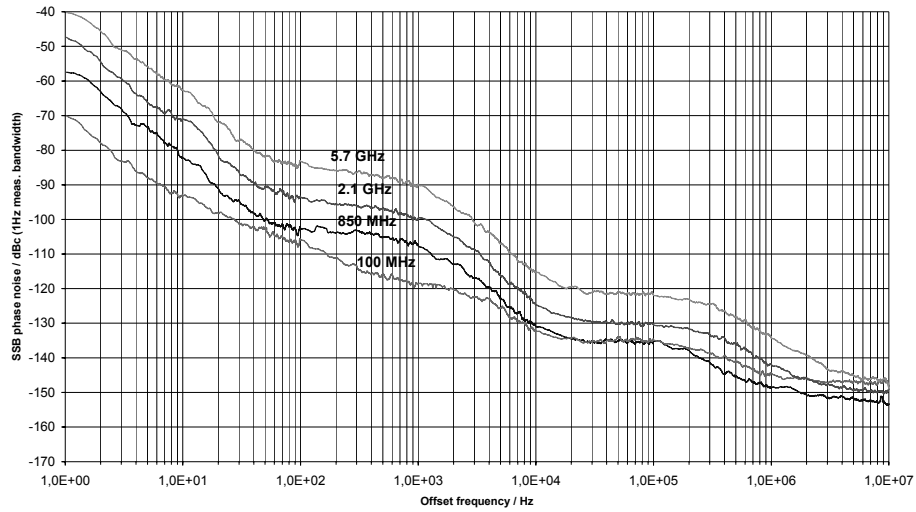
Measured SSB phase noise, unmodulated (typical values)
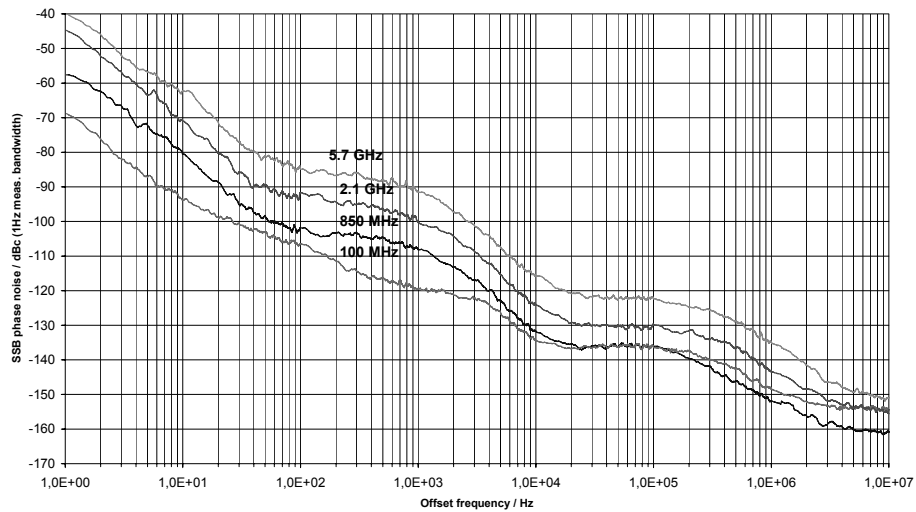
Measured SSB phase noise with Option B22, unmodulated (typical values)
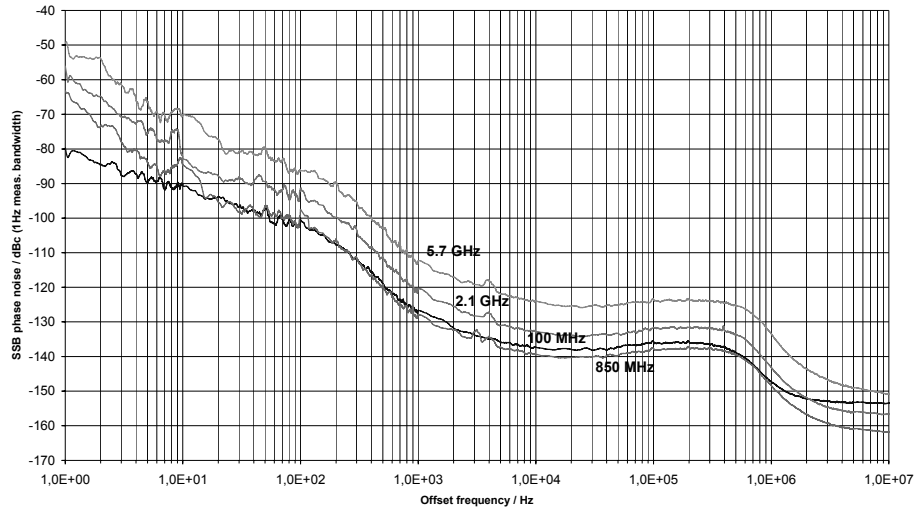
List mode

Frequency and level values can be stored in a list and set in an extremely short amount of time.		
Operating modes		automatic, single sweep, manual, or external trigger, fast hopping with immediate and external trigger
Max. number of channels		10000
Dwell time		1 ms to 1 s
Resolution		0.1 ms
Setting time	after external trigger	see frequency and level data
	additional trigger delay in two-path units, both paths operated in List mode	<200 µs

Analog modulation

Internal modulation generator

Frequency range		0.1 Hz to 1 MHz
Resolution of setting		0.1 Hz
Frequency uncertainty		<0.012 Hz + relative deviation of reference frequency
Frequency response	up to 100 kHz	<0.1 dB
	up to 1 MHz	<1 dB
Distortion	up to 100 kHz at R_L > 200 Ω, level (V_p) 1 V	<0.1 %
Output voltage	V_p at LF connector, R_L > 200 Ω	1 mV to 3 V
	resolution	1 mV
	setting uncertainty at 1 kHz	<(1 % of reading + 1 mV)
Output impedance		16 Ω
Frequency setting time	to within <1 × 10^{-7}, with GUI update stopped, after IEC/IEEE bus delimiter	<3 ms
Sweep	digital sweep in discrete steps	
	operating modes	automatic, step, single, external single, external step, manual or external trigger, linear or logarithmic spacing
	sweep range	full frequency range
	linear step width	full frequency range
	logarithmic step width	0.01 % to 100 % per step

Input for external modulation signals

Modulation input EXT MOD	input impedance	high (>100 kΩ), switchable to 50 Ω with R&S®SMU-B20 or R&S®SMU-B22 option
	input sensitivity (peak value for set modulation depth or deviation)	1 V
	absolute maximum rating	10 V

Amplitude modulation

Operating modes		internal, external AC/DC
Modulation depth	At high levels, modulation is clipped if the maximum PEP is reached.	0 % to 100 %
Resolution		0.1 %
Setting uncertainty	attenuator mode Auto, f_{mod} = 1 kHz and m <80 %	<(1 % of reading + 1 %)
AM distortion	PEP in specified range, attenuator mode Auto	
	f ≤ 3 GHz, at f_{mod} = 1 kHz, m = 30 %	<0.5 %
	m = 80 %	<0.8 %
	f > 3 GHz, at f_{mod} = 1 kHz, m = 30 %	<1 %
	m = 80 %	<1.6 %
Modulation frequency range		DC, 20 Hz to 500 kHz
Modulation frequency response	AC mode, 20 Hz to 500 kHz	<1 dB
Incidental φM at AM	m = 30 %, f_{mod} = 1 kHz, peak value	<0.1 rad

Wideband amplitude modulation

Operating modes	modulation input I	external DC
Modulation frequency response	as with I/Q modulation – external wideband I/Q	
Input impedance		50 Ω
Input sensitivity	peak voltage for 100 % AM	0.25 V

Pulse modulation

Operating modes		external, internal (duty cycle approx. 1:1)
ON/OFF ratio		>70 dB
Rise/fall time	10 %/90 % of RF amplitude	typ. 1 µs
Pulse repetition frequency		0 Hz to 100 kHz
Video crosstalk	spectral line of fundamental of 100 kHz squarewave modulation	<−30 dBc
Modulation input EXT MOD A/B	input level	rising 1.7 V, falling typ. 1.1 V
	input impedance	>10 kΩ
	polarity	selectable

Frequency modulation (R&S®SMU-B20 or R&S®SMU-B22 option)

Operating modes		internal, external, internal + external, AC/DC, Normal, Low Noise (with R&S®SMU-B22 only)
FM/φM range multiplier	$0.3\ \text{MHz} \le f \le 200\ \text{MHz}$	rm = 1
	$200\ \text{MHz} < f \le 375\ \text{MHz}$	rm = 0.25
	$375\ \text{MHz} < f \le 750\ \text{MHz}$	rm = 0.5
	$750\ \text{MHz} < f \le 1500\ \text{MHz}$	rm = 1
	$1500\ \text{MHz} < f \le 3000\ \text{MHz}$	rm = 2
	$f > 3000\ \text{MHz}$	rm = 4
Maximum deviation	FM mode Normal	rm × 10 MHz
	FM mode Low Noise	rm × 100 kHz
Resolution		<200 ppm, min. rm × 0.1 Hz
Setting uncertainty	f_{mod} = 10 kHz, deviation ≤ half of maximum deviation	
	internal	<(1.5 % of reading + 20 Hz)
	external	<(2.0 % of reading + 20 Hz)
FM distortion	f_{mod} = 10 kHz and 1 MHz deviation	<0.1 %
Modulation frequency response	FM mode Normal	
	10 Hz to 100 kHz	<0.5 dB
	10 Hz to 10 MHz	<3 dB
	FM mode Low Noise	
	10 Hz to 100 kHz	<3 dB
Synchronous AM	40 kHz deviation, f_{mod} = 1 kHz, f > 5 MHz	<0.1 %
	f > 3 GHz	<0.2 %
Carrier frequency offset at FM		<0.2 % of set deviation

Phase modulation (R&S®SMU-B20 or R&S®SMU-B22 option)

Operating mode		internal, external, internal + external, AC/DC, High Bandwidth, High Deviation, Low Noise (with R&S®SMU-B22 only)
Maximum deviation	φM mode High Deviation	rm × 20.0 rad
	φM mode High Bandwidth	rm × 1.0 rad
	φM mode Low Noise	rm × 0.25 rad
Resolution	φM mode High Deviation	<200 ppm, min. rm × 20 µrad
	φM mode High Bandwidth	<0.1 %, min. rm × 20 µrad
	φM mode Low Noise	<200 ppm, min. rm × 20 µrad
Setting uncertainty	f_{mod} = 10 kHz, deviation ≤ half of maximum deviation	
	internal	<(1.5 % of reading + 0.01 rad)
	external	<(2.0 % of reading + 0.01 rad)
φM distortion	f_{mod} = 10 kHz, half of maximum deviation	<0.2 %, typ. 0.1 %
Modulation frequency response	High Deviation, 10 Hz to 500 kHz	<1 dB
	High Bandwidth, 10 Hz to 10 MHz	<3 dB
	Low Noise, 10 Hz to 100 kHz	<3 dB

I/Q modulation

I/Q modulator

Operating modes		external wideband I/Q, internal baseband I/Q
I/Q impairments	I offset, Q offset	
	setting range	−10 % to +10 %
	resolution	0.01 %
	gain imbalance	
	setting range	−1.0 dB to +1.0 dB
	resolution	0.001 dB
	quadrature offset	
	setting range	−10° to +10°
	resolution	0.01°
I/Q swap	I and Q signals swapped	ON/OFF

External wideband I/Q

This type of modulation is possible only in path A.

I/Q inputs	input impedance	50 Ω
	VSWR up to 50 MHz	<1.2
	input voltage for full-scale input	$\sqrt{V_i^2 + V_q^2} = 0.5$ V
	minimum input voltage for ALC state ON	0.1 V
Modulation frequency range	I/Q wideband ON	100 MHz
RF frequency response for entire instrument in modulation bandwidth	I/Q wideband set to ON	
	up to 50 MHz	typ. <6 dB
	up to 5 MHz	typ. <1.0 dB
Carrier leakage	without input signal, referenced to full-scale input[4]	<−55 dBc, typ. <−65 dBc
Error vector	measured with 16QAM, root cosine filter, α = 0.5, symbol rate 10 kHz	
	rms value	
	f ≤ 200 MHz	<0.3 %
	f > 200 MHz	<(0.2 % + 0.1 % × f/GHz)
	peak value	
	f ≤ 200 MHz	<0.6 %
	f > 200 MHz	<(0.4 % + 0.2 % × f/GHz)
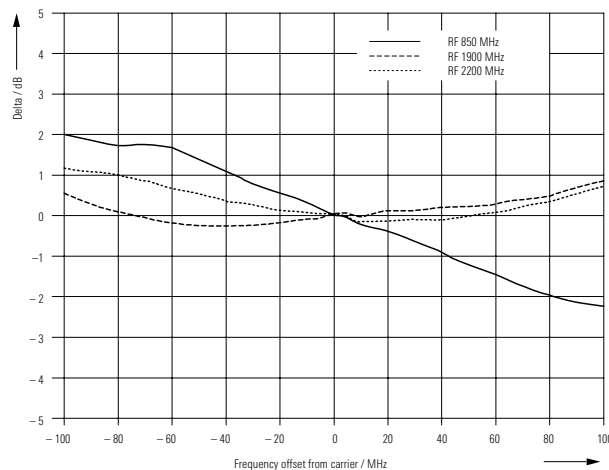
Measured frequency response of external wideband I/Q modulation

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[4]   Value applies after 1 hour warm-up time and recalibration for 4 hours of operation and temperature variations of less than +5 °C.

Internal baseband I/Q (with R&S®SMU-B13 option)

The R&S®SMU-B13 converts the internal digital baseband signals of the R&S®SMU-B9/-B10/-B11 into analog signals for driving the I/Q modulator. It also generates the analog I/Q output signals. One or two R&S®SMU-B13 can be installed. The first R&S®SMU-B13 drives RF path A, the second RF path B. The I/Q output signals are available either for path A or B.

D/A converter	data rate	100 MHz
	resolution	16 bit
	sampling rate	400 MHz (internal interpolation × 4)
Aliasing filter	with amplitude, group delay and Si correction	
	bandwidth, roll-off to −0.1 dB	40 MHz
	D/A converter interpolation spectra	
	up to 10 MHz	<−80 dBc
	up to 40 MHz	<−73 dBc
I/Q impairment	carrier leakage	
	setting range	−10 % to +10 %
	resolution	0.01 %
	$I \neq Q$ (imbalance)	
	setting range	−1 dB to +1 dB
	resolution	0.001 dB
	quadrature offset	
	setting range	−10° to +10°
	resolution	0.01°
RF frequency response for entire instrument in modulation bandwidth	I/Q wideband on, optimize internal I/Q impairments for RF output on, optimization mode High Quality, f > 100 MHz, −20 dBm ≤ level ≤ 10 dBm	
	up to 10 MHz	<0.5 dB, typ 0.1 dB
	up to 40 MHz	<2.0 dB, typ. 0.3 dB
Suppression of image sideband for entire instrument in modulation bandwidth[5]	up to 10 MHz	>50 dB, typ. 56 dB
	up to 40 MHz	>40 dB, typ. 50 dB
Carrier leakage[5]	referenced to full-scale input	<−55 dBc, typ. <−65 dBc
Additional level uncertainty referenced to CW	measured at 0 dBm with 16QAM, root cosine filter, α = 0.5, symbol rate 10 kHz	<0.2 dB
I/Q outputs		
Output impedance		50 Ω
Output voltage	EMF (output voltage depends on set modulation signal)	1 V (V_p)
Offset	EMF	<1 mV
Frequency response[6]	at R_L = 50 Ω	
	magnitude	
	up to 10 MHz	typ. 0.02 dB
	up to 40 MHz	typ. 0.03 dB
	nonlinear phase	
	up to 10 MHz	typ. 0.1°
	up to 30 MHz	typ. 0.2°
I/Q balance[6]	at R_L = 50 Ω	
	magnitude	
	up to 10 MHz	typ. 0.01 dB
	up to 40 MHz	typ. 0.02 dB
	nonlinear phase	
	up to 10 MHz	typ. 0.1°
	up to 30 MHz	typ. 0.2°

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[5] Value applies after 1 hour warm-up time and recalibration for 4 hours of operation and temperature variations of less than +5 °C.

[6] Optimize internal I/Q impairments for RF output switched OFF.

Spectral purity	at R_L = 50 Ω	
	SFDR (sine)	
	up to 2 MHz	>70 dB
	up to 20 MHz	typ. 60 dB
	phase noise	
	10 MHz sinewave at 20 kHz offset	typ. −150 dBc
	wideband noise	
	10 MHz sinewave at 1 MHz offset	typ. −155 dBc
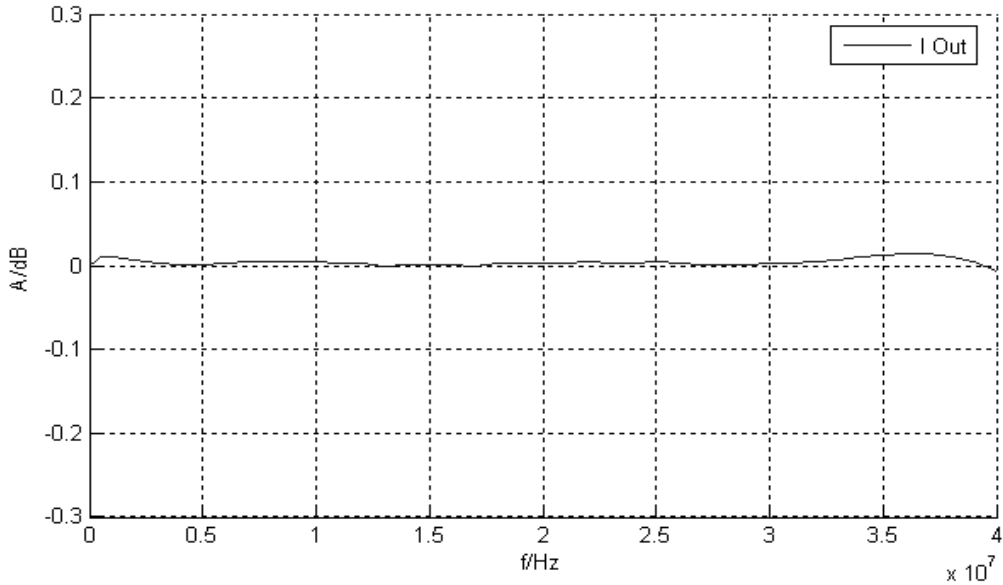
Frequency response of I/Q outputs
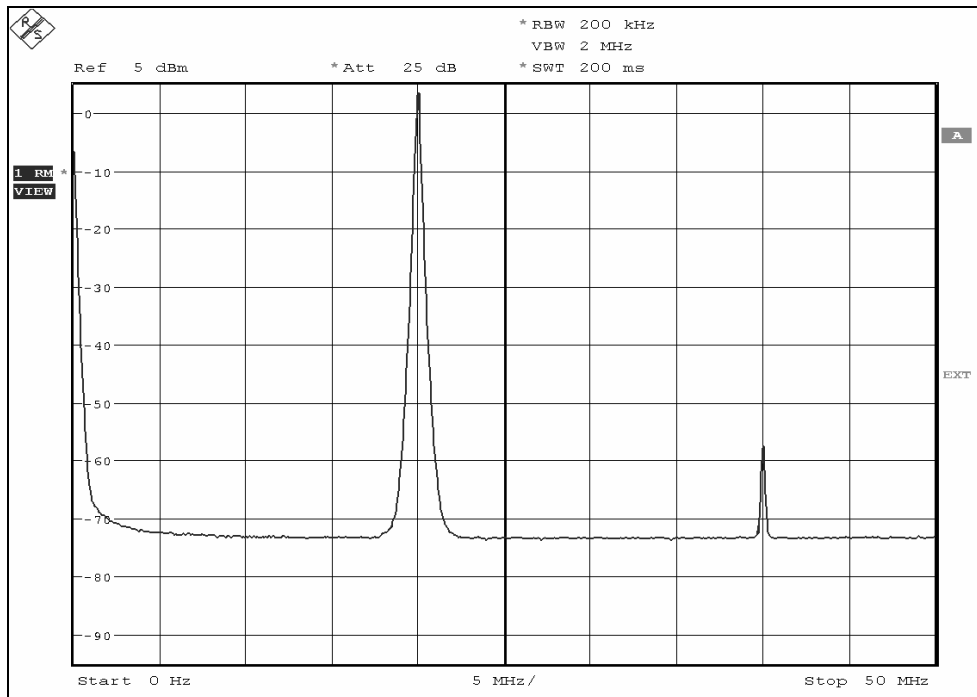
SFDR of I/Q outputs

Differential I/Q output (R&S®SMU-B16 option)

One R&S®SMU-B16 can be installed; the I/Q output signals are available either for path A or B.

Additional specifications for I/Q outputs with R&S®SMU-B16 option		
Output impedance		
Single-ended		50 Ω
Differential		100 Ω
Output voltage	output voltage depends on set modulation signal	
Single-ended	EMF	0.02 V to 2 V (V$_p$)
Resolution		1 mV
Differential	EMF	0.04 V to 4 V (V$_{pp}$)
Resolution		2 mV
Bias voltage (single-ended and differential)	EMF	–3.6 V to +3.6 V
Resolution		2 mV
Uncertainty		1 % + 4 mV
Offset voltage		
Differential	EMF	–300 mV to +300 mV
Resolution		0.2 mV
Uncertainty		1 % + 0.1 % × bias voltage + 1 mV
Differential signal balance	at R$_L$ = 50 Ω, output voltage >0.5 V (V$_p$)	
	magnitude	
up to 10 MHz		<0.2 dB, typ. 0.05 dB
up to 40 MHz		typ 0.2 dB
Frequency response[7]	at R$_L$ = 50 Ω, output voltage >0.5 V (V$_p$)	
	magnitude	
up to 10 MHz		typ. 0.02 dB
up to 40 MHz		typ. 0.03 dB
	nonlinear phase	
up to 10 MHz		typ. 0.1°
up to 30 MHz		typ. 0.2°

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[7] Optimize internal I/Q impairments for RF output switched OFF.

Digital baseband output (R&S®SMU-B18 option)

The R&S®SMU-B18 makes digital I/Q signals available on the rear panel of the instrument. The digital I/Q output can be used for the lossless connection of the R&S®SMU200A to the digital I/Q input of other Rohde & Schwarz instruments (e.g. R&S®AMU200A baseband signal generator and fading simulator). One R&S®SMU-B18 can be installed.

Interface	standard	in line with Rohde & Schwarz TVR290, I/Q data and control signals, data and interface clock
	level	LVDS
	connector	26-pin MDR
	data rate	30 MHz to 100 MHz with 1 MHz resolution, 81.6 MHz
I/Q sample rate		With source 'user-defined', the sample rate must be entered via the parameter 'sample rate', no I/Q data clock being necessary. With source 'digital I/Q out' or 'digital I/Q in', the sample rate will be estimated on the basis of the applied I/Q data clock.
	source	user-defined, digital I/Q out, digital I/Q in
	sample rate	400 Hz to 100 MHz
		max. sample rate limited by actual interface data rate
	resolution (user-defined)	0.001 Hz
	frequency uncertainty (user-defined)	$< 5 \times 10^{-14}$
I/Q data	resolution	18 bit
	logic format	two's complement
	physical signal level	
	setting range	0 to –60 dBFS
	resolution	0.01 dBFS
	bandwidth	
	sample rate = 100 MHz (no interpolation, user-defined)	40 MHz
	sample rate <100 MHz (interpolation)	0.31 x sample rate
Control signals	markers	4
	data valid	valid samples marked in data stream

Baseband input (analog/digital) (R&S®SMU-B17 option)

At least one R&S®SMU-B13 baseband main module and at least one R&S®SMU-B9/-B10/-B11 I/Q baseband generator must be installed. The R&S®SMU-B17 makes it possible to feed external analog or digital signals to the baseband section of the R&S®SMU200A. The frequency of the signals can be shifted, and the signals can be added to the internally generated signal with settable level ratio. If the R&S®SMU200A is equipped with a fading simulator, the input signals can also be faded.

Mode	see also simultaneous modulation	analog input digital input
Input level	peak level	
	setting range	−10 dB to 0 dB referenced to full scale
	resolution	0.01 dB
	crest factor	
	setting range	0 dB to 30 dB
	resolution	0.01 dB
	The adjust level function automatically determines the peak level and crest factor of the input signal.	
Frequency offset	With the aid of the frequency offset, the center frequency of the input signal can be shifted in the baseband. The restrictions caused by the modulation bandwidth apply.	
	setting range	−40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency accuracy	<5 × 10 − 10 × frequency offset + reference frequency error
I/Q swap	I and Q signals swapped	ON/OFF
Analog I/Q inputs All specifications apply to a peak level of 0 dB.		
I/Q inputs	input impedance	50 Ω
	VSWR up to 30 MHz	<1.1, typ. 1.03
	input voltage for full-scale input	$\sqrt{V_i{}^2 + V_q{}^2} = 0.5$ V
I/Q impairment	carrier leakage I, Q	
	setting range	−10 % to +10 %
	resolution	0.01 %
	I ≠ Q (imbalance)	
	setting range	−3 dB to +3 dB
	resolution	0.001 dB
	I/Q skew	
	setting range	−1 ns to +1 ns
	resolution	1 ps
A/D converter	sampling rate	100 MHz
	resolution	14 bit
Aliasing filter	with amplitude and group delay correction	
	bandwidth, roll-off to −0.1 dB	30 MHz
	stopband rejection, f ≥ 70 MHz	typ. 80 dB
RF frequency response for entire instrument in modulation bandwidth	I/Q wideband ON, optimize internal I/Q impairments for RF output ON	
	up to 10 MHz	typ. 0.2 dB
	up to 30 MHz	typ. 0.4 dB
Carrier leakage	referenced to full scale	<−55 dBc, typ. <−65 dBc
Suppression of image sideband for entire instrument in modulation bandwidth	up to 10 MHz	typ. 56 dB
	up to 30 MHz	typ. 50 dB

RF spectral purity	wideband noise, with full-scale DC input	
	20 MHz ≤ f ≤ 200 MHz	typ. −145 dBc
	200 MHz < f ≤ 1.5 GHz	typ. −148 dBc
	1.5 GHz < f ≤ 3 GHz	typ. −148 dBc
	f > 1.5 GHz	typ. −145 dBc
	ACLR with an ideal input signal, 3GPP test model 1, 64 DPCH	
	level ≤10.5 dBm PEP, ≤16.5 dBm PEP with R&S®SMU-B31, R&S®SMU-B36 options	
	frequency 1800 MHz to 2200 MHz	
	offset 5 MHz (baseband gain 3 dB)	typ. 70 dB
	offset 10 MHz (baseband gain 6 dB)	typ. 73 dB
Digital I/Q inputs		
Interface	standard	in line with R&S®TVR290, I/Q data and control signals, data and interface clock
	level	LVDS
	connector	26-pin MDR
	data rate	66 MHz to 100 MHz
I/Q sample rate Max. sample rate depends on interface data rate. With source 'user-defined', the sample rate must be entered via the parameter 'sample rate', no I/Q data clock being necessary. With source 'digital I/Q in', the sample rate will be estimated on the basis of the applied I/Q data clock.	source	user-defined, digital I/Q in
	sample rate	400 Hz to 100 MHz
	resolution (user-defined)	0.001 Hz
	frequency uncertainty (user-defined)	$< 5 \times 10^{-14}$
I/Q data	resolution	18 bit
	logic format	two's complement
	bandwidth	
	sample rate = 100 MHz (no interpolation, user-defined)	40 MHz
	sample rate <100 MHz (interpolation)	0.31 x sample rate
Control signals	markers	4
	data valid	valid samples marked in data stream

I/Q baseband generator (R&S®SMU-B9/-B10/-B11 option) – arbitrary waveform mode

At least one R&S®SMU-B13 baseband main module must be installed. One or two R&S®SMU-B9/-B10/-B11 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added in the digital domain with settable level ratio.

Waveform memory	output memory	
	waveform length with the R&S®SMU-B9	128 sample to 128 Msample in one-sample steps
	waveform length with the R&S®SMU-B10	128 sample to 64 Msample in one-sample steps
	waveform length with the R&S®SMU-B11	128 sample to 16 Msample in one-sample steps
	resolution	16 bit
	loading time 10 Msample	15 s
	nonvolatile memory	hard disk
Multisegment waveform	number of segments	max. 100 segments
	changeover modes	GUI, remote control, external trigger
	extended trigger modes	same segment, next segment, next segment seamless
	changeover time (external trigger, without clock change)	typ. 5 µs at 50 MHz clock rate
	seamless changeover	output up to end of current segment, followed by changeover to next segment
Multicarrier waveform	number of carriers	max. 32
	total RF bandwidth	max. 80 MHz
	crest factor modes	maximize, minimize, OFF
	signal period modes	longest file, shortest file, user (max. 1 s)
	single carrier gain	–80 dB to 0 dB
	single carrier start phase	0° to 360°
	single carrier delay	0 s to 1 s
Clock generation	clock rate	400 Hz to 100 MHz
	resolution	0.001 Hz
	operating mode	internal, external
	frequency uncertainty (internal)	$<5 \times 10^{-14} \times$ clock rate + uncertainty of reference frequency
Interpolation	The sampling rate of the waveform is automatically interpolated to the internal 100 MHz data rate.	
	bandwidth	
	clock rate = 100 MHz (no interpolation), roll-off to –0.1 dB	40 MHz
	clock rate ≤100 MHz, drop to –0.1 dB	0.31 × clock rate
Frequency offset	With the aid of the frequency offset, the center frequency of the wanted baseband signal can be shifted. The restrictions caused by the modulation bandwidth apply.	
	range	–40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency uncertainty	$<5 \times 10 - 10 \times$ frequency offset + reference frequency error

Triggering	In internal clock mode, a trigger event restarts the clock generation. The clock phase is then synchronous with the trigger (with a certain timing uncertainty). In external clock mode, the trigger event is synchronized to the symbol clock.	
	operating mode	internal, external
	modes	Auto, Retrig, Armed Auto, Armed Retrig
	setting uncertainty for clock phase related to trigger in internal clock mode	<18 ns
	external trigger delay	
	setting range	0 sample to $(2^{16} - 1)$ sample
	resolution	
	internal clock mode	0.01 sample
	external clock mode	1 sample
	setting uncertainty	<5 ns
	external trigger inhibit	
	setting range	0 sample to $(2^{26} - 1)$ sample
	resolution	1 sample
	external trigger pulse width	>15 ns
	external trigger frequency	<0.02 × sampling rate
Marker outputs	number	4
	level	LVTTL
	operating modes	unchanged, restart, pulse, pattern, ratio
	marker delay	
	setting range	0 sample to (waveform length − 1) sample
	setting range without recalculation	0 sample to 2000 sample
	resolution of setting	0.001 sample
	setting uncertainty	<10 ns

Operation with R&S®WinIQSIM2™: As of version 1.00, the software supports I/Q data download and control of the R&S®SMU-B9/-B10/-B11.

Operation with R&S®WinIQSIM™: As of version 4.40, the software supports I/Q data download and control of the R&S®SMU-B9/-B10/-B11.

I/Q baseband generator (R&S®SMU-B9/-B10/-B11 option) – realtime operation

At least one R&S®SMU-B13 baseband main module must be installed. One or two R&S®SMU-B9/-B10/-B11 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added in the digital domain with settable level ratio.

Types of modulation	ASK	
	modulation index	0 % to 100 %
	resolution	0.1 %
	FSK	2FSK, 4FSK, MSK
	deviation	0.1 to 1.5 × f_{sym}
	maximum	10 MHz
	resolution	<0.1 Hz
	setting uncertainty	<0.5 %
	variable FSK	4FSK, 8FSK, 16FSK
	deviations	−1.5 × f_{sym} to +1.5 × f_{sym}
	maximum	10 MHz
	resolution	<0.1 Hz
	PSK	BPSK, QPSK, QPSK 45° offset, OQPSK, π/4-QPSK, π/2-DBPSK, π/4-DQPSK, π/8-D8PSK, 8PSK, 8PSK EDGE
	QAM	16QAM, 32QAM, 64QAM, 256QAM, 1024QAM
Coding	Not all coding methods can be used with every type of modulation.	OFF, Differential, Diff. Phase, Diff. + Gray, Gray, GSM, NADC, PDC, PHS, TETRA, APCO25 (PSK), PWT, TFTS, INMARSAT, VDL, EDGE, APCO25(FSK), ICO, CDMA2000®[8], WCDMA
Baseband filter	Any filter can be used with any type of modulation. The bandwidth of the modulation signal is max. 25 MHz; the signal is clipped if the bandwidth is exceeded.	
	cosine, root cosine	
	filter parameter α	0.05 to 1.00
	Gaussian	
	filter parameter B × T	0.15 to 2.50
	cdmaOne, cdmaOne + equalizer	
	cdmaOne 705 kHz,	
	cdmaOne 705 kHz + equalizer	
	CDMA2000® 3x	
	APCO25 C4FM	
	rectangular	
	split phase	
	filter parameter B × T	0.15 to 2.5
	resolution of filter parameter	0.01

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[8]   CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

Symbol rate	If an external clock is used, the applied data rate may deviate from the set clock rate by ±2 %. The external clock can be used for internal and external data.	
	operating mode	internal, external
	setting range	
	ASK, PSK, QAM	400 Hz to 25 MHz
	FSK	400 Hz to 15 MHz
	resolution	0.001 Hz
	frequency uncertainty (internal)	$<5 \times 10^{-14} \times$ symbol rate + reference frequency uncertainty
	external clock	symbol, K × symbol, bit clock
	clock divider K	1 to 64
	external clock rate	max. 100 MHz
Frequency offset	With the aid of the frequency offset, the center frequency of the modulation signal in the baseband can be shifted. The restrictions caused by the modulation bandwidth apply.	
	setting range	−40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency uncertainty	$<5 \times 10 - 10 \times$ frequency offset + reference frequency error
Data sources	**internal**	
	all 0, all 1	
	PRBS	
	sequence length	9, 11, 15, 16, 20, 21, 23
	pattern	
	length	1 bit to 64 bit
	data lists	
	output memory of the R&S®SMU-B9	8 bit to 4 Gbit
	output memory of the R&S®SMU-B10	8 bit to 2 Gbit
	output memory of the R&S®SMU-B11	8 bit to 512 Mbit
	nonvolatile memory	hard disk
	external	
	In the case of serial transmission, the symbol strobe marks the LSB of the symbol, and the maximum symbol rate is limited by the data rate of the interface.	
	serial	
	word width	1 bit to 10 bit
	bit rate	max. 60 MHz
	parallel	
	word width	1 bit to 10 bit
	symbol rate	max. 25 MHz

Triggering	In internal clock mode, a trigger event restarts the clock generation. The clock phase is then synchronous with the trigger (with a certain timing uncertainty). In external clock mode, the trigger event is synchronized to the symbol clock.	
	operating mode	internal, external
	modes	Auto, Retrig, Armed Auto, Armed Retrig
	setting uncertainty for clock phase related to trigger in internal clock mode	<18 ns
	external trigger delay	
	setting range	0 sample to $(2^{16} - 1)$ sample
	resolution	
	internal clock mode	0.01 sample
	external clock mode	1 sample
	setting uncertainty	<5 ns
	external trigger inhibit	
	setting range	0 sample to $(2^{26} - 1)$ sample
	resolution	1 sample
	external trigger pulse width	>15 ns
	external trigger frequency	<0.02 × sampling rate
Marker outputs	number	4
	level	LVTTL
	operating modes	control list, restart, pulse, pattern, ratio
	marker delay (in sample)	
	setting range	0 to $2^{24} - 1$
	setting range without recalculation	0 to 2000
	resolution of setting	0.001
	setting uncertainty	<10 ns
Level reduction	Internal or external via LEVATT input. The signal switches between nominal and reduced level (without edge shaping). If an internal LEVATT signal is used, the connector is used as an output.	
	setting range	0 dB to 60 dB
	additional level error in case of reduction	
	up to 30 dB	<1 dB
	up to 50 dB	<3 dB
Burst	Internal or external via BURST input. The signal triggers the beginning of a power ramp. The positive edge starts power ramping from blank to full level, the negative edge ramping in the opposite direction from full level to blanking. If an internal BURST GATE signal is applied, the connector is used as an output.	
	operating range	max. 5 MHz
	rise/fall time	
	setting range	0.5 symbol to 16 symbol
	resolution	0.1 symbol
	ramp shape	cosine, linear
Trigger/clock/data inputs	The input impedance and trigger threshold can be set separately for the trigger and the clock/data inputs.	
	input impedance	1 kΩ, 50 Ω
	trigger threshold	
	setting range	0.00 V to 2.50 V
	resolution	0.01 V
Clock/data outputs	level	LVTTL

Predefined settings	modulation, filter, symbol rate and coding in line with standard	
	standards	Bluetooth® [9], DECT, ETC, GSM, GSM EDGE, NADC, PDC, PHS, TETRA, WCDMA 3GPP, TD-SCDMA, CDMA2000® Forward, CDMA2000® Reverse, Worldspace
Modulation errors		
Deviation error with 2FSK, 4FSK	deviation 0.2 to 0.7 × symbol rate	
	Gaussian filter with B × T = 0.2 to 0.7	
	symbol rate up to 2 MHz	<1.2 %, typ. 0.25 %
	symbol rate up to 10 MHz	typ. 0.75 %
Phase error with MSK	Gaussian filter with B × T = 0.2 to 0.7	
	bit rate up to 2 MHz	<0.4°, typ. 0.15°
	bit rate up to 10 MHz	typ. 0.3°
EVM with QPSK, OQPSK, π/4-DQPSK, 8PSK, 16QAM, 32QAM, 64QAM	cosine, root cosine filter with α = 0.2 to 0.7	
	symbol rate up to 5 MHz	<0.8 %, typ. 0.2 %
	symbol rate up to 20 MHz	typ. 0.7 %
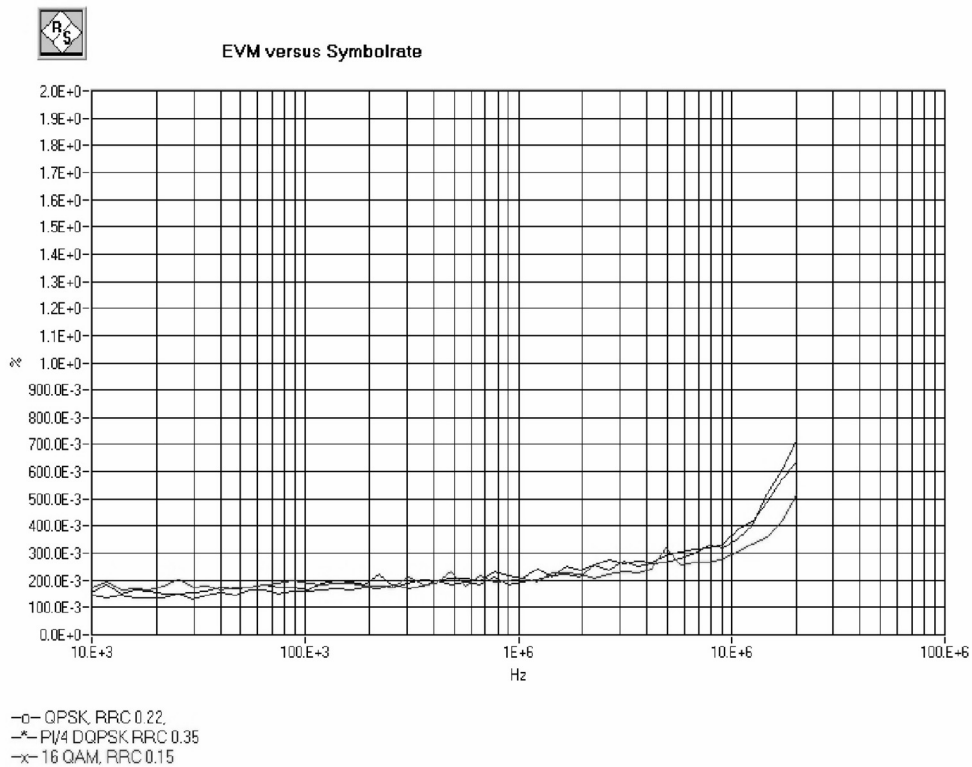
Measured EVM versus symbol rate

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[9]   The Bluetooth® word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Rohde & Schwarz is under license.

Modulation uncertainty for main standards

Typical values

Standard	GSM	EDGE	WCDMA 3GPP (1DPCH)	cdmaOne Reverse	DECT	TETRA	NADC	PDC	IEEE 802.11a
Frequency in MHz	400 to 2000	400 to 2000	1800 to 2200	800 to 900	1880 to 1990	380 to 480	824 to 894	810 to 956	2400 to 2485
				1850 to 2000			1850 to 2000	1429 to 1501	5150 to 5825
EVM in %	–	0.2	0.3	0.2	–	0.2	0.2	0.2	0.4
Phase error in °	0.15	–	–	–	–	–	–	–	–
Deviation error in kHz	–	–	–	–	0.5	–	–	–	–
Channel spacing	200 kHz	200 kHz	5 MHz	1.25 MHz	1.728 MHz	25 kHz	30 kHz	25 kHz	–
Adjacent channel power ratio (ACPR) in dB[10]									
In adjacent channel	–37	–38	–72[11]	–85[12]	–	–74[13]	–34	–74	–42 at 11 MHz
In alternate channel	–71	–71	–78[14]	–89[15]	–	–77[11]	–80	–82	–64 at 20 MHz
In 2nd alternate channel	–85	–85	–	–95[16]	–	–	–	–	–66 at 30 MHz

Signal performance for digital standards

GSM/EDGE	with R&S®SMU-K40 option	
Burst ON/OFF ratio		>100 dB
Phase error	MSK, Gaussian filter B × T = 0.3	
	rms	<0.4°, typ. 0.15°
	peak	<1.2°, typ. 0.4°
Error vector magnitude	8PSK EDGE, Gaussian linearized filter, rms	<0.5 %, typ. 0.2 %
Power density spectrum	values measured with 30 kHz resolution bandwidth, referenced to level in band center without power ramping	
	level ≤10.5 dBm, ≤16.5 dBm with R&S®SMU-B31, R&S®SMU-B36 options	
	200 kHz offset	<–34 dB, typ. –37 dB
	400 kHz offset	<–68 dB, typ. –71 dB
	600 kHz offset	<–80 dB, typ. –85 dB

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[10] Level restricted, see specs.

[11] Baseband gain 0 dB (standard).

[12] 885 kHz offset and 30 kHz bandwidth.

[13] Measured with root cosine filter.

[14] Baseband gain 6 dB (low noise).

[15] 1.25 MHz offset and 30 kHz bandwidth.

[16] 1.98 MHz offset and 30 kHz bandwidth.

3GPP FDD	with R&S®SMU-K42 option	
Error vector magnitude	1 DPCH, rms	<0.8 %, typ. 0.3 %
Adjacent channel leakage ratio (ACLR)	test model 1, 64 DPCH	
	level ≤10.5 dBm PEP, ≤16.5 dBm PEP with R&S®SMU-B31, R&S®SMU-B36 options	
	frequency 1800 MHz to 2200 MHz	
	offset 5 MHz (baseband gain 3 dB)	>67 dB, typ. 71 dB
	offset 10 MHz (baseband gain 6 dB)	>72 dB, typ. 74 dB
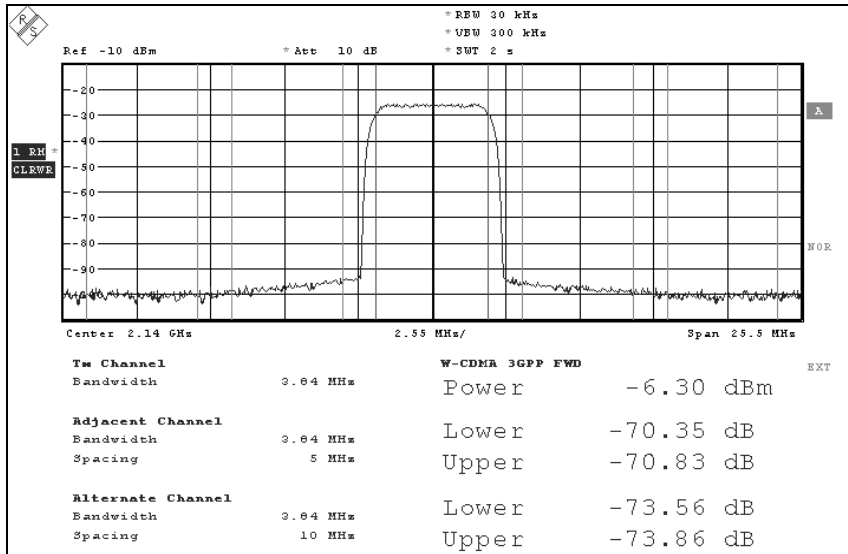
ACLR (typical values) for 3GPP test model 1, 64 DPCH (baseband gain +3 dB)
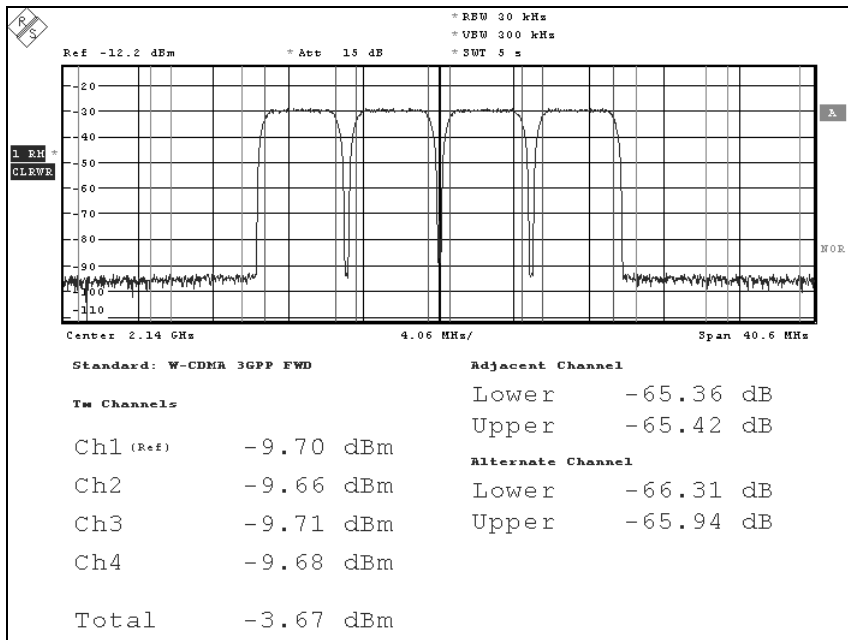
ACLR (typical values) for a 3GPP four-carrier signal with test model 1, 64 DPCH on each carrier (baseband gain +3 dB)

CDMA2000®	with R&S®SMU-K46 option	
Error vector magnitude (EVM)	F-PICH, F-SYNC, and one F-FCH, rms	<0.8 %, typ. 0.3 %
Adjacent channel leakage ratio (ACLR)	F-PICH, F-SYNC, and one F-FCH	
	level ≤10.5 dBm PEP, ≤16.5 dBm PEP with R&S®SMU-B31, R&S®SMU-B36 options	
	carrier frequency 800 MHz	
	channel spacing 0.75 MHz (bandwidth 30 kHz)	typ. 79 dB
	channel spacing 1.98 MHz (bandwidth 30 kHz)	typ. 91 dB

```
BS,1X,C0 :ADJ CHANNEL                    * RBW 10 kHz
                                         * VBW 300 kHz
Ref -6.8 dBm        * Att  10 dB         * SWT 5 s
```
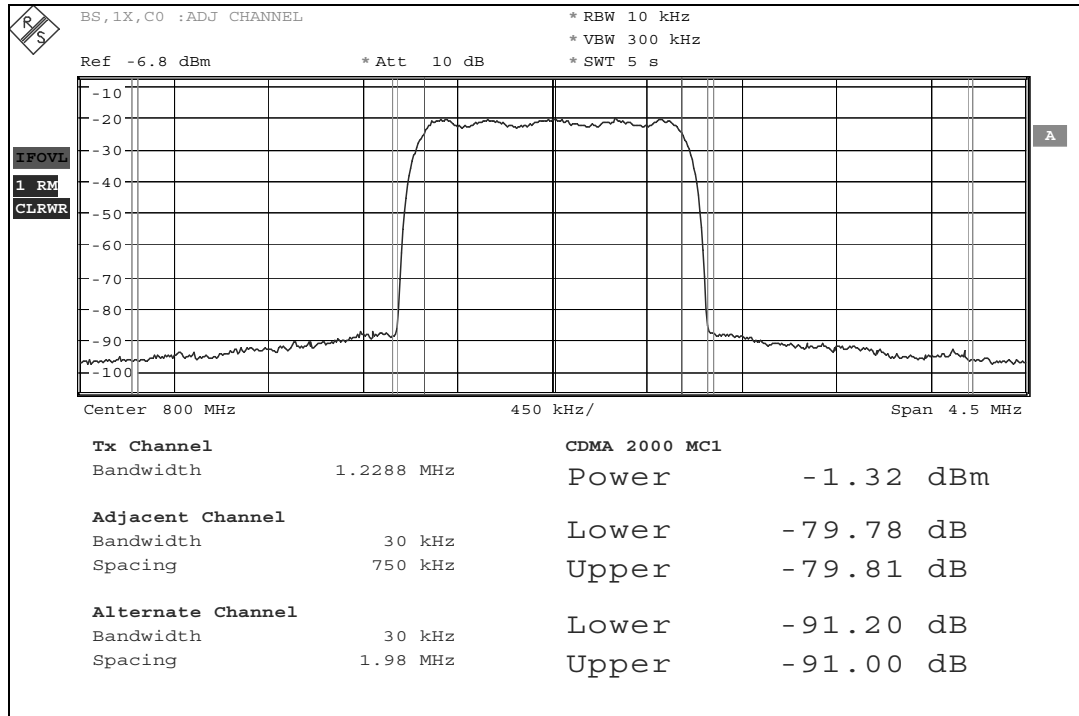
Tx Channel	**CDMA 2000 MC1**
Bandwidth 1.2288 MHz	Power -1.32 dBm
Adjacent Channel	
Bandwidth 30 kHz	Lower -79.78 dB
Spacing 750 kHz	Upper -79.81 dB
Alternate Channel	
Bandwidth 30 kHz	Lower -91.20 dB
Spacing 1.98 MHz	Upper -91.00 dB

ACLR (typical values) for a CDMA2000® 1x signal consisting of F-PICH, F-SYNC, and one F-FCH

Multicarrier CW	with R&S®SMU-K61 option	
RF frequency response	up to 10 MHz	<1.5 dB, typ 0.7 dB
	up to 40 MHz	<4.5 dB, typ. 2.0 dB
Suppression of unwanted carriers	up to 10 MHz	>50 dB, typ. 56 dB
	up to 40 MHz	>40 dB, typ. 50 dB

```
                                                    * RBW  50 kHz
                                                      VBW  500 kHz
    Ref  -20 dBm              Att   5 dB           * SWT  800 ms

     -20

     -30                                                                              A

1 RM *                                                                               SGL
CLRWR -40

     -50

     -60

     -70

     -80

     -90

    -100

    -110

    -120
    Center  2.2 GHz                    1 MHz/                    Span  10 MHz
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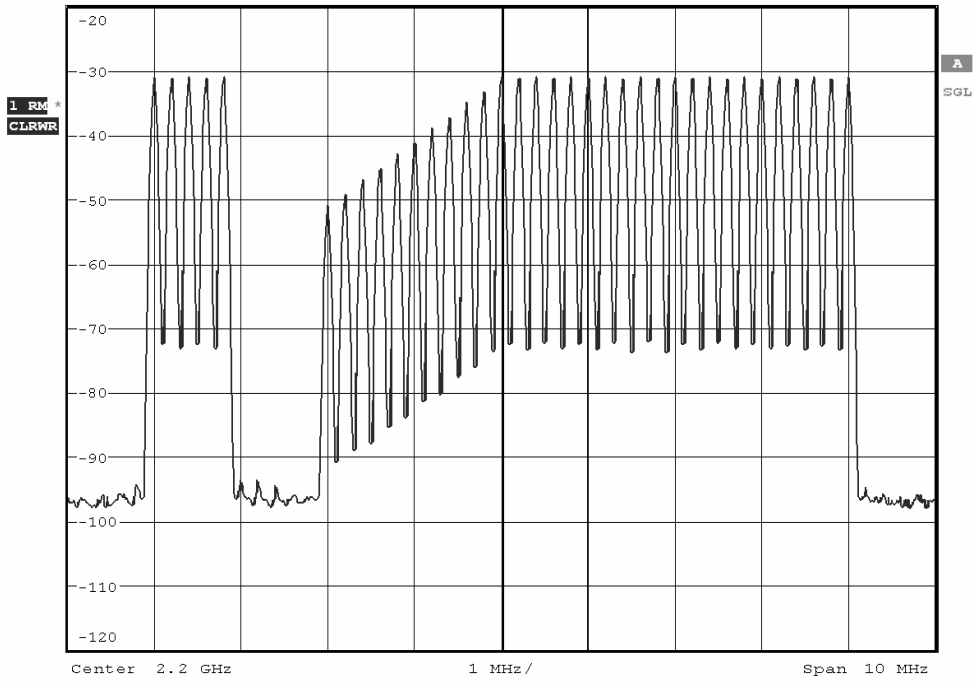
Example of multicarrier CW, with different carrier powers and some carriers switched off in the left half of the spectrum

Digital standards (for the R&S®SMU-B9/-B10/-B11)

At least one I/Q baseband generator (R&S®SMU-B9/-B10/-B11 options) must be installed. If two I/Q baseband generators are installed and two signals of the same standard (e.g. GSM/EDGE) are to be output simultaneously, two corresponding software options must also be installed (in this case R&S®SMU-K40). If only one R&S®SMU-K40 is installed and GSM/EDGE is selected in one I/Q baseband generator, the other I/Q baseband generator is disabled for GSM/EDGE. However, a software option is not tied to a specific I/Q baseband generator.

GSM/EDGE digital standard	R&S®SMU-K40 option
3GPP FDD digital standard	R&S®SMU-K42 option
3GPP FDD enhanced BS/MS tests including HSDPA	R&S®SMU-K43 option
GPS digital standard	R&S®SMU-K44 option
3GPP FDD enhanced BS/MS tests including HSUPA	R&S®SMU-K45 option
CDMA2000® digital standard	R&S®SMU-K46 option
1xEV-DO digital standard	R&S®SMU-K47 option
IEEE 802.11a/b/g digital standard	R&S®SMU-K48 option
IEEE 802.16 WiMAX digital standard including IEEE 802.16e	R&S®SMU-K49 option
TD-SCDMA (3GPP TDD LCR) digital standard	R&S®SMU-K50 option
TD-SCDMA (3GPP TDD LCR) enhanced BS/MS tests including HSDPA	R&S®SMU-K51 option
DVB-H digital standard	R&S®SMU-K52 option
DAB/T-DMB digital standard	R&S®SMU-K53 option
IEEE 802.11n digital standard	R&S®SMU-K54 option
EUTRA/LTE digital standard	R&S®SMU-K55 option
XM RADIO digital standard	R&S®SMU-K56 option
Multicarrier CW signal generation	R&S®SMU-K61 option
Assisted GPS	R&S®SMU-K65 option

The options are described in the Digital Standards data sheet (PD 5213.9434.22).

Digital standards with external PC software (for the R&S®SMU-B9/-B10/-B11)

At least one I/Q baseband generator (R&S®SMU-B9/-B10/-B11 options) must be installed. If two I/Q baseband generators are installed and two signals of the same standard are to be output simultaneously, two corresponding software options must also be installed. If only one software option is installed and the standard is selected in one I/Q baseband generator, the other I/Q baseband generator is disabled for this standard. However, a software option is not tied to a specific I/Q baseband generator.

Bluetooth® digital standard (external PC software)	R&S®SMU-K5 option
Pulse sequencer (external PC software)	R&S®SMU-K6 option
TETRA digital standard (external PC software)	R&S®SMU-K8 option

The options are described in the Digital Standards data sheet (PD 5213.9434.22).

Digital standards with R&S®WinIQSIM2™ (for the R&S®SMU-B9/-B10/-B11 ARB)

At least one I/Q baseband generator (R&S®SMU-B9/-B10/-B11 options) must be installed. If two I/Q baseband generators are installed and two waveforms of the same standard (e.g. GSM/EDGE) are to be output simultaneously, two corresponding software options must also be installed (in this case R&S®SMU-K240). If only one R&S®SMU-K240 is installed and GSM/EDGE waveforms are played in one I/Q baseband generator, the other I/Q baseband generator is disabled for GSM/EDGE waveforms. However, a software option is not tied to a specific I/Q baseband generator.

R&S®WinIQSIM2™ requires an external PC.

GSM/EDGE digital standard	R&S®SMU-K240 option
3GPP FDD digital standard	R&S®SMU-K242 option
3GPP FDD enhanced BS/MS tests including HSDPA	R&S®SMU-K243 option
GPS digital standard	R&S®SMU-K244 option
3GPP FDD enhanced BS/MS tests including HSUPA	R&S®SMU-K245 option
CDMA2000® digital standard	R&S®SMU-K246 option
1 x EV-DO digital standard	R&S®SMU-K247 option
IEEE 802.11a/b/g digital standard	R&S®SMU-K248 option
IEEE 802.16 WiMAX digital standard including IEEE 802.16e	R&S®SMU-K249 option
TD-SCDMA (3GPP TDD LCR) digital standard	R&S®SMU-K250 option
TD-SCDMA (3GPP TDD LCR) enhanced BS/MS tests including HSDPA	R&S®SMU-K251 option
DVB-H digital standard	R&S®SMU-K252 option
IEEE 802.11n digital standard	R&S®SMU-K254 option
EUTRA/LTE digital standard	R&S®SMU-K255 option
Multicarrier CW signal generation	R&S®SMU-K261 option
Additive white Gaussian noise (AWGN)	R&S®SMU-K262 option

The options are described in the R&S®WinIQSIM2™ data sheet (PD 5213.7460.22).

Digital standards with R&S®WinIQSIM™ (for the R&S®SMU-B9/-B10/-B11 ARB)

At least one I/Q baseband generator (R&S®SMU-B9/-B10/-B11 options) must be installed. If two I/Q baseband generators are installed and two waveforms of the same standard (e.g. 3GPP FDD) are to be output simultaneously, two corresponding software options must also be installed (in this case R&S®SMU-K20). If only one R&S®SMU-K20 is installed and 3GPP FDD waveforms are played in one I/Q baseband generator, the other I/Q baseband generator is disabled for 3GPP FDD waveforms. However, a software option is not tied to a specific I/Q baseband generator.

R&S®WinIQSIM™ requires an external PC.

IS-95 digital standard	R&S®SMU-K11 option
CDMA2000® digital standard	R&S®SMU-K12 option
3GPP TDD HDR digital standard	R&S®SMU-K13 option
3GPP TDD LDR digital standard (TD-SCDMA)	R&S®SMU-K14 option
OFDM with R&S®WinIQOFDM	R&S®SMU-K15 option
1 x EV-DO (Rev. 0) digital standard	R&S®SMU-K17 option
IEEE 802.11a/b/g digital standard	R&S®SMU-K19 option
3GPP FDD digital standard including HSDPA	R&S®SMU-K20 option

The options are described in the R&S®WinIQSIM™ data sheet (PD 0758.0680.32).

Fading and noise

Fading simulator (R&S®SMU-B14 option) and fading simulator extension (R&S®SMU-B15 option)

The R&S®SMU-B9/-B10/-B11 or R&S®SMU-B17 is required to generate input signals for the fading simulator.
All frequency and time settings are coupled to the internal reference frequency.

Number of signal paths	with R&S®SMU-B14	1
	with R&S®SMU-B14 and R&S®SMU-B15	1 or 2
Signal routing	only possible with R&S®SMU-B14 and R&S®SMU-B15	
	input	both signal paths split or combined
	output	split, one signal path only, or sum of both signal paths
Number of fading paths	depending on options and signal routing, see table on next page	
Fading path loss	setting range	0 dB to 50 dB
	resolution	0.01 dB
	accuracy	<0.01 dB
Fading path delay	setting range	0 ms to 2.56 ms
	resolution	10 ns
	with R&S®SMU-K71 option	0.01 ns
Delay groups		max. 4 per signal path
	permitted delay differences within one group	<40 µs
Speed range	at f = 1 GHz	0 km/h to 1725 km/h
	accuracy	<0.128 %
Doppler frequency	setting range	0 Hz to 1600 Hz
	accuracy	<0.1 %
Restart	standard	auto
	with R&S®SMU-B9/-B10/-B11 options installed	auto, internal from baseband A or B, external
Total insertion loss	automatic or user-definable, with clipping indicator	0 dB to 18 dB
Correlation	fading paths in signal path A pairwise with fading paths in signal path B	
	correlation coefficient	
	setting range	0 % to 100 %
	resolution	5 %
	correlation phase	
	setting range	0° to 360°
	resolution	1°
Fading profiles		
Rayleigh	pseudo-noise interval	>93 h
Pure Doppler	frequency ratio	(–1 to +1) × current Doppler frequency
	resolution	0.01 × current Doppler frequency
Rician	combination of Rayleigh and pure Doppler	
	power ratio	–30 dB to +30 dB
Lognormal	standard deviation	0 dB to 12 dB
	resolution	1 dB
	local constant at f = 1 GHz	12 m to 200 m
Static, constant phase	path loss	0 dB to 50 dB
	phase	0° to 360°
	resolution	1°

Number of fading paths, RF bandwidth, and timing resolution

	With R&S®SMU-K71 only

With R&S®SMU-B14

Signal paths	Fading paths	RF bandwidth	Timing resolution
1	20	80 MHz	10 ns
1	12	30 MHz	0.01 ns
1	8	50 MHz	0.01 ns

With R&S®SMU-B14 and -B15

Signal paths	Fading paths	RF bandwidth	Timing resolution
1	40	80 MHz	10 ns
1	24	30 MHz	0.01 ns
1	16	50 MHz	0.01 ns
2	20	80 MHz	10 ns
2	12	30 MHz	0.01 ns
2	8	50 MHz	0.01 ns

Dynamic fading and enhanced resolution (R&S®SMU-K71 option)

At least one R&S®SMU-B14 fading simulator must be installed. If both the R&S®SMU-B14 and the R&S®SMU-B15 are installed (signal paths A and B), dynamic fading and enhanced resolution can be used either on signal path A or B with one R&S®SMU-K71 option. For dynamic fading and enhanced resolution to be used on signal paths A and B simultaneously, two R&S®SMU-K71 must be installed.

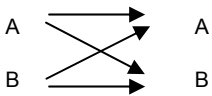| **Moving delay mode**		
System bandwidth		50 MHz
Number of fading paths		2 per signal path
Fading profiles		none
Basic delay	in steps of 10 ns	0 ms to 2.56 ms
Delay variation	peak to peak	0.3 µs to 40 µs
Variation period		10 s to 500 s
Variation speed		0 µs/s to 500 µs/s
Delay step size		<10 ps
Birth-death mode		
System bandwidth		50 MHz
Number of fading paths		2 per signal path
Fading profiles		pure Doppler
Delay range		0 µs to 40 µs
Delay grid		0 µs to 20 µs[17]
Positions		3 to 50[17]
Hopping dwell		100 ms to 5 s
Start offset	separately settable for each signal path	1 ms to 200 ms
Delay resolution		10 ns

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[17] The maximum delay range of 40 µs cannot be exceeded.

Extended statistic functions (R&S®SMU-K72 option)

At least one R&S®SMU-B14 fading simulator must be installed. If both the R&S®SMU-B14 and the R&S®SMU-B15 are installed (signal paths A and B), extended statistic functions can be used either on signal path A or B with one R&S®SMU-K72 option. For extended statistic functions to be used on signal paths A and B simultaneously, two R&S®SMU-K72 must be installed.

Fading profiles		
Gauss I, Gauss II	sum of two Gaussian distributions	in line with DAB standard
Gauss DAB 1, Gauss DAB 2	Gaussian distribution, shifted in frequency	in line with DAB standard
WiMAX Doppler	rounded Doppler PSD model	in line with IEEE 802.16a-03-01
WiMAX Rice	like WiMAX Doppler plus pure Doppler	in line with IEEE 802.16a-03-01
Predefined settings	SUI1 to SUI6	in line with IEEE 802.16a-03-01
	ITU OIP-A, ITU OIP-B, ITU V-A	in line with 3GPP TS34.121-1 annex D.2.2 table D.2.2.1A
	DAB-RA, DAB-TU, DAB-SFN	in line with EN 50248-2001

MIMO fading (R&S®SMU-K74 option)

The R&S®SMU-K74 option allows four fading channels to be simulated as is required for 2x2 MIMO receiver tests. Both the R&S®SMU-B14 and the R&S®SMU-B15 options must be installed (signal paths A and B) and two baseband sources (R&S®SMU-B9, -B10, or -B11) must be present.

Number of signal paths	with R&S®SMU-B14 and R&S®SMU-B15	4
Signal routing	2 x 2 MIMO, simulating fading channels between two Tx and two Rx antennas	
	input	always split
	output	sum of two signal paths
Number of fading paths	standard, RF bandwidth 80 MHz, timing resolution 10 ns	10
	with R&S®SMU-K71 option, RF bandwidth 50 MHz, timing resolution 0.01 ns	6
	with R&S®SMU-K71 option, RF bandwidth 30 MHz, timing resolution 0.01 ns	4
Steering matrix	The steering matrix can be set by setting the diagonal elements of the correlation matrix.	
Correlation	The correlation between corresponding fading paths of the four signal paths can be set in a correlation matrix. For each fading path index, an individual matrix can be set.	
	correlation coefficient	
	setting range	0 % to 100 %
	resolution	1 %
	correlation phase	
	setting range	0° to 360°
	resolution	1°
Correlation matrix setting		individually or with Kronecker assumption (Rx and Tx antenna correlation with automatic calculation of matrix)
Matrix representation		(real, imaginary) or (magnitude, phase)
Start seed		settable

Additive white Gaussian noise (AWGN, R&S®SMU-K62 option)

At least one R&S®SMU-B13 baseband main module must be installed. If two R&S®SMU-B13 are installed (paths A and B), AWGN can be generated either on path A or B with one R&S®SMU-K62 option. For AWGN to be generated on paths A and B simultaneously, two R&S®SMU-K62 must be installed.

Addition of an AWGN signal of settable bandwidth and settable C/N ratio or E_b/N_0 to a wanted signal. If the noise generator is used, a frequency offset cannot be added to the wanted signal.

Noise	distribution density	Gaussian, statistical, separate for I and Q
	crest factor	>18 dB
	periodicity	>48 h
C/N, E_b/N_0	setting range	−30 dB to +30 dB
	resolution	0.1 dB
	uncertainty for system bandwidth = symbol rate, symbol rate <4 MHz, −24 dB < C/N < 30 dB and crest factor <12 dB	<0.1 dB
System bandwidth	bandwidth for determining noise power	
	range	1 kHz to 80 MHz
	resolution	100 Hz

Other options

BER measurement (R&S®SMU-K80 option)

The data supplied by the DUT is compared with a reference pseudo-random bit sequence.

Clock		supplied by DUT; a clock pulse is required for each valid bit
Clock rate		100 Hz to 60 MHz
Data	PRBS	
	sequence length	9, 11, 15, 16, 20, 21, 23
	pattern ignore	OFF, all 0, all 1
	data enable	external
	modes	OFF, high, low
	restart	external
	modes	ON/OFF
Synchronization time		28 clock cycles
Interface	9-pin D-Sub connector, D-Sub/BNC cable supplied with option	
Clock, data, enable and restart inputs	input impedance	1 kΩ, 50 Ω
	trigger threshold	
	setting range	0.00 V to 2.50 V
	resolution	0.01 V
Polarity	data, clock, data enable	normal, inverted
Measurement time		selectable by means of maximum number of data bits or bit errors (max. 2^{31} bit each), continuous measurement
Measurement result	if selected number of data bits or bit errors is attained	BER in ppm, %, or decade values
Status displays		not synchronized, no clock, no data

BLER measurement (R&S®SMU-K80 option)

In BLER measurement mode, arbitrary data can be provided by the DUT. A signal marking the block's CRC has to be provided on the data enable connector of the BER/BLER option.

Clock		supplied by DUT; a clock pulse is required for each valid bit
Clock rate		100 Hz to 60 MHz
Data	input data	arbitrary
	data enable (marking the block's CRC)	external
	modes	high, low
CRC	CRC type	CCITT CRC16 ($x^{16} + x^{12} + x^5 + 1$)
	CRC bit order	MSB first, LSB first
Synchronization time		1 block
Interface	9-pin D-Sub connector, D-Sub/BNC cable supplied with option	
Clock, data, and enable inputs	input impedance	1 kΩ, 50 Ω
	trigger threshold	
	setting range	0 V to 2.50 V
	resolution	0.01 V
Polarity	data, clock, data enable	normal, inverted
Measurement time	selectable by means of maximum number of received blocks or errors (max. 2^{31} blocks each), continuous measurement	
Measurement result	if selected number of received blocks or errors is attained	BLER in ppm, %, or decade values
Status displays		not synchronized, no clock, no data

General data

Remote control

Systems		IEC/IEEE bus, IEC 60625 (IEEE 488) Ethernet
Command set		SCPI 1999.5
Connector		
IEC/IEEE		24-contact Amphenol
Ethernet		Western
IEC/IEEE bus address		0 to 30
Interface functions		IEC: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0

Operating data

Power supply	input voltage range, AC, nominal	100 V to 240 V
	AC supply frequency	47 Hz to 63 Hz
	input current	5.0 A to 1.6 A
	power factor correction	in line with EN 61000-3-2
EMC		in line with EN 55011 Class B, EN 61326
	with activated digital I/Q output	in line with EMC directive of EU (2004/108/EC), applied standard: EN 61326 (immunity for industrial environment; class A emissions)[18]
Immunity to interfering field strength		up to 10 V/m
Environmental conditions	operating temperature range	+5 °C to +45 °C in line with EN 60068-2-1, EN 60068-2-2
	storage temperature range	−20 °C to +60 °C
	climatic resistance	+40 °C / 90 % rel. humidity in line with EN 60068-2-3
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g (rms), in line with EN 60068-2-64
Shock		in line with EN 60068-2-27, MIL-STD-810E 40 g shock spectrum
Electrical safety		in line with EN 61010-1
Dimensions	width × height × depth	435 mm × 192 mm × 460 mm (17.1 in × 7.6 in × 18.1 in)
Weight	if fully equipped	25 kg (55.1 lb)
Recommended calibration interval		3 years

License information

The firmware of this device contains open source software. Details as well as license agreements can be found in release notes and operating manual.

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[18] The instrument complies with the emission requirements stipulated by EN 55011 class A. This means that the instrument is suitable for use in industrial environments. In line with EN61000-6-4, operation in residential, commercial and business areas or in small-size companies is not covered. Thus, the instrument may not be operated in residential, commercial and business areas or in small-size companies, unless additional measures are taken to ensure that EN 610000-6-3 is complied with.

Ordering information

Designation	Type	Order No.
Vector Signal Generator[19] including power cable, Quick Start Guide, and CD-ROM (with operating and service manual)	R&S®SMU200A	1141.2005.02
Options		
RF path A		
100 kHz to 2.2 GHz	R&S®SMU-B102	1141.8503.02
100 kHz to 3 GHz	R&S®SMU-B103	1141.8603.02
100 kHz to 4 GHz	R&S®SMU-B104	1141.8703.02
100 kHz to 6 GHz	R&S®SMU-B106	1141.8803.02
FM/φM Modulator	R&S®SMU-B20	1142.0006.02
FM/φM Modulator and Enhanced Phase Noise Performance	R&S®SMU-B22	1160.5006.02
High-Power Output	R&S®SMU-B31	1159.8011.04
RF path B		
100 kHz to 2.2 GHz	R&S®SMU-B202	1141.9400.02
100 kHz to 3 GHz	R&S®SMU-B203	1141.9500.02
High-Power Output	R&S®SMU-B36	1160.1000.04
Baseband		
Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)	R&S®SMU-B9	1161.0766.02
Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)	R&S®SMU-B10	1141.7007.02
Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)	R&S®SMU-B11	1159.8411.02
Baseband Main Module	R&S®SMU-B13	1141.8003.04
Differential I/Q Output	R&S®SMU-B16	1161.0066.02
Baseband Input (analog/digital)	R&S®SMU-B17	1142.2880.02
Digital Baseband Output	R&S®SMU-B18	1159.6954.02
Digital standards		
GSM/EDGE	R&S®SMU-K40	1160.7609.02
3GPP FDD	R&S®SMU-K42	1160.7909.02
3GPP Enhanced BS/MS Tests incl. HSDPA	R&S®SMU-K43	1160.9660.02
GPS	R&S®SMU-K44	1161.0566.02
3GPP FDD HSUPA	R&S®SMU-K45	1161.0666.02
CDMA2000®	R&S®SMU-K46	1160.9876.02
1xEV-DO	R&S®SMU-K47	1408.7410.02
IEEE 802.11 (a/b/g)	R&S®SMU-K48	1161.0266.02
IEEE 802.16	R&S®SMU-K49	1161.0366.02
TD-SCDMA	R&S®SMU-K50	1161.0966.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMU-K51	1161.1062.02
DVB-H	R&S®SMU-K52	1408.7010.02
DAB/T-DMB	R&S®SMU-K53	1400.6209.02
IEEE 802.11n	R&S®SMU-K54	1408.7562.02
EUTRA/LTE	R&S®SMU-K55	1408.7310.02
XM RADIO	R&S®SMU-K56	1161.1162.02
Multicarrier CW Signal Generation	R&S®SMU-K61	1160.8505.02
Assisted GPS	R&S®SMU-K65	1415.0053.02

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[19] The base unit can only be ordered with an R&S®SMU-B10x frequency option.

Digital standards using R&S®WinIQSIM2™[20]		
GSM/EDGE	R&S®SMU-K240	1408.5518.02
3GPP FDD	R&S®SMU-K242	1408.5618.02
3GPP Enhanced BS/MS Tests incl. HSDPA	R&S®SMU-K243	1408.5718.02
GPS	R&S®SMU-K244	1408.5818.02
3GPP FDD HSUPA	R&S®SMU-K245	1408.5918.02
CDMA2000® incl. 1xEV-DV	R&S®SMU-K246	1408.6014.02
1xEV-DO	R&S®SMU-K247	1408.7462.02
IEEE 802.11 (a/b/g)	R&S®SMU-K248	1408.6114.02
IEEE 802.16	R&S®SMU-K249	1408.6214.02
TD-SCDMA	R&S®SMU-K250	1408.6314.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMU-K251	1408.6414.02
DVB-H	R&S®SMU-K252	1408.7510.02
IEEE 802.11n	R&S®SMU-K254	1408.7610.02
EUTRA/LTE	R&S®SMU-K255	1408.7362.02
Multicarrier CW Signal Generation	R&S®SMU-K261	1408.6514.02
Additive white Gaussian noise (AWGN)	R&S®SMU-K262	1400.6609.02
Digital standards using R&S®WinIQSIM™[21]		
IS-95	R&S®SMU-K11	1160.5335.02
CDMA2000®	R&S®SMU-K12	1160.5658.02
3GPP TDD	R&S®SMU-K13	1160.5906.02
TD-SCDMA	R&S®SMU-K14	1160.6202.02
User-Defined OFDM Signals (with R&S®WinIQSIM™ and R&S®WinIQOFDM)	R&S®SMU-K15	1160.6402.02
1xEV-DO	R&S®SMU-K17	1160.7009.02
IEEE 802.11 (a/b/g)	R&S®SMU-K19	1160.8805.02
3GPP FDD incl. HSDPA	R&S®SMU-K20	1160.9460.02
Digital standards using external PC software		
Bluetooth®	R&S®SMU-K5	1161.0466.02
Pulse Sequencer	R&S®SMU-K6	1408.7662.02
TETRA	R&S®SMU-K8	1408.6714.02
MIMO, fading and noise		
Fading Simulator	R&S®SMU-B14	1160.1800.02
Fading Simulator Extension	R&S®SMU-B15	1160.2288.02
Additive White Gaussian Noise (AWGN)	R&S®SMU-K62	1159.8511.02
Dynamic Fading and Enhanced Resolution	R&S®SMU-K71	1160.9201.02
Extended Statistic Functions	R&S®SMU-K72	1408.7062.02
2 x 2 MIMO Fading	R&S®SMU-K74	1408.7762.02
Other options		
BER/BLER Measurement	R&S®SMU-K80	1159.8770.02
XM RADIO Waveforms	R&S®SMU-K256	1161.1240.02
Rear Panel Connectors for 1st RF Path	R&S®SMU-B81	1159.9001.02
Rear Panel Connectors for 2nd RF Path	R&S®SMU-B82	1159.9501.02
Recommended extras		
Hardcopy manuals (in German)		1007.9845.31
Hardcopy manuals (in English, UK)		1007.9845.32
Hardcopy manuals (in English, USA)		1007.9845.39
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Adapter for Telescopic Sliders	R&S®ZZA-T45	1109.3774.00
BNC Adapter for AUX I/O Connector	R&S®SMU-Z5	1160.4545.02
Keyboard with USB Interface (US assignment)	R&S®PSL-Z2	1157.6870.04
Mouse with USB Interface, optical	R&S®PSL-Z10	1157.7060.03
External USB CD-RW Drive	R&S®PSP-B6	1134.8201.22

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[20] R&S®WinIQSIM2™ requires an external PC.

[21] R&S®WinIQSIM™ requires an external PC.

Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal adjustments performed. Data designated "overrange" or "underrange" and data without tolerance limits is not binding.

EMC specifications are tested with sufficiently shielded cables and accessories (e.g. mouse and keypad). To prevent degradation of these specifications, it is the user's responsibility to use appropriate equipment.

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.

This document contains the specifications of the R&S®SMU200A, including RF characteristics, analog modulation, I/Q modulation, performance of the I/Q baseband generator, fading and noise. The functional specifications of the digital standards (R&S®SMU-K40 to -K61 options) and the digital standards with external PC software (R&S®SMU-K5, -K6, -K8) are described in the Digital Standards data sheet (document PD 5213.9434.22). The digital standards with R&S®WinIQSIM2™ are described in the R&S®WinIQSIM2™ data sheet (PD 5213.7460.22), the digital standards with R&S®WinIQSIM™ in the R&S®WinIQSIM™ data sheet (PD 0758.0680.32).

For product brochure, see PD 0758.0197.12
and www.rohde-schwarz.com
(search term: SMU200A)

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