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R&S®SMJ100A Vector Signal Generator

Data sheet

ROHDE&SCHWARZ

CONTENTS

Key features

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. –133 dBc (f = 1 GHz, 20 kHz carrier offset, 1 Hz measurement bandwidth)
- Wideband noise of typ. –153 dBc (CW, f = 1 GHz, >10 MHz carrier offset, 1 Hz measurement bandwidth)
- Excellent ACLR performance of typ. +69 dB with 3GPP FDD (test model 1, 64 DPCH)
- Very high level repeatability of 0.05 dB
- High-stability reference oscillator as standard

Unrivaled flexibility

- 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 and multisegment support
- 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

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

Baseband generator options

The R&S®SMJ100A can be equipped with one of the following I/Q baseband generators:

R&S®SMJ-B9	Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)
R&S®SMJ-B10	Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)
R&S®SMJ-B11	Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)
R&S®SMJ-B50	Baseband Generator with ARB (64 Msample)
R&S®SMJ-B51	Baseband Generator with ARB (16 Msample)

The R&S®SMJ-B9/-B10/-B11 baseband generators include an arbitrary waveform generator and a realtime coder. If these baseband generators are installed, the following software options can be added:

- Digital standards and modulation systems running on the instrument (R&S®SMJ-K40 to R&S®SMJ-K61 options)
- Digital standards with R&S®WinIQSIM2™ (R&S®SMJ-K240 to R&S®SMJ-K262 options); R&S®WinIQSIM2™ runs on an external PC
- Digital standards with R&S®WinIQSIM™ (R&S®SMJ-K11 to R&S®SMJ-K20 options); R&S®WinIQSIM™ runs on an external PC
- R&S®SMJ-K5/-K6/-K8 options

The R&S®SMJ-B50/-B51 baseband generators include an arbitrary waveform generator. If these baseband generators are installed, the following software options can be added:

- Digital standards with R&S®WinIQSIM2™ (R&S®SMJ-K240 to R&S®SMJ-K262 options); R&S®WinIQSIM2™ runs on an external PC
- Digital standards with R&S®WinIQSIM™ (R&S®SMJ-K11 to R&S®SMJ-K20 options); R&S®WinIQSIM™ runs on an external PC
- R&S®SMJ-K6 option

Modulation

Possible modulation types

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

Simultaneous modulation

	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®SMJ-B103	up to 3 GHz
	R&S®SMJ-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
Setting time[1]	to within <1 × 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, linear or logarithmic spacing
Sweep range		full frequency range
Step width	linear	full frequency range
	logarithmic	0.01 % to 100 % per step

Reference frequency

Aging	after 30 days of uninterrupted operation	<1 × 10^{-9}/day, <1 × 10^{-7}/year
Temperature effect	in operating temperature range	±6 × 10^{-8}
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
	input voltage	–10 V to +10 V
	input impedance	10 kΩ

[1] Installation of software that is not authorized by Rohde & Schwarz for use on the R&S®SMJ100A or installation of antivirus software can deteriorate the setting time performance.

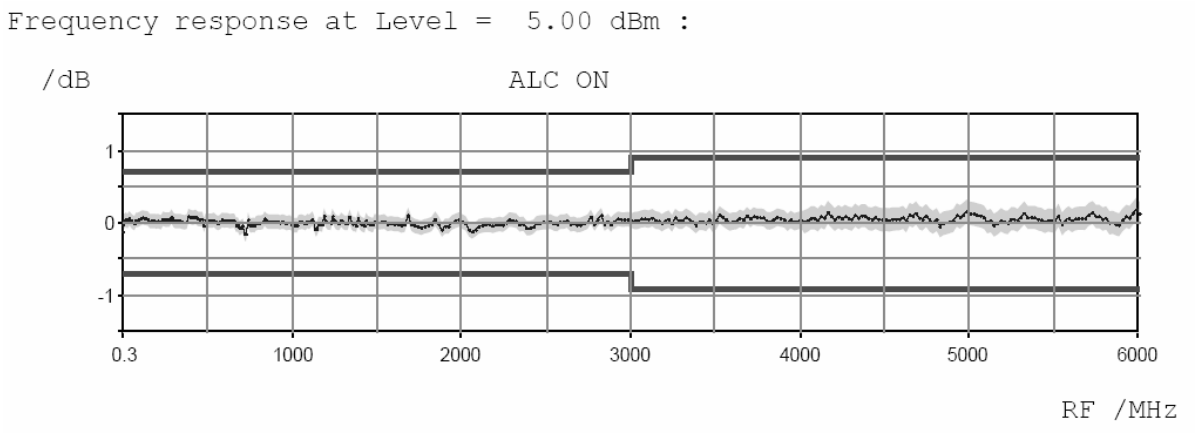
Level

Setting range		–145 dBm to +20 dBm
Maximum level	f ≤ 3 GHz	+13 dBm (PEP)[2]
	f > 3 GHz	+11 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 in some special applications.	<0.2 dB
Output impedance VSWR in 50 Ω system	ALC state ON f ≤ 3 GHz f > 3 GHz	 <1.6, typ. <1.4 <1.85, typ. <1.6
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
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

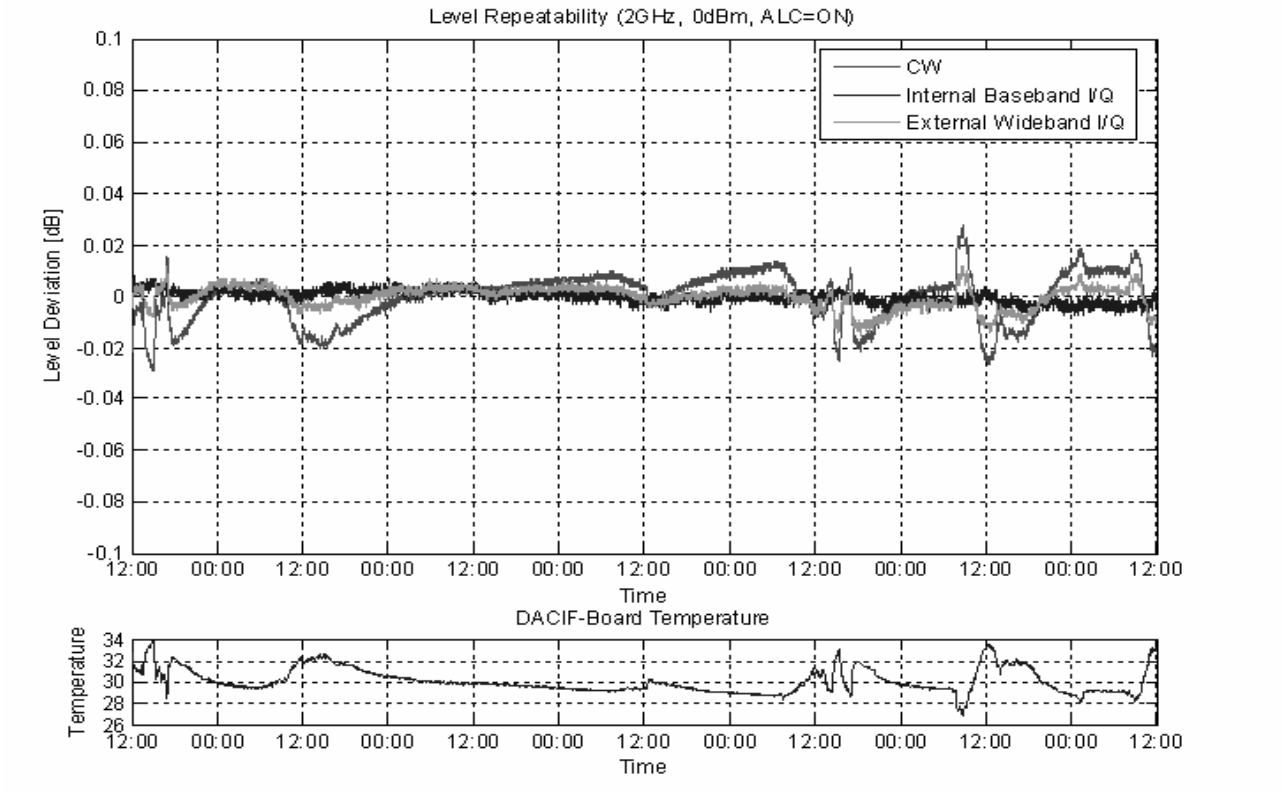
[2] PEP = peak envelope power.

[3] Installation of software that is not authorized by Rohde & Schwarz for use on the R&S®SMJ100A or installation of antivirus software can deteriorate the setting time performance.

Measured level data



Measured level versus frequency



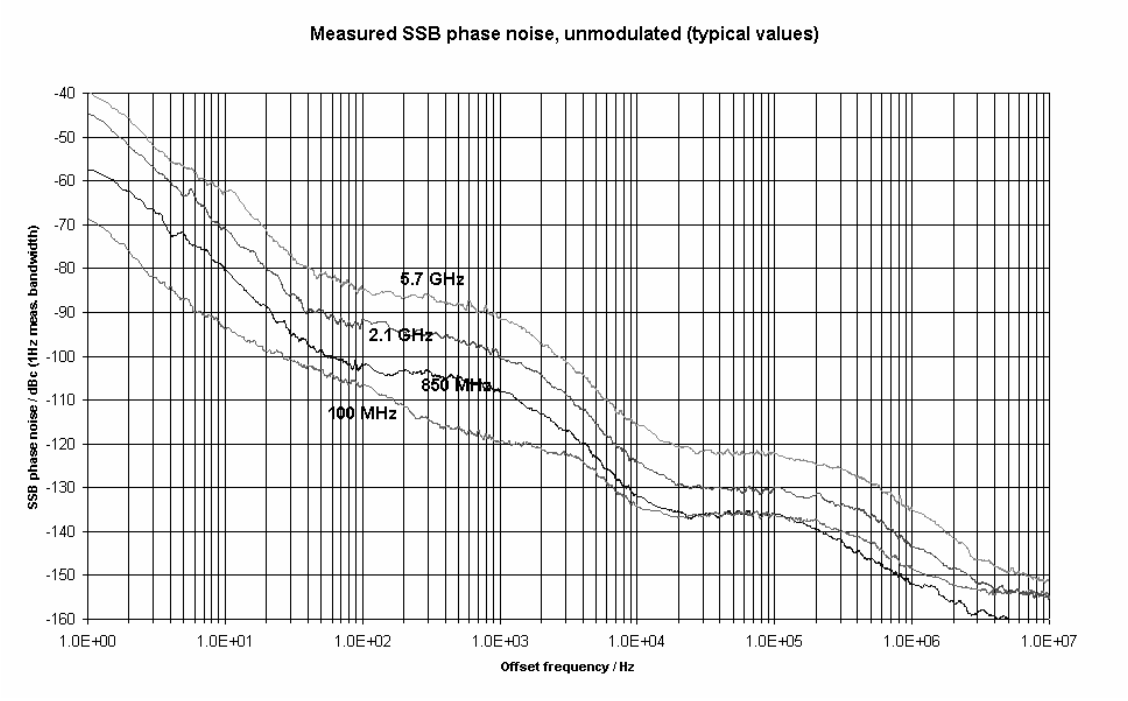
Level repeatability with random settings between measurements (upper diagram)
The lower diagram shows the temperature inside the instrument during the measurement

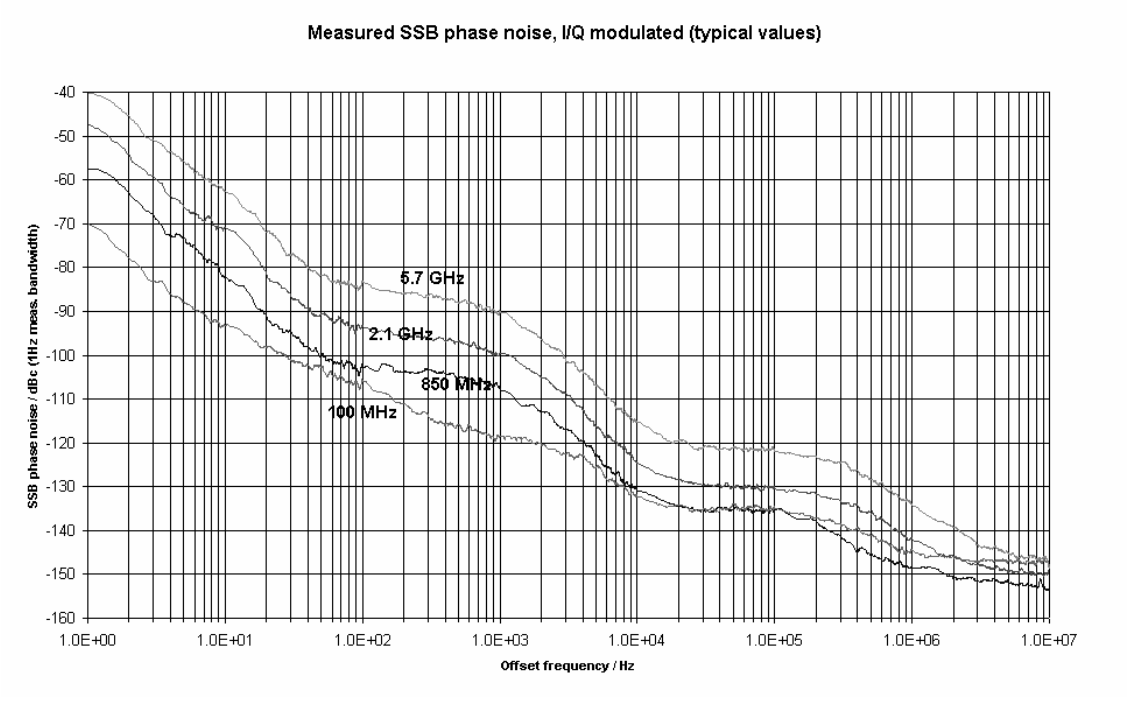
Level sweep

Operating modes	digital sweep in discrete steps	automatic, single, step, external single, external step, manual, or external trigger
Sweep range		full level range
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	unmodulated	
	level <8 dBm	<–30 dBc
	level <13 dBm	typ. <–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
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
	3000 MHz < f ≤ 6000 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	
	20 MHz ≤ f ≤ 200 MHz	<–140 dBc (typ. –143 dBc)
	200 MHz < f ≤ 1500 MHz	<–143 dBc (typ. –146 dBc)
	1.5 GHz < f ≤ 3 GHz	<–142 dBc (typ. –145 dBc)
	f > 3 GHz	<–140 dBc (typ. –143 dBc)
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz, unmodulated	
	20 MHz ≤ f ≤ 200 MHz	<–126 dBc (typ. –130 dBc)
	f = 1 GHz	<–129 dBc (typ. –133 dBc)
	f = 2 GHz	<–123 dBc (typ. –127 dBc)
	f = 3 GHz	<–119 dBc (typ. –123 dBc)
	f = 4 GHz	<–117 dBc (typ. –121 dBc)
	f = 6 GHz	<–113 dBc (typ. –117 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 %





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
Maximum 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

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®SMJ-B20 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®SMJ-B20 option)

Operating modes		internal, external, internal + external, AC/DC
FM/φM range multiplier	0.3 MHz ≤ f ≤ 200 MHz	rm = 1
	200 MHz < f ≤ 375 MHz	rm = 0.25
	375 MHz < f ≤ 750 MHz	rm = 0.5
	750 MHz < f ≤ 1500 MHz	rm = 1
	1500 MHz < f ≤ 3000 MHz	rm = 2
	f > 3000 MHz	rm = 4
Maximum deviation		rm × 10 MHz
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	10 Hz to 100 kHz	<0.5 dB
	10 Hz to 10 MHz	<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®SMJ-B20 option)

Operating mode		internal, external, internal + external, AC/DC, High Bandwidth, High Deviation
Maximum deviation	High Deviation φM mode	rm × 20.0 rad
	High Bandwidth φM mode	rm × 1.0 rad
Resolution	High Deviation φM mode	<200 ppm, min. rm × 20 µrad
	High Bandwidth φM mode	<0.1 %, 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

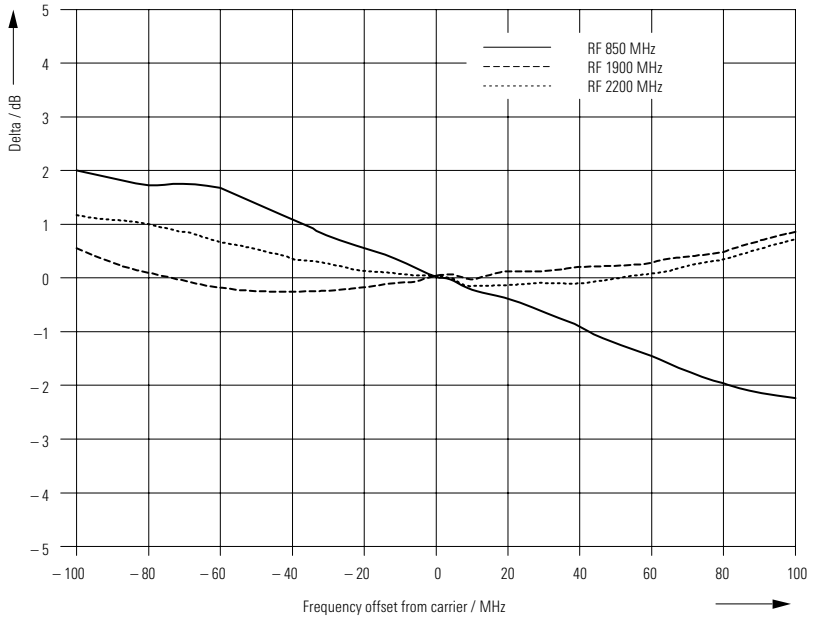
I/Q modulation

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

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
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

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

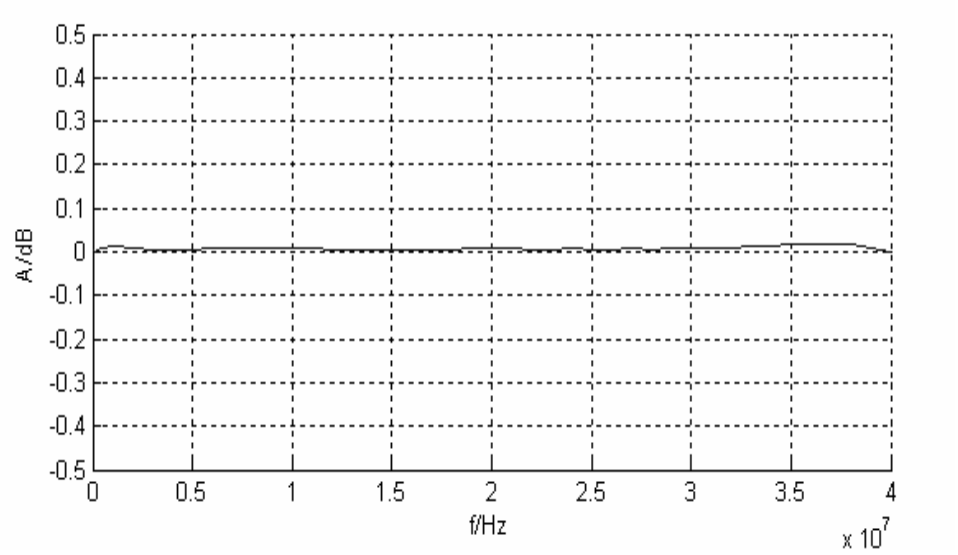
Internal baseband I/Q (with R&S®SMJ-B13 option)

The R&S®SMJ-B13 converts the internal digital baseband signals of the R&S®SMJ-B9/-B10/-B11/-B50/-B51 into analog signals for driving the I/Q modulator. It also generates the analog I/Q output signals.

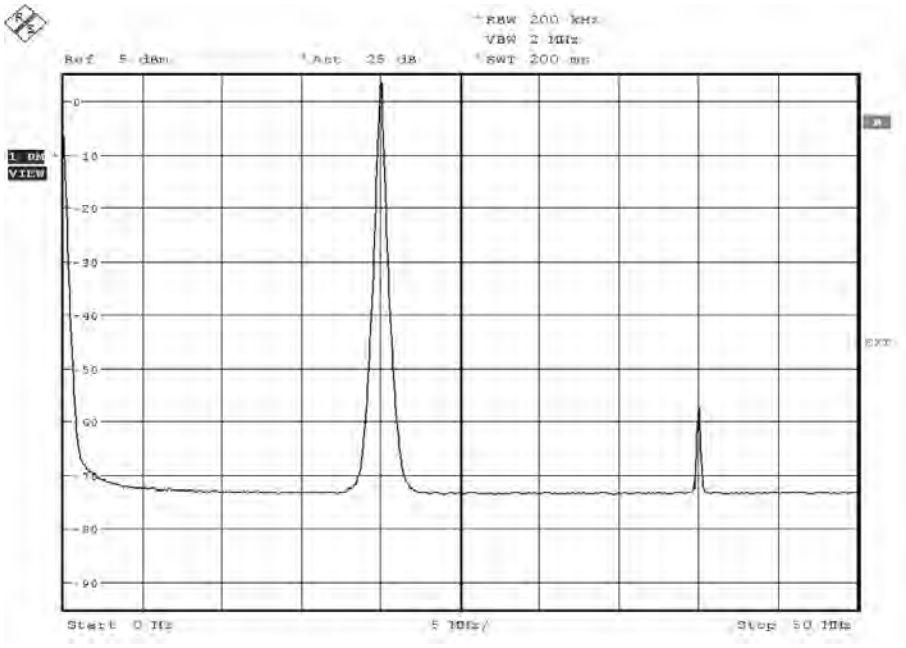
D/A converter	data rate	100 MHz
	resolution	16 bit
	sampling rate	400 MHz (internal interpolation × 4)
Aliasing filter	with amplitude, group delay and Si correction	
	bandwidth, roll-off to −0.1 dB	40 MHz
	D/A converter interpolation spectra	
	up to 10 MHz	<−80 dBc
	up to 40 MHz	<−73 dBc
I/Q impairment	carrier leakage	
	setting range	−10 % to +10 %
	resolution	0.01 %
	I ≠ 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	
	up to 10 MHz	<1.5 dB, typ 0.7 dB
	up to 40 MHz	<4.5 dB, typ. 2.0 dB
Suppression of image sideband for entire instrument in modulation bandwidth[5]	up to 10 MHz	>44 dB, typ. 50 dB
	up to 40 MHz	>34 dB, typ. 44 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°
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

[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.



Frequency response of I/Q outputs



SFDR of I/Q outputs

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

Additional specifications for I/Q outputs with R&S®SMJ-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°

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

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

The R&S®SMJ-B18 option 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®SMJ100A to the digital I/Q input of other Rohde & Schwarz instruments (e.g. R&S®AMU200A baseband signal generator and fading simulator).

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 × sample rate
Control signals	markers	4
	data valid	valid samples marked in data stream

I/Q baseband generator (R&S®SMJ-B9/-B10/-B11/-B50/-B51 option) – arbitrary waveform mode

The R&S®SMJ-B13 baseband main module must be installed.

Waveform memory	output memory	
	waveform length with the R&S®SMJ-B9	128 sample to 128 Msample in one-sample steps
	waveform length with the R&S®SMJ-B10/-B50	128 sample to 64 Msample in one-sample steps
	waveform length with the R&S®SMJ-B11/-B51	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)	$<5 \times 10^{-14}$ × 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

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 2.04, the software supports I/Q data download and control of the R&S®SMJ-B9/-B10/-B11/-B50/-B51.		
Operation with R&S®WinIQSIM™: As of version 4.50, the software supports I/Q data download and control of the R&S®SMJ-B9/-B10/-B11/-B50/-B51.		

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

The R&S®SMJ-B13 baseband main module must be installed.

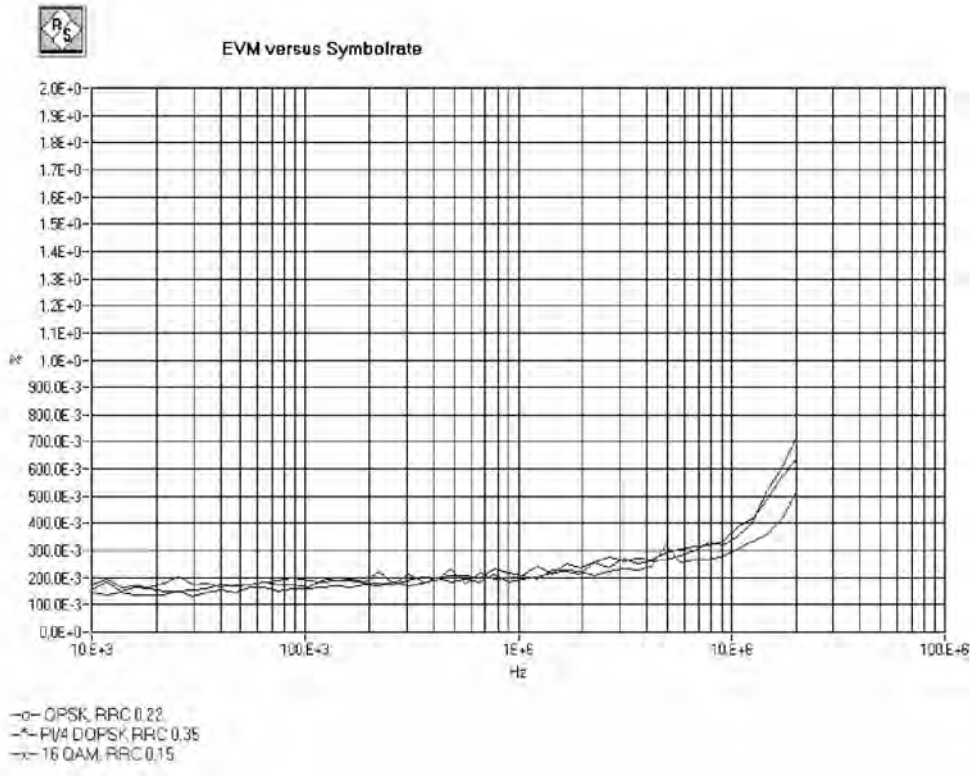
Types of modulation	ASK	
	modulation index	0 % to 100 %
	resolution	0.1 %
	FSK	2FSK, 4FSK, MSK
	deviation	0.1 to 1.5 × f_{sym}
	maximum	10 MHz
	resolution	<0.1 Hz
	setting uncertainty	<0.5 %
	variable FSK	4FSK, 8FSK, 16FSK
	deviations	–1.5 × f_{sym} to +1.5 × f_{sym}
	maximum	10 MHz
	resolution	<0.1 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.	OOFF, 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

[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)	$<5 \times 10^{-14}$ × 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	$<5 \times 10^{-10}$ × 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®SMJ-B9	8 bit to 4 Gbit
	output memory of the R&S®SMJ-B10	8 bit to 2 Gbit
	output memory of the R&S®SMJ-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	0 sample to (2^{26} – 1) sample
	setting range	
	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

[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

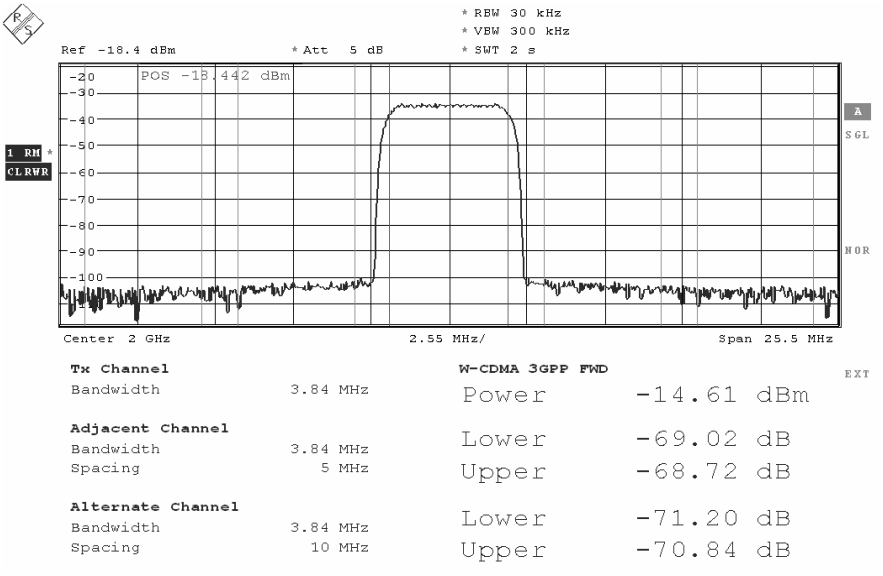
Typical values

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									
In adjacent channel	–37	–38	–72	–80 offset 750 kHz, bandwidth 30 kHz	–	–74	–34	–71	–42 at 11 MHz
In alternate channel	–71	–71	–76	–93 offset 1.98 MHz, bandwidth 30 kHz	–	–77	–78	–77	–64 at 20 MHz
In 2nd alternate channel	–85	–85	–	–	–	–	–	–	–66 at 30 MHz

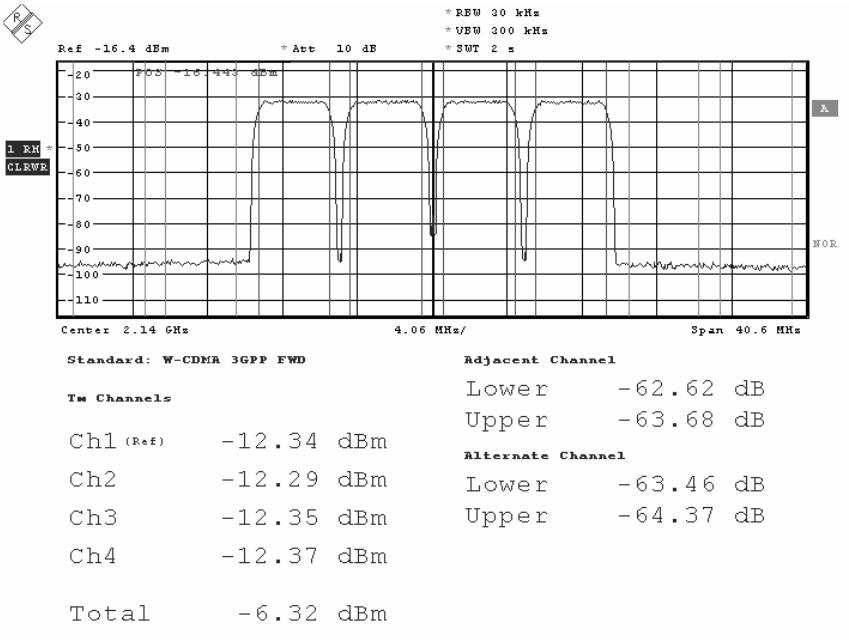
Signal performance for digital standards

GSM/EDGE	with R&S®SMJ-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	
	frequency 400 MHz to 2 GHz	
	200 kHz offset	<–34 dB, typ. –37 dB
	400 kHz offset	<–68 dB, typ. –71 dB
	600 kHz offset	<–80 dB, typ. –85 dB

3GPP FDD	with R&S®SMJ-K42 option	
Error vector magnitude	1 DPCH, rms	<0.8 %, typ. 0.3 %
Adjacent channel leakage ratio (ACLR)	test model 1, 64 DPCHs	
	level ≤10.5 dBm PEP	
	frequency 1800 MHz to 2200 MHz	
	offset 5 MHz	>66 dB, typ. 69 dB
	offset 10 MHz	>68 dB, typ. 71 dB

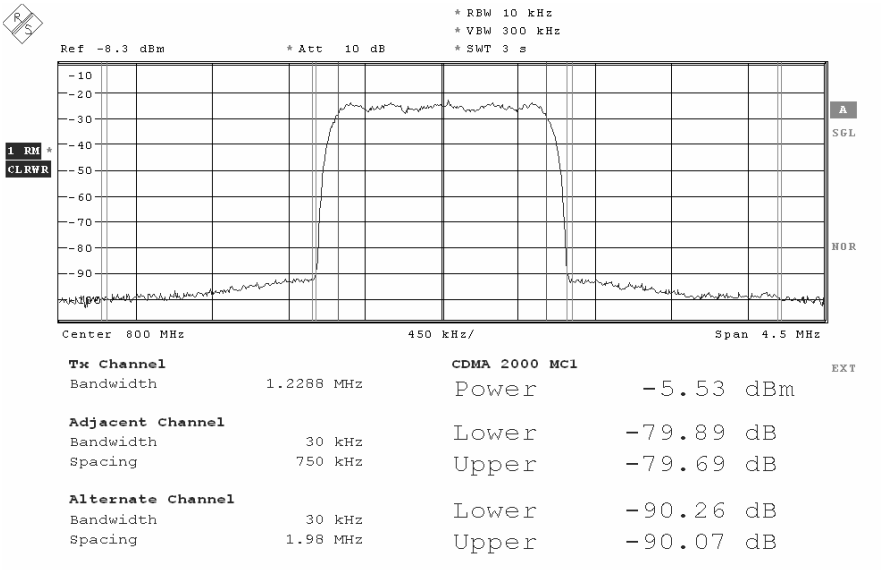


ACLR (typical values) for 3GPP test model 1, 64 DPCH



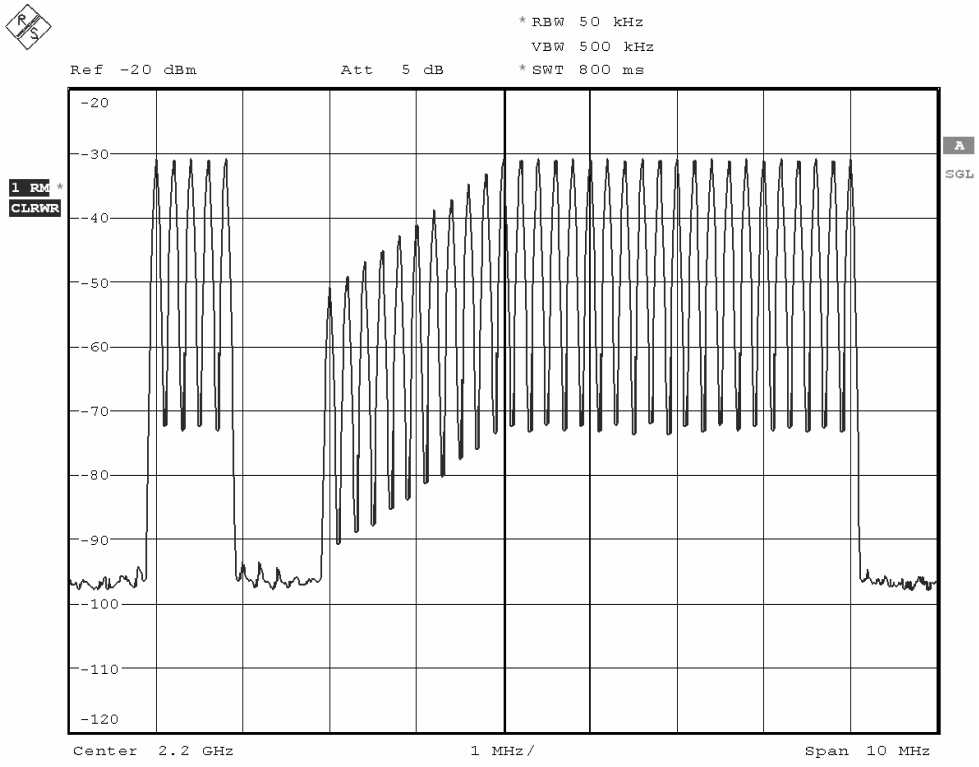
ACLR (typical values) for a 3GPP four-carrier signal with test model 1, 64 DPCH on each carrier

CDMA2000®	with R&S®SMJ-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	
	carrier frequency 800 MHz	
	channel spacing 0.75 MHz (bandwidth 30 kHz)	typ. 79 dB
	channel spacing 1.98 MHz (bandwidth 30 kHz)	typ. 90 dB



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

Multicarrier CW	with R&S®SMJ-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



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®SMJ-B9/-B10/-B11)

An R&S®SMJ-B9, R&S®SMJ-B10, or R&S®SMJ-B11 I/Q baseband generator is required. The specified data applies together with the parameters of the respective standard. The entire frequency range as well as filter parameters and symbol rates can be set by the user.

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

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

Digital standards with external PC software

An I/Q baseband generator must be installed. R&S®SMJ-K5 and -K8 require the R&S®SMJ-B9, -B10, or -B11. R&S®SMJ-K6 can be used with theR&S®SMJ-B9, -B10, -B11, -B50 or -B51.

Bluetooth® digital standard (external PC software)	R&S®SMJ-K5 option
Pulse sequencer (external PC software)	R&S®SMJ-K6 option
TETRA digital standard (external PC software)	R&S®SMJ-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®SMJ-B9/-B10/-B11/-B50/-B51 ARB)

GSM/EDGE digital standard	R&S®SMJ-K240 option
3GPP FDD digital standard	R&S®SMJ-K242 option
3GPP FDD enhanced BS/MS tests including HSDPA	R&S®SMJ-K243 option
GPS digital standard	R&S®SMJ-K244 option
3GPP FDD enhanced BS/MS tests including HSUPA	R&S®SMJ-K245 option
CDMA2000® digital standard	R&S®SMJ-K246 option
1 x EV-DO digital standard	R&S®SMJ-K247 option
IEEE 802.11a/b/g digital standard	R&S®SMJ-K248 option
IEEE 802.16 WiMAX digital standard including IEEE 802.16e	R&S®SMJ-K249 option
TD-SCDMA (3GPP TDD LCR) digital standard	R&S®SMJ-K250 option
TD-SCDMA (3GPP TDD LCR) enhanced BS/MS tests including HSDPA	R&S®SMJ-K251 option
DVB-H digital standard	R&S®SMJ-K252 option
IEEE 802.11n digital standard	R&S®SMJ-K254 option
EUTRA/LTE digital standard	R&S®SMJ-K255 option
XM RADIO digital standard	R&S®SMJ-K256 option
Multicarrier CW signal generation	R&S®SMJ-K261 option
Additive white Gaussian noise (AWGN)	R&S®SMJ-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®SMJ-B9/-B10/-B11/-B50/-B51 ARB)

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

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

Noise generation

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

The R&S®SMJ-B13 baseband main module 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®SMJ-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 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®SMJ-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)[10]
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	18 kg (39.7 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.

[10] 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[11] including power cable, Quick Start Guide, and CD-ROM (with operating and service manual)	R&S®SMJ100A	1403.4507.02
Options		
RF		
100 kHz to 3 GHz	R&S®SMJ-B103	1403.8502.02
100 kHz to 6 GHz	R&S®SMJ-B106	1403.8702.02
FM/φM Modulator	R&S®SMJ-B20	1403.9209.02
Baseband		
Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)	R&S®SMJ-B9	1404.1501.02
Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)	R&S®SMJ-B10	1403.8902.02
Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)	R&S®SMJ-B11	1403.9009.02
Baseband Main Module	R&S®SMJ-B13	1403.9109.02
Differential I/Q Output	R&S®SMJ-B16	1403.9409.02
Digital Baseband Output	R&S®SMJ-B18	1410.5705.02
Baseband Generator with ARB (64 Msample)	R&S®SMJ-B50	1410.5505.02
Baseband Generator with ARB (16 Msample)	R&S®SMJ-B51	1410.5605.02
Digital standards		
GSM/EDGE	R&S®SMJ-K40	1404.0305.02
3GPP FDD	R&S®SMJ-K42	1404.0405.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMJ-K43	1404.0505.02
GPS	R&S®SMJ-K44	1404.1401.02
3GPP FDD HSUPA	R&S®SMJ-K45	1409.1816.02
CDMA2000®	R&S®SMJ-K46	1404.0605.02
1xEV-DO	R&S®SMJ-K47	1409.2306.02
IEEE 802.11 (a/b/g)	R&S®SMJ-K48	1404.1001.02
IEEE 802.16	R&S®SMJ-K49	1404.1101.02
TD-SCDMA	R&S®SMJ-K50	1404.1660.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMJ-K51	1404.1760.02
DVB-H	R&S®SMJ-K52	1409.2106.02
DAB/T-DMB	R&S®SMJ-K53	1400.6309.02
IEEE 802.11n	R&S®SMJ-K54	1409.2506.02
EUTRA/LTE	R&S®SMJ-K55	1409.2206.02
XM RADIO	R&S®SMJ-K56	1404.1806.02
Multicarrier CW Signal Generation	R&S®SMJ-K61	1404.0705.02

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

Digital standards using R&S®WinIQSIM2™ [12]		
GSM/EDGE	R&S®SMJ-K240	1404.0510.02
3GPP FDD	R&S®SMJ-K242	1404.0610.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMJ-K243	1404.0710.02
GPS	R&S®SMJ-K244	1404.0810.02
3GPP FDD HSUPA	R&S®SMJ-K245	1404.0910.02
CDMA2000®	R&S®SMJ-K246	1404.1016.02
1xEV-DO	R&S®SMJ-K247	1409.2358.02
IEEE 802.11 (a/b/g)	R&S®SMJ-K248	1404.1116.02
IEEE 802.16	R&S®SMJ-K249	1404.1216.02
TD-SCDMA	R&S®SMJ-K250	1404.1316.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMJ-K251	1404.1416.02
DVB-H	R&S®SMJ-K252	1409.2406.02
IEEE 802.11n	R&S®SMJ-K254	1409.2506.02
EUTRA/LTE	R&S®SMJ-K255	1409.2258.02
Multicarrier CW Signal Generation	R&S®SMJ-K261	1404.1516.02
Additive White Gaussian Noise (AWGN)	R&S®SMJ-K262	1400.6650.02
Digital standards using R&S®WinIQSIM™ [12]		
IS-95	R&S®SMJ-K11	1403.9509.02
CDMA2000®	R&S®SMJ-K12	1403.9609.02
3GPP TDD	R&S®SMJ-K13	1403.9709.02
TD-SCDMA	R&S®SMJ-K14	1403.9809.02
User-Defined OFDM Signals (with R&S®WinIQSIM™ and R&S®WinIQOFDM)	R&S®SMJ-K15	1403.9909.02
1xEV-DO	R&S®SMJ-K17	1404.0005.02
IEEE 802.11 (a/b/g)	R&S®SMJ-K19	1404.0105.02
3GPP FDD incl. HSDPA	R&S®SMJ-K20	1404.0205.02
Digital standards using external PC software		
Bluetooth®	R&S®SMJ-K5	1404.1301.02
Pulse Sequencer	R&S®SMJ-K6	1409.2558.02
TETRA	R&S®SMJ-K8	1409.1716.02
Noise generation		
Additive White Gaussian Noise (AWGN)	R&S®SMJ-K62	1404.0805.02
Other options		
BER/BLER Measurement	R&S®SMJ-K80	1404.0905.02
XM RADIO Waveforms	R&S®SMJ-K256	1409.2606.02
Rear Connectors	R&S®SMJ-B81	1403.9309.02
Recommended extras		
Hardcopy manuals (in German)		1403.7458.31
Hardcopy manuals (in English, UK)		1403.7458.32
Hardcopy manuals (in English, USA)		1403.7458.39
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

[12] R&S®WinIQSIM2™ and R&S®WinIQSIM™ require 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®SMJ100A, including RF characteristics, analog modulation, I/Q modulation, and performance of the I/Q baseband generator. The functional specifications of the digital standards (R&S®SMJ-K40 to -K61 options) and the digital standards with external PC software (R&S®SMJ-K5, -K6, -K8 options) are described in the Digital Standards data sheet (PD 5213.9434.22). The digital standards with R&S®WinIQSIM2™ (R&S®SMJ-K240 to -K262 options) are described in the R&S®WinIQSIM2™ data sheet (PD 5213.7460.22), the digital standards with R&S®WinIQSIM™ (R&S®SMJ-K11 to -K20 options) in the R&S®WinIQSIM™ data sheet (PD 0758.0680.32).

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

For product brochure, see PD 5213.5074.12
and www.rohde-schwarz.com
(search term: SMJ100A)

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