Specifications

Version 03.00

November 2006

Vector Signal Generator R&S®SMATE200A

Specifications

ROHDE&SCHWARZ

CONTENTS

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", "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, the user is responsible for using 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.

Introduction

Based on the successful R&S®SMU200A platform, the R&S®SMATE200A is specifically designed for production environments. As such, the display and front panel user interface have been removed, the connectors moved to the rear, and performance has been optimized for fastest setting times to improve factory throughput. Like the R&S®SMU200A, however, the two-generators-in-one concept has been kept, occupying four height units – a plus for production where space is at a premium. All of this is available without compromising the excellent RF performance and baseband flexibility synonymous with the R&S®SMU200A.

Speaking of flexibility, the modular design concept of the R&S®SMATE200A means that the R&S®SMATE200A can easily be adapted to the needs of any application. Users have the choice of either 3 GHz or 6 GHz RF outputs in one or two paths and may opt for up to two completely independent baseband sources. As in the R&S®SMU200A, these sources may be used to produce complex signals in realtime or output preloaded waveforms from the internal arbitrary waveform generator.

In addition to its inherent speed, the R&S®SMATE200A also offers a special function to permit fast switching between different test signals. The multisegment waveform function allows users to easily combine waveforms, such as GSM and WCDMA, during test setup for even faster tests in production. This is just one of the R&S®SMATE200A's numerous adaptations to the special requirements of the production environment.

Key features

Designed for production

- Very short setting times for frequency and level (e.g. for frequency changes <1 ms over GPIB and <400 µs in List mode)
- Fast Hop mode offering flexibly addressable frequency/level pairs; as fast as normal List mode
- Multisegment waveform function enables fast switching between different test signals in waveform generator
- Special hardware triggers for basic functions
- Electronic CMOS-attenuator for entire frequency and level range
- Status LEDs on front, connectors on rear
- Revised cooling concept for longer life in production

Outstanding signal quality

- Very low SSB phase noise
  (typ. –135 dBc (1 Hz) at f = 1 GHz, 20 kHz offset; typ. –139 dBc (1 Hz) with the enhanced phase noise option)
- Wideband noise of typ. –153 dBc (>5 MHz carrier offset, f = 1 GHz, 1 Hz measurement bandwidth)
- High output power up to +19 dBm (PEP), typ. +26 dBm with high-power output option
- Very high level repeatability of typ. 0.05 dB
- I/Q modulator with 200 MHz RF bandwidth
- Excellent ACLR performance of typ. +71 dB with 3GPP FDD

Two signal generators in one

- Up to two completely independent signal generators in one unit
- Choice of 3 GHz or 6 GHz frequency options in one or two paths
- Up to two independent baseband sources that not only support realtime signal generation but also offer arbitrary waveform generation with up to 128 Msamples each

Connectivity

- Remote-controllable via LAN (Gigabit Ethernet), GPIB and USB
- User-definable triggers and markers combined in one SCSI connector
- USB connectors for keyboard, mouse and memory stick
- VGA connector for an external display

Frequency and enhancement options

Frequency options

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

R&S®SMATE-B103	100 kHz to 3 GHz
R&S®SMATE-B106	100 kHz to 6 GHz

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

R&S®SMATE-B203	100 kHz to 3 GHz
R&S®SMATE-B206	100 kHz to 6 GHz

Enhancement options

The following options can be installed in path A and B.

Low phase noise and FM/φM	
R&S®SMATE-B22	FM/φM and Low Phase Noise (can be installed in each RF path A or B)
High-power output	
R&S®SMATE-B31	High-Power Output (RF path A)
R&S®SMATE-B36	High-Power Output (RF path B)

Modulation

Possible modulation types

RF paths A and B

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

Simultaneous modulation

On the same RF path

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

	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	–	+	+	+	–	–	–	/

RF characteristics

Frequency

Range	underrange	100 kHz to <300 kHz
	R&S®SMATE-B103, R&S®SMATE-B203	up to 3 GHz
	R&S®SMATE-B106, R&S®SMATE-B206	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 option R&S®SMATE-B22	0.2 µHz
Setting time	to within $<1 \times 10^{-7}$ for f > 200 MHz or <124 Hz for f < 200 MHz, with GUI update stopped, no mouse and keyboard connected after IEC/IEEE bus delimiter	
	PLL FAST, ALC PRESET[1]	<1 ms, typ. 0.6 ms
	PLL NORMAL, ALC ON	<2 ms, typ. 1 ms
	PLL NORMAL, ALC OFF MODE S&H	<4 ms, typ. 2 ms
	after trigger pulse in List mode/Fast Hop mode	<400 µs, typ. 300 µs
Phase offset		adjustable in 0.1° steps

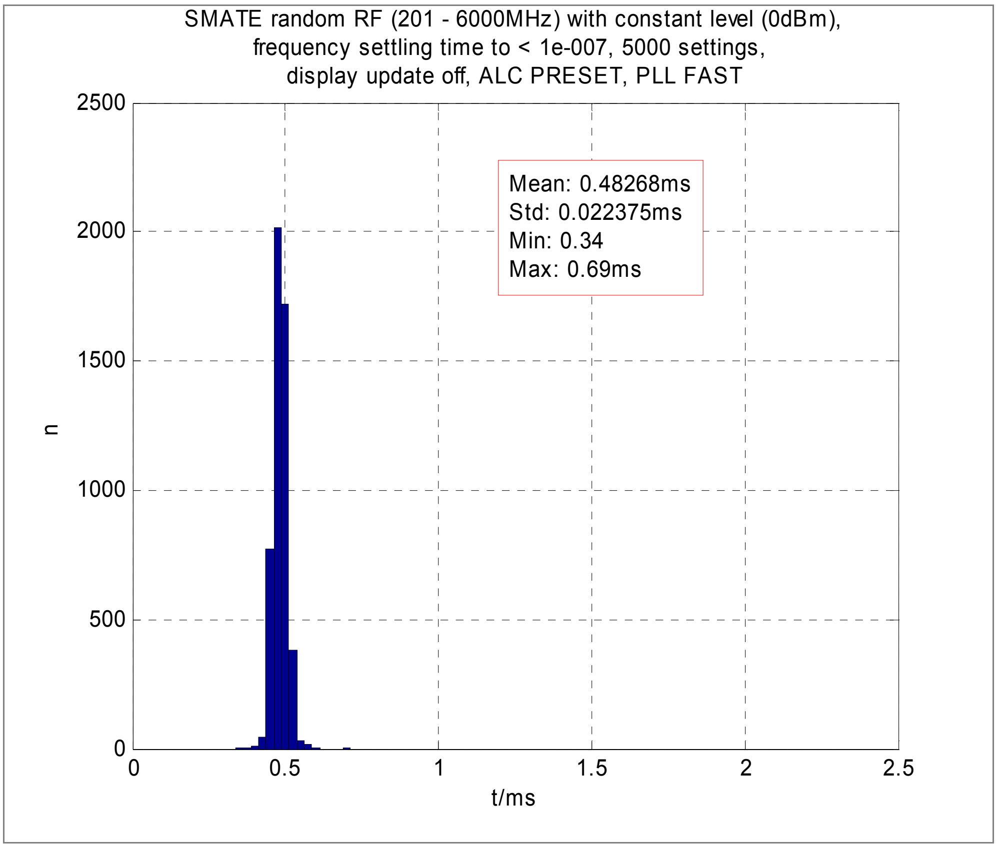
Frequency sweep

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

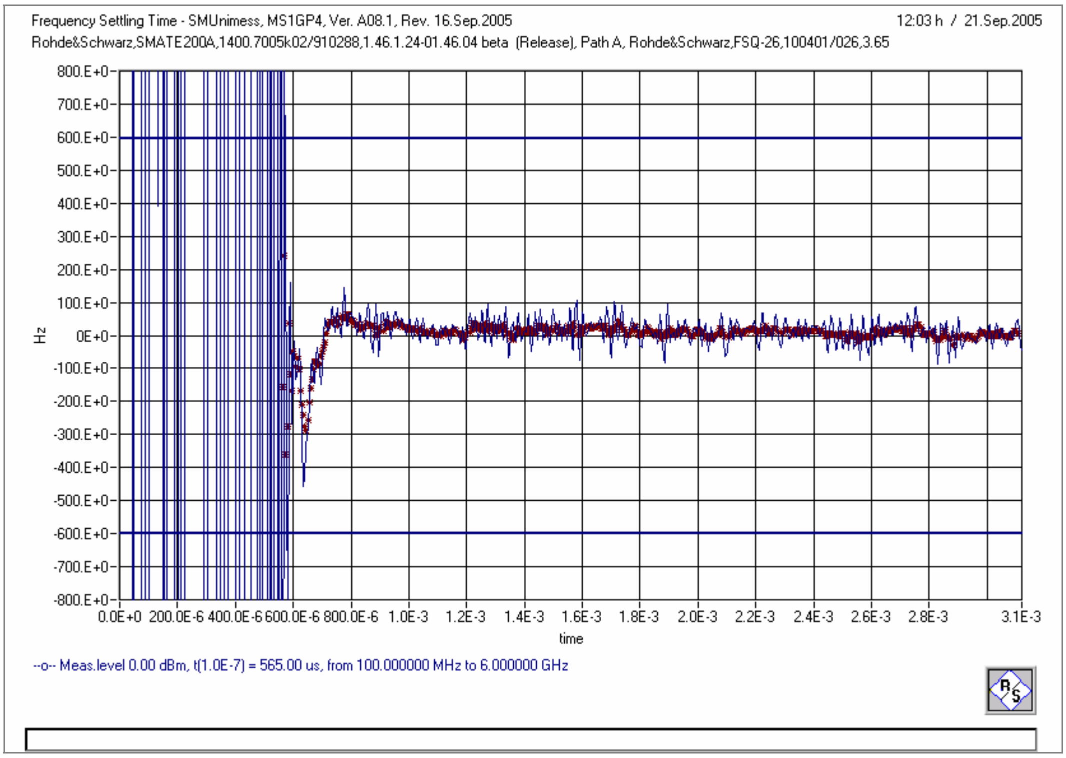
Reference frequency

Aging	after 30 days of uninterrupted operation	$<1 \times 10^{-9}$/day, $<1 \times 10^{-7}$/year
	with option R&S®SMATE-B22	$<5 \times 10^{-10}$/day, $<3 \times 10^{-8}$/year
Temperature effect	in operating temperature range	$<6 \times 10^{-8}$
	with option R&S®SMATE-B22	$<6 \times 10^{-9}$
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 option R&S®SMATE-B22	typ. 4×10^{-9}/V to 1.2×10^{-8}/V
	input voltage	–10 V to +10 V
	input impedance	10 kΩ

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



Frequency settling time statistics for remote control, after IEC bus delimiter



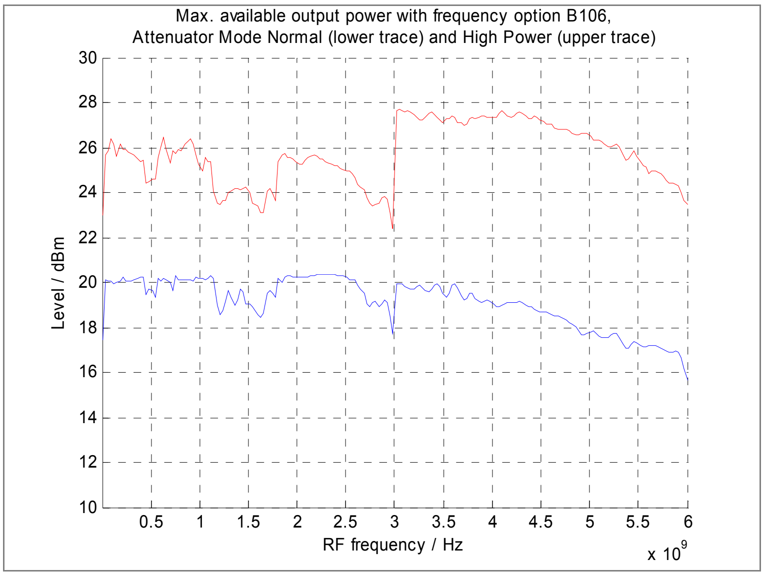
Frequency setting time, PLL FAST, ALC PRESET, after IEC bus delimiter

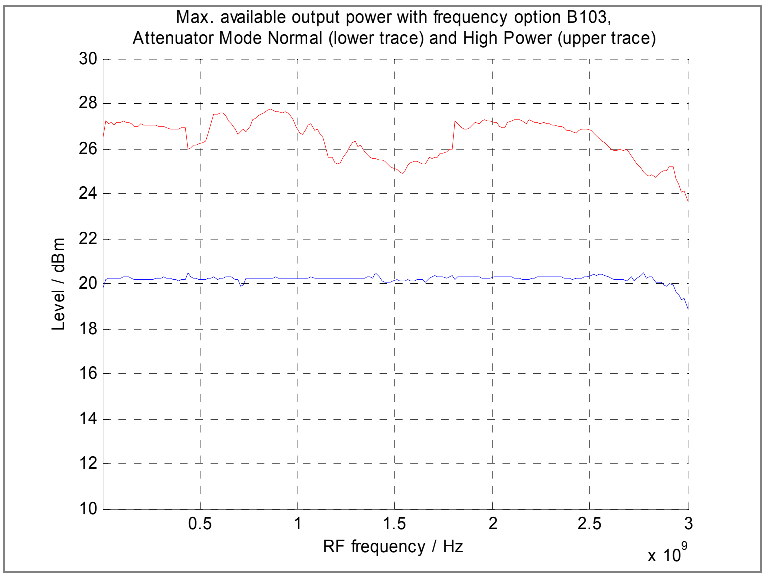
Level

Setting range	standard	–145 dBm to +20 dBm
	with option R&S®SMATE-B31 or R&S®SMATE-B36	to +30 dBm
Maximum level	standard	
	f ≤ 3 GHz	+13 dBm (PEP)[2]
	f > 3 GHz	+11 dBm (PEP)
	with option R&S®SMATE-B31 or R&S®SMATE-B36	
	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 +33 °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, standard	
	f ≤ 3 GHz	<1.6, typ. <1.4
	f > 3 GHz	<1.85, typ. <1.6
	ALC state ON, with options R&S®SMATE-B31 or R&S®SMATE-B36	
	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	after IEC/IEEE bus delimiter, with GUI update stopped, no mouse and keyboard connected, temperature range +18 °C to +33 °C	
	to <0.1 dB deviation from final value	
	PLL FAST, ALC PRESET[3]	<1 ms, typ. 0.6 ms
	PLL NORMAL, ALC ON	<2 ms, typ. 1.1 ms
	PLL NORMAL, ALC OFF	<4 ms, typ. 2.5 ms
	after trigger in List mode/Fast Hop mode	
	to <0.3 dB deviation from final value	<450 µs , typ. 300 µs
	to <0.1 dB deviation from final value	<800 µs , typ. 400 µs
	range switch-over with option R&S®SMATE-B31 or R&S®SMATE-B36	<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 of RF path for f > 1 MHz	
	1 MHz < f ≤ 3 GHz	50 W
	3 GHz < f ≤ 6 GHz	10 W
	maximum permissible DC voltage	50 V

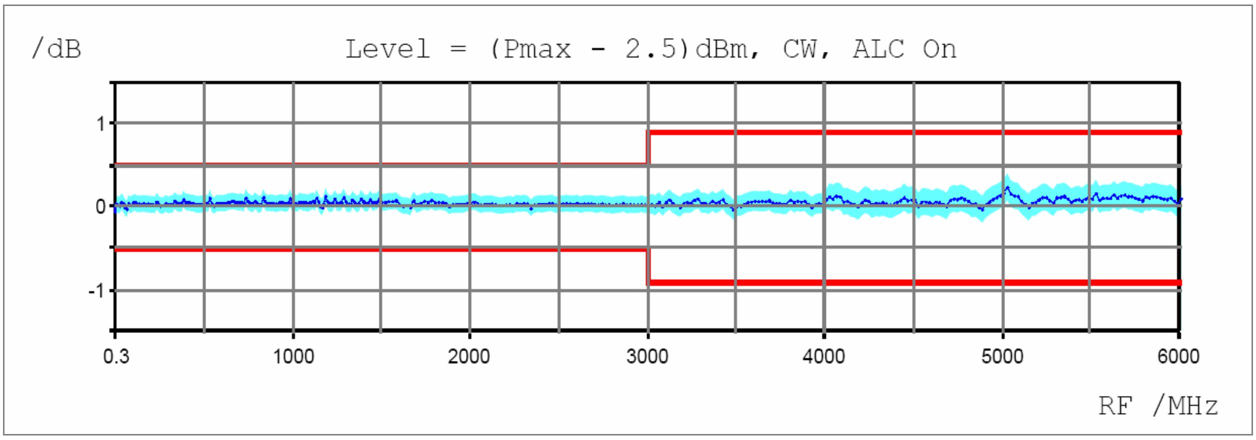
[2] PEP = peak envelope power.

[3] Value applies after 1 hour warm-up and internal level adjustment for 4 hours of operation and temperature variation of less than +5 °C.

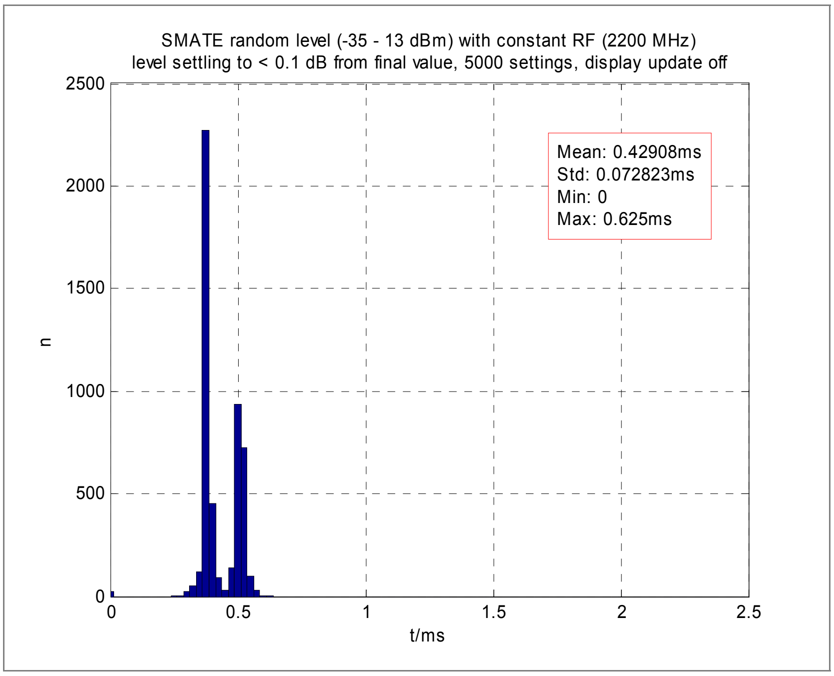




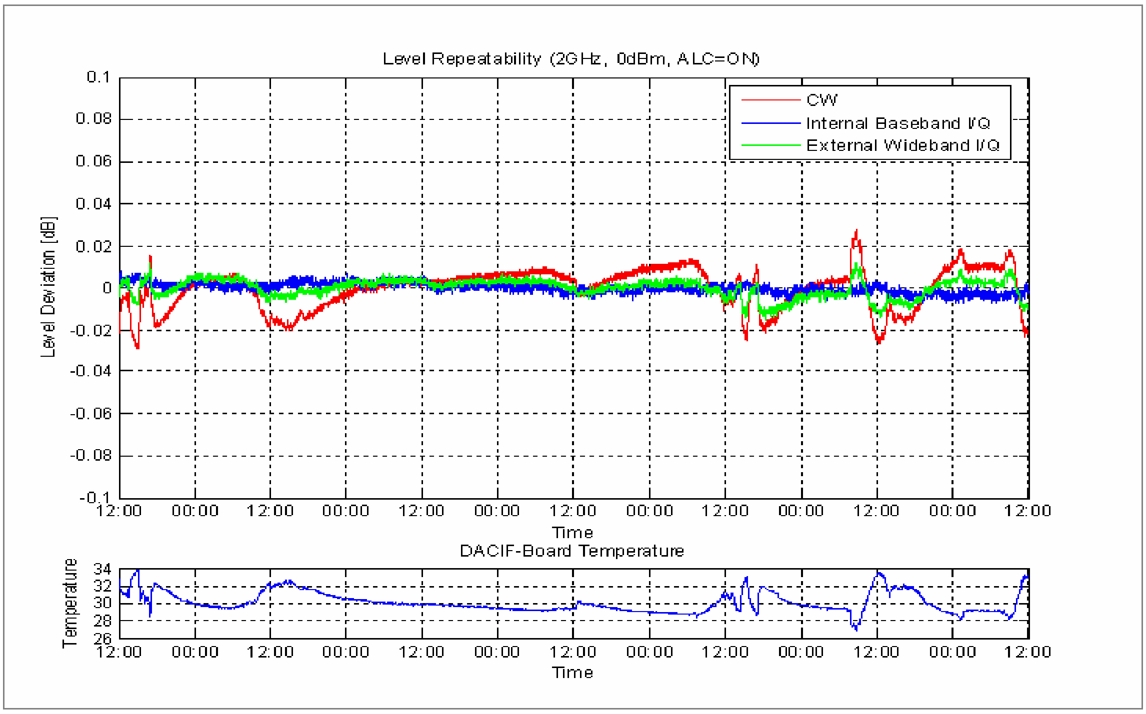
Measured maximum available output level versus frequency



Measured level versus frequency at 0 dBm



Level setting time statistics for remote control, after IEC bus delimiter



Level repeatability with random settings between measurements, modulation 3GPP test model 1, 64 channels

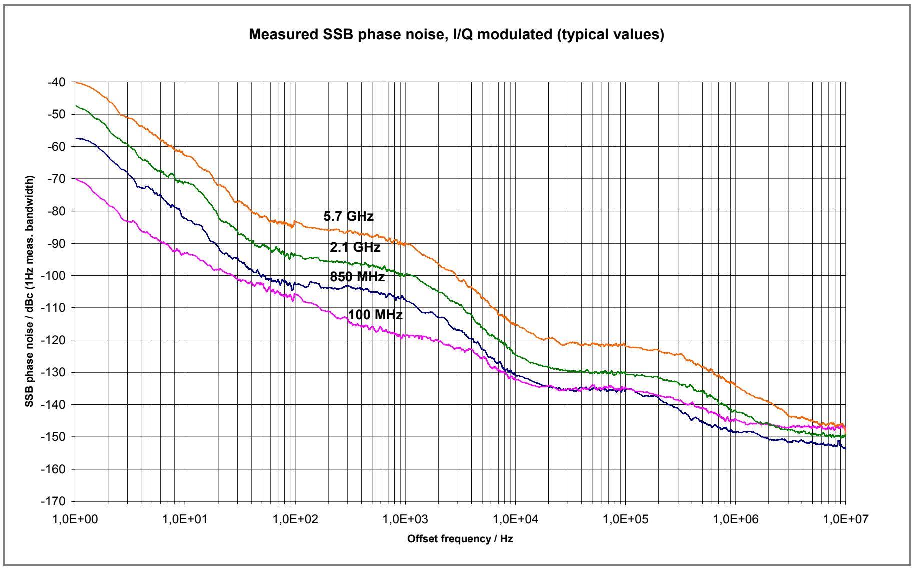
Level sweep

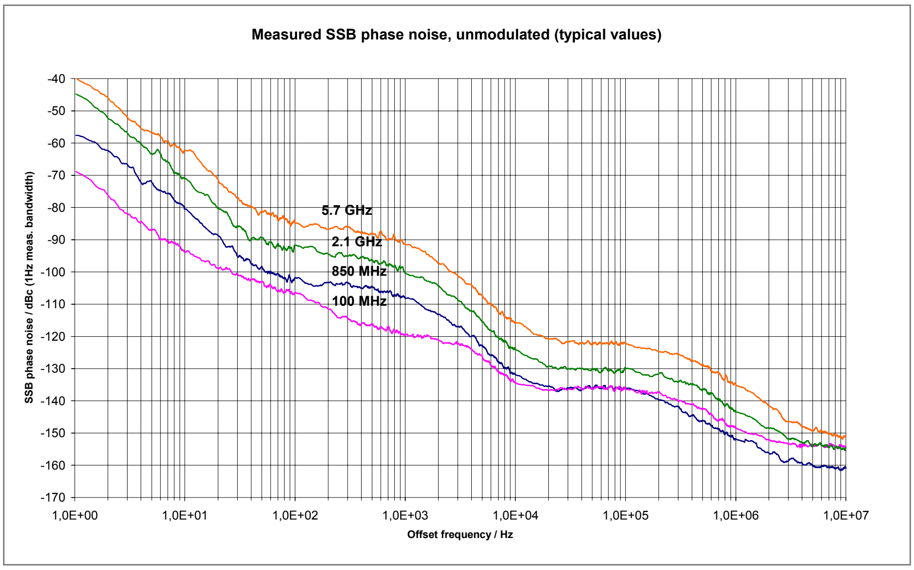
Operating modes	digital sweep in discrete steps	auto, single, step, extern single, extern step manual or external trigger
Sweep range		level range of attenuator modes "normal" or "high power"
Step width	logarithmic	0.1 dB to 20 dB per step
Dwell time	range	10 ms to 10 s
	resolution	0.1 ms

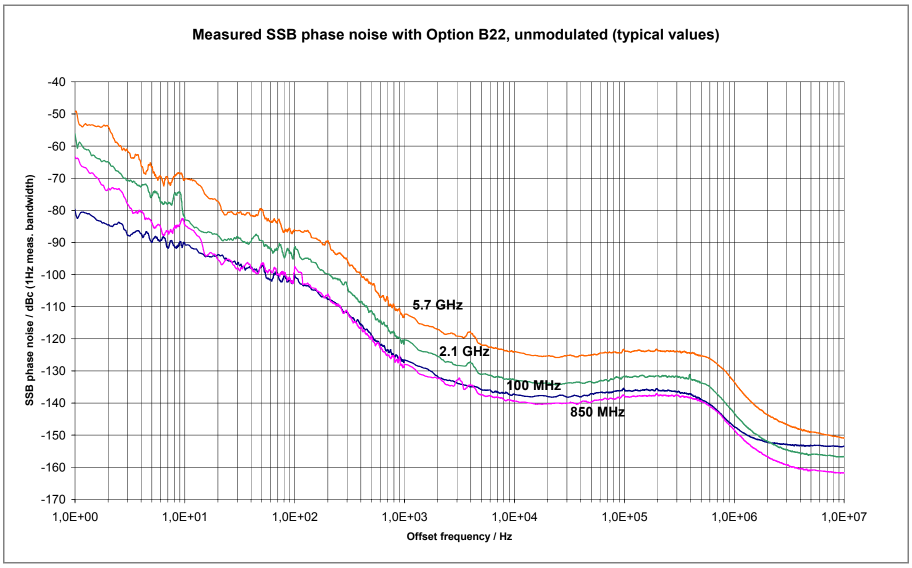
Spectral purity

Harmonics	standard, unmodulated	
	level <8 dBm	<–30 dBc
	level <13 dBm	typ.<–30 dBc
	with options R&S®SMATE-B31or R&S®SMATE-B36A, unmodulated, 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 option R&S®SMATE-B22	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 the carrier	<–70 dBc
Subharmonics	1.5 GHz < f ≤ 3 GHz	<–74 dBc
	3 GHz < f ≤ 6 GHz	<–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, unmodulated	
	PLL mode NORMAL	
	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
	PLL mode FAST	
	20 MHz ≤ f ≤ 200 MHz	<–127 dBc, typ. –131 dBc
	f = 1 GHz	<–130 dBc, typ. –134 dBc
	f = 2 GHz	<–124 dBc, typ. –128 dBc
	f = 3 GHz	<–120 dBc, typ. –124 dBc
	f = 4 GHz	<–118 dBc, typ. –122 dBc
	f = 6 GHz	<–114 dBc, typ. –118 dBc
SSB phase noise with option R&S®SMATE-B22	carrier offset 20 kHz, measurement bandwidth 1 Hz	
	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)
5.7 GHz
2.1 GHz
850 MHz
100 MHz
SSB phase noise / dBc (1Hz meas. bandwidth)
Offset frequency / Hz


Measured SSB phase noise, unmodulated (typical values)
5.7 GHz
2.1 GHz
850 MHz
100 MHz
SSB phase noise / dBc (1Hz meas. bandwidth)
Offset frequency / Hz


Measured SSB phase noise with Option B22, unmodulated (typical values)
5.7 GHz
2.1 GHz
100 MHz
850 MHz
SSB phase noise / dBc (1Hz meas. bandwidth)
Offset frequency / Hz

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 20 s
Resolution		0.1 ms
Setting time	after external trigger	see frequency and level data
	additional trigger delay in two-path units, both operated in List mode/Fast Hop mode	<200 µs

Hardware I/O

Hardware control lines for direct and fast access to instrument functions		
OPC A/B Output for operation complete signal of path A/B	level	LVTTL
	response time	typ. 10 µs
RF OFF A/B Input for fast switching of RF output A/B	level	LVTTL
	response time	typ. 10 µs

Analog modulation

The R&S®SMATE200A has two EXT MOD inputs for independent analog modulation of both RF paths.

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 extern trigger, spacing linear or logarithmic
	sweep range	full frequency range
	step width linear	full frequency range
	step width logarithmic	0.01 % to 100 % per step

Input for external modulation signals

Modulation input EXT MOD A/B	input impedance	high (>100 kΩ), switchable to 50 Ω with option R&S®SMATE-B22
	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	mode AC, 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 (option R&S®SMATE-B22)

Operating modes		internal, external, internal + external, AC/DC, "Normal", "Low Noise"
FM/φM range multiplier	f ≤ 200 MHz	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	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 max.	
	internal	<(1.5 % of reading + 20 Hz)
	external	<(2.0 % of reading + 20 Hz)
Synchronous AM	40 kHz deviation, f_{mod} = 1 kHz, f > 5 MHz	<0.1 %
	f > 3 GHz	<0.2 %
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 (option R&S®SMATE-B22)

Operating mode		internal, external, internal + external, AC/DC, "High Bandwidth, "High Deviation", "Low Noise"
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 x 20 µrad
	φM mode "Low Noise"	<200 ppm, min. rm × 20 µrad
Setting uncertainty	f_{mod} = 10 kHz, deviation ≤ half of max.	
	internal	<(1.5 % of reading + 0.01 rad)
	external	<(2.0 % of reading + 0.01 rad)
φM distortion	f_{mod} = 10 kHz, half of max. 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

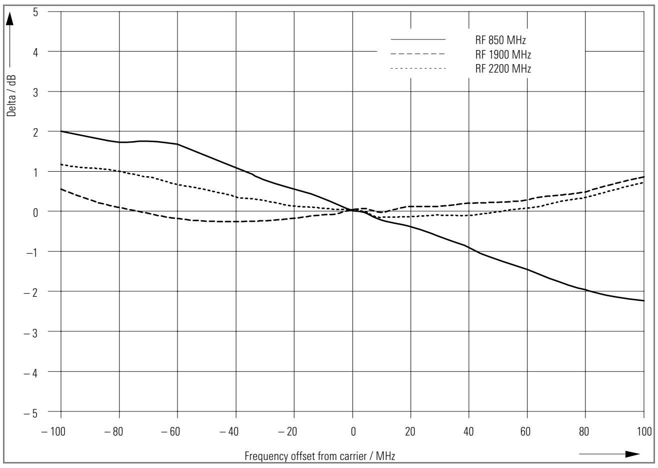
Operating modes		external wideband I/Q, internal baseband I/Q
I/Q impairments	I offset, Q offset	
	setting range	–10 % to +10 %
	resolution	0.01 %
	gain imbalance	
	setting range	–1.0 to +1.0 dB
	resolution	0.001 dB
	quadrature offset	
	setting range	–10° to +10°
	resolution	0.01°
I/Q swap	I and Q signals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

External wideband I/Q

The R&S®SMATE200A has two I/Q inputs for independent I/Q modulation of both RF paths.

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	IQ wideband on	100 MHz
RF frequency response for entire instrument in modulation bandwidth	IQ 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, filter root cosine, 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)

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



Measured frequency response of external wideband I/Q modulation

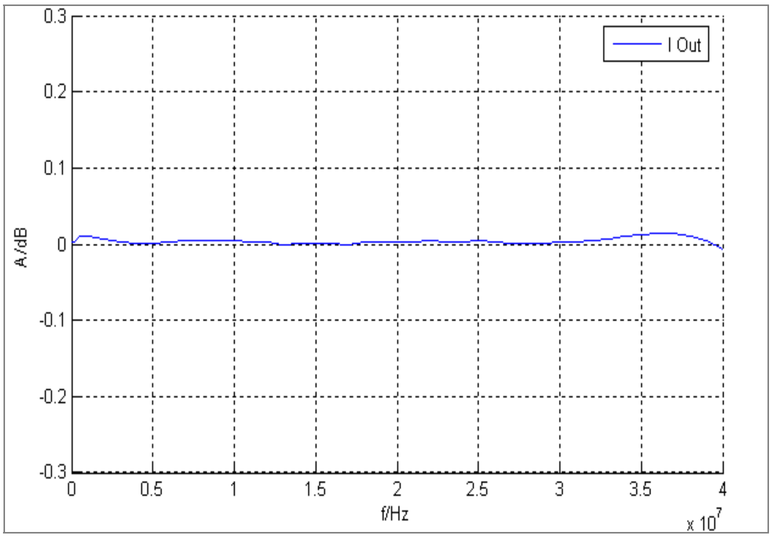
Internal baseband I/Q (with option R&S®SMATE-B13)

The R&S®SMATE-B13 converts the internal digital baseband signals of the R&S®SMATE-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®SMATE-B13 can be installed. The first R&S®SMATE-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 ≠ 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	>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 relating to CW	measured at 0 dBm with 16QAM, filter root cosine, α = 0.5, symbol rate 10 kHz	<0.2 dB

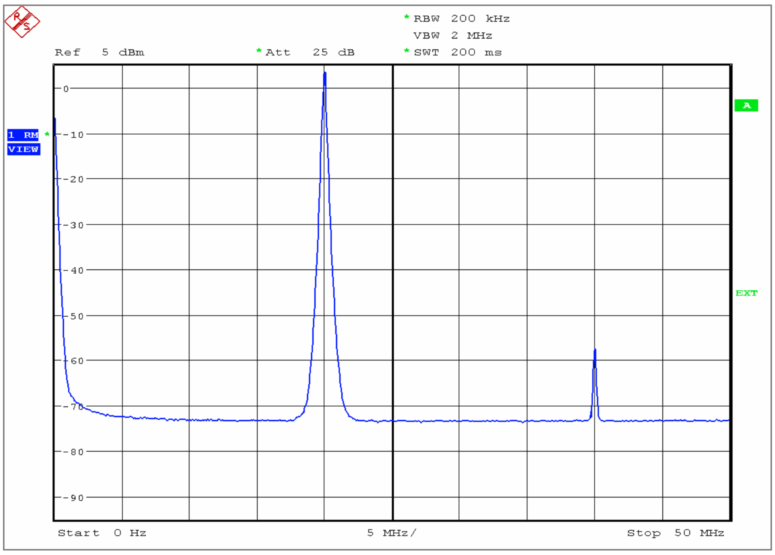
[5] Value applies after 1 hour warm-up and recalibration for 4 hours operation and temperature variations of less than +5 °C.

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	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



Frequency response of I/Q outputs

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



SFDR of I/Q outputs

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

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

Additional specifications for I/Q outputs with option R&S®SMATE-B16		
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 (maximum voltage depends on output voltage)	–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.

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

At least one Baseband Main Module R&S®SMATE-B13 must be installed. One or two R&S®SMATE-B9/-B10/-B11 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added in the digital domain.

Waveform memory	output memory	
	waveform length R&S®SMATE-B9	128 sample to 128 Msample in one-sample steps
	waveform length R&S®SMATE-B10	128 sample to 64 Msample in one-sample steps
	waveform length R&S®SMATE-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
	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
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 still apply.	
	range	–40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency uncertainty	<5 × 10 – 10 × 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®WinIQSIM™: As of version 4.10, the software supports download of I/Q data and control of the R&S®SMATE-B10/-B11.		

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

At least one Baseband Main Module R&S®SMATE-B13 must be installed. One or two R&S®SMATE-B9/-B10/-B11 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added.

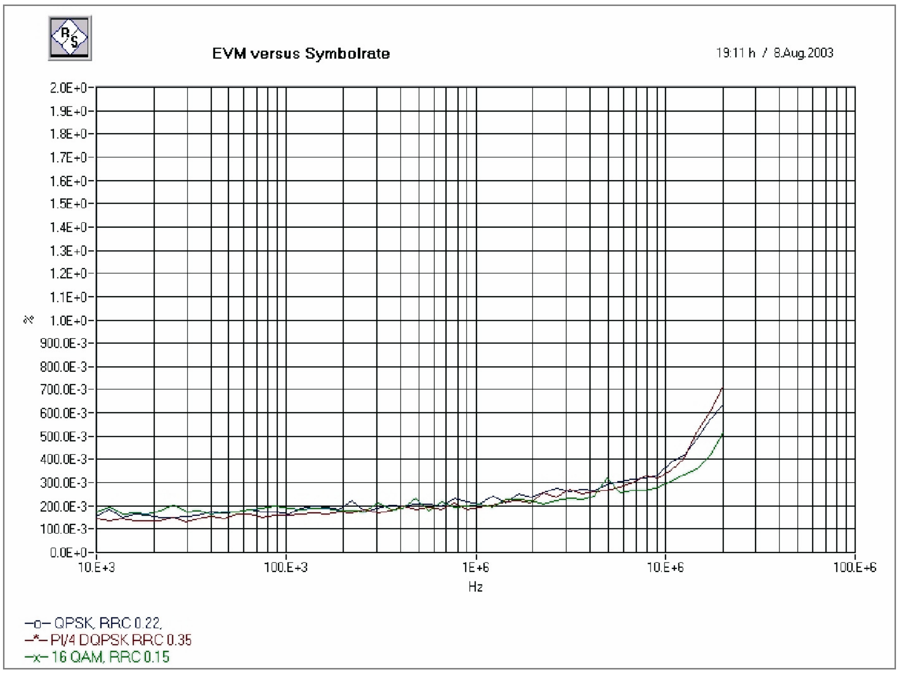
Types of modulation	ASK	
	modulation index	0 % to 100 %
	resolution	0.1 %
	FSK	2FSK, 4FSK, MSK
	deviation	0.1 to 1.5 × f_{sym}
	maximum	10 MHz
	resolution	<0.1 Hz
	setting uncertainty	<0.5 %
	variable FSK	4FSK, 8FSK, 16FSK
	deviations	–1.5 × f_{sym} to +1.5 × f_{sym}
	maximum	10 MHz
	resolution	<0.1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

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

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 × 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	8 bit to 2 Gbit
	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	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 to 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 %

[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.



Typical EVM versus symbol rate

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/ 1850 to 2000	1880 to 1990	380 to 480	824 to 894/ 1850 to 2000	810 to 956/ 1429 to 1501	2400 to 2485/ 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[10]	–80	–82	–64 at 20 MHz
In 2nd alternate channel	–85	–85	–	–95[16]	–	–	–	–	–66 at 30 MHz

[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.

Digital modulation systems

At least one I/Q baseband generator (option R&S®SMATE-B9/-B10/-B11) 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®SMATE-K40). If only one R&S®SMATE-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.

The data specified 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.

Digital standard GSM/EDGE (option R&S®SMATE-K40)

Digital standard GSM/EDGE		in line with GSM standard
Frequency range	frequency bands in line with GSM 05.05 in uplink and downlink	GSM 450 GSM 480 GSM 850 GSM 900 (P-GSM, E-GSM, R-GSM) DCS 1800 PCS 1900
	range	as R&S®SMATE200A
Modes	unframed	generation of a signal without slot and frame structure and power ramping, with symbol rate and filtering to GSM standard; MSK or 8PSK EDGE modulation can be selected
	framed (single)	configuration of a signal via frame structure (see frame structure below)
	framed (double) application: simulation of modulation change in a slot versus time	configuration of simple multiframe scenarios by combining two frames (frame structure see below); a repetition factor can be specified for each of the two frames
Modulation		MSK, switchable to FSK with settable deviation for simulating frequency deviation errors 8PSK EDGE
Symbol rate	standard	270.833 kHz
	range	400 Hz to 300 kHz
Baseband filter	GSM, standard	Gaussian with B × T = 0.3
	range	B × T = 0.15 to 2.5
	EDGE, standard	Gaussian linearized (EDGE)
Frame structure	Change between GSM and EDGE possible from slot to slot and frame to frame; half rate and GPRS at the physical layer. Slots 0 to 7 of the frames are user-defined for uplink and downlink. In the normal burst half-rate mode, the burst parameters can be defined independently for two users which alternate from frame to frame.	
	burst types	normal (full rate) normal (half rate) EDGE synchronization frequency correction (normal + compact) dummy access all data (GSM) all data (EDGE)
Burst rise/fall time	standard	in line with GSM power time template
	selectable	
	ramp time	0.3 symbol to 4 symbol
	ramp delay	–1.0 symbol to 1.0 symbol
	rise delay	–9 symbol to 9 symbol
	fall delay	–9 symbol to 9 symbol

Settable slot attenuation		0.0 dB to 60.0 dB, 8 different levels simultaneously possible (full level and 7 attenuated levels)
Burst on/off ratio		>100 dB
Data sources	For characteristics of data sources, see section I/Q baseband generator (option R&S®SMATE-B9/-B10/-B11) – realtime operation	
	internal data sources	
Training sequence	for normal burst (full rate), normal burst (half rate), EDGE burst	TSC0 to TSC7 user TSC
	for sync burst	standard CTS compact user
	for access burst	TS0 to TS2
Triggering		see I/Q baseband generator
Markers		convenient graphics editor for defining marker signals, and in addition: frame, multiple frame slot, multiple slot pulse pattern on/off ratio
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 options R&S®SMATE-B31, R&S®SMATE-B36 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

Digital standard 3GPP FDD (option R&S®SMATE-K42)

Digital standard WCDMA 3GPP FDD		in line with 3GPP standard, release 5
Frequency range	frequency bands in line with 3GPP TS 25.101 in uplink and downlink	UTRA FDD frequency bands I to III
	range	as R&S®SMATE200A
Signal generation modes/sequence length	Combination of realtime operation (enhanced channels) and arbitrary waveform mode. In downlink mode, the P-CCPCH (BCCH with running SFN) and up to three DPCHs can be generated in realtime. All other channels (frame-cycle control channels such as SCH, OCNS simulation, other base stations, etc) can be added via the ARB. In uplink mode, one mobile station can be simulated in realtime (PRACH, PCPCH or DPCCH and up to 6 DPDCHs); further mobile stations (three user-configured and up to 64 of identical mode) can be simulated via the ARB and added to the realtime signal. The sequence length of the ARB component can be entered in frames (10 ms each); the max. length depends on chip rate, mode and in some cases on oversampling.	
Enhanced channels	special capabilities in up to 4 channels of base station 1 on downlink and in all channels of mobile station 1 on uplink: realtime calculation, optional channel coding, simulation of bit and block errors, data lists as sources for data and TPC fields	
Modulation		BPSK (uplink)
		QPSK (downlink)
		16QAM (downlink HSDPA)
Test models	downlink (in line with TS 25.141)	test model 1 with 16/32/64 channels
		test model 2
		test model 3 with 16/32 channels
		test model 4
		test model 5 with 8/4/2 HS-PDSCH channels
	uplink (not standardized)	DPCCH + 1 DPDCH at 60 ksps
		DPCCH + 1 DPDCH at 960 ksps
Test case wizard		shortcut in line with TS 25.141 test cases
Generate waveform file		filtering of data generated in ARB mode and saving as waveform file
Realtime component		
WCDMA signal in realtime	generation of WCDMA signals with up to 4 active enhanced channels	
Applications	continuous measurement of BER and BLER (with channel coding) in a code channel with any (PN) data without wrap-around problems use of user data (data lists) with externally processed long data sequences for enhanced channels	
Data lists for data and TPC field	The data fields and the transmit power control (TPC) field of the slots of enhanced channels can be filled from data lists. Externally generated data can thus be fed into the signal generation process of the R&S®SMATE200A, e.g. with payload information from higher layers, on transport or physical layer. Long power control profiles for power control of the DUT can also be generated.	
Applications	measurement of power control steps of a mobile station (UE power control steps)	
	measurement of maximum output power of a mobile station (UE max. output power)	

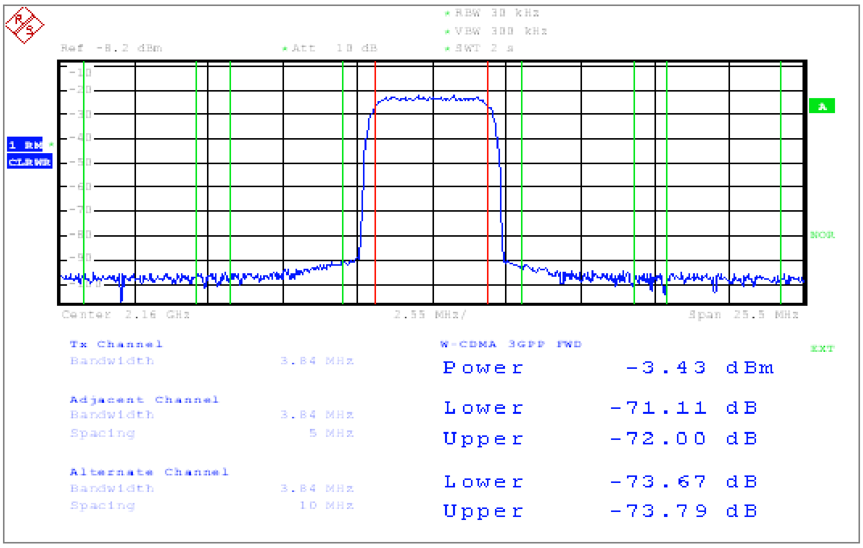
Channel coding	coding of up to 4 enhanced channels in line with the definition of reference measurement channels in TS 25.101, TS 25.104 and TS 25.141; in addition, user-configurable channel coding for each enhanced channel station.	
	predefined channel coding schemes for uplink and downlink	RMC 12.2 kbps
		AMR 12.2 kbps
		RMC 64 kbps
		RMC 144 kbps
		RMC 384 kbps
	possible settings of user-configurable channel coding	
	transport channels	1 DCCH up to 6 DTCHs
	transport block size	1 to 4096
	transport blocks	1 to 16
	rate matching attribute	16 to 1024
	transport time interval	10 ms, 20 ms, 40 ms, 80 ms
	CRC size	none, 8, 12, 16, 24
	error protection	none, convolutional coding rate 1/3, convolutional coding rate 1/2, turbo coding rate 1/3
	interleaver 1/2 state	on, off
Applications	BER measurements in line with TS 25.101/104/141 (radio transmission and reception), e.g. adjacent channel selectivity blocking characteristics intermodulation characteristics	
	BLER measurements in line with TS 25.101/104 (radio transmission and reception), e.g. demodulation of dedicated channel under static propagation conditions (AWGN generation together with R&S®SMATE-K62) test of decoder in receiver	
Bit error insertion	deliberate generation of bit errors by impairing the data stream prior to channel coding or at the physical layer	
	bit error ratio	0.5 to 10^{-7}
Application	verification of internal BER calculation in line with TS 25.141 (BS conformance testing)	
Block error insertion	deliberate generation of block errors by impairing the CRC during coding of enhanced channels	
	block error ratio	0.5 to 10^{-4}
Application	verification of internal BLER calculation in line with TS 25.141 (BS conformance testing)	
Add OCNS	Simulation of orthogonal background and interfering channels of a base station in line with TS 25.101. The power of the OCNS channels is configured automatically so that the total power of the BS is 1.	
Applications	testing the receiver of the mobile station under real conditions; measuring the maximum input level to TS 25.101	
Additional mobile stations	simulation of up to 64 mobile stations in addition to the 4 user-configurable mobile stations; the additional mobile stations use different scrambling codes.	
Parameters	number of additional mobile stations	1 to 50
	scrambling code step	1 to 1000 hex
	power offset	–20 dB to 20 dB
Applications	base station tests under real receive conditions	

General settings		
Triggering		see I/Q baseband generator
Chip rate	standard	3.840 Mcps (15 slots/frame)
	range	1 Mcps to 5 Mcps
Link direction		uplink (reverse link) and downlink (forward link)
Baseband filter	standard	$\sqrt{\cos}$, α = 0.22
	other filters	$\sqrt{\cos}$, cos, user filters
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor.	
	modes	vector |i + j q|
		scalar |i|, |q|
	clipping level	1 % to 100 %
Code channels	downlink	up to 512 data channels (plus special channels) divided among up to 4 base stations (BS) of 128 code channels each
	uplink	up to four user-configurable mobile stations (MS) and 64 additional MS of identical configuration in each of the modes PRACH only, PCPCH only, DPCCH + DPDCHs
Parameters of every BS		
State		ON/OFF
Scrambling code		0 to 5FFF hex
2nd search code group		0 to 63
Page indicators per frame		18, 36, 72, 144
Time delay	The signals of the various base stations are delayed against each other.	0 chips to 38400 chips
Transmit diversity	The output signal can be generated either for antenna 1 or 2, as defined in the standard.	OFF/Antenna 1/Antenna 2
Physical channels in downlink		
	primary common pilot channel (P-CPICH)	
	secondary common pilot channel (S-CPICH)	
	primary sync channel (P-SCH)	
	secondary sync channel (S-SCH)	
	primary common control physical channel (P-CCPCH)	
	secondary common control physical channel (S-CCPCH)	
	page indication channel (PICH)	
	access preamble acquisition indication channel (AP-AICH)	
	collision detection acquisition indication channel (AICH)	
	physical downlink shared channel (PDSCH)	
	dedicated physical control channel (DL-DPCCH)	
	dedicated physical channel (DPCH)	
	high-speed shared control channel (HS-SCCH)	
	high-speed physical downlink shared channel (HS-PDSCH)	
	modulation QPSK or 19QAM	

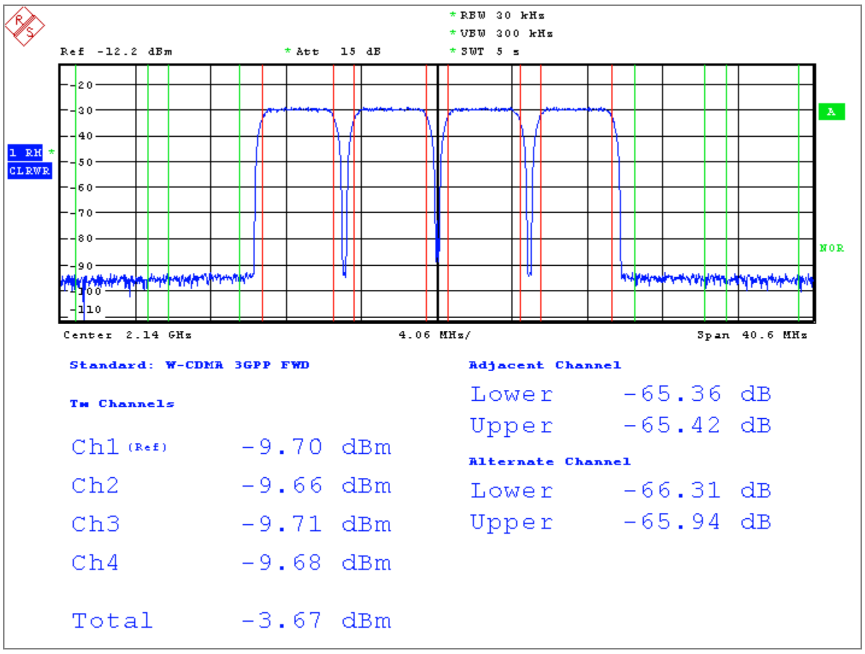
Parameters of every downlink code channel that can be set independently		
State		ON/OFF
Slot format	depending on physical channel type	0 to 16
Symbol rate	depending on physical channel type	7.5 ksps to 960 ksps
Channelization code	value range depending on physical channel type and symbol rate	0 to 511
Power		–80 dB to 0 dB
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 bit to 64 bit) data lists
Multicode state		ON/OFF
Timing offset	time offset that can be separately set for each code channel	0 to 150 (in units of 256 chips)
Pilot length	depending on symbol rate	2 bit, 4 bit, 8 bit, 16 bit
Pilot power offset	power offset of pilot field against data fields	–10 dB to 10 dB
TPC pattern		All 0, All 1, pattern (length 1 bit to 32 bit), data lists
TPC pattern readout mode	application mode for TPC pattern	continuous, single + All 0, single + All 1, single + alt. 01, single + alt. 10
Use of TPC for dynamic output power control	If this function is active, the TPC pattern is used to vary the transmit power of the code channels versus time.	
	state	ON/OFF
	output power control step	–10 dB to +10 dB
TPC power offset	power offset of TPC field relative to data fields	–10 to +10 dB
TFCI state		ON/OFF
TFCI		0 dB to 1023 dB
TFCI power offset	power offset of TFCI field relative to data fields	–10 dB to +10 dB
Parameters of every MS		
State		ON/OFF
Mode		PRACH only, PCPCH only, DPCCH + DPDCHs
Scrambling code		0 to FF FFFF hex
Scrambling code mode		long, short
Time delay	The signals of the various mobile stations are delayed against each other.	0 chips to 38400 chips
Physical channels in uplink		
	physical random access channel (PRACH)	
	physical common packet channel (PCPCH)	
	dedicated physical control channel (DPCCH)	
	dedicated physical data channel (DPDCH)	

PRACH Only mode		
Sub modes	Preamble only: Only preambles are generated. Application: detection of RACH preamble in line with TS 25.141.	
	Standard: The message part of the PRACH is generated in addition to a settable number of preambles. It can also be channel-coded. Application: Demodulation of RACH message part in line with TS 25.141.	
Frame structure		preamble(s), message part consisting of data and control component
Slot format		0 to 3
Symbol rate		15 ksps, 30 ksps, 60 ksps, 120 ksps
Preamble part power		–80 dB to 0 dB
Preamble power step		0 dB to 10 dB
Preamble repetition		1 to 10
Data part power		–80 dB to 0 dB
Control part power		–80 dB to 0 dB
Signature		0 to 15
Access slot		0 to 14
AICH transmisson timing		0 (3 access slots) or 1 (4 access slots)
Message part length		1, 2 frames
TFCI		0 to 1023
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 to 64 bit), data lists
Channel coding	reference measurement channel for UL RACH in line with TS 25.141	
	state	ON/OFF
	transport block size	168, 360
PCPCH Only mode		
Sub modes	Preamble only: Only preambles are generated. Application: Detection of CPCH preamble in line with TS 25.141.	
	Standard: The message part of the PCPCH is generated in addition to a settable number of preambles. It can also be channel-coded. Application: Demodulation of CPCH message part in line with TS 25.141.	
Frame structure		access preamble(s), collision detection preamble, power control preamble, message part consisting of data and control component
Slot format control part		0 to 2
Symbol rate		15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps
Preamble part power		–80 dB to 0 dB
Preamble power step		0 dB to 10 dB
Preamble repetition		1 to 10
Data part power		–80 dB to 0 dB
Control part power		–80 dB to 0 dB
Signature		0 to 15
Access slot		0 to 14
AICH transmisson timing		0 (3 access slots) or 1 (4 access slots)
Message part length		1 to 10 frames
Power control preamble length		0, 8 slots
FBI state		OFF/1 bit/2 bit
FBI pattern		pattern (length 1 bit to 32 bit)

Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 to 64 bit) data lists
Channel coding	reference measurement channel for UL CPCH in line with TS 25.141	
	state	ON/OFF
	transport block size	168, 360
DPCCH + DPDCH Only mode		
DPCCH (dedicated physical control channel)	symbol rate	15 ksps
	power	–80 dB to 0 dB
	channelization code	0, fixed
	FBI state	OFF/1 bit/2 bit
	FBI pattern	pattern (length 1 bit to 32 bit)
	TFCI state	OFF/ON
	TFCI	0 to 1023
	TPC pattern	All 0, All 1, pattern (length 1 bit to 32 bit), data lists
	TPC pattern readout mode (application mode for TPC pattern)	continuous, single + All 1, single + All 1, single + alt. 01, single + alt. 10
	use TPC for dynamic output power control (If this function is active, the TPC pattern is used to vary the transmit power of the code channels of the MS versus time.)	
	state	OFF/ON
	output power control step	–10 dB to +10 dB
DPDCH (dedicated physical data channel)	Overall symbol rate (total symbol rate of all uplink DPDCHs)	15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps, 2 × 960 ksps, 3 × 960 ksps, 4 × 960 ksps, 5 × 960 ksps, 6 × 960 ksps
	depending on overall symbol rate:	
	active DPDCHs	1 to 6
	symbol rate	fixed for active DPDCHs
	channelization code	fixed for active DPDCHs
	channel power	–80 dB to 0 dB
	payload data	PRBS: 9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 bit to 64 bit) data lists
Graphical display		domain conflicts, code domain, channel graph, slot structure and formats offered in graphics block
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	
	≤16.5 dBm PEP with options R&S®SMATE-B31, R&S®SMATE-B36	
	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)

3GPP FDD enhanced BS/MS test including HSDPA (option R&S®SMATE-K43)

At least one R&S®SMATE-K42 option must be installed.

General parameters	This option extends the R&S®SMATE-K42 (digital standard 3GPP FDD) to full HSDPA support and dynamic power control. Therefore, all general parameters of the R&S®SMATE-K42 such as frequency range or modulation are also valid for the R&S®SMATE-K43.	
Downlink simulation		
HSDPA channels (HS-SCCH, HS-PDSCH and F-DPCH)		
Enhancements	The R&S®SMATE-K42 supports simulation of HDSPA channels in a continuous mode needed for TX measurements in line with TS 25.141 (test model 5). The R&S®SMATE-K43 now supports simulation of HS-SCCH (high speed shared control channel) and HS-PDSCH (high speed physical downlink shared channel) in line with TS 25.211. This implies the correct timing between these channels as well as the possibility to set start subframe and inter-TTI distance. In addition, several F-DPCHs (Fractional Dedicated Physical Channel) can be generated.	
Application	TX measurements on 3GPP FDD Node Bs with realistic statistics	
	RX measurements on 3GPP FDD UEs with correct timing	
Ranges (valid for HS-SCCH and HS-PDSCH)	HSDPA mode	continuous, subframe 0 to subframe 4 (where first packet is sent), H set
	inter-TTI distance	1 to 16
	burst mode	ON: DTX between two HS-PDSCH packets OFF: Transmission of Dummy-Data between two HS-PDSCH packets
Fixed reference channel definition H set		
Enhancements	The R&S®SMATE-K43 allows to generate HSDPA downlink channels with channel coding in line with the definition of the fixed reference channels (H set) in TS 25.101; in addition, user-configurable bit/block error insertion.	
Ranges	H set	H set 1-5
	slot format	QPSK, 16QAM (H set 1-3)
	RV parameter	0 to 7
	UEID	0 to 65535
	bit error insertion	0.5 to 10^{-7} (insertion prior to channel coding or at the physical layer)
	block error insertion	0.5 to 10^{-4}
Dynamic power control		
Enhancements	The R&S®SMATE-K42 provides a method to vary the output power of a code channel in arbitrary waveform mode by misusing its TPC pattern. The R&S®SMATE-K43 now allows the variation of the output power in realtime mode for up to 3 DPCHs in three sub modes:	
	external	UE provides TPC info to R&S®SMATE200A by external connector (TTL level)
	by TPC pattern	TPC pattern is used to control the output power
	manual	the output power is changed incrementally by pressing buttons or sending the corresponding remote control commands
Application	RX measurements on 3GPP FDD UEs where closed loop power control is needed	
	RX measurements on 3GPP FDD UEs with varied code channel power without dropouts in the signal	
Ranges	mode	external, by TPC pattern, manual
	direction	up, down
	power step	0.5 dB to 6 dB
	up range	0 dB to 20 dB
	down range	0 dB to 20 dB

Uplink simulation		
HS-DPCCH (high speed dedicated physical control channel)		
Enhancements	The R&S®SMATE-K42 does not support HSDPA for uplink. The R&S®SMATE-K43 now allows the simulation of a HS-DPCCH (high speed dedicated physical control channel) in realtime operation (UE1) and arbitrary waveform mode (UE2 to UE4).	
Application	TX measurements on 3GPP FDD UEs supporting HSDPA	
	RX measurements on 3GPP FDD Node Bs supporting HDSPA	
Ranges	power	–80 dB to 0 dB
	start delay	101 to 250 (in units of 256 chips)
	inter-TTI distance	1 subframe to 16 subframes
	CQI pattern	up to 10 CQI values sent periodically, support of DTX
	ACK/NACK pattern	up to 32 ACK/NACK commands sent periodically, support of DTX
Dynamic power control		
Enhancements	The R&S®SMATE-K42 provides a method to vary the output power of a code channel in arbitrary waveform mode by misusing its TPC pattern. The R&S®SMATE-K43 now allows the variation of the output power in realtime mode for UE1 in three sub modes	
	external	node B provides TPC info to the R&S®SMATE200A by external connector (TTL level)
	by TPC pattern	TPC pattern is used to control the output power
	manual	the output power is changed incrementally
Application	RX measurements on 3GPP FDD Node Bs where closed loop power control is needed	
	RX measurements on 3GPP FDD Node Bs with varied UE power without dropouts in the signal	
Ranges	mode	external, by TPC pattern, manual
	direction	up, down
	power step	0.5 dB to 6 dB
	up range	0 dB to 20 dB
	down range	0 dB to 20 dB

Digital standard GPS (option R&S®SMATE-K44)

Digital standard GPS	to ICD-GPS-200 Revision C	
General settings		
Frequency		default L1 = 1575.42 MHz user-selectable in entire frequency range of R&S®SMATE200A
Output level		default –115 dBm user-selectable in entire output level range of R&S®SMATE200A
Modulation		BPSK (CDMA)
Symbol rate (chip rate)		1.023 MHz
Baseband filter		Gaussian filter parameter B × T = 1
Simulation modes		generic mode
		localization mode
Marker		navigation data bit (20460 chips)
		navigation data word (30 data bits)
		navigation data subframe (10 data words)
		navigation page (5 data subframes)
		complete navigation message (25 data pages)
		pulse
		pattern
		ON/OFF ratio
Triggering		see I/Q baseband generator
Navigation data	identical for each satellite	All 0 All 1 pattern (up to 64 bit) PN 9 to PN 23 data lists real navigation data
Real navigation data		support of SEM-Almanac, arbitrary valid date and time (GMT)
Navigation data rate		50 bps
Satellite configurations		
Number of channels		1 to 4 satellites
Use spreading code	identical for each satellite	ON/OFF
State	separately settable for each satellite	ON/OFF
Space vehicle ID	separately settable for each satellite	C/A-codes: 37 Gold codes, 1023 chips each
Time shift	separately settable for each satellite	0 to 10000000 (C/A-code-chip)/16
Power	separately settable for each satellite	±10 dB
Doppler shift	separately settable for each satellite	±100 kHz (selectable in steps of 0.01 Hz)
Localization mode		
Latitude	latitude of simulated location	±90° (selectable in steps of 0.1 s)
Longitude	longitude of simulated location	±180° (selectable in steps of 0.1 s)
Altitude	altitude of simulated location	±10000 m (selectable in steps of 0.1 m)

3GPP FDD HSUPA (option R&S®SMATE-K45)

At least one R&S®SMATE-K42 option must be installed.

General parameters	This option extends the R&S®SMATE-K42 (digital standard 3GPP FDD) to full HSUPA support. Therefore, all general parameters of the R&S®SMATE-K42 such as frequency range or modulation are also valid for the R&S®SMATE-K45.	
Downlink simulation		
HSUPA channels (E-AGCH, E-RGCH, E-HICH)		
Enhancements	The R&S®SMATE-K45 in downlink supports simulation of HSUPA control channels E-AGCH (E-DCH Absolute Grant Channel), E-RGCH (E-DCH Relative Grant Channel) and E-HICH (E-DCH Hybrid ARQ Indicator Channel) in line with TS 25.211.	
Application	RX measurements on 3GPP FDD UEs with correct timing	
Ranges (valid for E-RGCH and E-HICH)	type of cell	serving cell, non serving cell
	E-DCH TTI	2 ms, 10 ms
	signature sequence index	0 to 39 (in line with TS 25.211)
	relative grant pattern	up to 32 UP/DOWN/HOLD commands sent periodically
	ACK/NACK pattern	up to 32 ACK/NACK commands sent periodically
Uplink simulation		
E-DPCCH (E-DCH dedicated physical control channel), E-DPDCH (E-DCH dedicated physical data channel)		
Enhancements	The R&S®SMATE-K45 allows the simulation of an E-DPCCH (E-DCH dedicated physical control channel) and up to four E-DPDCHs (E-DCH dedicated physical data channel) with channel coding in line with the definition of the fixed reference channels in TS 25.104 and TS 25.141.	
Application	RX measurements on 3GPP FDD Node BS supporting HSUPA	
E-DPCCH	power	–80 dB to 0 dB
	retransmission sequence number	0 to 3
	E-TFCI Information	0 to 127
	happy bit	0, 1
	E-DCH TTI	2 ms, 10 ms
	DTX pattern	up to 32 TX/DTX commands sent periodically
E-DPDCH	overall symbol rate (total symbol rate of all uplink E-DPDCHs)	60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps, 2 × 960 ksps, 2 × 1920 ksps, 2 × 960 ksps, 2 × 1920 ksps
	depending on overall symbol rate	
	active E-DPDCHs	1 to 4
	symbol rate	fixed for active E-DPDCHs
	channelization code	fixed for active E-DPDCHs
	common for all E-DPDCHs	
	channel power	–80 dB to 0 dB
	payload data	PRBS: 9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 bit to 64 bit) data lists
	E-DCH TTI	2 ms, 10 ms
	DTX pattern	up to 32 TX/DTX commands sent periodically

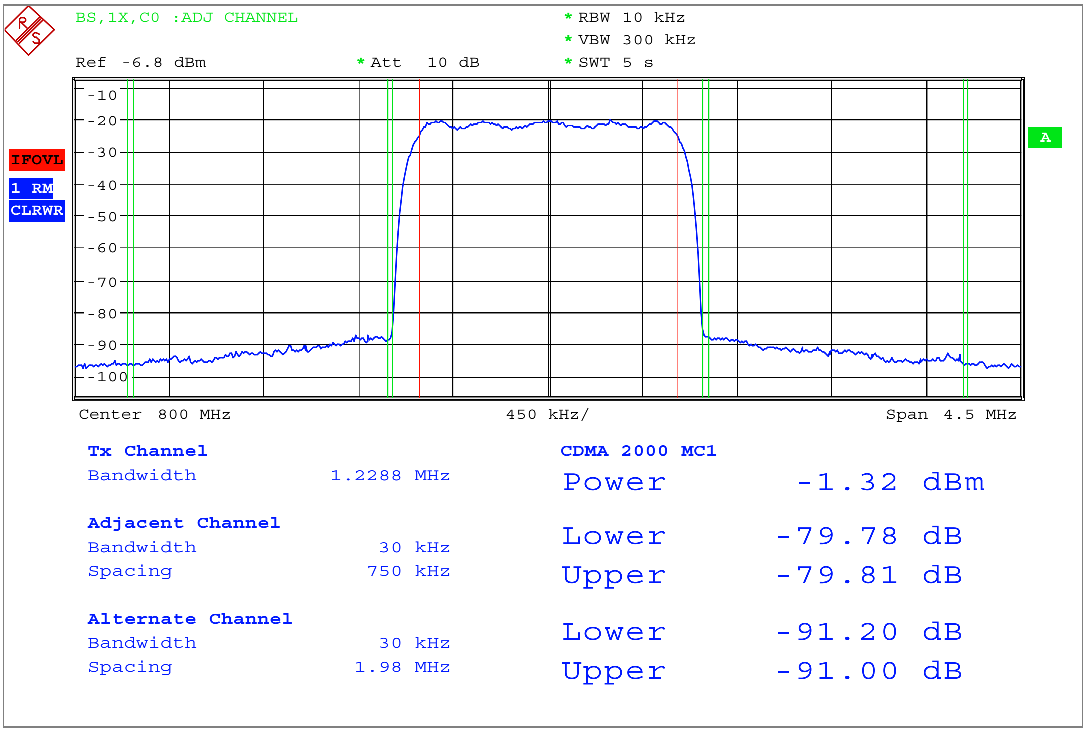
HSUPA FRC	channel coding in line with the definition of fixed reference channels in TS 25.104 and TS 25.141; in addition, user-configurable “Virtual HARQ-Mode” and bit/block error insertion	
	Fixed reference channel (FRC) (predefined channel coding schemes)	FRC 1-7
	DTX pattern	up to 32 TX/DTX commands sent periodically
	HARQ ACK/NACK pattern (individual ACK/NACK pattern for each HARQ-Process	up to 32 ACK/NACK commands sent periodically
	bit error insertion (deliberate generation of bit errors by impairing the data stream prior to channel coding or at the physical layer)	
	bit error ratio	0.5 to 10^{-7}
	application	verification of internal BER calculation in line with TS 25.141 (BS conformance testing)
	block error insertion (deliberate generation of block errors by impairing the CRC during coding of enhanced channels)	
	block error ratio	0.5 to 10^{-4}
	application	verification of internal BLER calculation in line with TS 25.141 (BS conformance testing)

Digital standard CDMA2000® incl. 1xEV-DV (option R&S®SMATE-K46)

Digital standard CDMA2000®	release C	in line with 3GPP2 C.S0002-C
Frequency	band class 0 to band class 12	410 MHz to 2170 MHz
Chip rates	standard	1.2288 MHz (1X)
	range	1 MHz to 5 MHz
Modes	1× direct spread (spreading rate 1)	
Link direction		forward link and reverse link
Sequence length	sequence length of ARB component entered in frames (80 ms each), max. length 1022 frames with R&S®SMATE-B9, 511 frames with R&S®SMATE-B10, 160 frames with R&S®SMATE-B11	
Baseband filter	standard for reverse link	cdmaOne
	standard for forward link	cdmaOne + equalizer
	for enhanced ACLR	
	reverse link	cdmaOne 705 kHz
	forward link	cdmaOne 705 kHz + equalizer
Code channels	forward link	4 base stations with a maximum of 78 code channels each (depending on radio configuration)
	reverse link	4 mobile stations with a maximum of 8 code channels each (depending on radio configuration)
Clipping level	Setting of a limit value relative to the highest peak in percent. Limitation is effected prior to baseband filtering and reduces the crest factor.	the value range is 1 % to 100 %
Generate waveform file	filtering of data generated in ARB mode and saving as waveform file	
Parameters of every BS		
State		ON/OFF
Time delay	timing offset of signals of individual base stations	
	BS1	0 chips (fixed)
	BS2 to BS4	0 chips to 98304 chips
PN offset		0 to 511
Transmit diversity	If this function is activated, the output signal can be generated for either antenna 1 or 2, as defined in the standard.	OFF antenna 1 antenna 2
Diversity mode		OTD/STS
Quasi-orthogonal Walsh sets		set 1 to set 3
Parameters of every forward link code channel that can be set independently		
State		ON/OFF
Channel types Forward link		forward pilot (F-PICH)
		transmit diversity pilot (F-TDPICH)
		auxiliary pilot (F-APICH)
		auxiliary transmit diversity pilot (F-ATDPCH)
		sync (F-SYNC)
		paging (F-PCH)
		broadcast (F-BCH)
		quick paging (F-QPCH)
		common power control (F-CPCCH)
		common assignment (F-CACH)
		common control (F-CCCH)
		packet data control (F-PDCCH)
		packet data (F-PDCH)
		traffic channel
		fundamental (F-FCH)
		supplemental (F-SCH)
		dedicated control (F-DCCH)
Radio configuration	chip rate 1.2288 Mcps (1X)	RC 1 to RC 5 and RC 10

Frame length	depending on channel type and radio configuration	5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 160 ms
Data rate	depending on channel type and radio configuration	1.2 kbps to 1036.8 kbps
Walsh code	depending on channel type and radio configuration	0 to 127
Quasi-orthogonal code		ON/OFF
Power		–80 dB to 0 dB
Data		All 0 All 1 pattern (up to 64 bit) PN 9 to PN 23 data lists
Long code mask		0 to 3FF FFFF FFFF hex
Power control data source		All 0 All 1 pattern (up to 64 bit) data list
(Mis)use for output power control	If this function is active, the power control data is used to vary the transmit power of the code channels versus time.	
	state	ON/OFF
	output power control step	–10 dB to +10 dB
Channel coding	All stages of channel coding specified by IS-2000 (e.g. frame quality indicator, convolutional encoder/turbo coder, symbol puncture and interleaver) are available.	
	All frame length and data rate combinations are supported.	
	Four options are available:	
	OFF	channel coding off
	complete	channel coding completely on
	without interleaving	channel coding on but without interleaver
	interleaving only	channel coding off, only interleaver is active
Parameters of every MS		
State		ON/OFF
Radio configuration	chip rate 1.2288 Mcps (1X)	RC 1 to RC 4
Channel coding	All stages of channel coding specified by IS-2000 (e.g. frame quality indicator, convolutional encoder, symbol puncture and interleaver) are available.	
	All frame length and data rate combinations are supported.	
	four options are available:	
	OFF	channel coding off
	complete	channel coding completely on
	without interleaving	channel coding on but without interleaver
	interleaving only	channel coding off, only interleaver is active
Operation mode	simulates MS operation mode and defines available channels	traffic
		access
		enhanced access
		common control
Long code mask		0 to 3FF FFFF FFFF hex
Power control data source	In reverse link, the power control data is used only for the misuse mode.	All 0 All 1 pattern (up to 64 bit) data list
(Mis)use for output power control	If this function is active, the power control data is used to vary the transmit power of the code channels versus time.	
	state	ON/OFF
	output power control step	–10 dB to +10 dB

Parameters of every reverse link code channel that can be set independently		
State		ON/OFF
Channel types Reverse link		reverse pilot (R-PICH)
		access (R-ACH)
		enhanced access (R-EACH)
		reverse common control (R-CCCH)
		reverse dedicated control (R-DCCH)
		traffic channel
		fundamental (R-FCH)
		supplemental code (R-SCCH)
		supplemental (R-SCH)
Frame length	depending on channel type and radio configuration	5 ms, 10 ms, 20 ms, 40 ms, 80 ms
Data rate	depending on channel type and radio configuration	1.2 kbps to 1036.8 kbps
Power		–80 dB to 0 dB
Data		All 0 All 1 pattern (up to 64 bit) PN 9 to PN 23 data lists
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	
	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



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

Digital standard IEEE 802.11 a/b/g (option R&S®SMATE-K48)

Digital standard IEEE 802.11 a/b/g		in line with IEEE 802.11a-1999, IEEE 802.11b-1999, IEEE 802.11g-2003
General settings		
Modes	unframed	generation of a non-packet-oriented signal without frame structure, with the modulation modes and data rates defined by the IEEE 802.11 standard
	framed	generation of a sequence of data packets with the frame structure defined by the standard, interrupted by an idle time
Sequence length		1 to 511 frames (depending on frame duration)
Clipping		vector or scalar clipping, applied before filtering
Marker modes		restart, frame start, frame active part, pulse, pattern, on/off ratio
Triggering		see I/Q baseband generator
Parameters in framed mode		
Idle time	time between two successive packets (PPDUs)	
	range	0 s to 10000 µs
MAC header		activating and configuring the MAC header with the parameters frame control, duration/ID, address 1 to 4 and sequence control
Frame check sequence		activating or deactivating a 32 bit (4 byte) check sum for protecting the MAC header and the user data (frame body)
Settings for CCK (IEEE 802.11b/IEEE 802.11g)		
Chip rate	standard	11 Mcps
	range	as R&S®SMATE200A
Baseband filter		spectral mask in line with IEEE 802.11b-1999 – Wireless LAN MAC and PHY specifications – chapter 18.4.7.3
Parameters in framed mode	PLCP preamble and header format	long PLCP and short PLCP
	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, CCK
	PSDU data length (length of user data field in bytes of the packet to be transferred	
	range	0 byte to 4095 byte
	scrambling	data scrambling can be activated or deactivated
Parameters in unframed mode	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps or 11 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, CCK
	scrambling	data scrambling can be activated or deactivated
Settings for OFDM (IEEE 802.11a/IEEE 802.11g)		
Kernel sample rate	standard	20 Msample/s
	range	as R&S®SMATE200A
Baseband filter		spectral mask in line with IEEE 802.11b-1999 – Wireless LAN MAC and PHY specifications – chapter 17.3.9.6.2

Parameters in framed mode	PLCP preamble and header format	long PLCP and short PLCP
	PLCP signal field	automatically calculated
	PSDU bit rate	6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps or 54 Mbps
	PSDU modulation (depending on PSDU bit rate)	BPSK, QPSK, 16QAM, 64QAM
	PSDU data length (length of user data field in bytes of the packet to be transferred	
	range	0 byte to 4095 byte
	number of data symbols (number of OFDM symbols in data portion of packet)	directly proportional to PSDU data length
	scrambling	data scrambling can be activated or deactivated; initial scrambler state can be set randomly or to a user-defined value
	interleaver	can be activated or deactivated
	time domain windowing (transition times)	0 s to 1000 ns
	service field	user-defined service field value supported
Parameters in unframed mode	PSDU bit rate	6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps or 54 Mbps
	PSDU modulation (depending on PSDU bit rate)	BPSK, QPSK, 16QAM, 64QAM
	PSDU data length (length of user data field in bytes of the packet to be transferred	
	range	0 byte to 2312 byte
	number of data symbols (number of OFDM symbols to be generated)	directly proportional to PSDU data length
	scrambling	data scrambling can be activated or deactivated; initial scrambler state can be set randomly or to a user-defined value
	interleaver	can be activated or deactivated
	time domain windowing (transition times)	0 s to 1000 ns
	service field	user-defined service field value supported
Settings for PBCC (IEEE 802.11b/IEEE 802.11g)		
Chip rate	standard	11 Mcps
	range	as R&S®SMATE200A
Baseband filter		spectral mask in line with IEEE 802.11b-1999-Wireless LAN MAC and PHY specifications – chapter 18.4.7.3
Parameters in framed modes	PLCP preamble and header format	long PLCP and short PLCP
	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps, 22 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, PBCC
	PSDU data length (length of user data field in bytes of the packet to be transferred)	
	range	0 byte to 4095 byte
	scrambling	data scrambling can be activated or deactivated
Parameters in unframed mode	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps, 22 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, PBCC
	scrambling	data scrambling can be activated or deactivated

Digital standard IEEE 802.16 WiMAX including IEEE 802.16e (option R&S®SMATE-K49)

Digital standard IEEE 802.16		in line with IEEE 802.16 – 2004/Cor1/D5 and IEEE 802.16e-2005
Link direction		forward link and reverse link
Physical layer modes		OFDM, OFDMA, OFDMA – WiBro
Duplexing		TDD, FDD
Frame durations		2 ms, 2.5 ms, 4 ms, 5 ms, 8 ms, 10 ms, 12.5 ms, 20 ms, continuous, user
Sequence length (frames)	depending on frame duration, sample rate and available ARB memory	1 to >2000
Predefined frames	in OFDM mode	short, mid and long test messages for BPSK, QPSK, 16QAM and 64QAM modulation
Level reference	in OFDM mode	FCH/burst or preamble
	in OFDMA/WiBro mode	preamble or subframe RMS power
Parameters in OFDM mode		
Predefined frequency bands		ETSI, MMDS, WCS, U-NII, user
Channel bandwidth	depending on selected frequency band	1.25 MHz to 30 MHz
Sampling rate	depending on channel bandwidth	1.5 MHz to 32 MHz
Tg/Tb settings		1/4, 1/8, 1/16, 1/32
FFT size		256 (fixed)
Frame preamble		long, short, off
Modulation and RS-CC rates		BPSK 1/2, QPSK 1/2, QPSK 3/4, 16QAM 1/2, 16QAM 3/4, 64QAM 2/3, 64QAM 3/4
Subchannelization (number of possible channels)		1, 2, 4, 8, 16 (all)
No. of bursts with different modulation formats per frame		64
Burst types		data, DL-MAP, UL-MAP, ranging
Data		All 0 All 1 pattern (up to 64 bit) PN 9 to PN 23 data lists
Midamble repetition	in uplink mode	off, 5, 9, 17
Parameters in OFDMA Mode		
Predefined frequency bands		ETSI, MMDS, WCS, U-NII, WiBro, user
Channel bandwidth	depending on selected frequency band	1.25 MHz to 30 MHz
Sampling rate	depending on channel bandwidth	1.5 MHz to 32 MHz
Tg/Tb settings		1/4, 1/8, 1/16, 1/32
FFT size		128, 512, 1024, 2048
Preamble modes		Auto and User with index 0 to 113
Number of zones/segments		8
Space-time coding modes		OFF 2 antennas matrix A 2 antennas matrix B
Modulation and coding rates		QPSK 1/2, QPSK 3/4, 16QAM 1/2, 16QAM 3/4, 64QAM 1/2, 64QAM 2/3, 64QAM 3/4
Channel coding modes		off, CC, CTC
Channel coding parts		scrambler, FEC, interleaver can be switched on/off independently
Repetition coding		0, 2, 4, 6

Subcarrier permutation		FUSC, PUSC
Subchannel map		user definable for PUSC
Number of bursts with different modulation formats		64
Burst types		FCH, DL-MAP, UL-MAP, ranging, data
Data		All 0 All 1 pattern (up to 64 bit) PN 9 to PN 23 data lists

Digital standard TD-SCDMA (3GPP TDD LCR) (option R&S®SMATE-K50)

Digital standard WCDMA 3GPP TDD LCR (TD-SCDMA)		in line with 3GPP TDD standard for chiprate 1.28 Mcps (low chiprate mode)
Frequency range	frequency bands in line with 3GPP TS 25.102 in uplink and downlink	UTRA TDD frequency bands a) to d)
	range	as R&S®SMATE200A
Signal generation modes/sequence length	Simulation of up to 4 TD-SCDMA cells with variable switching point of uplink and downlink. Freely configurable channel table for each slot and simulation of the downlink and uplink pilot time slot. In uplink, also a PRACH can be generated.	
	The sequence length can be entered in frames (10 ms each).	
Modulation	QPSK, 8PSK	
Generate waveform file	filtering of data generated in ARB mode and saving as waveform file	
	application: for multicarrier or multisegment scenarios	
General settings		
Triggering		see I/Q baseband generator
Chip rate	standard	1.28 Mcps (7 slots/subframe)
	range	1 Mcps to 5 Mcps
Link direction		uplink (reverse link)
		downlink (forward link)
Baseband filter	standard	$\sqrt{\cos}$, α = 0.22
	other filters	$\sqrt{\cos}$, cos, user filters
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor.	
	modes	vector |i + j q| scalar |i|, |q|
	clipping level	1 % to 100 %
Code channels	downlink/uplink: up to 16 data channels (plus special channels) per slot, 7 slots per subframe, simulation of up to 4 cells	
Configure cell		
Reset all cells	all channels are deactivated	
Copy cell	adopting the configuration of a cell for another cell to define multicell scenarios	
	parameters: source and destination of copying	
Predefined settings	generation of complex signal scenarios with parameterizable default settings	
	selectable parameters: use of P-CCPCH, number and spreading factors of data channels, crest factor: minimal/average/worst	
Parameters of each cell		
State		ON/OFF
Scrambling code	scrambling code can be disabled for testing	0 to 127
SYNC-DL code	automatic selection depending on scrambling code	0 to 31
SYNC-UL code	range depending on SYNC-DL code	0 to 255
Number of users		2, 4, 6, 8, 10, 12, 14, 16
Switching point	switchover between uplink and downlink slots	1 to 6
DwPTS power		–80 dB to 10 dB
Parameters for each downlink slot		
State		ON/OFF
Slot mode	downlink dedicated: simulation of up to 16 DPCHs and max. 6 special channels	DPCH QPSK/8PSK: 0 to 24
		DPCH PDSCH: 0 to 24
		S-CCPCH: 0 to 9
Parameters for each uplink slot		
State		ON/OFF
Slot mode	uplink dedicated: simulation of up to 16 DPCHs and 1 PUSCH	DPCH QPSK, PUSCH: 0 to 69
	PRACH: simulation of one Physical Random Access Channel	DPCH 8PSK: 0 to 24

Physical channels in downlink		
	primary common control physical channel 1 (P-CCPCH 1)	
	primary common control physical channel 2 (P-CCPCH 2)	
	secondary common control physical channel 1 (S-CCPCH 1)	
	secondary common control physical channel 2 (S-CCPCH 2)	
	fast physical access channel (FPACH)	
	physical downlink shared channel (PDSCH)	
	dedicated physical channel modulation QPSK (DPCH QPSK)	
	dedicated physical channel modulation 8PSK (DPCH 8PSK)	
Physical channels in uplink		
	physical uplink shared channel (PUSCH)	
	dedicated physical channel modulation QPSK (DPCH QPSK)	
	dedicated physical channel modulation 8PSK (DPCH 8PSK)	
Parameters of every code channel that can be set independently		
State		ON/OFF
Midamble shift	time shift of midamble in chips: step width 8 chips	0 to 120
	controlled via the current user and the number of users	
Slot format	depending on physical channel type	0 to 69
Spreading factor	depending on physical channel type and link direction	1, 2, 4, 8, 16
Spreading code	depending on physical channel type and spreading factor	1 to 16
Power		–80 dB to 0 dB
Payload data	PRBS	9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 bit to 64 bit), data lists
Number of TFCI bits	depending on modulation type	
	QPSK	0, 4, 8, 16, 32
	8PSK	0, 6, 12, 24, 48
TFCI value		0 to 1023
Number of sync shift & TPC bits	depending on modulation type	
	QPSK	0 & 0, 3 & 3, 48 & 48
	8PSK	0 & 0, 2 & 2, 32 & 32
Sync shift pattern	up to 64 UP/DOWN/HOLD commands sent periodically	"1" → up: increase sync shift
		"0" → down: decrease sync shift
		"–" → do nothing
Sync shift repetition M		1 to 8
TPC source		All 0, All 1, pattern (length 1 bit to 64 bit), data lists
TPC read out mode		Continuous, Single + All 0, Single + All 1, Single + alt. 01, Single + alt. 10
Parameters in uplink PRACH mode		
UpPTS start subframe	selection of first frame in which UpPTS is sent	1 subframe to 10 subframes
UpPTS power		–80 dB to 0 dB
UpPTS power step		0 dB to 10 dB
Distance UpPTS	distance UpPTS to PRACH message part	1 subframe to 4 subframes
UpPTS repetition	number of UpPTS repetitions	1 to 10
RACH message part state		ON/OFF
Message part length		1 subframe, 2 subframes, 4 subframes
Spreading factor		4, 8, 16
Spreading code		0 to (spreading factor – 1)
Message part power		–80 dB to 0 dB
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 All 0, All 1, pattern (length 1 bit to 64 bit), data lists
Current user		1 to 16

TD-SCDMA (3GPP TDD LCR) enhanced BS/MS test including HSDPA (option R&S®SMATE-K51)

At least one R&S®SMATE-K50 option must be installed.

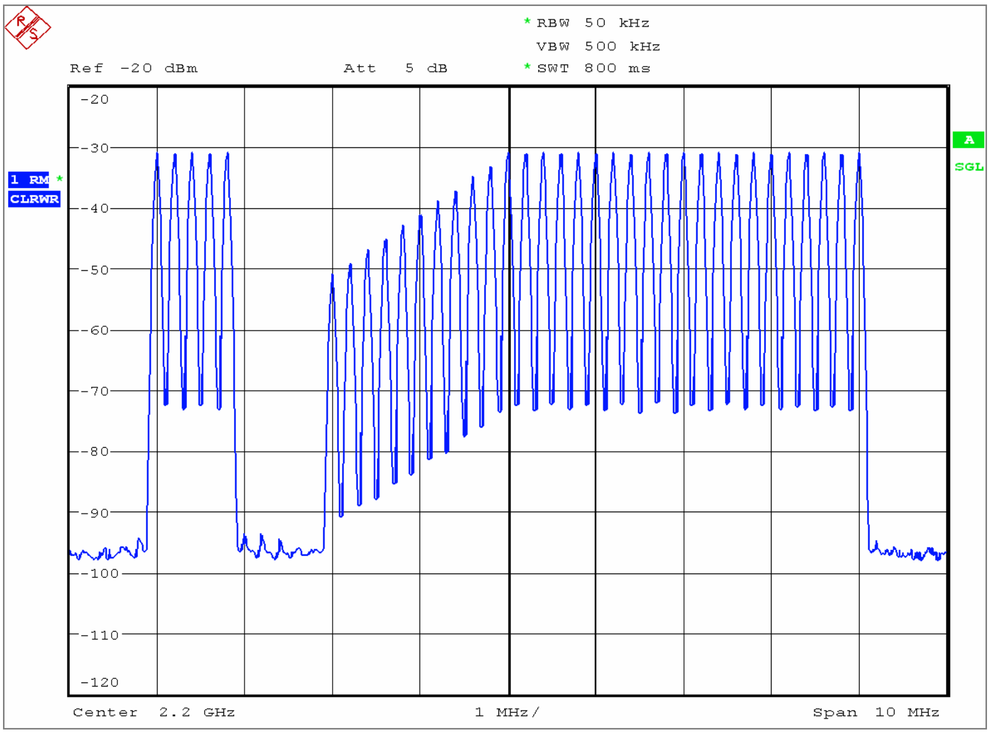
General parameters	This option extends the R&S®SMATE-K50 (digital standard TD-SCDMA) to full channel coding and HSDPA support. Therefore, all general parameters of the R&S®SMATE-K50 such as frequency range or modulation are also valid for the R&S®SMATE-K51.	
Signal generation modes/sequence length	Simulation of up to 4 TD-SCDMA cells with generation of the coded P-CCPCH (BCH with running SFN) and the reference measurement channels RMC 12.2 kbps up to RMC 2048 kbps. Simulation of the HSDPA channels HS-SCCH, HS-PDSCH (QPSK and 16QAM modulation), HS-SICH and the channel coded H-RMC 526 kbps and H-RMC 730 kbps.	
	Furthermore, bit and block errors can be inserted.	
Modulation	QPSK, 8PSK, 16QAM	
HSDPA physical channels	high speed shared control channel 1 (HS-SCCH 1)	
	high speed shared control channel 2 (HS-SCCH 2)	
	high speed physical downlink shared channel QPSK (HS-PDSCH QPSK)	
	high speed physical downlink shared channel 16QAM (HS-PDSCH 16QAM)	
	high speed shared information channel (HS-SICH)	
Channel codings	coding of enhanced channels in line with the definition of reference measurement channels in TS 25.102, TS 25.105 and TS 25.142	
	predefined channel coding schemes for	
	downlink	coded BCH including SFN RMC 12.2 kbps RMC 64 kbps RMC 144 kbps RMC 384 kbps RMC 2048 kbps H-RMC 526 kbps H-RMC 730 kbps
	uplink	RMC 12.2 kbps RMC 64 kbps RMC 144 kbps RMC 384 kbps RMC 2048 kbps
Applications	BER measurements in line with TS 25.102/105/142 (radio transmission and reception), e.g. adjacent channel selectivity blocking characteristics intermodulation characteristics	
	BLER measurements in line with TS 25.102/105 (radio transmission and reception), e.g. demodulation of dedicated channel under static propagation conditions (AWGN generation together with R&S®SMATE-K62)	
	test of decoder in receiver	
Bit error insertion	deliberate generation of bit errors by impairing the data stream prior to channel coding or at the physical layer	
	bit error ratio	0.5 to 10^{-7}
Application	verification of internal BER calculation in line with TS 25.142 (BS conformance testing)	
Block error insertion	deliberate generation of block errors by impairing the CRC during coding of enhanced channels	
	block error ratio	0.5 to 10^{-4}
Application	verification of internal BLER calculation in line with TS 25.142 (BS conformance testing)	

Digital standard DVB-H (option R&S®SMATE-K52)

Digital standard DVB-H		in line with ETSI EN 300 744 V1.5.1 standard
General settings		
Frequency		default VHF 212.5 MHz user-selectable in entire frequency range of R&S®SMU200A
Output level		default –30 dBm user-selectable in entire output level range of R&S®SMU200A
Hierarchy mode		non-hierarchical
Sequence length	number of superframes	min: 1 max: depending on memory option
Baseband filter	standard	cosine, α = 0.1
	other	see I/Q baseband generator
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor.	
	modes	vector |i + j q| scalar |i|, |q|
	clipping level	1 % to 100 %
Marker		restart
		superframe start
		frame start
		pulse
		pattern
		ON/OFF ratio
Triggering		see I/Q baseband generator
Signal path parameters		
Input data	zero-packets are generated and filled up with desired data	PN 15, 23 All 0 All 1
	transport stream	transport stream file (.gts)
Scrambler	state	ON/OFF
Outer coder		Reed Solomon (204, 188, t = 8)
	state	ON/OFF
Outer interleaver		convolutional byte-wise (depth: 12)
	state	ON/OFF
Inner coder		convolutional, punctured
	state	ON/OFF
	code rates	1/2, 2/3, 3/4, 5/6, 7/8
Inner interleaver		bit-wise interleaving
		symbol interleaving
	state	ON/OFF
	symbol interleaving block size	1512 bits in 2K mode
		3024 bits in 4K mode
		6048 bits in 8K mode
	symbol interleaving modes	native, in-depth
Modulation		QPSK, 16QAM, 64QAM
Transmission modes		2K with 1705 carriers 4K with 3409 carriers 8K with 6817 carriers
Guard interval	cyclic continuation of useful signal part	length: 1/4, 1/8, 1/16, 1/32 of useful signal part
Framing and Signaling		
Super frame size		4 frames
Frame size		68 OFDM symbols
TPS settings	cell ID	0000 to FFFF (user defined)
	time slicing	ON/OFF
	MPE-FEC	ON/OFF

Multicarrier CW signal generation (option R&S®SMATE-K61)

Signal generation		simulation of unmodulated multicarrier signals in arbitrary waveform mode
Number of carriers		1 to 8192
Carrier spacing	user-settable, maximum spacing depending on number of carriers	1 Hz to 80 MHz
Parameters of each carrier	state	ON/OFF
	power	–80 dB to 0 dB
	start phase	0° to +360°
Crest factor	optimization of crest factor by varying the start phases of the carrier; available modes:	
	off	no optimization, manual entry of phase possible
	chirp	the phases of each carrier are set such that a chirp signal is obtained for the I and Q components
	target crest	iterative variation of carrier start phases until a presettable crest factor is attained
Triggers	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} 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} sample
	resolution	1 sample
	external trigger pulse width	>15 ns
	external trigger frequency	<0.02 × sampling rate
Marker	number	4
	level	LVTTL
	operating modes	unchanged, restart, pulse, pattern, ratio
	marker delay (in sample)	
	setting range	0 to waveform length – 1
	setting range without recalculation	0 to 2000
	resolution of setting	0.001
	setting uncertainty	<10 ns
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



Spectrum of multicarrier CW

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

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

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

Noise

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

At least one Baseband Main Module R&S®SMATE-B13 must be installed. If two R&S®SMATE-B13 are installed (paths A and B), AWGN can be generated either on path A or B with one R&S®SMATE-K62 option. If AWGN is to be generated on paths A and B simultaneously, two R&S®SMATE-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

General data

Remote control

Systems	IEC/IEEE bus, IEC 60625 (IEEE 488) Ethernet, TCP/IP USB (USB 2.0)
Command set	SCPI 1999.5
Connector	IEC: 24-contact Amphenol; Ethernet: Western; USB
IEC/IEEE bus address	0 to 30
Interface functions	IEC: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0
Additional delay for path B in two-path units for simultaneously frequency or level settings	<250 µs

Operating data

Power supply	input voltage range, AC, nominal	100 V to 240 V
	AC supply frequency	50 Hz to 60 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
Immunity to interfering field strength		up to 10 V/m
Environmental conditions	operating temperature range	+5 °C to +45 °C in line with DIN EN 60068-2-1, DIN EN 60068-2-2
	storage temperature range	–20 °C to +60 °C
	climatic resistance	
	+40 °C/90 % rel. humidity	in line with DIN EN 60068-2-3
Mechanical resistances	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 DIN EN 60068-2-6
	vibration, random	10 Hz to 300 Hz, acceleration 1.2 g (rms), in line with DIN EN 60068-2-64
	shock	in line with DIN EN 60068-2-27, MIL-STD-810E, 40 g shock spectrum
Electrical safety		in line with EN 61010-1
Dimensions	width x height x depth	435 mm x 192 mm x 560 mm
Weight	if fully equipped	25 kg
Recommended calibration interval		3 years

Ordering information

Designation	Type	Order No.
Vector Signal Generator[17]	R&S®SMATE200A	1400.7005.02
including power cable, Quick Start Guide and CD-ROM (with operating and service manual)		
Options		
RF Path A		
100 kHz to 3 GHz	R&S®SMATE-B103	1401.1000.02
100 kHz to 6 GHz	R&S®SMATE-B106	1401.1200.02
High-Power Output	R&S®SMATE-B31	1401.1800.04
RF Path B		
100 kHz to 3 GHz	R&S®SMATE-B203	1401.1400.02
100 kHz to 6 GHz	R&S®SMATE-B206	1401.1600.02
High-Power Output	R&S®SMATE-B36	1401.2107.04
RF Paths A and B		
FM/φM and Low Phase Noise	R&S®SMATE-B22	1401.2507.02
Baseband		
Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)	R&S®SMATE-B9	1404.7500.02
Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)	R&S®SMATE-B10	1401.2707.02
Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)	R&S®SMATE-B11	1401.2807.02
Baseband Main Module	R&S®SMATE-B13	1401.2907.02
Differential I/Q Output	R&S®SMATE-B16	1401.2407.02
Digital modulation systems		
Digital Standard GSM/EDGE	R&S®SMATE-K40	1404.5107.02
Digital Standard 3GPP FDD	R&S®SMATE-K42	1404.5207.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMATE-K43	1404.5307.02
Digital Standard GPS	R&S®SMATE-K44	1404.5407.02
3GPP FDD HSUPA	R&S®SMATE-K45	1404.7300.02
Digital Standard CDMA2000® incl. 1xEV-DV	R&S®SMATE-K46	1404.5507.02
Digital Standard IEEE 802.11 (a/b/g)	R&S®SMATE-K48	1404.6703.02
Digital Standard IEEE 802.16	R&S®SMATE-K49	1404.6803.02
Digital Standard TD-SCDMA	R&S®SMATE-K50	1404.7100.02
TD-SCDMA enhanced BS/MS Tests	R&S®SMATE-K51	1404.7200.02
Multicarrier CW Signal Generation	R&S®SMATE-K61	1404.5707.02

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

Designation	Type	Order No.
Digital modulation systems using R&S®WinIQSIM™[18]		
Digital Standard IS-95 (with R&S®WinIQSIM™)	R&S®SMATE-K11	1404.5907.02
Digital Standard CDMA2000® (with R&S®WinIQSIM™)	R&S®SMATE-K12	1404.6003.02
Digital Standard 3GPP TDD (with R&S®WinIQSIM™)	R&S®SMATE-K13	1404.6090.02
Digital Standard TD-SCDMA (with R&S®WinIQSIM™)	R&S®SMATE-K14	1404.6203.02
User-Defined OFDM Signals (with R&S®WinIQSIM™ and R&S® WinIQOFDM)	R&S®SMATE-K15	1404.6303.02
Digital Standard 1xEV-DO (with R&S®WinIQSIM™)	R&S®SMATE-K17	1404.6403.02
Digital Standard IEEE 802.11 (a/b/g) (with R&S®WinIQSIM™)	R&S®SMATE-K19	1404.6503.02
Digital Standard 3GPP FDD incl. HSDPA (with R&S®WinIQSIM™)	R&S®SMATE-K20	1404.6603.02
Noise		
Additive White Gaussian Noise (AWGN)	R&S®SMATE-K62	1404.5807.02
Recommended extras		
Hardcopy manuals (in English, USA)	R&S®SMATE-M	
BNC Adapter for AUX I/O connector	R&S®SMU-Z5	1160.4545.02
Keyboard with USB Interface (US assignment)	R&S®PSL-Z2	1157.6870.03
Mouse with USB Interface, optical	R&S®PSL-Z10	1157.7060.03
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Adapter for Telescopic Sliders	R&S®ZZA-T45	1109.3774.00
External USB CD-RW Drive	R&S®PSP-B6	1134.8201.12

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

For product brochure, see PD 0758.1893.12
and www.rohde-schwarz.com
(search term: SMATE200A)

ROHDE&SCHWARZ

www.rohde-schwarz.com

Europe: +49 1805 12 4242, customersupport@rohde-schwarz.com
USA and Canada: +1-888-837-8772, customer.support@rsa.rohde-schwarz.com
Asia: +65 65 130 488, customersupport.asia@rohde-schwarz.com

PD 0758.1893.22 · Version 03.00 · November 2006 · R&S®SMATE200A · Data without tolerance limits is not binding · Subject to change