R&S®SMW200A
VECTOR SIGNAL GENERATOR

Specifications

Specifications
Version 31.00

ROHDE&SCHWARZ
Make ideas real

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Key features

For all your needs

- Frequency range from 100 kHz to 3/6/7.5/12.75/20/31.8/40/44/56/67 GHz
- Optional second RF path with 100 kHz up to 3/6/7.5/12.75/20/31.8/44 GHz
- Versatile configuration: from single-path vector signal generator to multichannel MIMO receiver tester
- Ideal for MIMO, MSR or LTE-Advanced applications thanks to up to eight signal sources and up to 64 fading channels
- Modular architecture for optimal adaptation to the application at hand

Simplify your setup

- Easy generation of complex signals
- Maximum eight baseband generators on two internal baseband modules with real-time coder and ARB
- Internal digital adding of baseband signals, even with frequency and level offset
- Wideband baseband and vector signal generator in one box
- Support of all important digital standards such as 5G New Radio, LTE (up to release 15), NB-IoT, eMTC, 3GPP FDD/HSPA/HSPA+, GSM/EDGE/EDGE Evolution, WLAN IEEE 802.11a/b/g/n/j/p/ac/ax/be/ad/ay, DVB-S2/DVB-S2X
- No separate PC software required for digital standards
- Generation of radar signal scenarios for module, receiver and DFS tests
- LTE and 3GPP test case wizards for easy base station conformance testing, in line with 3GPP TS 25.141 or 3GPP TS 36.141
- Envelope tracking and AM/AM, AM/PM predistortion options enable full test and verification of ET modulator chipsets
- Generation of notched signals for noise power ratio measurements

Bring reality to your lab

- Optional integrated fading section for channel emulation with up to 800 MHz bandwidth
- All important fading scenarios available as presets
- Installation of up to four fading modules, providing as many as 64 logical faders
- Implementation of all key MIMO fading scenarios such as 2x2, 3x3, 4x4, 8x4, 4x8 and 2x4x4 using a single instrument
- Support of complex applications such as dual-carrier HSPA, LTE carrier aggregation and multi-user LTE
- Connection of R&S®SGT100A signal generator modules to provide up to eight RF paths
- Simulation of AWGN, phase noise and impulsive noise

Make your device even better

- Excellent signal quality for high accuracy in spectral and modulation measurements
- Up to 2 GHz I/Q modulation bandwidth (in RF) with internal baseband
- Exceptional modulation frequency response of < 0.4 dB (meas.) over 2 GHz bandwidth
- User-defined frequency response correction to compensate for the effects of external components
- High-end pulse modulation with on/off ratio > 80 dB and rise/fall time < 10 ns
- Excellent spectral purity (SSB phase noise –150 dBc (typ.) at 1 GHz, 10 kHz offset)
- 3 GHz, 6 GHz, 7.5 GHz and 12.75 GHz RF paths with electronic attenuator
- Phase coherence option, e.g. for beamforming applications

Speed up your development

- Intuitive operating concept and clever help functions for quick success
- Block diagram as key operating element to visualize signal flow
- Adaptive GUI for overview of both simple and complex scenarios
- Graphical signal monitoring at practically every point in the signal flow
- Context-sensitive online help system with complete user documentation
- SCPI macro recorder and code generator for generating executable remote control code from manual operating steps (for MATLAB, LabWindows/CVI, etc.)

Grows with your needs

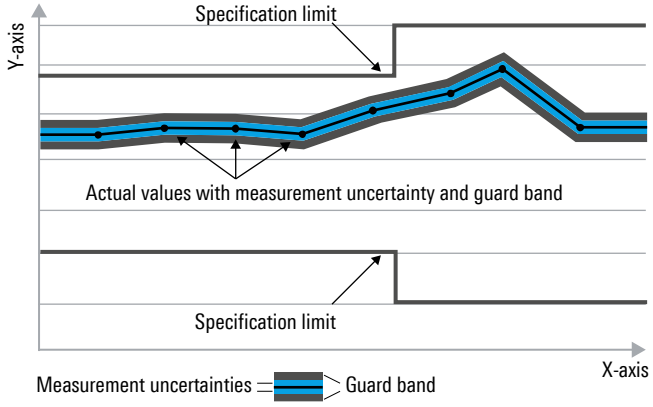
- Customizing of instrument to accommodate virtually every application
- Advanced plug-in system for retrofitting baseband modules without instrument recalibration
- Software upgrades possible at any time, simple and quick activation via key codes

Definitions

General
Product data applies under the following conditions:

- Three hours of storage at ambient temperature followed by 30 minutes of warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Non-traceable specifications with limits (n. trc.)
Represent product performance that is specified and tested as described under Specifications with limits above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

Frequency and baseband main module options

Frequency options

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

R&S®SMW-B1003	100 kHz to 3 GHz
R&S®SMW-B1006	100 kHz to 6 GHz
R&S®SMW-B1007	100 kHz to 7.5 GHz
R&S®SMW-B1012	100 kHz to 12.75 GHz
R&S®SMW-B1020	100 kHz to 20 GHz
R&S®SMW-B1031	100 kHz to 31.8 GHz
R&S®SMW-B1040, R&S®SMW-B1040N	100 kHz to 40 GHz
R&S®SMW-B1044, R&S®SMW-B1044N, R&S®SMW-B1044O	100 kHz to 44 GHz
R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O	100 kHz to 56 GHz
R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	100 kHz to 67 GHz

In addition, one of the following frequency options can be installed in RF path B:

R&S®SMW-B2003	100 kHz to 3 GHz
R&S®SMW-B2006	100 kHz to 6 GHz
R&S®SMW-B2007	100 kHz to 7.5 GHz
R&S®SMW-B2012	100 kHz to 12.75 GHz
R&S®SMW-B2020	100 kHz to 20 GHz
R&S®SMW-B2031	100 kHz to 31.8 GHz
R&S®SMW-B2044, R&S®SMW-B2044N, R&S®SMW-B2044O	100 kHz to 44 GHz

The R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012 and R&S®SMW-B2012 options include an electronic attenuator, whereas the R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B1044O, R&S®SMW-B2044N, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N and R&S®SMW-B1067O options include a mechanical step attenuator.

For possible RF path combinations, see section Frequency options and RF path combinations.

Signal routing and baseband main module options

One of the following options must be installed:

R&S®SMW-B13	one I/Q path to RF section
R&S®SMW-B13T	two I/Q paths to RF section
R&S®SMW-B13XT	wideband, two I/Q paths to RF section

If RF path B is equipped with an R&S®SMW-B20xx frequency option, an R&S®SMW-B13T or R&S®SMW-B13XT option must be installed as the baseband main module.

R&S®SMW-B13 and R&S®SMW-B13T cannot be installed in instruments equipped with R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O or R&S®SMW-B1067O frequency options.

Baseband hardware overview

To select between two different baseband sections, simply choose the appropriate baseband main module.

To select the standard baseband section, choose the R&S®SMW-B13 or R&S®SMW-B13T option as the baseband main module. The standard baseband section enables RF modulation bandwidths up to 160 MHz and allows further options for fading and MIMO to be installed. It provides the following additional hardware options:

R&S®SMW-B10	standard baseband generator
R&S®SMW-B14	fading simulator

To select the wideband baseband section, choose the R&S®SMW-B13XT option as the baseband main module. The wideband baseband section enables RF modulation bandwidths up to 2 GHz and allows further options for fading and MIMO to be installed. It provides the following additional hardware options:

R&S®SMW-B9	wideband baseband generator
R&S®SMW-B9F	wideband baseband generator for GNSS with high dynamics
R&S®SMW-B15	fading simulator and signal processor

Frequency options and RF path combinations

The following RF path combinations are possible (● = possible, – = not possible).

Cells with grey background: These RF path combinations require the R&S®SMW-B94L option (deeper chassis).
Note that R&S®SMW-B94L is only possible with these RF path combinations.

Cells with white background: These RF path combinations come with the standard chassis (included in the base unit).

			3 GHz	6 GHz	7.5 GHz	12.75 GHz	20 GHz	31.8 GHz	44 GHz
	Path A \ **Path B**	(path B not equipped)	R&S®SMW-B2003	R&S®SMW-B2006	R&S®SMW-B2007	R&S®SMW-B2012	R&S®SMW-B2020	R&S®SMW-B2031	R&S®SMW-B2044(N/O)
3 GHz	R&S®SMW-B1003	●	●	–	–	–	–	–	–
6 GHz	R&S®SMW-B1006	●	–	●	–	–	●	–	–
7.5 GHz	R&S®SMW-B1007	●	–	–	●	–	–	–	–
12.75 GHz	R&S®SMW-B1012	●	–	●	–	●	–	–	–
20 GHz	R&S®SMW-B1020	●	–	●	–	–	●	–	–
31.8 GHz	R&S®SMW-B1031	●	–	–	–	–	–	●	–
40 GHz	R&S®SMW-B1040(N)	●	–	–	–	–	–	–	–
44 GHz	R&S®SMW-B1044(N/O)	●	–	–	–	–	–	–	● [1]
56 GHz	R&S®SMW-B1056(N/O)	●	–	–	–	–	–	–	–
67 GHz	R&S®SMW-B1067(N/O)	●	–	–	–	–	–	–	–

Low phase noise options

The R&S®SMW200A can be equipped with different types of low phase noise options, providing different levels of phase noise performance.

As a general rule, all installed RF paths must have the same phase noise performance level. For example, if RF path A is equipped with an ultra low phase noise option, and a second RF path (B) shall be installed, the second RF path must also be equipped with an ultra low phase noise option.

The following table shows the possible option combinations for instruments with two RF paths.

Phase noise performance level	**Required options for RF path A**	**Required options for RF path B**
Standard performance	R&S®SMW-B10xx frequency option	R&S®SMW-B20xx frequency option
Low phase noise	R&S®SMW-B10xx frequency option and R&S®SMW-B709	R&S®SMW-B20xx frequency option and R&S®SMW-B719
Improved close-in phase noise performance	R&S®SMW-B10xx frequency option and R&S®SMW-B710	R&S®SMW-B20xx frequency option and R&S®SMW-B720
Ultra low phase noise	R&S®SMW-B10xx frequency option and R&S®SMW-B711	R&S®SMW-B20xx frequency option and R&S®SMW-B721

[1] R&S®SMW-B1044 can only be combined with R&S®SMW-B2044, R&S®SMW-B1044N can only be combined with R&S®SMW-B2044N and R&S®SMW-B1044O can only be combined with R&S®SMW-B2044O.

RF characteristics

Frequency

Range	R&S®SMW-B1003, R&S®SMW-B2003	100 kHz to 3 GHz
	R&S®SMW-B1006, R&S®SMW-B2006	100 kHz to 6 GHz
	R&S®SMW-B1007, R&S®SMW-B2007	100 kHz to 7.5 GHz
	R&S®SMW-B1012, R&S®SMW-B2012	100 kHz to 12.75 GHz
	R&S®SMW-B1020, R&S®SMW-B2020	100 kHz to 20 GHz
	R&S®SMW-B1031, R&S®SMW-B2031	100 kHz to 31.8 GHz
	R&S®SMW-B1040, R&S®SMW-B1040N	100 kHz to 40 GHz
	R&S®SMW-B1044, R&S®SMW-B1044N, R&S®SMW-B1044O, R&S®SMW-B2044, R&S®SMW-B2044N, R&S®SMW-B2044O	100 kHz to 44 GHz
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O	100 kHz to 56 GHz
	R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	100 kHz to 67 GHz
	overrange	67 GHz to 72 GHz
Resolution of setting		0.001 Hz
Resolution of synthesis	f = 1 GHz	0.053 nHz (nom.)
Setting time	to within < $1 \cdot 10^{-7}$ for f > 200 MHz or < 124 Hz for f < 200 MHz, with GUI update stopped, I/Q optimization mode: fast, after IEC/IEEE bus delimiter, health and utilization monitoring service (HUMS) off	
	standard	
	R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006	< 1.2 ms, 0.9 ms (typ.)
	R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020	< 1.4 ms, 1.0 ms (typ.)
	R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O	< 1.7 ms, 1.4 ms (typ.)
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	< 1.8 ms, 1.6 ms (typ.)
	with R&S®SMW-B711, R&S®SMW-B721	< 4.0 ms

Setting time (list mode)	to within < 1 · 10^{-7} for f > 200 MHz or < 124 Hz for f < 200 MHz, with GUI update stopped, I/Q optimization mode: fast, after trigger pulse, health and utilization monitoring service (HUMS) off	
	R&S®SMW-B1003, R&S®SMW-B2003	< 0.8 ms, 0.6 ms (typ.)
	R&S®SMW-B1006, R&S®SMW-B2006	< 0.8 ms, 0.6 ms (typ.)
	R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020	< 1.0 ms, 0.7 ms (typ.)
	R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O	< 1.2 ms, 0.9 ms (typ.)
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	< 1.4 ms, 1.1 ms (typ.)
	with R&S®SMW-B711, R&S®SMW-B721, run mode: live	< 4.0 ms
Resolution of phase offset setting		adjustable in 0.1° steps

Frequency sweep

Operating mode		digital sweep in discrete steps
Trigger modes	execute sweep continuously with internal trigger source	auto
	execute one full sweep	single
	execute one step	step
	sweep start and stop controlled by external trigger signal	start/stop
Trigger source		external trigger signal (INST TRG A or B at rear), rotary knob, touchpanel, remote control
Sweep range		full frequency range
Sweep shape		sawtooth, triangle
Step size setting resolution	linear	0.001 Hz
	logarithmic	0.01 % to 100 % per step
Dwell time setting range		1 ms to 100 s
	with R&S®SMW-B711, R&S®SMW-B721	5 ms to 100 s
Dwell time setting resolution		0.1 ms

Reference frequency

Frequency error	at time of calibration in production	
	standard or with R&S®SMW-B709 option	< $1 \cdot 10^{-8}$
	with R&S®SMW-B710 or R&S®SMW-B711 option	< $5 \cdot 10^{-9}$
Aging	after 30 days of uninterrupted operation	
	standard	≤ $1 \cdot 10^{-9}$/day, ≤ $1 \cdot 10^{-7}$/year
	with R&S®SMW-B709/-B710/-B711 options	≤ $5 \cdot 10^{-10}$/day, ≤ $3 \cdot 10^{-8}$/year
Temperature effect	in temperature range from 0 °C to +45 °C	
	standard	±$6 \cdot 10^{-8}$
	with R&S®SMW-B709 option	±$6 \cdot 10^{-9}$
	with R&S®SMW-B710 or R&S®SMW-B711 option	±$3 \cdot 10^{-9}$
Warm-up time	to nominal thermostat temperature	≤ 10 min (nom.)
Input for external reference frequency		
Connector type	REF in on rear panel	BNC female
Input frequency	standard	10 MHz
	with R&S®SMW-K703 option	10 MHz, 100 MHz
	with R&S®SMW-K704 option	10 MHz, 1 MHz to 100 MHz, variable
Input frequency setting resolution	with R&S®SMW-K704 option	0.1 Hz
Input level range	level limits	0 dBm to 20 dBm
	recommended input level for optimum phase noise performance	7 dBm to 13 dBm
Input impedance		50 Ω (nom.)
Minimum frequency locking range	synchronization bandwidth: wide	±$3 \cdot 10^{-6}$
	synchronization bandwidth: narrow	
	standard or with R&S®SMW-B709 option	±$0.3 \cdot 10^{-6}$
	with R&S®SMW-B710 or R&S®SMW-B711 option	±$0.15 \cdot 10^{-6}$
Output for internal reference frequency		
Connector type	REF OUT on rear panel	BNC female
Output frequency	standard	sine wave 10 MHz
	with R&S®SMW-K703 option	sine wave 10 MHz, 100 MHz
	with R&S®SMW-K704 option	
	instrument set to internal reference	sine wave 10 MHz
	instrument set to external reference	sine wave 10 MHz, applied external reference frequency
Output level		7 dBm to 14 dBm
Source impedance		50 Ω (nom.)
Wideband noise	with R&S®SMW-K703 option, 100 MHz, internal reference, carrier offset = 10 MHz, measurement bandwidth = 1 Hz	< –155 dBc, –159 dBc (typ.)
Ultra low noise 1 GHz reference frequency (R&S®SMW-K703 option)		
Input connector type	1 GHz in on rear panel	SMA female
Input frequency		1 GHz
Input level range	level limits	≥ 6 dBm, ≤ 20 dBm
	recommended input level for optimum phase noise performance	7 dBm to 13 dBm
Input impedance		50 Ω (nom.)
Minimum frequency locking range		±$3 \cdot 10^{-6}$
Output connector type	1 GHz out on rear panel	SMA female
Output frequency		sine wave 1 GHz
Output level		7 dBm to 14 dBm
Source impedance		50 Ω (nom.)
Wideband noise	1 GHz, internal reference, carrier offset = 10 MHz, measurement bandwidth = 1 Hz	< –154 dBc, –158 dBc (typ.)

Input for electronic tuning of internal reference frequency		
Connector type	EFC on rear panel	BNC female
Sensitivity	external tuning slope	$1 \cdot 10^{-8}$/V (typ.)
Input voltage		–10 V to +10 V
Input impedance		10 kΩ (nom.)

R&S®SMW-K703 option (100 MHz, 1 GHz reference input/output)
When this option is installed, the 1 GHz low noise input and output for synchronization can be used.
In WIDE mode, the signal generator will use this signal directly as a reference for the synthesizer.
This option should be used if a very high phase stability between multiple generators is required.
The 100 MHz low noise input and output mode is only available with this option.

R&S®SMW-K704 option (flexible reference input)
When this option is installed, the reference input frequency can be set in 0.1 Hz steps from 1.0 MHz to 100 MHz.
The signal generator will lock its internal reference oscillator on the input frequency.

Note on choosing the proper reference synchronization bandwidth.
The user has the choice to set the synchronization bandwidth either to NARROW or WIDE.
In WIDE mode, the best possible phase stability is achieved.
The phase noise performance close to the carrier depends on the phase noise of the external signal source.
In NARROW mode, the reference PLL acts as a clean-up-loop in which the phase noise is mainly determined by the signal generator's internal reference source.
This mode is recommended when using external reference sources with close-to-carrier phase noise worse than the R&S®SMW200A (i. e. rubidium standards).
Note that due to the slow synchronization, reference locking can take up to 10 s.

Level

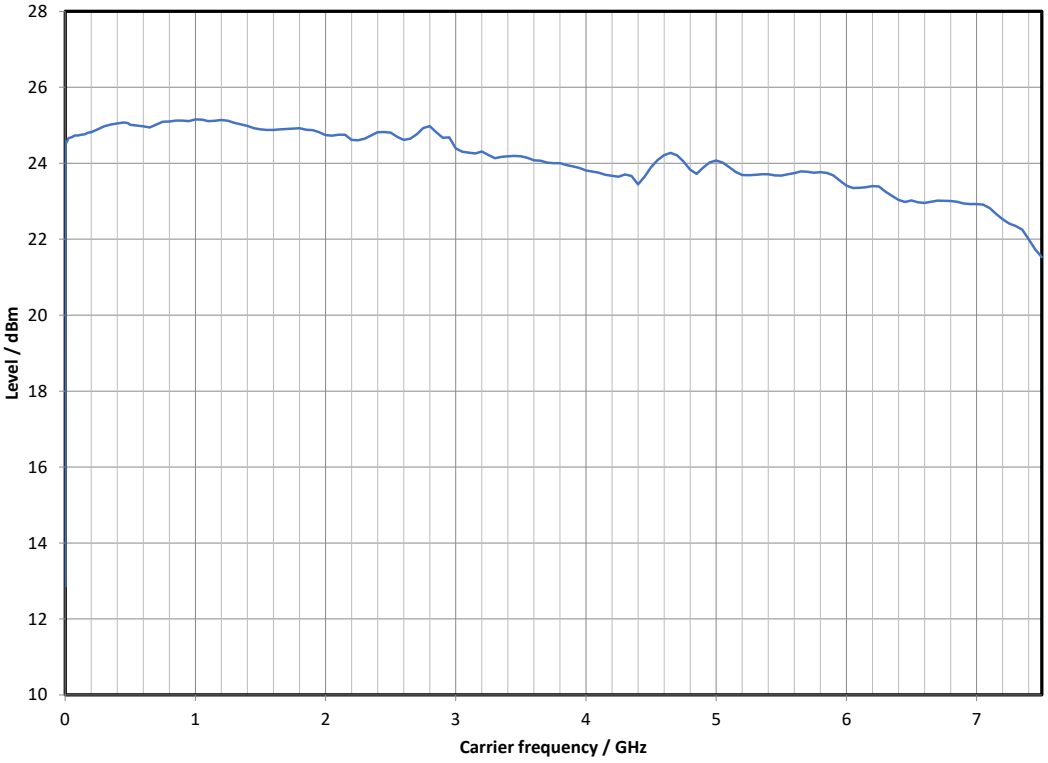
Specified level range		
With R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020 frequency options		
	100 kHz ≤ f < 1 MHz	–120 dBm to +3 dBm (PEP) [2]
	1 MHz ≤ f ≤ 3 MHz	–120 dBm to +8 dBm (PEP) [2]
	3 MHz < f ≤ 20 GHz	–120 dBm to +18 dBm (PEP) [2]
With R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O frequency options		
	100 kHz ≤ f < 1 MHz	–120 dBm to +3 dBm (PEP) [2]
	1 MHz ≤ f ≤ 3 MHz	–120 dBm to +8 dBm (PEP) [2]
	3 MHz < f ≤ 3 GHz	–120 dBm to +18 dBm (PEP) [2]
	3 GHz < f ≤ 14 GHz	–120 dBm to +17 dBm (PEP) [2]
	14 GHz < f ≤ 20 GHz	
	CW, I/Q modulation, signal bandwidth ≤ 160 MHz	–120 dBm to +15 dBm (PEP) [2]
	I/Q modulation, signal bandwidth > 160 MHz	–120 dBm to +12 dBm (PEP) [2]
	20 GHz < f ≤ 29 GHz	–120 dBm to +18 dBm (PEP) [2]
	29 GHz < f ≤ 33 GHz	–120 dBm to +17 dBm (PEP) [2]
	33 GHz < f ≤ 40 GHz	–120 dBm to +15 dBm (PEP) [2]
	40 GHz < f ≤ 42 GHz	–120 dBm to +13 dBm (PEP) [2]
	42 GHz < f ≤ 44 GHz	–120 dBm to +12 dBm (PEP) [2]
With R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options		
	100 kHz ≤ f < 1 MHz	–120 dBm to +3 dBm (PEP) [2]
	1 MHz ≤ f ≤ 3 MHz	–120 dBm to +8 dBm (PEP) [2]
	3 MHz < f ≤ 16 GHz	–120 dBm to +15 dBm (PEP) [2]
	16 GHz < f ≤ 20 GHz	
	CW, I/Q modulation, signal bandwidth ≤ 160 MHz	–120 dBm to +13 dBm (PEP) [2]
	I/Q modulation, signal bandwidth > 160 MHz	–120 dBm to +10 dBm (PEP) [2]
	20 GHz < f ≤ 33 GHz	–120 dBm to +15 dBm (PEP) [2]
	33 GHz < f ≤ 43 GHz	–115 dBm to +10 dBm (PEP) [2]
	43 GHz < f ≤ 60 GHz	–115 dBm to +12 dBm (PEP) [2]
	60 GHz < f ≤ 67 GHz	–115 dBm to +10 dBm (PEP) [2]

[2] PEP = peak envelope power.

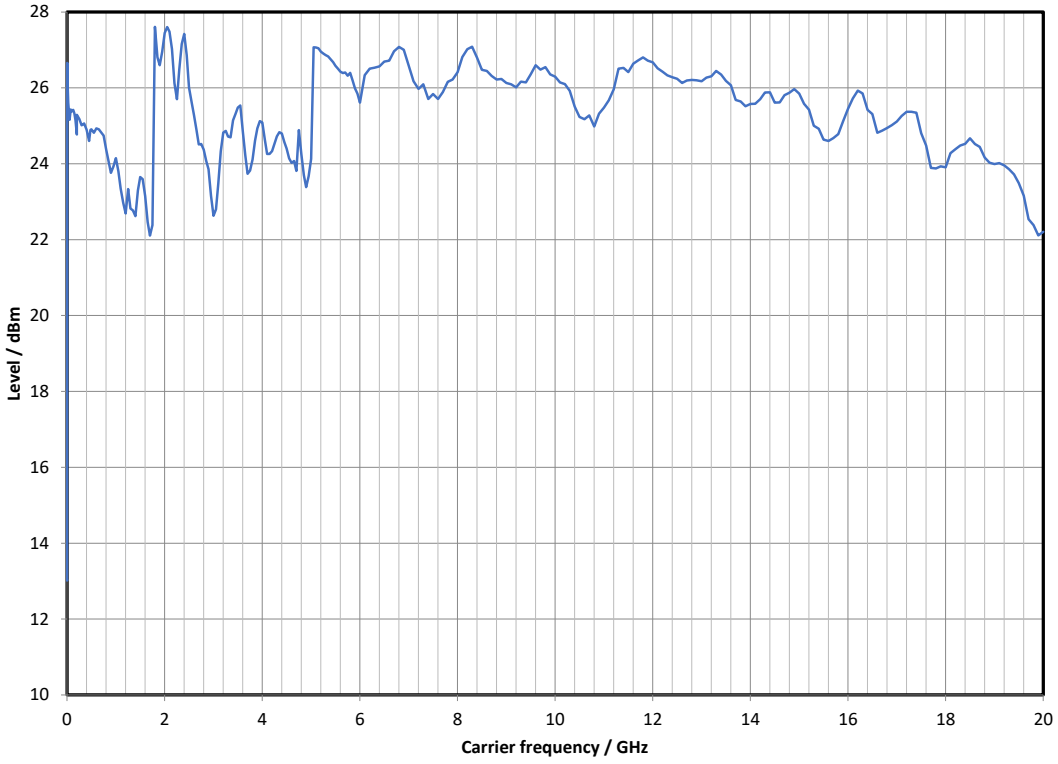
Setting range	100 kHz ≤ f < 1 MHz	–145 dBm to +8 dBm
	1 MHz ≤ f < 3 MHz	–145 dBm to +13 dBm
	3 MHz ≤ f ≤ 67 GHz	–145 dBm to +30 dBm
Resolution of setting		0.01 dB (nom.)
Level error	level setting characteristic: auto, temperature range from +18 °C to +33 °C	
	100 kHz ≤ f ≤ 3 GHz	< 0.5 dB
	3 GHz < f ≤ 6 GHz	< 0.7 dB
	6 GHz < f ≤ 20 GHz	< 0.9 dB
	R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, 20 GHz < f ≤ 40 GHz	< 1.1 dB
	R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, 20 GHz < f ≤ 44 GHz	< 1.2 dB
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O, 20 GHz < f ≤ 43 GHz	< 1.1 dB
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, 43 GHz < f ≤ 56 GHz	
	level ≥ –90 dBm	< 1.2 dB
	level < –90 dBm	< 1.5 dB
	R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O, 43 GHz < f ≤ 67 GHz	
	level ≥ –90 dBm	< 1.2 dB
	level < –90 dBm	< 1.5 dB
Additional level error	I/Q modulation	
	optimization mode: high quality, fast	< 0.3 dB
	pulse modulation	< 0.5 dB
Output impedance, VSWR in 50 Ω system	ALC state: on	
	R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006	
	100 kHz < f ≤ 6 GHz	< 1.9, < 1.5 (typ.)
	R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012	
	100 kHz < f ≤ 12.75 GHz	< 2.0, < 1.6 (typ.)
	R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O	
	100 kHz < f ≤ 20 GHz	< 2.1, < 1.7 (typ.)
	step attenuator = 0 dB, 20 GHz < f ≤ 38 GHz	< 2.2, < 1.8 (typ.)
	step attenuator = 0 dB, 38 GHz < f ≤ 44 GHz	< 2.6, < 2.2 (typ.)
	step attenuator ≥ 5 dB, 20 GHz < f ≤ 44 GHz	< 2.1, < 1.7 (typ.)
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	
	100 kHz < f ≤ 38 GHz	< 2.2, < 1.8 (typ.)
	38 GHz < f ≤ 50 GHz	< 2.6, < 2.2 (typ.)

Setting time	to < 0.3 dB deviation from final value, with GUI update stopped, no relay switchover, f > 10 MHz, I/Q optimization mode: fast, health and utilization monitoring service (HUMS) off, level setting characteristic: auto	
	after IEC/IEEE bus delimiter [3]	< 1.2 ms, 1 ms (typ.)
	with switching of mechanical step attenuator, after IEC/IEEE bus delimiter	< 25 ms
	R&S®SMW-B1044, R&S®SMW-B1044N, R&S®SMW-B1044O, R&S®SMW-B2044, R&S®SMW-B2044N, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O, with switching of mechanical step attenuator, after IEC/IEEE bus delimiter	< 30 ms
Setting time (list mode)	to < 0.3 dB deviation from final value, with GUI update stopped, no relay switchover, f > 10 MHz, I/Q optimization mode: fast, health and utilization monitoring service (HUMS) off, level setting characteristic: auto	
	after trigger pulse [3]	< 0.8 ms, 0.55 ms (typ.)
	with R&S®SMW-B711, R&S®SMW-B721, run mode: live	< 1 ms
Interruption-free level setting range	level setting characteristic: uninterrupted level setting	> 20 dB
Reverse power (from 50 Ω source)	maximum permissible RF power in output frequency range of RF path with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006 frequency options; Note: The RF path is switched off if the reverse power exceeds a limit (+27 dBm (meas.), depends on RF frequency).	
	1 MHz < f ≤ 3 GHz	50 W
	3 GHz < f ≤ 6 GHz	10 W
	maximum permissible RF power in output frequency range of RF path with R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options	
	1 MHz < f ≤ 67 GHz	0.5 W
Maximum permissible DC voltage	R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006 frequency options	50 V
	R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012 frequency options	35 V
	R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options	0 V

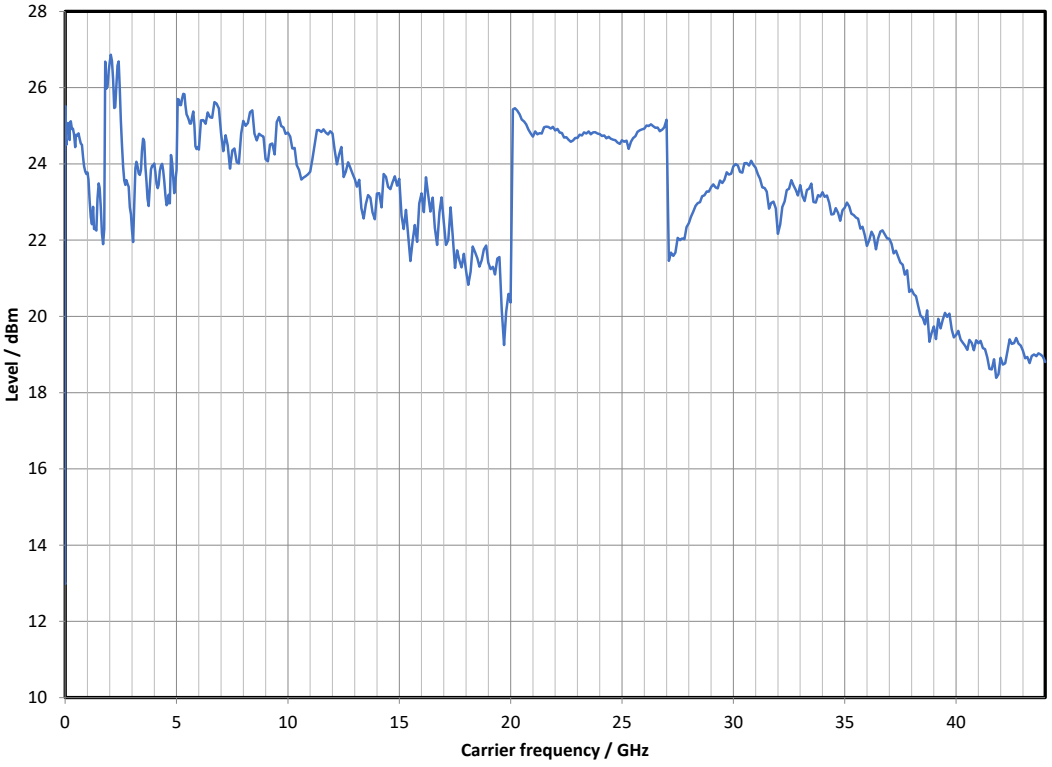
[3] Ambient temperature > +18 °C.



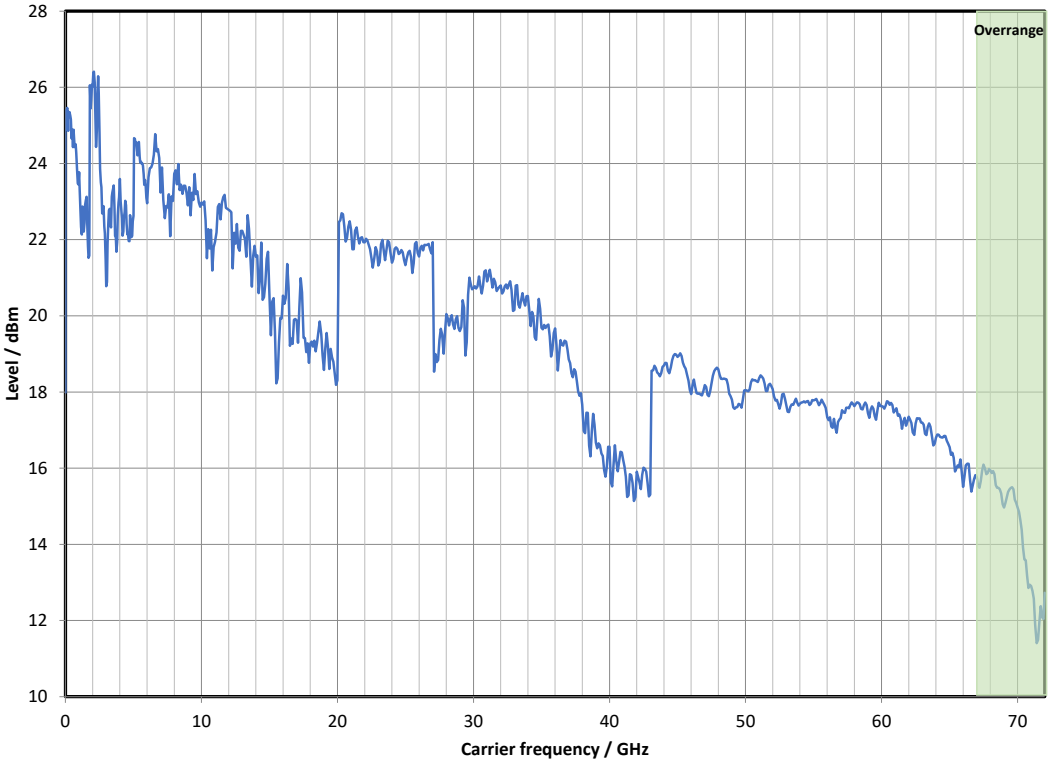
Measured maximum available output level versus carrier frequency with R&S®SMW-B1007, R&S®SMW-B2007 frequency options



Measured maximum available output level versus carrier frequency with R&S®SMW-B1020, R&S®SMW-B2020 frequency options



Measured maximum available output level versus carrier frequency with R&S®SMW-B1044, R&S®SMW-B1044N, R&S®SMW-B1044O, R&S®SMW-B2044, R&S®SMW-B2044N, R&S®SMW-B2044O frequency options



Measured maximum available output level versus carrier frequency with R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options

Level sweep

Operating mode		digital sweep in discrete steps
Trigger modes	free run	auto
	execute one full sweep	single
	execute one step	step
	sweep start and stop controlled by external trigger signal	start/stop
Trigger source	internal	external trigger signal (INST TRG A or B at rear), rotary knob, touchpanel, remote control
Trigger slope	external trigger signal	positive, negative
Sweep range	interruption-free level sweep, level setting characteristic: uninterrupted level setting	0.01 dB to 20 dB
Sweep shape		sawtooth, triangle
Step size setting resolution		0.01 dB
Dwell time setting range		1 ms to 100 s
Dwell time setting resolution		0.1 ms

Spectral purity

Harmonics [4]	CW, f > 1 MHz	
	R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, frequency options, level < 10 dBm	< –30 dBc
	R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, frequency options, level < 8 dBm	< –30 dBc
	R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O frequency options, level < 10 dBm	
	f ≤ 3.5 GHz	< –30 dBc
	f > 3.5 GHz	< –55 dBc
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options, level < 6 dBm	
	f ≤ 3.5 GHz	< –30 dBc
	f > 3.5 GHz	< –55 dBc
Nonharmonics	CW, I/Q modulation (full-scale DC input), level > –10 dBm, > 10 kHz offset from carrier and outside the modulation spectrum	
	100 kHz ≤ f ≤ 200 MHz	< –80 dBc
	200 MHz < f ≤ 1500 MHz	
	with R&S®SMW-B13/-B13T options	< –85 dBc
	with R&S®SMW-B13XT option	< –80 dBc
	1500 MHz < f ≤ 3 GHz	< –79 dBc
	3 GHz < f ≤ 6 GHz	< –73 dBc
	6 GHz < f ≤ 12 GHz	< –67 dBc
	12 GHz < f ≤ 24 GHz	< –61 dBc
	24 GHz < f ≤ 44 GHz	< –55 dBc
	44 GHz < f ≤ 60 GHz	< –53 dBc
	60 GHz < f ≤ 67 GHz	< –47 dBc
Nonharmonics with R&S®SMW-B711/-B721 options	CW, I/Q modulation (full-scale DC input), level > –10 dBm, > 10 kHz offset from carrier and outside the modulation spectrum	
	100 kHz ≤ f ≤ 200 MHz	< –80 dBc
	200 MHz < f ≤ 1500 MHz	
	with R&S®SMW-B13/-B13T options	< –90 dBc
	with R&S®SMW-B13XT option	< –80 dBc
	1500 MHz < f ≤ 3 GHz	
	with R&S®SMW-B13/-B13T options	< –84 dBc
	with R&S®SMW-B13XT option	< –80 dBc
	3 GHz < f ≤ 6 GHz	< –83 dBc
	6 GHz < f ≤ 12 GHz	< –77 dBc
	12 GHz < f ≤ 24 GHz	< –71 dBc
	24 GHz < f ≤ 44 GHz	< –65 dBc
	44 GHz < f ≤ 60 GHz	< –63 dBc
	60 GHz < f ≤ 67 GHz	< –57 dBc
Subharmonics [5]	CW, I/Q modulation (full-scale DC input)	
	f ≤ 3 GHz	
	standard	< –85 dBc
	with R&S®SMW-B711/-B721 options	< –95 dBc
	3 GHz < f ≤ 6 GHz	< –74 dBc
	6 GHz < f ≤ 40 GHz	< –60 dBc
	40 GHz < f ≤ 42 GHz	< –60 dBc
	42 GHz < f ≤ 44 GHz	< –50 dBc
	44 GHz < f ≤ 67 GHz, CW	< –50 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 %

[4] Specifications are not valid for harmonics beyond "specified frequency range".

[5] Specifications are not valid for subharmonics beyond "specified frequency range".

Wideband noise	carrier offset > 30 MHz, measurement bandwidth = 1 Hz	
	CW, level = 10 dBm	
	R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006 frequency options	
	20 MHz ≤ f ≤ 200 MHz	< –146 dBc, –149 dBc (typ.)
	200 MHz < f ≤ 6 GHz	< –150 dBc, –152 dBc (typ.)
	R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020 frequency options	
	20 MHz ≤ f ≤ 400 MHz	< –146 dBc, –149 dBc (typ.)
	400 MHz < f ≤ 5 GHz	< –150 dBc, –152 dBc (typ.)
	5 GHz < f ≤ 12 GHz	< –147 dBc, –149 dBc (typ.)
	12 GHz < f ≤ 20 GHz	< –144 dBc, –146 dBc (typ.)
	R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options	
	20 MHz ≤ f ≤ 200 MHz	< –146 dBc, –149 dBc (typ.)
	200 MHz < f ≤ 600 MHz	< –148 dBc, –150 dBc (typ.)
	600 MHz < f ≤ 5 GHz	< –150 dBc, –152 dBc (typ.)
	5 GHz < f ≤ 12 GHz	< –147 dBc, –149 dBc (typ.)
	12 GHz < f ≤ 20 GHz	< –144 dBc, –146 dBc (typ.)
	20 GHz < f ≤ 30 GHz, carrier offset = 30 MHz	< –135 dBc, –138 dBc (typ.)
	30 GHz < f ≤ 44 GHz, carrier offset = 30 MHz	< –131 dBc, –134 dBc (typ.)
	44 GHz < f ≤ 67 GHz, carrier offset = 40 MHz	< –130 dBc, –133 dBc (typ.)
	I/Q modulation with full-scale internal single carrier signal, I/Q input gain = +4 dB, level = 10 dBm	
	20 MHz ≤ f ≤ 200 MHz	< –139 dBc, –142 dBc (typ.)
	200 MHz < f ≤ 1 GHz	< –141 dBc, –144 dBc (typ.)
	1 GHz < f ≤ 3 GHz	< –142 dBc, –145 dBc (typ.)
	3 GHz < f ≤ 12 GHz	< –140 dBc, –143 dBc (typ.)
	R&S®SMW-B1020, R&S®SMW-B2020 frequency options	
	12 GHz < f ≤ 20 GHz	< –138 dBc, –141 dBc (typ.)
	R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options	
	12 GHz < f ≤ 20 GHz	< –138 dBc, –141 dBc (typ.)
	20 GHz < f ≤ 44 GHz, carrier offset = 30 MHz	< –130 dBc, –135 dBc (typ.)
	44 GHz < f ≤ 67 GHz, carrier offset = 40 MHz	< –129 dBc, –133 dBc (typ.)
SSB phase noise	CW, standard performance, carrier offset = 20 kHz, measurement bandwidth = 1 Hz, level = 10 dBm or maximum specified output power, whichever is lower	
	20 MHz ≤ f ≤ 200 MHz	< –134 dBc, –140 dBc (typ.)
	f = 1 GHz	< –134 dBc, –140 dBc (typ.)
	f = 2 GHz	< –128 dBc, –134 dBc (typ.)
	f = 3 GHz	< –124 dBc, –130 dBc (typ.)
	f = 4 GHz	< –122 dBc, –128 dBc (typ.)
	f = 6 GHz	< –118 dBc, –124 dBc (typ.)
	f = 10 GHz	< –114 dBc, –120 dBc (typ.)
	f = 20 GHz	< –108 dBc, –114 dBc (typ.)
	f = 30 GHz	< –104 dBc, –110 dBc (typ.)
	f = 40 GHz	< –102 dBc, –108 dBc (typ.)
	f = 44 GHz	< –101 dBc, –107 dBc (typ.)
	f = 56 GHz	< –96 dBc, –102 dBc (typ.)
	f = 67 GHz	< –94 dBc, –100 dBc (typ.)

SSB phase noise with R&S®SMW-B709/-B719 options

Specified values in plain text, measured values in brackets *( ) and italics.*

SSB phase noise in dBc, measurement bandwidth = 1 Hz, CW, level = 10 dBm				
Offset frequency / Carrier frequency	**1 Hz**	**10 Hz**	**100 Hz**	**1 kHz**
f = 10 MHz	*(–96)*	–112	–121	–131
f = 100 MHz	*(–77)*	–99	–120	–131
f = 1 GHz	*(–59)*	–83	–104	–124
f = 2 GHz	*(–53)*	–77	–98	–118
f = 3 GHz	*(–49)*	–73	–94	–114
f = 4 GHz	*(–47)*	–71	–92	–112
f = 6 GHz	*(–43)*	–67	–88	–108
f = 10 GHz	*(–39)*	–63	–84	–104
f = 20 GHz	*(–33)*	–57	–78	–98
f = 30 GHz	*(–29)*	–53	–74	–94
f = 40 GHz	*(–27)*	–51	–72	–92
f = 44 GHz	*(–26)*	–50	–71	–91
f = 56 GHz	*(–21)*	–45	–66	–86
f = 67 GHz	*(–19)*	–43	–64	–84

SSB phase noise in dBc, measurement bandwidth = 1 Hz, CW, level = 10 dBm				
Offset frequency / Carrier frequency	**10 kHz**	**100 kHz**	**1 MHz**	**10 MHz**
f = 10 MHz	–138	–136	–141	
f = 100 MHz	–138	–136	–141	–149
f = 1 GHz	–139	–137	–144	–152
f = 2 GHz	–133	–131	–138	–152
f = 3 GHz	–129	–127	–134	–152
f = 4 GHz	–127	–125	–132	–152
f = 6 GHz	–123	–121	–128	–151
f = 10 GHz	–119	–117	–124	–145
f = 20 GHz	–113	–111	–118	–137
f = 30 GHz	–109	–107	–114	–134
f = 40 GHz	–107	–105	–112	–132
f = 44 GHz	–106	–104	–111	–130
f = 56 GHz	–101	–99	–106	–129
f = 67 GHz	–99	–97	–104	–128

SSB phase noise with R&S®SMW-B710/-B720 options

Specified values in plain text, typical values in brackets ( ), measured values in brackets *( ) and italics.*

SSB phase noise in dBc, measurement bandwidth = 1 Hz, CW, level = 10 dBm				
Offset frequency / Carrier frequency	**1 Hz**	**10 Hz**	**100 Hz**	**1 kHz**
f = 10 MHz	*(–110)*	–112 (–118)	–122 (–128)	–131 (–139)
f = 100 MHz	*(–100)*	–110 (–116)	–121 (–127)	–131 (–139)
f = 1 GHz	*(–82)*	–97 (–103)	–111 (–117)	–131 (–137)
f = 2 GHz	*(–76)*	–91 (–97)	–105 (–111)	–125 (–131)
f = 3 GHz	*(–72)*	–87 (–93)	–101 (–107)	–121 (–127)
f = 4 GHz	*(–70)*	–85 (–91)	–99 (–105)	–119 (–125)
f = 6 GHz	*(–66)*	–81 (–87)	–95 (–101)	–115 (–121)
f = 10 GHz	*(–62)*	–77 (–83)	–91 (–97)	–111 (–117)
f = 20 GHz	*(–56)*	–71 (–77)	–85 (–91)	–105 (–111)
f = 30 GHz	*(–52)*	–67 (–73)	–81 (–87)	–101 (–107)
f = 40 GHz	*(–50)*	–65 (–71)	–79 (–85)	–99 (–105)
f = 44 GHz	*(–49)*	–64 (–70)	–78 (–84)	–98 (–104)
f = 56 GHz	*(–45)*	–59 (–65)	–73 (–79)	–93 (–99)
f = 67 GHz	*(–42)*	–57 (–63)	–71 (–77)	–91 (–97)

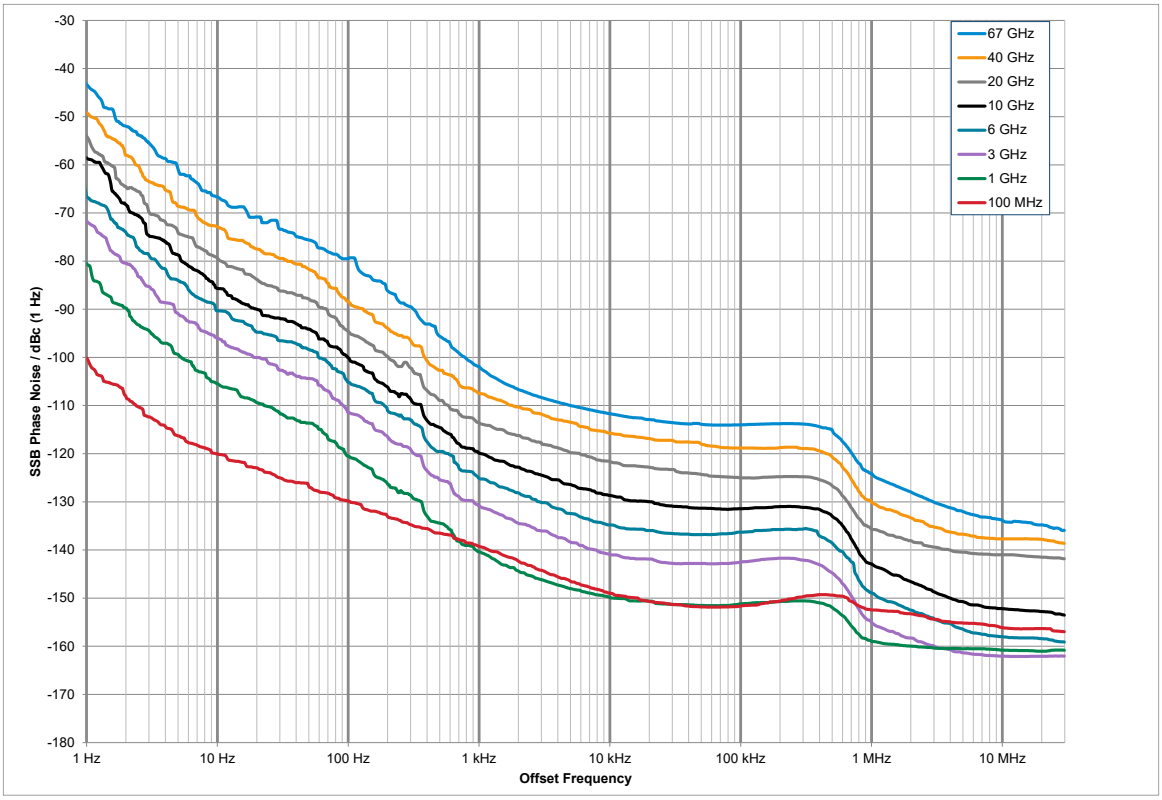
SSB phase noise in dBc, measurement bandwidth = 1 Hz, CW, level = 10 dBm				
Offset frequency / Carrier frequency	**10 kHz**	**100 kHz**	**1 MHz**	**10 MHz**
f = 10 MHz	–138 (–144)	–136 (–142)	–141 (–147)	
f = 100 MHz	–138 (–144)	–136 (–142)	–141 (–147)	–149 (–155)
f = 1 GHz	–139 (–145)	–137 (–143)	–144 (–150)	–152 (–155)
f = 2 GHz	–133 (–139)	–131 (–137)	–138 (–144)	–152 (–155)
f = 3 GHz	–129 (–135)	–127 (–133)	–134 (–140)	–152 (–155)
f = 4 GHz	–127 (–133)	–125 (–131)	–132 (–138)	–152 (–155)
f = 6 GHz	–123 (–129)	–121 (–127)	–128 (–134)	–151 (–157)
f = 10 GHz	–119 (–125)	–117 (–123)	–124 (–130)	–145 (–151)
f = 20 GHz	–113 (–119)	–111 (–117)	–118 (–124)	–137 (–143)
f = 30 GHz	–109 (–115)	–107 (–113)	–114 (–120)	–134 (–140)
f = 40 GHz	–107 (–113)	–105 (–111)	–112 (–118)	–132 (–138)
f = 44 GHz	–106 (–112)	–104 (–110)	–111 (–117)	–130 (–136)
f = 56 GHz	–101 (–107)	–99 (–105)	–106 (–112)	–129 (–135)
f = 67 GHz	–99 (–105)	–97 (–103)	–104 (–110)	–128 (–134)

SSB phase noise with R&S®SMW-B711/-B721 option

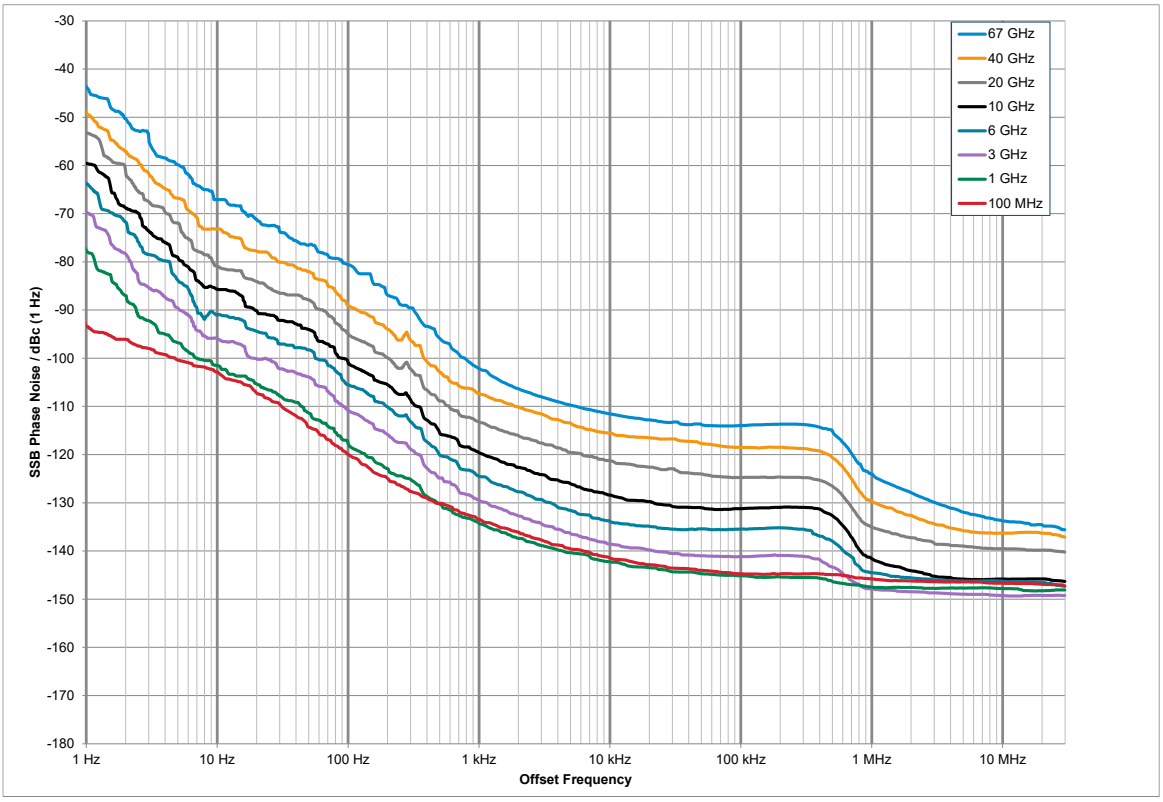
Specified values in plain text, typical values in brackets ( ), measured values in brackets *( ) and italics.*

SSB phase noise in dBc, measurement bandwidth = 1 Hz, CW, level = 10 dBm				
Offset frequency / Carrier frequency	**1 Hz**	**10 Hz**	**100 Hz**	**1 kHz**
f = 10 MHz	*(–110)*	–112 (–128)	–122 (–128)	–133 (–140)
f = 100 MHz	*(–100)*	–110 (–116)	–121 (–127)	–133 (–140)
f = 1 GHz	*(–82)*	–97 (–103)	–111 (–117)	–135 (–141)
f = 2 GHz	*(–76)*	–91 (–97)	–105 (–111)	–129 (–135)
f = 3 GHz	*(–72)*	–87 (–93)	–101 (–107)	–125 (–131)
f = 4 GHz	*(–70)*	–85 (–91)	–99 (–105)	–123 (–129)
f = 6 GHz	*(–66)*	–81 (–87)	–95 (–101)	–119 (–125)
f = 10 GHz	*(–62)*	–77 (–83)	–91 (–97)	–115 (–121)
f = 20 GHz	*(–56)*	–71 (–77)	–85 (–91)	–109 (–115)
f = 30 GHz	*(–52)*	–67 (–73)	–81 (–87)	–105 (–111)
f = 40 GHz	*(–50)*	–65 (–71)	–79 (–85)	–103 (–109)
f = 44 GHz	*(–49)*	–64 (–70)	–78 (–84)	–102 (–108)
f = 56 GHz	*(-45)*	–60 (-66)	–74 (–80)	–98 (–104)
f = 67 GHz	*(-43)*	–58 (-64)	–72 (–78)	–96 (–102)

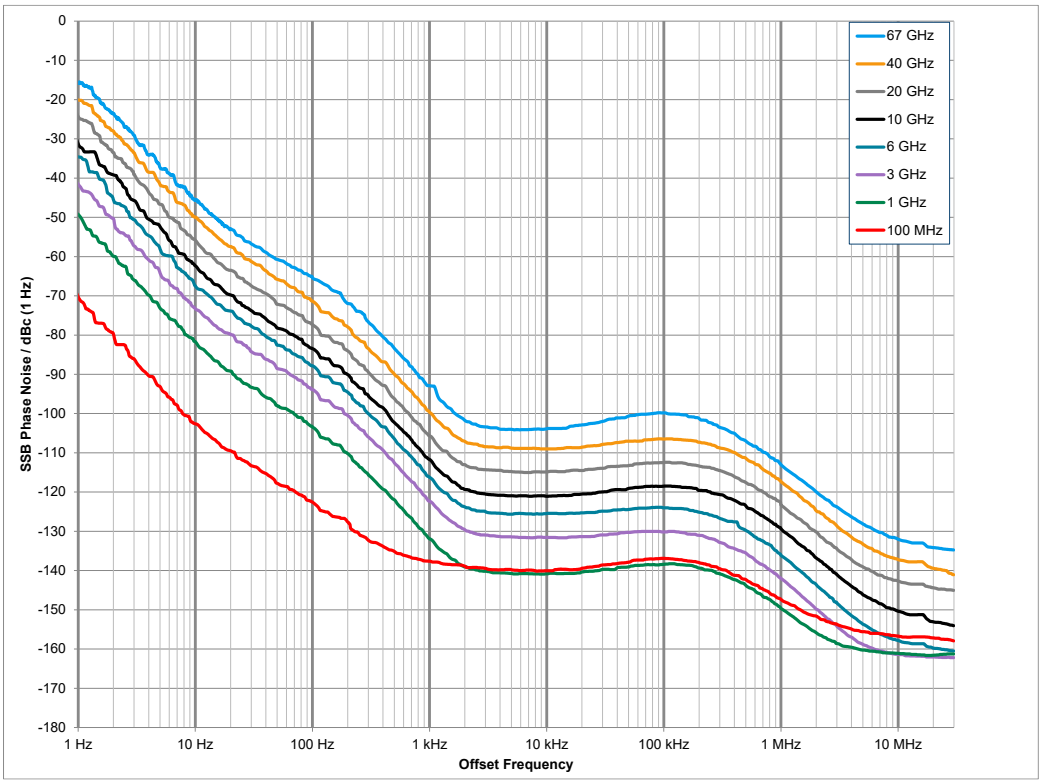
SSB phase noise in dBc, measurement bandwidth = 1 Hz, CW, level = 10 dBm				
Offset frequency / Carrier frequency	**10 kHz**	**100 kHz**	**1 MHz**	**10 MHz**
f = 10 MHz	–143 (–149)	–144 (–149)	–146 (–152)	
f = 100 MHz	–143 (–149)	–146 (–152)	–146 (–152)	–149 (–155)
f = 1 GHz	–144 (–150)	–145 (–151)	–151 (–161)	–152 (–155)
f = 2 GHz	–138 (–144)	–140 (–145)	–147 (–157)	–152 (–155)
f = 3 GHz	–134 (–140)	–136 (–141)	–145 (–156)	–152 (–155)
f = 4 GHz	–132 (–138)	–134 (–139)	–143 (–151)	–152 (–155)
f = 6 GHz	–128 (–134)	–130 (–135)	–139 (–150)	–152 (–155)
f = 10 GHz	–124 (–130)	–126 (–131)	–134 (–145)	–147 (–153)
f = 20 GHz	–118 (–124)	–120 (–125)	–128 (–139)	–137 (–143)
f = 30 GHz	–114 (–120)	–116 (–121)	–124 (–127)	–135 (–141)
f = 40 GHz	–112 (–118)	–114 (–119)	–122 (–133)	–133 (–139)
f = 44 GHz	–111 (–117)	–113 (–118)	–121 (–131)	–132 (–138)
f = 56 GHz	–107 (–113)	–109 (–115)	–118 (–124)	–131 (–137)
f = 67 GHz	–105 (–111)	–107 (–113)	–116 (–122)	–128 (–134)



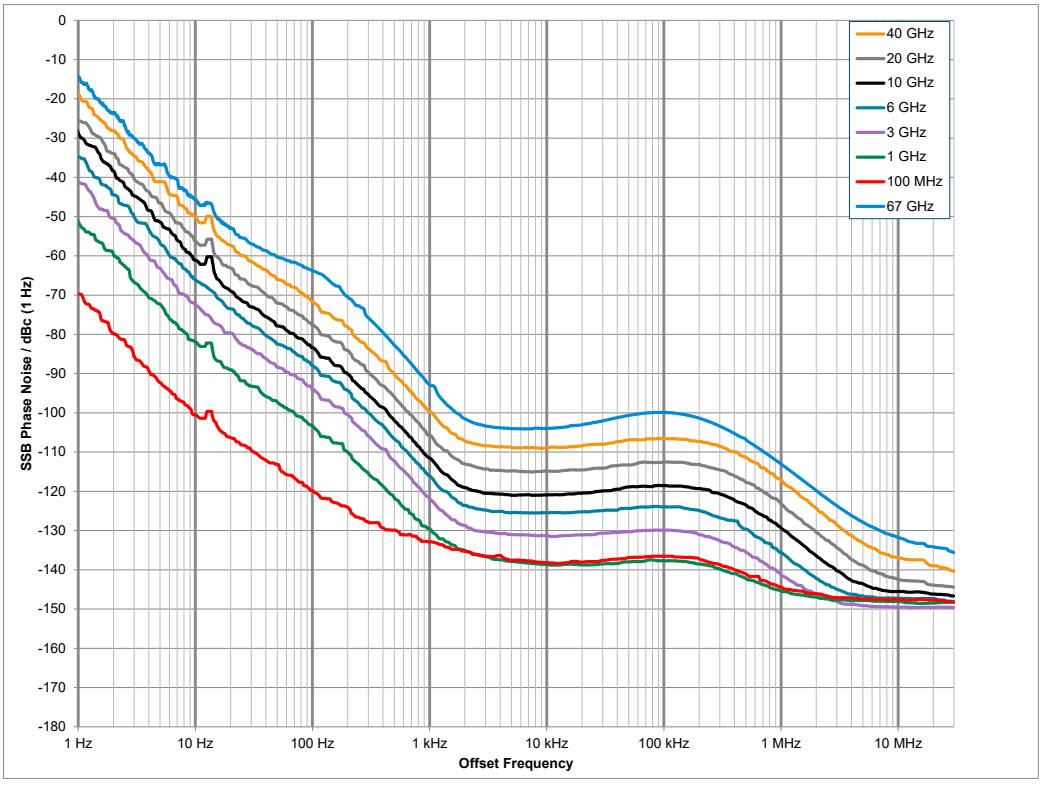
Measured SSB phase noise performance with R&S®SMW-B711/-B721 options, CW mode



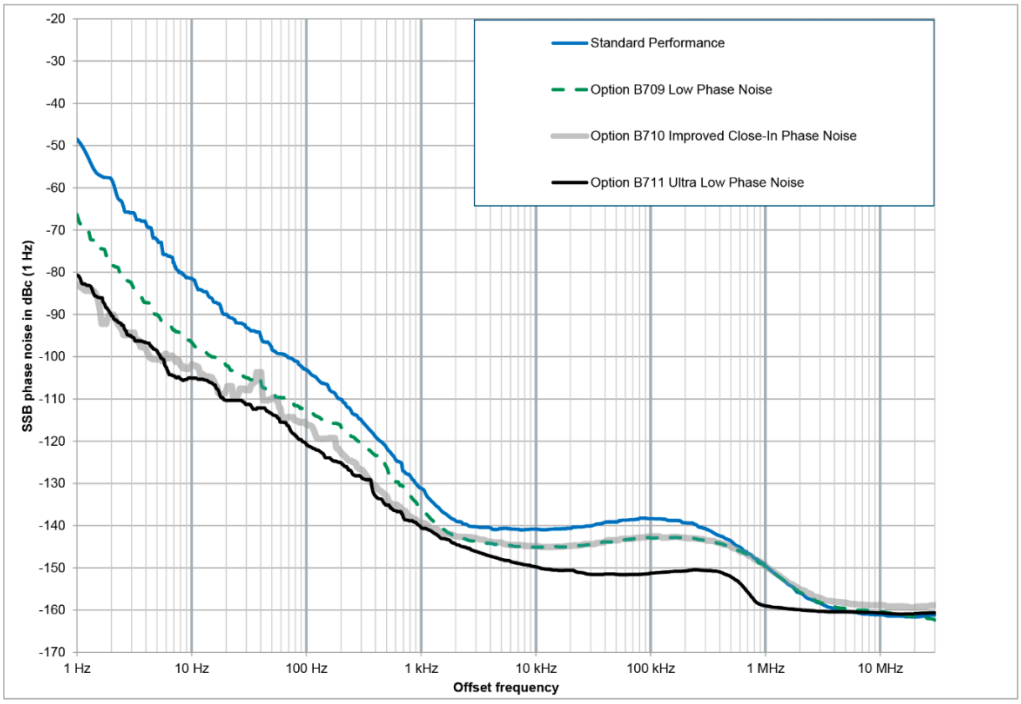
Measured SSB phase noise performance with R&S®SMW-B711/-B721 options, I/Q mode



Measured SSB phase noise performance, standard instrument, CW mode



Measured SSB phase noise performance, standard instrument, I/Q mode



Measured SSB phase noise performance at f = 1 GHz, CW mode, standard performance versus the R&S®SMW-B709, R&S®SMW-B710 and R&S®SMW-B711 options

List mode

Frequency and level values can be stored in a list and set in an extremely short amount of time, triggered by an internal timer or an external trigger connector. There are two run modes available:

- Learned: faster (see frequency and level data), limited number of steps, cannot be combined with I/Q optimization mode “high quality”, not available if the instrument is equipped with R&S®SMW-B711/-B721 ultra low phase noise options
- Live: works only for dwell times above 2 ms

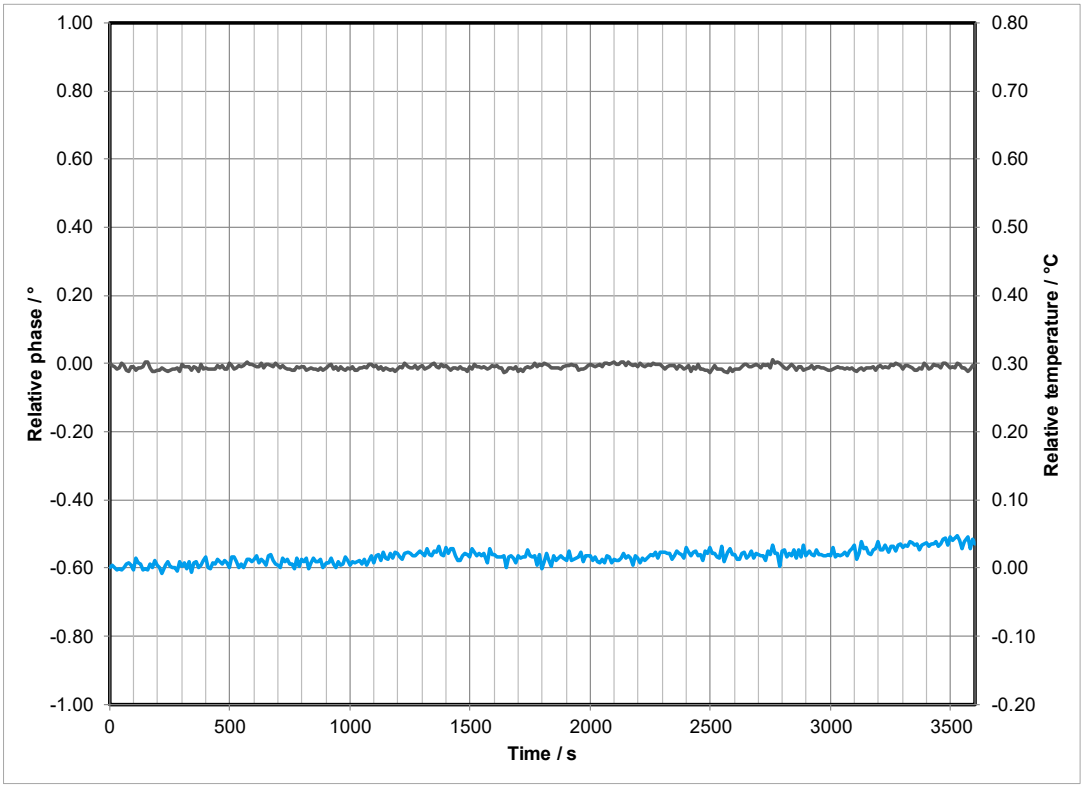
Run modes		learned, live
Operating modes	internal trigger, infinite	automatic
	internal trigger, one sweep per trigger event	single
	internal trigger, one step per trigger event	step
	external trigger, one sweep per trigger event	extern single
	external trigger, one step per trigger event	extern step
Maximum number of steps (learned mode)		10000
Dwell time	can be set individually for each step	0.5 ms to 100 s
Resolution		0.1 ms
Setting time	after external trigger	see frequency and level data

Phase coherence (R&S®SMW-B90 option)

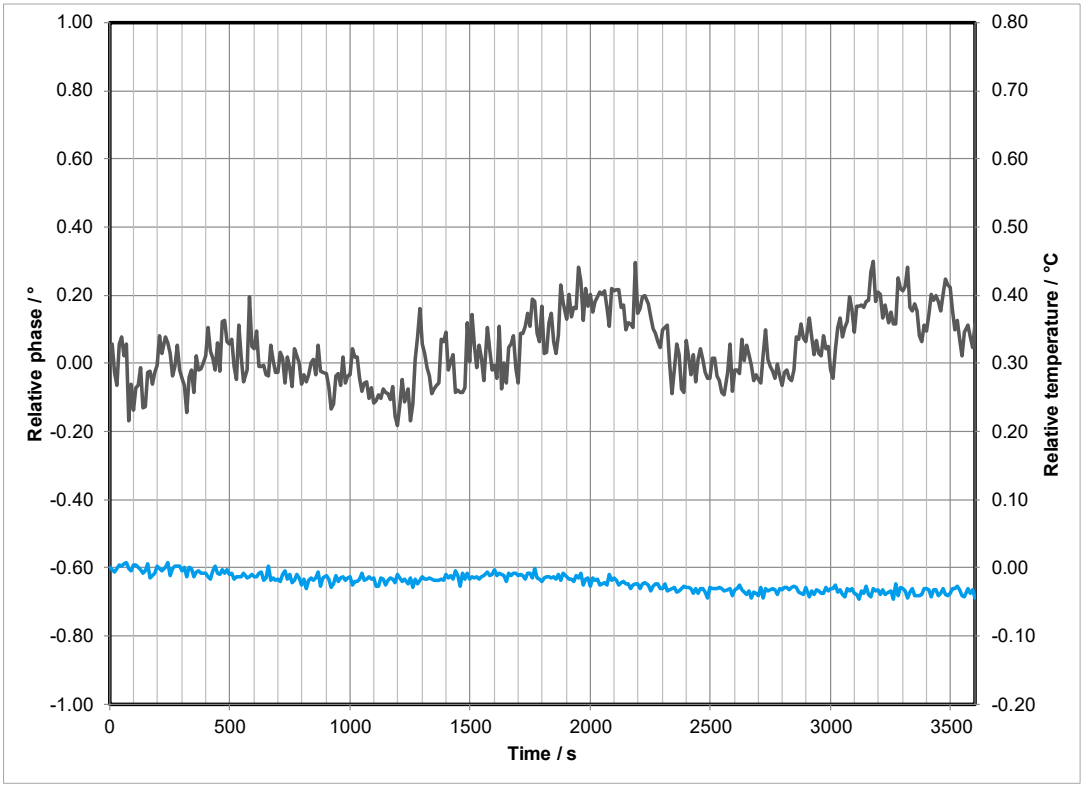
The R&S®SMW-B90 option can be installed once, but can be used with all installed RF paths. It provides phase-coherent RF outputs for the two RF paths or two or more instruments.

The option cannot be installed if an R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O or R&S®SMW-B1067O option is installed.

LO coupling modes	This mode corresponds to internal LO operation in path A and path B.	A, B internal
	This mode corresponds to internal LO operation in path A, and LO of path B is coupled to path A.	A internal, A → B coupled
	This mode corresponds to external LO operation at the LO IN connector in path A and internal LO operation in path B.	A external, B internal
	This mode corresponds to external LO operation at the REF/LO IN connector in path A and path B.	A external, A → B coupled
REF/LO OUT states	The active LO signal of path B can be routed to the LO OUT connector (in order to couple two or more instruments).	on/off
Input of phase coherence signal		
Connector type	LO IN on rear panel	SMA female
Input impedance		50 Ω (nom.)
Input level range of external LO signal		7 dBm to 13 dBm
Frequency range of external LO signal	for RF setting 200 MHz < f ≤ 6.5 GHz	1.0 · f
	for RF setting 6.5 GHz < f ≤ 13 GHz	0.5 · f
	for RF setting 13 GHz < f ≤ 26 GHz	0.25 · f
	for RF setting 26 GHz < f ≤ 44 GHz	0.125 · f
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1067, R&S®SMW-B1067N frequency options	
	for RF setting 43 GHz < f ≤ 65 GHz	0.1 · f
	for RF setting 65 GHz < f ≤ 72 GHz	0.05 · f
Output of phase coherence signal		
Connector type	LO OUT on rear panel	SMA female
Output impedance		50 Ω (nom.)
Output level range of internal LO signal		7 dBm to 13 dBm
Frequency range of internal LO signal	for RF setting 200 MHz < f ≤ 6.5 GHz	1.0 · f
	for RF setting 6.5 GHz < f ≤ 13 GHz	0.5 · f
	for RF setting 13 GHz < f ≤ 26 GHz	0.25 · f
	for RF setting 26 GHz < f ≤ 44 GHz	0.125 · f
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1067, R&S®SMW-B1067N frequency options	
	for RF setting 43 GHz < f ≤ 65 GHz	0.1 · f
	for RF setting 65 GHz < f ≤ 72 GHz	0.05 · f



Measured relative phase between two LO coupled R&S®SMW200A RF paths versus time, carrier frequency = 2 GHz, level = –10 dBm (the lower curve/right vertical axis indicates the temperature variation)



Measured relative phase between two LO coupled R&S®SMW200A RF paths versus time, carrier frequency = 40 GHz, level = –10 dBm (the lower curve/right vertical axis indicates the temperature variation)

Simultaneous modulation

In the same RF path.

● = compatible, – = incompatible
○ = compatible with limitations (ALC mode = off)

	Amplitude modulation	Frequency modulation	Phase modulation	Pulse modulation	I/Q modulation
Amplitude modulation		●	●	○	–
Frequency modulation	●		–	●	●
Phase modulation	●	–		●	●
Pulse modulation	○	●	●		○
I/Q modulation	–	●	●	○	

Two-path instruments: Frequency modulation and phase modulation are not compatible with I/Q and amplitude modulation in the other RF path.

For simultaneous I/Q and frequency modulation, or simultaneous I/Q and phase modulation, the instrument must be equipped with a two-path signal routing and baseband main module (R&S®SMW-B13T or R&S®SMW-B13XT option).

Instruments equipped with R&S®SMW-B2031, R&S®SMW-B2044, R&S®SMW-B2044N or R&S®SMW-B2044O in RF path B: Amplitude modulation, frequency modulation and phase modulation are only possible in RF path A. When activating frequency or phase modulation in RF path A, RF path B is switched off.

Analog modulation

Amplitude modulation (R&S®SMW-K720 option)

This option is not available for R&S®SMW-B2031, R&S®SMW-B2044, R&S®SMW-B2044N and R&S®SMW-B2044O.

Modulation source		internal, external
External coupling		AC, DC
Modulation depth	modulation is clipped at high levels when maximum PEP is reached	0 % to 100 %
Resolution of setting		0.1 %
AM depth (m) error	f ≤ 20 GHz	
	f_{mod} = 1 kHz and m < 80 %	< (1 % of reading + 1 %)
	20 GHz < f	
	f_{mod} = 1 kHz and m < 80 %	< (2 % of reading + 1 %)
AM distortion	f ≤ 3 GHz, f_{mod} = 1 kHz	
	m = 30 %	< 0.8 %
	m = 80 %	< 1.4 %
	3 GHz < f ≤ 20 GHz, f_{mod} = 1 kHz	
	m = 30 %	< 1 %
	m = 80 %	< 1.6 %
	20 GHz < f, f_{mod} = 1 kHz, level = 0 dBm	
	m = 30 %	< 1.5 %
	m = 80 %	< 2.4 %
Modulation frequency range		DC, 20 Hz to 500 kHz
Modulation frequency response	AC mode, 20 Hz to 500 kHz	< 1 dB
Incidental PM at AM	m = 30 %, f_{mod} = 1 kHz, peak value	< 0.1 rad

Frequency modulation (R&S®SMW-K720 option)

R&S®SMW-B13T or R&S®SMW-B13XT must be installed.

This option is not available for R&S®SMW-B2031, R&S®SMW-B2044, R&S®SMW-B2044N and R&S®SMW-B2044O.

FM multiplier (N) for different frequency ranges	100 kHz ≤ f ≤ 200 MHz	N = 1
	200 MHz < f ≤ 375 MHz	N = 1/4
	375 MHz < f ≤ 750 MHz	N = 1/2
	750 MHz < f ≤ 1500 MHz	N = 1
	1.5 GHz < f ≤ 3 GHz	N = 2
	3 GHz < f ≤ 6 GHz	N = 4
	6 GHz < f ≤ 12 GHz	N = 8
	12 GHz < f ≤ 24 GHz	N = 16
	24 GHz < f ≤ 44 GHz	N = 32
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O	
	43 GHz < f ≤ 56 GHz	N = 40
	R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	
	43 GHz < f ≤ 60 GHz	N = 40
	60 GHz < f ≤ 67 GHz	N = 80
Modulation source		internal, external, internal and external
External coupling		AC, DC
FM modes		normal, low noise
Maximum deviation	FM mode: normal	N · 10 MHz
	FM mode: low noise	N · 100 kHz
Resolution of setting		< 200 ppm, min. N · 0.1 Hz
FM deviation error	f_{mod} = 10 kHz, deviation ≤ half of maximum deviation or 10 MHz, whichever is lower	
	internal	< (1.5 % of reading + 20 Hz)
	external	< (2.0 % of reading + 20 Hz)
FM distortion	f_{mod} = 10 kHz, deviation = N · 1 MHz	< 0.1 %
Modulation frequency response	FM mode: normal (DC/AC coupling), 50 Ω input impedance	
	DC, 10 Hz to 100 kHz	< 0.5 dB
	DC, 10 Hz to 10 MHz, f ≤ 3 GHz DC, 10 Hz to 5 MHz, f > 3 GHz	< 3 dB
	FM mode: low noise (DC/AC coupling), 50 Ω input impedance	
	DC, 10 Hz to 100 kHz	< 3 dB

Synchronous AM with FM	40 kHz deviation, f_{mod} = 1 kHz	
	5 MHz < f ≤ 3 GHz	< 0.1 %
	3 GHz < f ≤ 6 GHz	< 0.2 %
	6 GHz < f ≤ 44 GHz	< 0.2 %
Carrier frequency offset at FM		< 0.2 % of set deviation

Phase modulation (R&S®SMW-K720 option)

R&S®SMW-B13T or R&S®SMW-B13XT must be installed.

This option is not available for R&S®SMW-B2031, R&S®SMW-B2044, R&S®SMW-B2044N and R&S®SMW-B2044O.

PM multiplier (N) for different frequency ranges	100 kHz ≤ f ≤ 200 MHz	N = 1
	200 MHz < f ≤ 375 MHz	N = 1/4
	375 MHz < f ≤ 750 MHz	N = 1/2
	750 MHz < f ≤ 1500 MHz	N = 1
	1.5 GHz < f ≤ 3 GHz	N = 2
	3 GHz < f ≤ 6 GHz	N = 4
	6 GHz < f ≤ 12 GHz	N = 8
	12 GHz < f ≤ 24 GHz	N = 16
	24 GHz < f ≤ 44 GHz	N = 32
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O	
	43 GHz < f ≤ 56 GHz	N = 40
	R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	
	43 GHz < f ≤ 60 GHz	N = 40
	60 GHz < f ≤ 67 GHz	N = 80
Modulation source		internal, external, internal and external
External coupling		AC, DC
PM modes		high deviation, high bandwidth, low noise
Maximum deviation	PM mode: high deviation f_{mod} ≤ N · 10 MHz / deviation	N · 20.0 rad
	PM mode: high bandwidth	N · 1.0 rad
	PM mode: low noise	N · 0.25 rad
Resolution of setting	PM mode: high deviation	< 200 ppm, min. N · 20 µrad
	PM mode: high bandwidth	< 0.1 %, min. N · 20 µrad
	PM mode: low noise	< 200 ppm, min. N · 20 µrad
PM deviation error	f_{mod} = 10 kHz, deviation ≤ half of maximum deviation	
	internal	< (1.5 % of reading + 0.01 rad)
	external	< (2.0 % of reading + 0.01 rad)
Modulation frequency response	DC/AC coupling, 50 Ω input impedance	
	PM mode: high deviation	
	deviation ≤ N · 5 rad, DC, 10 Hz to 500 kHz	< 1 dB
	deviation > N · 5 rad, DC, 10 Hz to 10 kHz	< 1 dB
	PM mode: high bandwidth	
	DC, 10 Hz to 10 MHz for f ≤ 3 GHz, DC, 10 Hz to 5 MHz for f > 3 GHz	< 3 dB
	PM mode: low noise	
	DC, 10 Hz to 100 kHz	< 3 dB

Pulse modulation (R&S®SMW-K22 option)

If two RF paths are installed (signal paths A and B), pulse modulation can be used either on signal path A or B with one R&S®SMW-K22 option. For simultaneous pulse modulation on signal paths A and B, two R&S®SMW-K22 must be installed.

Modulation source		external, internal
On/off ratio		> 80 dB
	with R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O, f > 43 GHz, CW	> 65 dB
Rise/fall time	10 %/90 % of RF amplitude	
	with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006 frequency options	
	transition type = fast	< 10 ns
	transition type = smoothed	< 200 ns
	with R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020 frequency options	
	transition type = fast	< 10 ns
	transition type = smoothed, only available for: f ≤ 5 GHz, CW; f ≤ 3.5 GHz, I/Q modulation or AM modulation	< 200 ns
	with R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options	
	transition type = fast	< 15 ns
	transition type = smoothed, only available for: f ≤ 5 GHz, CW; f ≤ 3.5 GHz, I/Q modulation or AM modulation	< 200 ns
Minimum pulse width	50 %/50 % of RF amplitude, transition type = fast	
	with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1056, R&S®SMW-B1067 frequency options	20 ns
	with R&S®SMW-B1040N, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1056N, R&S®SMW-B1067N frequency options	
	f ≤ 19.5 GHz	20 ns
	19.5 GHz < f ≤ 43 GHz	30 ns
	f > 43 GHz	20 ns
	with R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O, R&S®SMW-B1067O frequency options	
	f ≤ 31.8 GHz	20 ns
	31.8 GHz < f ≤ 37 GHz	30 ns
	f > 37 GHz	20 ns
Pulse repetition frequency		0 Hz to 10 MHz

Video feedthrough	with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, R&S®SMW-B1007, R&S®SMW-B2007 frequency options	
	level < 10 dBm	< 10 % of RF, < 200 mV (V_{pp})
	with R&S®SMW-B1012, R&S®SMW-B2012 frequency options	
	f ≤ 5 GHz: level < 5 dBm	< 10 % of RF, < 200 mV (V_{pp})
	f > 5 GHz: level < 10 dBm	< 10 % of RF, < 20 mV (V_{pp})
	with R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options	
	f ≤ 5 GHz: level < 5 dBm	< 10 % of RF, < 200 mV (V_{pp})
	f > 5 GHz: level < 10 dBm or maximum specified level, whichever is lower	< 10 % of RF, < 2 mV (V_{pp})
Pulse overshoot		< 10 %

Input for external modulation signals

Modulation inputs EXT 1, EXT 2 for AM/FM/PM		
Connector type	EXT 1, EXT 2 on rear panel	BNC female
Input impedance	selectable	100 kΩ or 50 Ω (nom.)
Coupling		AC, DC
Input sensitivity	peak value for set modulation depth or deviation	1 V (nom.)
Bandwidth	analog input bandwidth	0 Hz to 10 MHz
Input damage voltage		±10 V
Modulation input for pulse modulation		
Input		selectable from USER 1, 2, 3 on front panel or USER 4, 5, 6 on rear panel
Connector type	USER 1, 2, 3 on front panel, USER 4, 5, 6 on rear panel	BNC female
Input impedance	selectable	1 kΩ or 50 Ω (nom.)
Threshold voltage		0.1 V to 2.0 V (nom.)
Input damage voltage		–0.5 V; 3.8 V
Input polarity	selectable	normal, inverse

Modulation sources for analog modulation

Internal modulation generator

Shape		sinusoidal
Frequency range		0.1 Hz to 1 MHz
Resolution of setting		0.1 Hz
Frequency uncertainty		< 0.001 Hz + relative deviation of reference frequency

Multifunction generator (R&S®SMW-K24 option)

If two RF paths are installed (signal paths A and B), the multifunction generator can be used either on signal path A or B with one R&S®SMW-K24 option. For the multifunction generator to be used on signal paths A and B simultaneously, two R&S®SMW-K24 must be installed.

The R&S®SMW-K24 multifunction generator option consists of three function generators that can be set independently. Two of the three signal sources can be added with different weighting. The total voltage is limited by the maximum output voltage.

Sources	LF generator 1/2	sine wave, pulse, triangle, trapezoid
	noise generator	noise amplitude distribution: Gaussian, equal
Frequency range	sine wave	0.1 Hz to 10 MHz
	pulse, triangle, trapezoid	0.1 Hz to 1 MHz (displayed value)
	noise bandwidth	100 kHz to 10 MHz
Resolution of setting	sine wave	0.1 Hz
	pulse, triangle, trapezoid	10 ns
	noise bandwidth	100 kHz
Frequency uncertainty		< 0.001 Hz + relative deviation of reference frequency

LF output

Monitoring of resulting modulation signal	for	AM, FM, PM
Source		LF generator 1, LF generator 2, external 1, external 2, noise generator
Output voltage	V_p at LF connector, open circuit voltage EMF	
Setting range		20 mV to 1 V
Setting resolution		1 mV
Setting accuracy	at 1 kHz	< (1 % of reading + 1 mV)
Output impedance		50 Ω
DC offset		–0.2 V to +2.5 V
Frequency response	sine wave, up to 1 MHz	0.05 dB (meas.)
	sine wave, up to 10 MHz	0.1 dB (meas.)
Distortion	f < 100 kHz, at R_L > 50 Ω, level (V_{EMF}) 1 V	< 0.1 %

High-performance pulse generator (R&S®SMW-K23 option)

If two RF paths are installed (signal paths A and B), the high-performance pulse generator can be used either on signal path A or B with one R&S®SMW-K23 option. For the high-performance pulse generator to be used on signal paths A and B simultaneously, two R&S®SMW-K23 must be installed.

Pulse modes		single pulse, double pulse
Trigger modes	free run, internally triggered	auto
		external trigger
		external gate
Active trigger edge		positive or negative
Pulse period		
Setting range		20 ns to 100 s
Setting resolution	with R&S®SMW-B13XT option	3.333 ns
	with R&S®SMW-B13, R&S®SMW-B13T options	5 ns
Pulse width		
Setting range	pulse widths of double pulses are independently settable	
	with R&S®SMW-B13XT option	3.333 ns to 100 s
	with R&S®SMW-B13, R&S®SMW-B13T options	5 ns to 100 s
Setting resolution	with R&S®SMW-B13XT option	3.333 ns
	with R&S®SMW-B13, R&S®SMW-B13T options	5 ns
Pulse delay		
Setting range		0 ns to 100 s
Setting resolution	with R&S®SMW-B13XT option	3.333 ns
	with R&S®SMW-B13, R&S®SMW-B13T options	5 ns
Double-pulse delay		
Setting range		20 ns to 1 s
Setting resolution	with R&S®SMW-B13XT option	3.333 ns
	with R&S®SMW-B13, R&S®SMW-B13T options	5 ns
Uncertainty for pulse timing	pulse timing generated digitally; ensured by design	relative deviation of reference frequency
External trigger		
Delay	trigger to RF output	50 ns (meas.)
Jitter		< 10 ns (meas.)
PULSE/VIDEO/SYNC output		LVTTL signal (R_L ≥ 50 Ω)

I/Q modulation

I/Q modulation performance

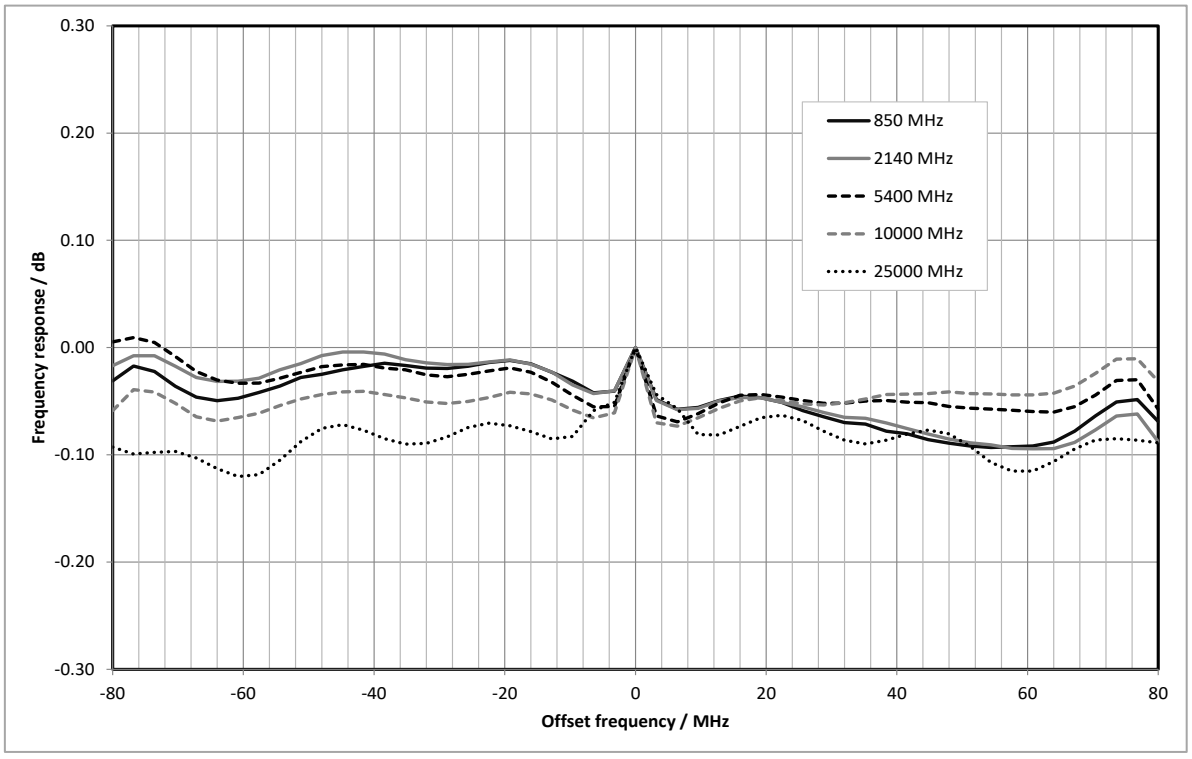
Operating modes		external wideband I/Q, internal baseband I/Q
	with R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O, R&S®SMW-B1067O frequency options	internal baseband I/Q
RF modulation bandwidth		
RF modulation bandwidth with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1056, R&S®SMW-B1067 frequency options		
With internal baseband I/Q, wideband baseband (R&S®SMW-B13XT), I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	f > 2.5 GHz	±1 GHz
With internal baseband I/Q, standard baseband (R&S®SMW-B13 or -B13T), I/Q wideband on	1 MHz < f ≤ 250 MHz	±32 % of carrier frequency
	f > 250 MHz	±80 MHz
With external wideband I/Q inputs, I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	f > 2.5 GHz	±1 GHz [6]
RF modulation bandwidth with R&S®SMW-B1040N, R&S®SMW-B1044N, R&S®SMW-B2044N frequency options		
With internal baseband I/Q, wideband baseband (R&S®SMW-B13XT), I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	2.5 GHz < f ≤ 20 GHz	±1 GHz
	f > 20 GHz	±275 MHz
With internal baseband I/Q, standard baseband (R&S®SMW-B13 or -B13T), I/Q wideband on	1 MHz < f ≤ 250 MHz	±32 % of carrier frequency
	f > 250 MHz	±80 MHz
With external wideband I/Q inputs, I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	2.5 GHz < f ≤ 20 GHz	±1 GHz
	f > 20 GHz	±275 MHz
RF modulation bandwidth with R&S®SMW-B1056N, R&S®SMW-B1067N frequency options		
With internal baseband I/Q, wideband baseband (R&S®SMW-B13XT), I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	2.5 GHz < f ≤ 20 GHz	±1 GHz
	20 GHz < f ≤ 43 GHz	±275 MHz
	f > 43 GHz	±1 GHz
With internal baseband I/Q, standard baseband (R&S®SMW-B13 or -B13T), I/Q wideband on	1 MHz < f ≤ 250 MHz	±32 % of carrier frequency
	f > 250 MHz	±80 MHz
With external wideband I/Q inputs, I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	2.5 GHz < f ≤ 20 GHz	±1 GHz
	20 GHz < f ≤ 43 GHz	±275 MHz
	f > 43 GHz	±1 GHz
RF modulation bandwidth with R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O, R&S®SMW-B1067O frequency options [7]		
With internal baseband I/Q, wideband baseband (R&S®SMW-B13XT), I/Q wideband on	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 2.5 GHz	±40 % of carrier frequency
	2.5 GHz < f ≤ 31.15 GHz	±1 GHz
	31.15 GHz < f ≤ 31.75 GHz	±500 MHz
	31.75 GHz < f < 37.05 GHz	±225 MHz
	37.05 GHz ≤ f < 37.65 GHz	±500 MHz
	f ≥ 37.65 GHz	±1 GHz

[6] ±500 MHz for R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012.

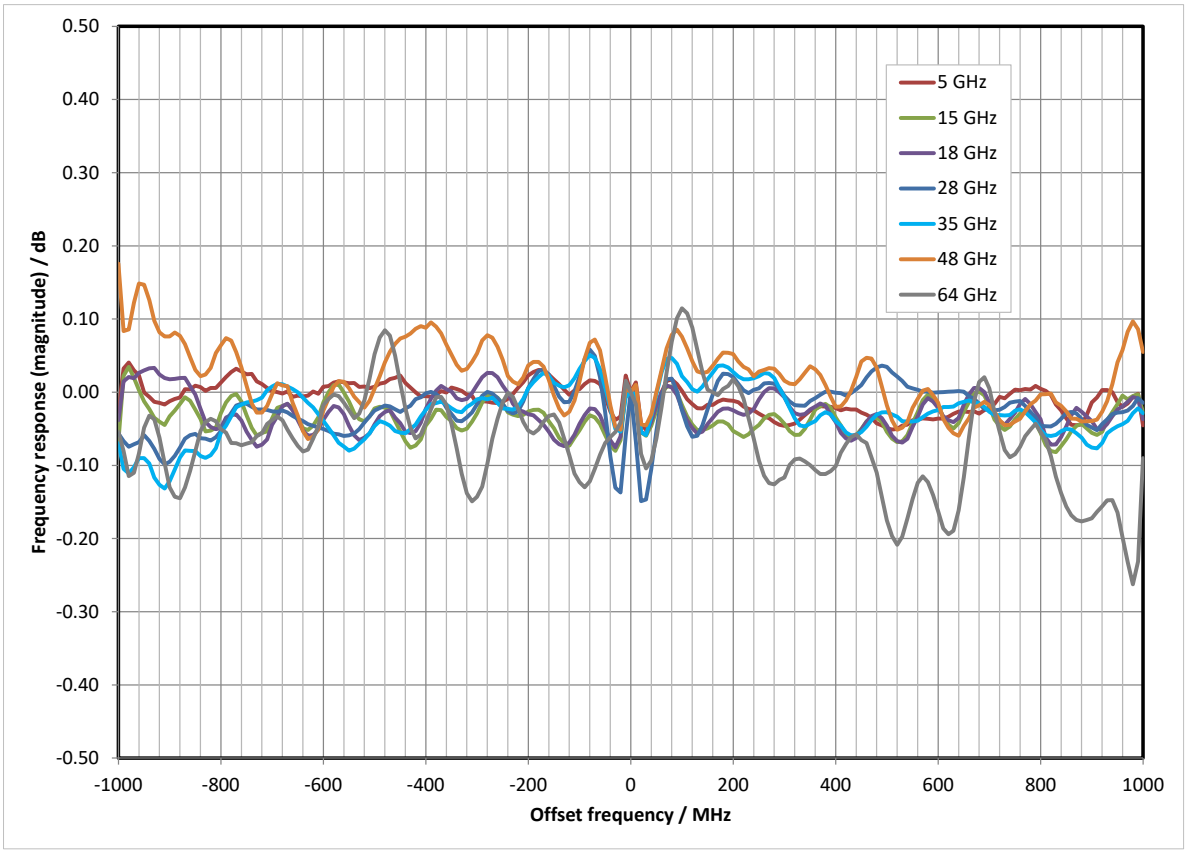
[7] Bandwidth limitation for O options comes with an additional sample rate limitation. Sample rate is limited to 1.2 Gsample in the ranges: 31.15 GHz < f ≤ 31.75 GHz and 37.05 GHz ≤ f < 37.65 GHz. Sample rate is limited to 550 Msample in the range: 31.75 GHz < f < 37.05 GHz.

RF frequency response in specified RF modulation bandwidth	with external wideband I/Q inputs	
	I/Q wideband on	
	f ≤ 44 GHz	< 9 dB, < 6 dB (meas.)
	f > 44 GHz	<10 dB
	I/Q wideband off	< 5 dB, < 3 dB (meas.)
	with internal baseband I/Q, standard baseband (R&S®SMW-B13 or -B13T), I/Q wideband on, optimization mode: high quality	< 1.0 dB, < 0.3 dB (meas.)
	with internal baseband I/Q, wideband baseband (R&S®SMW-B13XT), I/Q wideband on, optimization mode: high quality	< 1.0 dB, < 0.4 dB (meas.)
Carrier leakage [8]	mode: internal baseband I/Q, referenced to full-scale input	< –55 dBc
	f ≤ 20 GHz	< –55 dBc
	f > 20 GHz	< –40 dBc
	43 GHz < f ≤ 67 GHz with R&S®SMW-B1056, R&S®SMW-B1067, R&S®SMW-B1056N, R&S®SMW-B1067N, R&S®SMW-B1056O, R&S®SMW-B1067O frequency options	< –50 dBc
Suppression of image sideband for entire instrument in modulation bandwidth [8]	with internal baseband I/Q, standard baseband (R&S®SMW-B13 or -B13T), optimization mode: high quality, up to 160 MHz RF modulation bandwidth	> 50 dB, 60 dB (typ.)
	with internal baseband I/Q, wideband baseband (R&S®SMW-B13XT), optimization mode: high quality	
	RF modulation bandwidth ≤ 1600 MHz	> 40 dB, 50 dB (meas.)
	1600 MHz < RF modulation bandwidth ≤ 2000 MHz	> 37 dB, 47 dB (meas.)
Two-tone IMD (2 carriers)	PEP = 0 dBm, up to 80 MHz carrier spacing	
	f ≤ 3 GHz	< –50 dBc (typ.)
	3 GHz < f ≤ 10 GHz	< –45 dBc (typ.)
	10 GHz < f ≤ 20 GHz	< –40 dBc (typ.)
	20 GHz < f ≤ 30 GHz	< –38 dBc (typ.)
	30 GHz < f ≤ 44 GHz	< –32 dBc (typ.)
	44 GHz < f ≤ 67 GHz, PEP = –4 dBm	< –26 dBc (typ.)
I/Q impairments (analog)	These impairments are set within the analog I/Q modulator section. They can be used in external wideband I/Q mode and internal baseband I/Q mode. They cannot be applied to the analog or digital I/Q outputs.	
	I offset, Q offset	
	setting range	–10 % to +10 %
	setting resolution	0.01 %
	gain imbalance	
	setting range	–1.0 dB to +1.0 dB
	setting resolution	0.01 dB
	quadrature offset	
	setting range	–10° to +10°
	setting resolution	0.01°

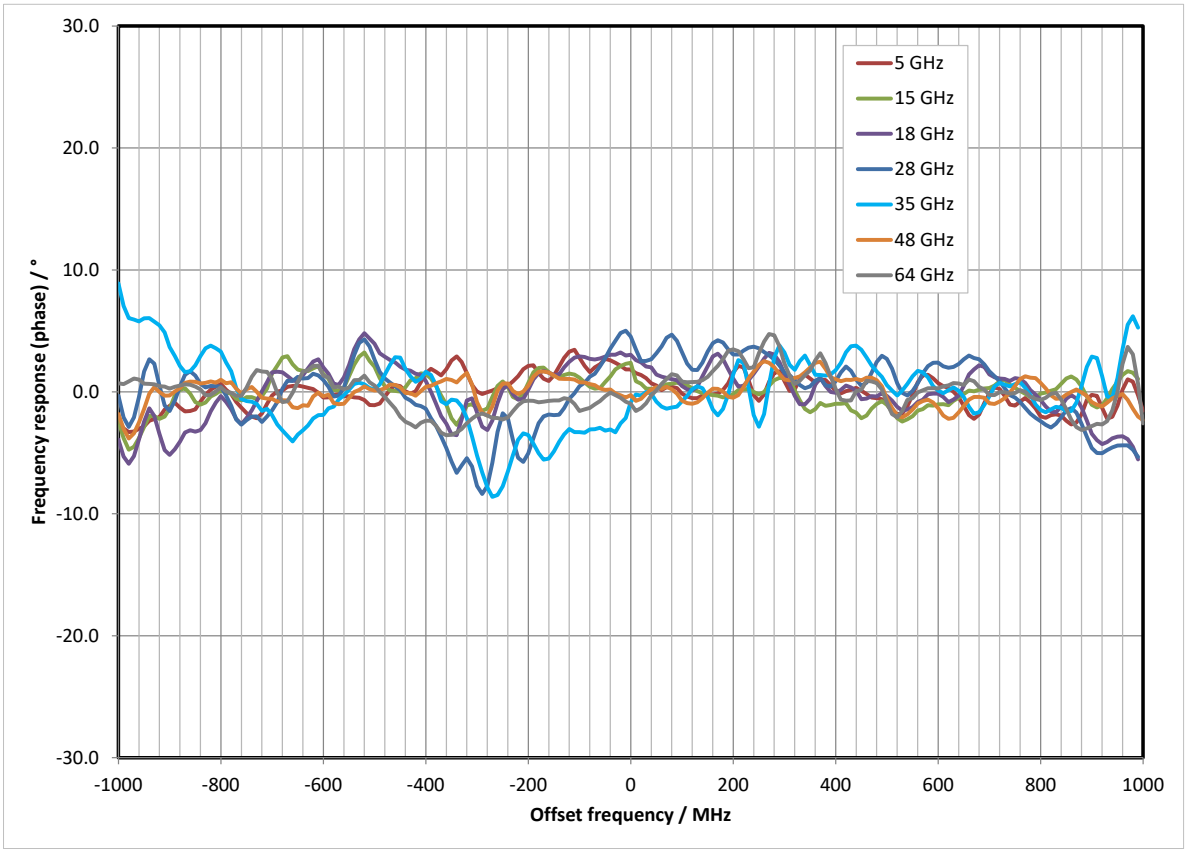
[8] Value applies after 1 hour warm-up time and recalibration for 4 hours of operation and temperature variations of less than +5 °C.



Measured RF modulation frequency response (magnitude) with internal baseband I/Q, standard baseband



Measured RF modulation frequency response (magnitude) with internal baseband I/Q, wideband baseband



Measured RF modulation frequency response (phase) with internal baseband I/Q, wideband baseband

Analog I/Q inputs

For each installed RF path A or B, one pair of I and Q inputs is available on the front panel (single-ended input mode). With the R&S®SMW-K739 option installed, the input mode for RF path A can also be switched to differential. In this mode, all four available connectors are used for RF path A.

Analog I/Q input signals are directly applied to the analog I/Q modulation circuit and are not routed through the baseband section of the R&S®SMW200A.

Analog I/Q inputs are not available if an R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O or R&S®SMW-B1067O option is installed.

Input mode		single-ended
	with R&S®SMW-K739 option, for RF path A	
	R&S®SMW-B1003, R&S®SMW-B1006, R&S®SMW-B1007, R&S®SMW-B1012, R&S®SMW-B1020, R&S®SMW-B1044, R&S®SMW-B1044N	single-ended or differential
	R&S®SMW-B1031, R&S®SMW-B1040, R&S®SMW-B1040N	
	f ≤ 20 GHz	single-ended or differential
	f > 20 GHz	single-ended
Connector types	I, Q on front panel (for each installed RF path A or B)	BNC female
Input impedance		50 Ω (nom.)
VSWR	with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006, R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012, R&S®SMW-B1020, R&S®SMW-B2020 frequency options	
	up to 200 MHz	< 1.2 (typ.)
	200 MHz to 500 MHz	< 1.35 (typ.)
	500 MHz to 1 GHz	< 1.45 (typ.)
	with R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1056, R&S®SMW-B1067 frequency options	
	up to 200 MHz, f ≤ 20 GHz	< 1.2 (typ.)
	up to 200 MHz, f > 20 GHz	< 1.35 (typ.)
	200 MHz to 500 MHz	< 1.35 (typ.)
	500 MHz to 1 GHz	< 1.5 (typ.)
	with R&S®SMW-B1040N, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1056N, R&S®SMW-B1067N frequency options	
	up to 200 MHz, f ≤ 20 GHz	< 1.2 (typ.)
	200 MHz to 500 MHz, f ≤ 20 GHz	< 1.35 (typ.)
	500 MHz to 1 GHz, f ≤ 20 GHz	< 1.5 (typ.)
	up to 275 MHz, f > 20 GHz	< 1.35 (typ.)
Nominal input voltage for full-scale input		$\sqrt{V_i^2 + V_q^2} = 0.5\ V$
Damage voltage		±2 V

Standard baseband characteristics

Standard baseband is not available for instruments equipped with R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O or R&S®SMW-B1067O frequency options.

Internal baseband characteristics (R&S®SMW-B13 or R&S®SMW-B13T option)

The R&S®SMW-B13 option provides one I/Q path to the RF section (to RF path A) as well as one analog I/Q output (i.e. one I and one Q output connector). The R&S®SMW-B13T option provides two I/Q paths to the RF section (if two RF paths are installed) as well as two analog I/Q outputs. With two RF paths, R&S®SMW-B13T is required.

Either R&S®SMW-B13 or R&S®SMW-B13T must be installed on the instrument.

R&S®SMW-B13 and R&S®SMW-B13T cannot be installed in instruments equipped with R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O or R&S®SMW-B1067O frequency options.

D/A converter		
Data rate		200 MHz
Resolution		16 bit
Sample rate		800 MHz (internal interpolation · 4)
Aliasing filter	with amplitude, group delay and S_i correction	
Bandwidth, rolloff to –0.1 dB		80 MHz
SFDR (excluding harmonics)	up to 10 MHz	< –80 dBc
	up to 80 MHz	< –73 dBc
I/Q impairments (digital baseband)	These impairments are set in the digital baseband section of the R&S®SMW200A. They act on the I/Q signal sent to the I/Q modulator/RF section, as well as on the I/Q signals at the analog or digital I/Q outputs (of the respective path).	
Carrier leakage		
Setting range		–10 % to +10 %
Setting resolution		0.01 %
I ≠ Q (imbalance)		
Setting range		–1 dB to +1 dB
Setting resolution		0.001 dB
Quadrature offset		
Setting range		–10° to +10°
Setting resolution		0.01°

Analog I/Q outputs (R&S®SMW-B13 or R&S®SMW-B13T option)

Number of I/Q outputs	with R&S®SMW-B13 option	1
	with R&S®SMW-B13T option	2
Output impedance		50 Ω
Output voltage	EMF (output voltage depends on set modulation signal)	1 V (V_p)
Offset	EMF	< 1 mV
Frequency response [9]	at R_L = 50 Ω	
Magnitude	up to 10 MHz	0.02 dB (meas.)
	up to 80 MHz	0.03 dB (meas.)
I/Q balance [10]	at R_L = 50 Ω	
Magnitude	up to 10 MHz	0.01 dB (meas.)
	up to 80 MHz	0.02 dB (meas.)
Spectral purity	at R_L = 50 Ω	
SFDR (sine wave)	up to 2 MHz	> 70 dB
	up to 20 MHz	60 dB (meas.)
Wideband noise	10 MHz sine wave at 1 MHz offset	–155 dBc (typ.)

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

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

Differential analog I/Q outputs (R&S®SMW-K16 option)

This option can be installed once if the instrument is equipped with the R&S®SMW-B13 option. If the instrument is equipped with the R&S®SMW-B13T option, differential analog I/Q outputs can be used either on signal path A or B with one R&S®SMW-K16 option. For differential analog I/Q outputs to be used on signal paths A and B simultaneously, two R&S®SMW-K16 must be installed.

Output impedance		
Single-ended		50 Ω
Differential		100 Ω
Output voltage (V_{out})	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 (V_{bias})		
Single-ended	EMF	(–4 V + V_{out}) to (+4 V – V_{out})
Differential	EMF	(–4 V + V_{out} / 2 + V_{offset} / 2) to (+4 V – V_{out} / 2 – V_{offset} / 2)
Resolution		2 mV
Uncertainty		1 % + 4 mV
Offset voltage (V_{offset})		
Differential	EMF	(–4 V + V_{out} / 2 + V_{bias} / 2) to (+4 V – V_{out} / 2 – V_{bias} / 2)
Resolution		0.1 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, 0.05 dB (meas.)
	up to 80 MHz	0.2 dB (meas.)
Frequency response [11]	at R_L = 50 Ω, output voltage > 0.5 V (V_p)	
Magnitude	up to 10 MHz	0.02 dB (meas.)
	up to 80 MHz	0.03 dB (meas.)

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

Digital baseband inputs/outputs

Depending on the installed software and hardware options, the R&S®SMW200A is able to receive digital baseband signals and to output digital baseband signals. The digital I/Q input/output can be used for the lossless connection of the R&S®SMW200A to the digital I/Q input/output of other Rohde & Schwarz instruments (for example the CMW500 wideband radio communication tester in fading applications).

Digital baseband outputs: At least one R&S®SMW-K18 option must be installed. This option can be installed once if the instrument is equipped with the R&S®SMW-B13 option. If the instrument is equipped with the R&S®SMW-B13T option, digital baseband outputs can be used either on signal path A or B with one R&S®SMW-K18 option. For digital baseband outputs to be used on signal paths A and B simultaneously, two R&S®SMW-K18 must be installed. Furthermore, to enable two or more digital baseband outputs in MIMO modes, two R&S®SMW-K18 must be installed.

Signal outputs		analog and digital, digital only
	with 2 × R&S®SMW-K18 installed	analog and digital, digital only, digital only multiplexed
Digital only	The streams are output via the digital I/Q outputs only; analog I/Q outputs are not available. External modulation signals can be output via the RF outputs (I/Q modulation mode: external wideband I/Q). Note: System configurations with more than 4 streams are not available in this mode.	
	with R&S®SMW-K551 installed	The instrument runs at reduced speed depending on the device connected to the digital I/Q output (slow I/Q).
Digital only multiplexed	The streams are output via BBMM1 and BBMM2 in multiplexed mode, i.e. up to 4 streams are output via a single digital output. Analog I/Q outputs are not available. External modulation signals can be output via the RF outputs (I/Q modulation mode: external wideband I/Q). Note: All system configurations available on the instrument are available in this mode.	
	with R&S®SMW-K551 installed	The instrument runs at reduced speed depending on the device connected to the digital I/Q output (slow I/Q).
Analog and digital	The instrument runs in regular operating mode, both analog and digital outputs are available, slow I/Q is not possible.	
Number of digital outputs		according to selected system configuration (see table below)
Number of streams per digital output	digital only	1
	digital only multiplexed	1 to 4
Bandwidth	general	according to selected system configuration (see section Multichannel, MIMO, fading and noise, specifications for R&S®SMW-K74, -K75, -K76 options)
	4 streams mapped to one digital output	40 MHz

The following table gives an overview of which software and hardware options are required for which digital I/Q connectivity:

Minimum required R&S®SMW200A options	Digital I/Q inputs	Digital I/Q outputs
R&S®SMW-B13 + 1 × R&S®SMW-K18	–	1
R&S®SMW-B13T + 2 × R&S®SMW-K18	–	2
1 × R&S®SMW-B10	1	–
1 × R&S®SMW-B10 + R&S®SMW-B13 + 1 × R&S®SMW-K18	1	1
1 × R&S®SMW-B10 + R&S®SMW-B13T + 2 × R&S®SMW-K18	1	2
2 × R&S®SMW-B10	2	–
2 × R&S®SMW-B10 + R&S®SMW-B13 + 1 × R&S®SMW-K18	2	1
2 × R&S®SMW-B10 + R&S®SMW-B13T + 2 × R&S®SMW-K18	2	2

Minimum required R&S®SMW200A options	Digital I/Q inputs	Digital I/Q outputs
2 × R&S®SMW-B10 + 4 × R&S®SMW-B14 + R&S®SMW-B13T + 2 × R&S®SMW-K18	depends on selected system configuration (for required additional options for specific system configurations, see section Multichannel, MIMO, fading and noise, specifications for R&S®SMW-K74, -K75, -K76 options)	
3x1	3	1
3x2	3	2
3x3	3	3
1x3	1	3
2x3	2	3
4x1	4	1
4x2	4	2
4x3	4	3
4x4	4	4
1x4	1	4
2x4	2	4
3x4	3	4
8x1	–	1
8x2	–	2
8x4	–	4
8x8	–	subset 1: 4, subset 2: 4
1x8	1	6
2x8	2	6
4x8	2	6
3x1x1	3	3
4x1x1	4	4
5x1x1	–	3
6x1x1	–	4
7x1x1	–	5
8x1x1	–	6
2x1x2	2	4
2x2x1	4	2
2x2x2	4	4
2x1x3, 2x2x3	2	5
2x1x4, 2x2x4	2	6
2x3x1, 2x4x1	2	2
2x3x2, 2x4x2	2	4
2x3x3, 2x4x3	–	5
2x3x4, 2x4x4	–	6
3x2x1	2	3
3x1x2, 3x2x2	2	4
4x2x1	2	4
4x1x2, 4x2x2	2	6

Output parameters

Interface		
Standard		in line with R&S®Digital I/Q Interface PAD-R [12], I/Q data and control signals, data and interface clock
Level		LVDS
Connector		26-pin MDR
I/Q sample rate	With source "user-defined", the sample rate must be entered via the parameter "sample rate", no I/Q data clock being necessary. With source "digital I/Q out", the sample rate will be estimated on the basis of the applied I/Q data clock.	
Source		user-defined, digital I/Q out
Sample rate	maximum sample rate depends on connected receiving device	400 Hz to 200 MHz
Resolution (user-defined)		0.001 Hz
Frequency uncertainty (user-defined)		< (5 · 10^{-14} + relative deviation of reference frequency) · sample rate (nom.)
I/Q data		
Resolution		up to 18 bit
Logic format		two's complement
Physical signal level		
Setting range		0 to –60 dBFS
Setting resolution		0.01 dBFS
Bandwidth (RF)	sample rate = 200 MHz (no interpolation, user-defined)	160 MHz
	sample rate < 200 MHz (interpolation)	0.8 · sample rate
Control signals	markers	3

Input parameters

Input level	peak level	
Peak level		
Setting range		–60 dB to +3 dB, referenced to full scale
Setting resolution		0.01 dB
Crest factor		
Setting range		0 dB to +30 dB
Setting resolution		0.01 dB
Adjust level function		automatically determines peak level and crest factor of input signal
I/Q swap	I and Q signals swapped	on/off
Interface		
Standard		in line with R&S®Digital I/Q Interface PAD-R [12], I/Q data and control signals, data and interface clock
Level		LVDS
Connector		26-pin MDR
I/Q sample rate	With source "user-defined", the sample rate must be entered via the parameter "sample rate", no I/Q data clock being necessary. With source "digital I/Q in", the sample rate will be estimated on the basis of the applied I/Q data clock.	
Source		user-defined, digital I/Q in
Sample rate	maximum sample rate depends on connected transmitting device	400 Hz to 200 MHz
Resolution (user-defined)		0.001 Hz
Frequency uncertainty (user-defined)		< (5 · 10^{-14} + relative deviation of reference frequency) · sample rate (nom.)
I/Q data		
Resolution		18 bit
Logic format		two's complement
Bandwidth (RF)	sample rate = 200 MHz (no interpolation, user-defined)	160 MHz
	sample rate < 200 MHz (interpolation)	0.8 · sample rate
Control signals	markers	3

[12] R&S®Digital I/Q Interface PAD-R is a Rohde & Schwarz internal company guideline for the transmission of digital I/Q data. It is supported by a wide range of signal generators, signal analyzers and radio communication testers.

Standard baseband generator (R&S®SMW-B10 option) – arbitrary waveform mode

One or two R&S®SMW-B10 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added in the digital domain with settable level ratio.

Prerequisite: Either R&S®SMW-B13 or R&S®SMW-B13T must be installed.

Waveform length		1 sample to 64 Msample in one-sample steps
	with R&S®SMW-K511 option (memory extension)	1 sample to 512 Msample in one-sample steps
	with R&S®SMW-K512 option (memory extension)	1 sample to 1 Gsample in one-sample steps
Supported file formats		.wv, .mat, .csv, .iq.tar
Nonvolatile memory		solid state disk
Sample resolution	equivalent to D/A converter	16 bit
Sample rate		400 Hz to 150 MHz
	with R&S®SMW-K522 option	400 Hz to 200 MHz
Sample frequency error	internal clock	< ($5 \cdot 10^{-14}$ + relative deviation of reference frequency) · sample rate (nom.)
Sample clock source		internal, external
Bandwidth (RF)	using the maximum sample rate, rolloff to –0.1 dB	120 MHz
	using a reduced sample rate, rolloff to –0.1 dB (The waveform is automatically interpolated to the internal sample rate of 150 MHz.)	0.8 · sample rate
Bandwidth (RF) with R&S®SMW-K522 option	using the maximum sample rate, rolloff to –0.1 dB	160 MHz
	using a reduced sample rate, rolloff to –0.1 dB (The waveform is automatically interpolated to the internal sample rate of 200 MHz.)	0.8 · sample rate
Frequency offset	The frequency offset can be used to shift the center frequency of the wanted baseband signal. The restrictions caused by the modulation bandwidth still apply.	
Frequency offset setting range		–60 MHz to +60 MHz
	with R&S®SMW-K522 option	–80 MHz to +80 MHz
Frequency offset setting resolution		0.01 Hz
Frequency offset error		< $7 \cdot 10^{-7}$ Hz + relative deviation of reference frequency · frequency offset (nom.)
Triggering	A trigger event restarts I/Q generation. The I/Q signal is then synchronous with the trigger (with a specific timing jitter).	
Trigger source	event triggered via GUI or remote command	internal
	event triggered by other baseband generator	internal (baseband A/B)
	event triggered by external trigger signal	external
Trigger modes	The signal is generated continuously.	auto
	The signal is generated continuously. A trigger event causes a restart.	retrig
	The signal is started only when a trigger event occurs. Subsequent trigger events are ignored.	armed auto
	The signal is started only when a trigger event occurs. Every subsequent trigger event causes a restart.	armed retrig
	The signal is started only when a trigger event occurs. The signal is generated once.	single

External trigger input		selectable from USER 1, 2, 3 on front panel or T/M/C 1, T/M 2, T/M 3 of respective baseband generator on rear panel
Connector type	USER 1, 2, 3 on front panel, T/M/C 1, T/M 2, T/M 3 of respective baseband generator on rear panel	BNC female
Input level		0 V to 3 V (nom.)
Threshold	USER 1, 2, 3	settable from 0.1 V to 2.0 V
	T/M/C 1, T/M 2, T/M 3	settable from 0.3 V to 2.0 V
Input damage voltage		–0.5 V; 3.8 V
Input impedance	selectable	1 kΩ or 50 Ω (nom.)
Trigger jitter		±2.5 ns
External trigger delay		
Setting range		0 sample to $2.147 \cdot 10^9$ sample
Setting resolution	without R&S®SMW-B14 option	5 ns
	with R&S®SMW-B14 option	1/fading clock rate (= 5 ns or 10 ns)
External trigger inhibit		
Setting range		0 sample to (21.47 s · sample rate) sample
Setting resolution		1 sample
External trigger pulse width		> 7.5 ns
Marker signals		
Number of marker signals		3
Operating modes		unchanged, restart, pulse, pattern, ratio
Marker outputs		selectable from USER 1, 2, 3 on front panel or T/M/C 1, T/M 2, T/M 3 of respective baseband generator on rear panel
Connector type	USER 1, 2, 3 on front panel, T/M/C 1, T/M 2, T/M 3 of respective baseband generator on rear panel	BNC female
Level		LVTTL
Marker delay		
Setting range		0 sample to (waveform length – 1) sample
Setting resolution		1 sample
Marker duration		
Minimum value		1 sample
Multisegment waveform mode		
Number of segments		1 to 1024
Changeover modes		GUI, remote control, external trigger
Extended trigger modes		same segment, next segment, next segment seamless, sequencer
Changeover time	at 50 MHz clock rate, external trigger, without clock change	20 µs (meas.)
Seamless changeover		output up to end of current segment, followed by changeover to next segment
Sequencer play list length		max. 1024
Sequencer segment repetitions		max. 1 048 575
Multicarrier waveform mode		
Number of carriers		max. 512
Total RF bandwidth		max. 120 MHz
	with R&S®SMW-K522 option	max. 160 MHz
Carrier spacing		
Setting range		depends on number of carriers and signal RF bandwidth
Setting resolution		0.01 Hz
Crest factor modes		maximize, minimize, off
Signal period modes		longest file, shortest file, user (max. 1 s)
Single carrier gain		
Setting range		–80 dB to 0 dB
Setting resolution		0.01 dB
Single carrier start phase		
Setting range		0° to 360°
Setting resolution		0.01°
Single carrier delay		
Setting range		0 s to 1 s
Setting resolution		1 ns

Extended sequencing (R&S®SMW-K501 option)

The R&S®SMW-K501 option enables waveform sequencing and real-time signal generation for ultra long playtime. Waveform variations such as offset frequency, amplitude and phase are calculated in real-time and do not require precalculated waveforms. The R&S®SMW-K501 option offers two different modes:

In user mode, all sequences are based on user-defined XML based lists with up to 5 levels of nested loops. Special list types for frequency changes over time and amplitude changes over time are also available.

In pulse sequencer mode, the extended sequencing is controlled by the external R&S®Pulse Sequencer Software, a powerful software tool for simulating complex sequencing scenarios.

At least one R&S®SMW-B10 option (standard baseband generator) must be installed. If two R&S®SMW-B10 options are installed (signal paths A and B), extended sequencing can be used either on signal path A or B with one R&S®SMW-K501 option. For extended sequencing to be used simultaneously on signal paths A and B, two R&S®SMW-K501 options must be installed.

General settings		
Modes	sequencing via user-defined XML lists	user
	controlled by external R&S®Pulse Sequencer Software (R&S®SMW-K300 required)	pulse sequencer
User mode		
List types	Sequencing lists define an arbitrary number of entries that represent either a waveform or a sublist with further entries.	sequencing list
	Time lists store a list of different off times between waveform segments. They can be referenced in sequence entries.	time list
	Attenuation lists define the power level of the output signal over time.	attenuation list
	Hopping lists define frequency offsets of the output signal over time.	hopping list
Sequence		link to a sequencing list XML file
Attenuation over time		link to an attenuation list XML file
Hopping		link to a hopping list XML file
Pulse sequencer mode	see R&S®Pulse Sequencer Software specifications (PD 3607.1388.22)	
Waveform segments		
Segment length		1 sample to 64 Msample
Minimum memory allocation		64 sample
Maximum number of segments		depends on segment lengths and baseband generator ARB memory size
Waveform sequences		
Sequencing		continuously repeating
Maximum number of segments per sequence		depends on segment lengths and baseband generator ARB memory size
Maximum number of segment repetitions		2^{32}
Clock		see section Standard baseband generator (R&S®SMW-B10 option) – arbitrary waveform mode
Triggering		see section Standard baseband generator (R&S®SMW-B10 option) – arbitrary waveform mode
Marker signals		
Number of marker signals		3
Operating modes	marker at every start of sequence	restart
	marker 1 embedded in waveform	unchanged
	XML-defined marker for each entry	entry
Marker outputs		see section Standard baseband generator (R&S®SMW-B10 option) – arbitrary waveform mode
Marker delay		see section Standard baseband generator (R&S®SMW-B10 option) – arbitrary waveform mode
Marker duration		see section Standard baseband generator (R&S®SMW-B10 option) – arbitrary waveform mode

Standard baseband generator (R&S®SMW-B10 option) – real-time operation (custom digital modulation)

See Digital Standards for Signal Generators specifications (PD 5213.9434.22).

Wideband baseband characteristics

Internal baseband characteristics (R&S®SMW-B13XT option)

The R&S®SMW-B13XT provides I/Q paths that can be routed to the installed RF paths or to the analog I/Q outputs. Up to two signals can be output at the same time, for example:

- Signal A is routed to RF path A, signal B to RF path B
- Signal A is routed to RF path A, signal B to analog I/Q out 1

D/A converter		
Data rate		2400 MHz
Resolution		14 bit
Sample rate		4800 MHz (internal interpolation · 2)
Aliasing filter	with amplitude, group delay and S_i correction	
Bandwidth, rolloff to –0.1 dB		1000 MHz
SFDR overall		> 55 dB
I/Q impairments (digital baseband)	These impairments are set in the digital baseband section of the R&S®SMW200A. They act on the I/Q signal sent to the I/Q modulator/RF section, as well as on the I/Q signals at the analog or digital I/Q outputs (of the respective path).	
Carrier leakage		
Setting range		–10 % to +10 %
Setting resolution		0.01 %
I ≠ Q (imbalance)		
Setting range		–1 dB to +1 dB
Setting resolution		0.01 dB
Quadrature offset		
Setting range		–10° to +10°
Setting resolution		0.01°

Wideband analog I/Q outputs (R&S®SMW-B13XT option)

Number of I/Q outputs	single-ended	2
Output impedance		50 Ω
Output voltage	EMF (output voltage depends on set modulation signal)	1 V (V_p)
Offset	EMF	< 1 mV
Frequency response [13]	at R_L = 50 Ω	
Magnitude	up to 100 MHz	0.1 dB (meas.)
	up to 1000 MHz	0.2 dB (meas.)
I/Q balance [14]	at R_L = 50 Ω	
Magnitude	up to 100 MHz	0.1 dB (meas.)
	up to 1000 MHz	0.1 dB (meas.)
Spectral purity	at R_L = 50 Ω	
SFDR (sine wave)	100 MHz	> 60 dB
	up to 1000 MHz	55 dB (meas.)
Wideband noise	10 MHz sine wave at 1 MHz offset	–155 dBc (typ.)

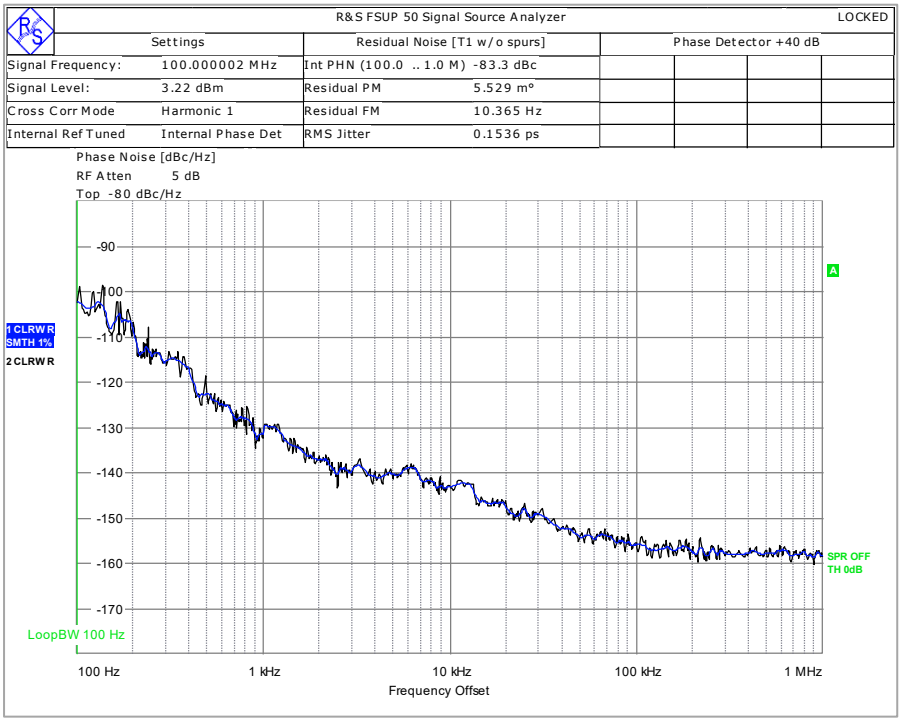
[13] "Optimize internal I/Q impairments for RF output" switched off.

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

Wideband differential analog I/Q outputs (R&S®SMW-K17 option)

This option can be installed once if the instrument is equipped with the R&S®SMW-B13XT option. Differential analog I/Q outputs can be used on signal path A only. If the differential output mode is activated, analog I/Q outputs for signal path B are not available.

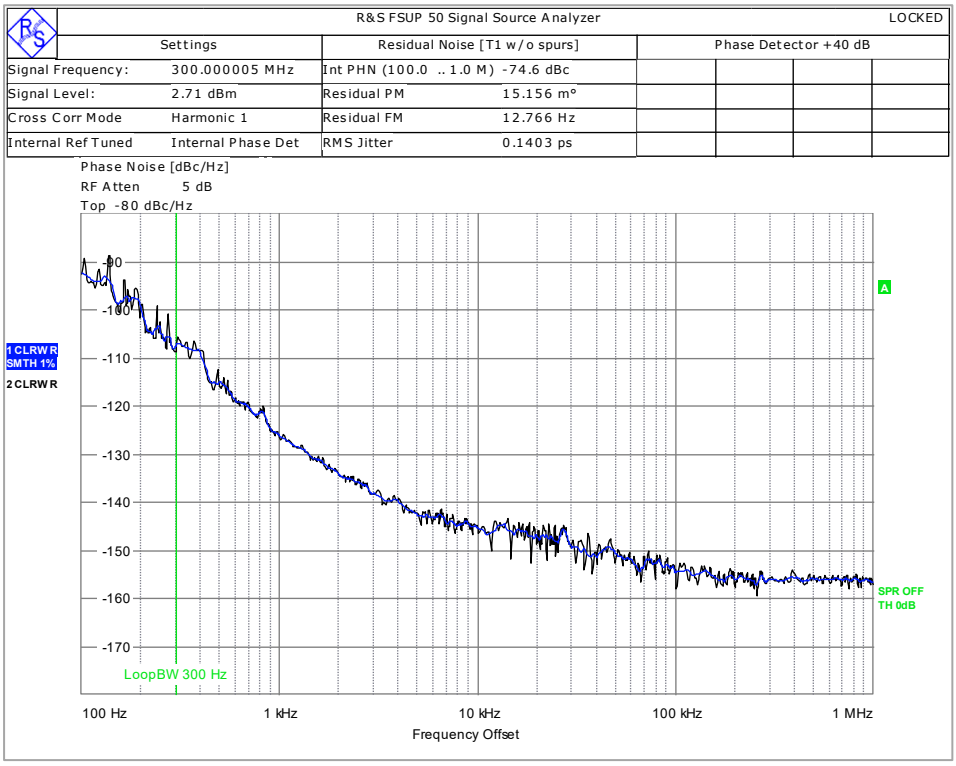
Output impedance		
Single-ended		50 Ω
Differential		100 Ω
Output voltage (V_{out})	output voltage depends on set modulation signal	
Single-ended	EMF	0.02 V to 1 V (V_p)
Resolution		0.1 mV
Differential	EMF	0.04 V to 2 V (V_{pp})
Resolution		0.1 mV
Bias voltage (single-ended and differential)	EMF	–0.2 V to +2.5 V [15]
Resolution		0.1 mV
Uncertainty		1 % + 2 mV
Offset voltage		
Differential	EMF	(–2 V + V_{out}) to (+2 V – V_{out})
	RF envelope: on (R&S®SMW-K540 required), EMF	–2 V to +2 V
Resolution		0.1 mV
Uncertainty		1 % + 1 mV
Differential signal balance	at R_L = 50 Ω, output voltage > 0.5 V (V_p)	
Magnitude	up to 100 MHz	0.1 dB (meas.)
	up to 500 MHz	0.15 dB (meas.)
	up to 1000 MHz	0.2 dB (meas.)
Frequency response [16]	at R_L = 50 Ω, output voltage > 0.5 V (V_p)	
Magnitude	up to 100 MHz	0.1 dB (meas.)
	up to 1000 MHz	0.2 dB (meas.)
Wideband noise	10 MHz sine wave at 1 MHz offset	–160 dBc (typ.)



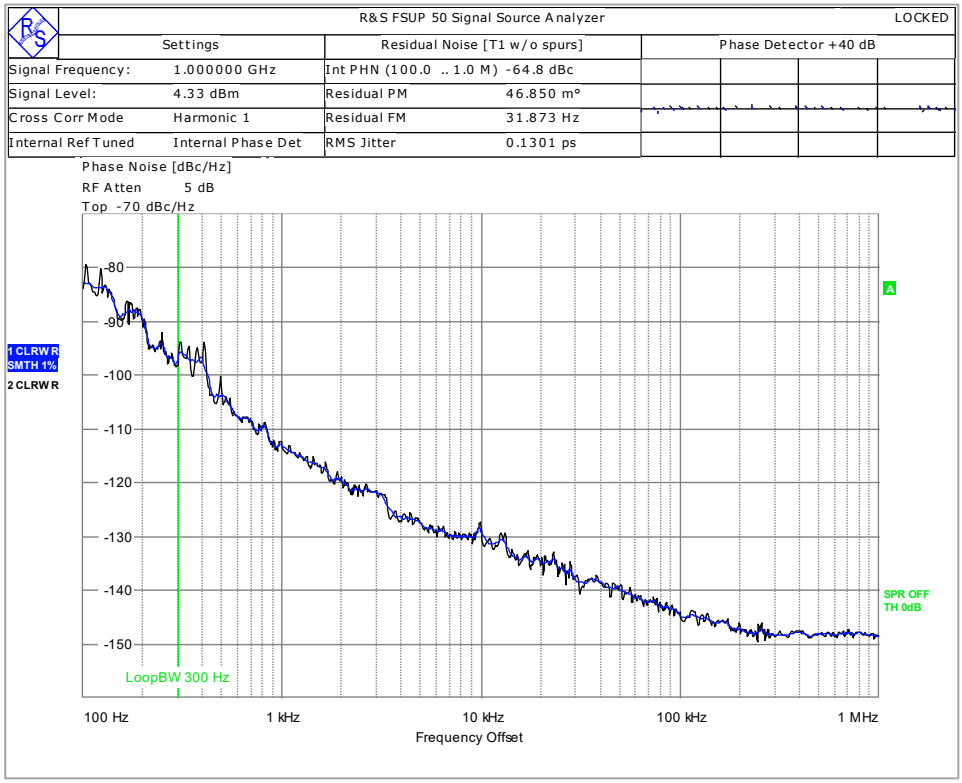
Measured phase noise of wideband analog I/Q outputs; single-ended sine wave with f = 100 MHz

[15] The magnitude of the sum of output voltage and bias voltage must not exceed 4 V.

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



Measured phase noise of wideband analog I/Q outputs; single-ended sine wave with f = 300 MHz



Measured phase noise of wideband analog I/Q outputs; single-ended sine wave with f = 1 GHz

Digital baseband inputs/outputs for wideband baseband

Depending on the installed software and hardware options, the R&S®SMW200A is able to receive digital baseband signals and output digital baseband signals. The digital I/Q input/output can be used for the lossless connection of the R&S®SMW200A to the digital I/Q input/output of other Rohde & Schwarz instruments.

Digital baseband outputs: At least one R&S®SMW-K19 option must be installed. Digital baseband outputs can be used either on signal path A or B with one R&S®SMW-K19 option. For digital baseband outputs to be used on signal paths A and B simultaneously, two R&S®SMW-K19 must be installed. To enable two or more digital baseband outputs in multichannel or other advanced modes, two R&S®SMW-K19 must be installed.

The R&S®SMW-K19 option requires R&S®SMW-B13XT with DACW board revision 4.00 or higher.

Signal outputs	system configuration mode: standard	analog only, digital only (HS [17])
	system configuration mode: advanced [18]	analog and digital, analog and digital (HS), digital only (HS)
Digital only (HS)	The streams are output via the digital I/Q outputs only (HS DIG I/Q interface standard). Analog I/Q outputs are not available. External modulation signals can be output via the RF outputs (I/Q modulation mode: external wideband I/Q).	
	with R&S®SMW-K551 installed and system configuration mode: advanced	The instrument runs at reduced speed, depending on the device connected to the digital I/Q output (slow I/Q).
Analog and digital	The instrument runs in regular operating mode, both analog and digital outputs (DIG I/Q interface standard) are available.	
Analog and digital (HS)	The instrument runs in regular operating mode, both analog and digital outputs (HS DIG I/Q interface standard) are available.	
Analog only	The instrument runs in regular operating mode, only analog outputs are available.	
Number of digital outputs		according to selected system configuration (see table below)
	signal outputs: digital only (HS)	maximum 2 (on R&S®SMW-B13XT)
	signal outputs: analog and digital	maximum 8 (on R&S®SMW-B13XT and R&S®SMW-B15) depending on entities · RX antennas of MIMO/SIMO configuration
	signal outputs: analog and digital (HS)	maximum 2 (on R&S®SMW-B13XT)
Number of streams per output	signal outputs: digital only (HS)	
	system configuration mode: standard	1 to 2
	system configuration mode: advanced	1 to 8
Number of streams per input	system configuration mode: standard; signal outputs: analog only, HS DIG I/Q	1 to 2
	system configuration mode: advanced; signal outputs: analog and digital, 200 MHz, interface either DIG I/Q or HS DIG I/Q	
	HS DIG I/Q	1 to 2
	DIG I/Q	1 to 2
	system configuration mode: advanced; signal outputs: analog and digital, 400 MHz or 800 MHz, HS DIG I/Q	1 to 2

[17] HS = high-speed.

[18] The following functions are not available in advanced system configuration mode: analog modulation, modulation sources for analog modulation, envelope tracking, AM/AM, AM/PM predistortion, Digital Doherty.

Bandwidth (RF)	general	according to selected system configuration
	system configuration mode: standard	bandwidth of wideband baseband generator (see section Wideband baseband generator, specification for R&S®SMW-B9 option) or maximum specified bandwidth (RF) of the selected interface, whichever is smaller
	system configuration mode: advanced	200 MHz or maximum specified bandwidth (RF) of the selected interface, whichever is smaller (see section Multichannel, MIMO, fading and noise, specifications for R&S®SMW-K75/-K821 options)
	with R&S®SMW-K822 option	400 MHz or maximum specified bandwidth (RF) of the selected interface, whichever is smaller (see section Multichannel, MIMO, fading and noise, specifications for R&S®SMW-K75/-K821 options)
	with R&S®SMW-K823 option	800 MHz or maximum specified bandwidth (RF) of the selected interface, whichever is smaller (see section Multichannel, MIMO, fading and noise, specifications for R&S®SMW-K75/-K821 options)

Minimum required R&S®SMW200A options	**Digital I/Q inputs**		**Digital I/Q outputs**	
Interface standard	DIG I/Q	HS DIG I/Q	DIG I/Q	HS DIG I/Q
R&S®SMW-B13XT + 1 × R&S®SMW-K19	–	–	1	1
R&S®SMW-B13XT + 2 × R&S®SMW-K19	–	–	2	2
1 × R&S®SMW-B9 + R&S®SMW-B13XT	1	1	–	–
1 × R&S®SMW-B9 + R&S®SMW-B13XT + 1 × R&S®SMW-K19	1	1	1	1
1 × R&S®SMW-B9 + R&S®SMW-B13XT + 2 × R&S®SMW-K19	1	1	2	2
2 × R&S®SMW-B9 + R&S®SMW-B13XT	2	2	–	–
2 × R&S®SMW-B9 + R&S®SMW-B13XT + 1 × R&S®SMW-K19	2	2	1	1
2 × R&S®SMW-B9 + R&S®SMW-B13XT + 2 × R&S®SMW-K19	2	2	2	2
2 × R&S®SMW-B9 + 4 × R&S®SMW-B15 + R&S®SMW-B13XT + 2 × R&S®SMW-K19	depends on selected system configuration (for required additional options for specific system configurations, see section Multichannel, MIMO, fading and noise, specifications for R&S®SMW-K74, -K75, -K76 options)			
2×1×1	2	2	2	2
other	–	–	up to 8	2

Output parameters

DIG I/Q interface		
Interface		
Standard		DIG I/Q, in line with R&S®Digital I/Q Interface PAD-R [19], I/Q data and control signals, data and interface clock
Level		LVDS
Connector		26-pin MDR
I/Q sample rate	With source "user-defined", the sample rate must be entered via the parameter "sample rate".	
Source		user-defined
Sample rate		250 MHz
Resolution	source: user-defined	0.001 Hz
Frequency uncertainty	source: user-defined	< (1 · 10^{-12} + relative deviation of reference frequency) · sample rate (nom.)

[19] R&S®Digital I/Q Interface PAD-R is a Rohde & Schwarz internal company guideline for the transmission of digital I/Q data. It is supported by a wide range of signal generators, signal analyzers and radio communication testers.

I/Q data		
Resolution		18 bit
Logic format		two's complement
Physical signal level		
Setting range		0 to –60 dBFS
Resolution		0.01 dBFS
Bandwidth (RF)	system configuration mode: advanced	0.8 · sample rate
Control signals	markers	3
Earliest supported R&S®SMW200A firmware version		4.30.046.221
HS DIG I/Q interface		
Interface		
Standard		HS DIG I/Q, in line with R&S®Digital I/Q Interface 40G PAD-R [20] (DIG I/Q 40G), I/Q data and control signals
Level		LVDS
Connector		QSFP+/QSFP 28
I/Q sample rate		
Sample rate	maximum sample rate depends on connected receiving device and system configuration mode	
	system configuration mode: standard	
	40G	up to 1.05 GHz
	50G	up to 1.25 GHz
	system configuration mode: advanced	
	analog and digital (HS)	1000 MHz
	digital only (HS)	up to 250 MHz
Resolution		0.001 Hz
Frequency uncertainty		< (1 · 10^{-12} + relative deviation of reference frequency) · sample rate (nom.)
I/Q data		
Resolution		up to 16 bit
Logic format		two's complement
Physical signal level		
Setting range		0 to –60 dBFS
Setting resolution		0.01 dBFS
Bandwidth (RF)	system configuration mode: standard	0.83 · sample rate
	system configuration mode: advanced	0.8 · sample rate
Control signals	markers	2
Setup external RF with R&S®SMW-B13XT to R&S®SMW-B9		
Earliest supported R&S®SMW200A firmware version		4.70.128.xx
Notes	If both R&S®SMW200A have DACW board revision 4.00 and DACW board revision 5.00, use DACW board revision 5.00 as signal source.	
Setup external RF with R&S®SMW-B13XT to R&S®SMM100A		
Earliest supported R&S®SMW200A firmware version		4.90.049.xx
Setup external RF with R&S®SMW-B13XT to R&S®SMCV100B		
Earliest supported R&S®SMW200A firmware version		4.90.049.xx

Input parameters

DIG I/Q interface		
Input level	peak level	
Peak level		
Setting range	referenced to full scale	–60 dB to +3 dB
Resolution		0.01 dB
Crest factor		
Setting range		0 dB to +30 dB
Resolution		0.01 dB
Adjust level function		automatically determines peak level and crest factor of input signal

[20] R&S®Digital I/Q Interface 40G PAD-R is a Rohde & Schwarz internal company guideline for the transmission of digital I/Q data. It is supported by a wide range of signal generators, signal analyzers and radio communication testers.

Interface		
Standard		DIG I/Q, in line with R&S®Digital I/Q Interface PAD-R [21], I/Q data and control signals, data and interface clock
Level		LVDS
Connector		26-pin MDR
I/Q sample rate	With source "user-defined", the sample rate must be entered via the parameter "sample rate". With source "Digital I/Q In", the sample rate will be used based on information provided by the transmitting device.	
Source		user-defined, Digital I/Q In
Sample rate	maximum sample rate depends on connected receiving device	400 Hz to 250 MHz
Resolution	source: user-defined	0.001 Hz
Frequency uncertainty	source: user-defined	< (1 · 10^{-12} + relative deviation of reference frequency) · sample rate (nom.)
I/Q data		
Resolution		18 bit
Logic format		two's complement
Bandwidth (RF)	system configuration mode: advanced	0.8 · sample rate
Control signals	markers	3
HS DIG I/Q interface		
Input level	peak level	
Setting range		–60 dB to +3 dB, referenced to full scale
Setting resolution		0.01 dB
Crest factor		
Setting range		0 dB to +30 dB
Setting resolution		0.01 dB
Adjust level function		automatically determines peak level and crest factor of input signal
Standard		HS DIG I/Q, in line with R&S®Digital I/Q Interface 40G PAD-R [21] (DIG I/Q 40G), I/Q data and control signals
Level		LVDS
Connector		QSFP+/QSFP 28
I/Q sample rate		
Source	the sample rate will be used based on information provided by the transmitting device	HS digital I/Q In
Sample rate	maximum sample rate depends on connected transmitting device and system configuration mode	
	system configuration mode: standard	
	40G	up to 1.05 GHz
	50G	up to 1.25 GHz
	system configuration mode: advanced	up to 250 MHz
	with R&S®SMW-K822 option	up to 500 MHz
	with R&S®SMW-K823 option	up to 1000 MHz
Resolution		0.001 Hz
Frequency uncertainty		< (1 · 10^{-12} + relative deviation of reference frequency) · sample rate (nom.)
I/Q data		
Resolution		16 bit
Logic format		two's complement
Bandwidth (RF)	system configuration mode: standard	0.83 · sample rate
Control signals	markers	2

[21] R&S®Digital I/Q Interface PAD-R is a Rohde & Schwarz internal company guideline for the transmission of digital I/Q data. It is supported by a wide range of signal generators, signal analyzers and radio communication testers.

Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode

One or two R&S®SMW-B9 can be installed. Their I/Q signals can be assigned a frequency offset.

Prerequisite: R&S®SMW-B13XT must be installed.

Waveform length		1 sample to 256 Msample in one-sample steps
	with R&S®SMW-K515 option (memory extension)	1 sample to 2 Gsample in one-sample steps
Supported file formats		.wv, .mat, .csv, .iq.tar
Nonvolatile memory		solid state disk
Sample resolution	equivalent to D/A converter	14 bit
Sample rate		400 Hz to 600 MHz
	with R&S®SMW-K525 option	400 Hz to 1200 MHz
	with R&S®SMW-K527 option	400 Hz to 2400 MHz
Sample frequency error	internal clock	< (1 · 10^{-12} + relative deviation of reference frequency) · sample rate (nom.)
Sample clock source		internal
Bandwidth (RF)	at maximum sample rate, rolloff to –0.1 dB	500 MHz
	at reduced sample rate, rolloff to –0.1 dB (The waveform is automatically interpolated to the internal sample rate of 600 MHz.)	0.833 · sample rate
Bandwidth (RF) with R&S®SMW-K525 option	at maximum sample rate, rolloff to –0.1 dB	1000 MHz
	at reduced sample rate, rolloff to –0.1 dB (The waveform is automatically interpolated to the internal sample rate of 1200 MHz.)	0.833 · sample rate
Bandwidth (RF) with R&S®SMW-K527 option	at maximum sample rate, rolloff to –0.1 dB	2000 MHz
	at reduced sample rate, rolloff to –0.1 dB (The waveform is automatically interpolated to the internal sample rate of 2400 MHz.)	0.833 · sample rate
Frequency offset	Using the frequency offset, the center frequency of the wanted baseband signal can be shifted. The restrictions caused by the modulation bandwidth still apply.	
Frequency offset setting range		–250 MHz to +250 MHz
	with R&S®SMW-K525 option	–500 MHz to +500 MHz
	with R&S®SMW-K527 option	–1000 MHz to +1000 MHz
Frequency offset setting resolution		0.01 Hz
Frequency offset error		< 9 · 10^{-6} Hz + relative deviation of reference frequency · frequency offset (nom.)
Triggering	A trigger event restarts I/Q generation. The I/Q signal is then synchronous with the trigger (with a specific timing jitter).	
Trigger source	event triggered via GUI or remote command	internal
	event triggered by other baseband generator	internal (baseband A/B)
	event triggered by external trigger signal	external
Trigger modes	The signal is generated continuously.	auto
	The signal is generated continuously. A trigger event causes a restart.	retrig
	The signal is started only when a trigger event occurs. Subsequent trigger events are ignored.	armed auto
	The signal is started only when a trigger event occurs. Every subsequent trigger event causes a restart.	armed retrig

Trigger modes (continued)	The signal is started only when a trigger event occurs. The signal is generated once.	single
External trigger input		selectable from USER 1, 2, 3 on front panel, or USER 4, 5, 6 on rear panel
Connector type	USER 1, 2, 3 on front panel, USER 4, 5, 6 on rear panel	BNC female
Input level		0 V to 3 V (nom.)
Threshold	USER 1, 2, 3	settable from 0.1 V to 2.0 V
	USER 4, 5, 6	settable from 0.1 V to 2.0 V
Input damage voltage		–0.5 V, 3.8 V
Input impedance	selectable	1 kΩ or 50 Ω (nom.)
Trigger jitter		±1.67 ns
External trigger delay		
Setting range		0 sample to $2.147 \cdot 10^9$ sample
Setting resolution		0.4 ns
External trigger inhibit		
Setting range		0 sample to (21.47 s · sample rate) sample
Setting resolution		1 sample
External trigger pulse width		> 7.5 ns
Marker signals		
Number of marker signals		3
Operating modes		unchanged, restart, pulse, pattern, ratio
Marker outputs		selectable from USER 1, 2, 3 on front panel or USER 4, 5, 6 on rear panel
Connector type	USER 1, 2, 3 on front panel, USER 4, 5, 6 on rear panel	BNC female
Level		LVTTL
Jitter	marker to waveform	±1.67 ns
Marker delay		
Setting range		0 sample to (waveform length – 1) sample
Setting resolution		1 sample
Marker duration		
Minimum value	sample rate ≤ 300 Msample/s	1 sample
	300 Msample/s < sample rate ≤ 600 Msample/s	2 sample
	600 Msample/s < sample rate ≤ 1200 Msample/s	4 sample
	1200 Msample/s < sample rate ≤ 2400 Msample/s	8 sample
Marker signals (high precision)		
Number of marker signals		2
Marker outputs		analog I/Q output A
Connector type		BNC female
Level		max. 2.5 V
Jitter		< 100 ps
Multisegment waveform mode		
Number of segments		1 to 1024
Changeover modes		GUI, remote control
Extended trigger modes		same segment, next segment, next segment seamless, sequencer
Seamless changeover		output up to end of current segment, followed by changeover to next segment
Sequencer play list length		max. 1024
Sequencer segment repetitions		max. 1 048 575
Multicarrier waveform mode		
Number of carriers		max. 512
Total RF bandwidth		max. 500 MHz
	with R&S®SMW-K525 option	max. 1000 MHz
	with R&S®SMW-K527 option	max. 2000 MHz
Carrier spacing		
Setting range		depends on number of carriers and signal RF bandwidth
Setting resolution		0.01 Hz
Crest factor modes		maximize, minimize, off
Signal period modes		longest file, shortest file, user (max. 1 s)

Single carrier gain		
Setting range		–80 dB to 0 dB
Setting resolution		0.01 dB
Single carrier start phase		
Setting range		0° to 360°
Setting resolution		0.01°
Single carrier delay		
Setting range		0 s to 1 s
Setting resolution		1 ns

ARB Ethernet upload (R&S®SMW-K507 option)

ARB Ethernet upload is a sub mode of arbitrary waveform mode, see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode. This feature allows a fast upload und playback of waveform I/Q samples from an external source via UDP over a QSFP+ LAN interface into a Rohde & Schwarz signal generator (R&S®SMW200A).

The waveform parameter and I/Q samples are transferred using special transmission commands (Rohde & Schwarz upload protocol, see R&S®K507 user manual).

At least one R&S®SMW-B9 wideband baseband generator option must be installed. If two R&S®SMW-B9 options are installed (signal paths A and B), the ARB Ethernet upload can be used either on signal path A or B with one R&S®SMW-K507 option. For simultaneous usage on signal paths A and B, two R&S®SMW-K507 options must be installed.

ARB Waveform		
File size, technical specification		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
File generation		see R&S®SMW200A user manual, section Using the Arbitrary Waveform Generator (ARB)
Upload transmission protocol		
R&S®ARB upload protocol		see K507 user manual
Marker signals		
Number of marker signals		3
Operating modes		waveform (unchanged), restart
Marker outputs		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Interface parameters		
LAN interface		
Connector	HS DIG I/Q 1, 2 on rear panel	QSFP+/QSFP 28
Protocol		UDP over Ethernet
Data rate	10 Gigabit Ethernet or 40 Gigabit Ethernet can be configured in the user interface	10 Gbit/s, 40 Gbit/s

ARB Ethernet streaming (R&S®SMW-K508 option)

ARB Ethernet streaming is a sub mode of arbitrary waveform mode, see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode. This feature allows the input of a continuous, infinite stream of I/Q samples from an external source via UDP over a QSFP+ interface into the R&S®SMW200A vector signal generator to be output at the RF.

The waveform parameter and I/Q samples are transferred using special transmission commands (Rohde & Schwarz UDP based protocol).

At least one R&S®SMW-B9 wideband baseband generator option must be installed. If two R&S®SMW-B9 options are installed (signal paths A and B), the ARB Ethernet streaming can be used either on signal path A or B with one R&S®SMW-K508 option. For simultaneous usage on signal paths A and B, two R&S®SMW-K508 options must be installed.

I/Q sample input		
I/Q samples		32 bit I/Q samples (16 bit I + 16 bit Q precision)
Sample rate		≤ 600 Msamples
	with R&S®SMW-K525 or R&S®SMW-K527 option	≤ 1 Gsamples
Bandwidth		0.833 · sample rate
Protocol		Rohde & Schwarz UDP based protocol
Connector	HS DIG I/Q 1, 2 on rear panel	QSFP+/QSFP 28

Ethernet streaming with dynamic offset control (R&S®SMW-K573 option)

The R&S®SMW-K573 option enhances the R&S®SMW-K508 option by adding a dedicated streaming interface for manipulating an incoming I/Q stream via offset descriptor words (ODW).

ODWs are streamed via the external LAN interface to control a real-time engine on the R&S®SMW-B9 and provide manipulation of frequency, phase and amplitude. These variations are applied in real time onto the I/Q data that is streamed from an external source via UDP over a QSFP+ interface into the R&S®SMW200A vector signal generator to be output at the RF.

The waveform parameter and I/Q samples are transferred using special transmission commands (Rohde & Schwarz UDP based protocol).

At least one R&S®SMW-B9 wideband baseband generator option must be installed. If two R&S®SMW-B9 options are installed (signal paths A and B), the R&S®SMW-K573 can be used either on signal path A or B with one R&S®SMW-K508 option. For simultaneous usage on signal paths A and B, two R&S®SMW-K508 options must be installed.

ODW parameters		
ODW format		
Size		32 byte fixed length
Controllable parameters		frequency offset, amplitude offset, phase offset
Update rate		2 million ODW/s
Setting granularity		
Time		417 ps
Amplitude offset	voltage based	16 bit
Phase offset		< 0.01°
Frequency offset		0.58 Hz
Operating modes		
TOA		ODW execution on timestamp
Instant		instant ODW execution after reception
Marker signals		
Number of marker signals		3
Operating modes		restart, ODW
Marker outputs		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Marker delay		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Interface parameters		
LAN interface		
Connector	ADV DATA/CTRL 1, 2 on rear panel	RJ-45
ODW buffer		
Size		536 870 656 byte

Extended sequencing (R&S®SMW-K502 option)

The R&S®SMW-K502 option enables waveform sequencing and real-time signal generation for ultra long playtime. Waveform variations such as offset frequency, amplitude and phase are calculated in real-time and do not require precalculated waveforms.

The extended sequencing is controlled by the external R&S®Pulse Sequencer Software, a powerful software tool for simulating complex sequencing scenarios.

At least one R&S®SMW-B9 wideband baseband generator option must be installed. If two R&S®SMW-B9 options are installed (signal paths A and B), extended sequencing can be used either on signal path A or B with one R&S®SMW-K502 option. For extended sequencing to be used simultaneously on signal paths A and B, two R&S®SMW-K502 options must be installed.

General settings		
Modes	controlled by external R&S®Pulse Sequencer Software (R&S®SMW-K300 required)	pulse sequencer
Pulse sequencer mode		see R&S®Pulse Sequencer Software specifications (PD 3607.1388.22)
Waveform segments		
Segment length		1 sample to 64 Msample
Minimum memory allocation		64 sample
Maximum number of segments		depends on segment lengths and baseband generator ARB memory size

Waveform sequences		
Sequencing		continuously repeating
Maximum number of segments per sequence		depends on segment lengths and baseband generator ARB memory size
Maximum number of segment repetitions		2^{32}
Clock		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Triggering		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Marker signals		
Number of marker signals		3
Operating modes	marker at every start of sequence	restart
	marker 1 embedded in waveform	unchanged
	marker at every pulse	pulse
Marker outputs		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Marker delay		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Marker duration		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode

Real-time control interface (R&S®SMW-K503/-K504 options)

The R&S®SMW-K503/-K504 option enhances the R&S®SMW-B9 wideband baseband generator option by adding a dedicated 1 Gbit/s LAN interface for pulse descriptor word (PDW) streaming. PDWs are streamed via the external LAN interface to control a real-time sequencer on the R&S®SMW-B9. Either a precalculated waveform can be played back or certain signals such as rectangular pulses, Barker codes and chirps can be generated in real time.

In addition to these different signal types, the interface provides agile switching of frequency, phase and amplitude. These variations are calculated in real time.

The real-time control interface is controlled by an external simulator that streams the PDWs in a proprietary Rohde & Schwarz format.

At least one R&S®SMW-B9 wideband baseband generator option and one R&S®SMW-K502 option must be installed. If two R&S®SMW-B9 options and two R&S®SMW-K502 options are installed (signal paths A and B), the real-time control interface can be used either on signal path A or B with R&S®SMW-K503 or -K504 option. For simultaneous usage on signal paths A and B, two R&S®SMW-K503/-K504 options must be installed. The R&S®SMW-K504 option increases the maximum PDW rate from 1 MPDW to 2 MPDW. Each R&S®SMW-K504 option requires an R&S®SMW-K503 option to be installed.

PDW parameters		
PDW format		
PDW	basic	32 byte fixed length
	expert	32 byte/48 byte fixed length
CNTRL PDW		16 byte fixed length
Controllable parameters	PDW	
	variant no. 1	time of arrival, frequency offset, amplitude offset, phase offset, real-time modulation on pulse (MOP, see real-time MOP types below), I/Q waveform index
	variant no. 2	time of arrival, rise time, fall time, edge type (linear, cosine), repetitions (in burst mode), frequency offset, amplitude offset, phase offset, real-time modulation on pulse (MOP, see real-time MOP types below), I/Q waveform index
	CNTRL PDW	absolute amplitude, absolute frequency
Setting granularity		
Time		417 ps
Amplitude		16 bit (voltage based)
Phase		< 0.01°
Frequency		0.58 Hz

I/Q segments		
Maximum individual segments		16 777 216
Length granularity		32 sample
Time parameters		
Maximum play time	variant no. 1	2 h
	variant no. 2	521 h
Minimum pulse width	real-time	3.3 ns
	I/Q segment	417 ps
Minimum PRI real-time signals	variant no. 1	
	with R&S®SMW-K503 option	1 µs
	with R&S®SMW-K504 option	0.5 µs
	variant no. 2	
	with R&S®SMW-K503 option	1 µs
	with R&S®SMW-K504 option	0.5 µs without extension fields, 1 µs with extension fields
Minimum I/Q segment playback repetition interval		1.0 µs
Real-time MOP types		
Unmod		rectangular pulse
Linear FM		up, down, triangular
Maximum hirp deviation		±1 GHz
Phase		Barker
Barker codes		R3, R4a, R4b, R5, R7, R11, R13
Marker signals		
Number of marker signals		3
Operating modes		pulse, restart, PDW
Marker outputs		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Marker delay		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Interface parameters		
LAN interface		
Connector	ADV DATA/CTRL 1, 2 on rear panel	RJ-45
PDW buffer		
Size		536 870 656 byte

Pulse-on-pulse simulation (R&S®SMW-K315 option)

This option enhances the R&S®SMW-K502 option to simulate up to 6 true parallel instances of the extended sequencer in a single instrument. It allows the generation of time overlapping pulse-on-pulse signals. As a result, up to 6 emitters can be generated simultaneously in one R&S®SMW200A. If the R&S®SMW-K306 option is installed, each extended sequencer can also be used to generate a group of interleaved emitters. In case of interleaving emitters, drop-out rates can be reduced by distributing emitters onto more hardware resources.

Two R&S®SMW-B9 options (wideband baseband generator), two R&S®SMW-K502 options and at least two R&S®SMW-B15 options (fading simulator and signal processor) must be installed. Depending on the operating mode, additional options are required:

Operating modes	radar signal generation with R&S®Pulse Sequencer Software	pulse sequencer
	radar signal generation using PDW streaming with R&S®SMW-K503/-K504 options	real-time control interface
Minimum required options	operating mode: pulse sequencer	two R&S®SMW-B9, two R&S®SMW-K502, two R&S®SMW-K300, two R&S®SMW-K301, two or four R&S®SMW-B15
	operating mode: real-time control interface	two R&S®SMW-B9, two R&S®SMW-K502, two R&S®SMW-K503, two or four R&S®SMW-B15
Number of extended sequencers	two R&S®SMW-B15 installed	4
	four R&S®SMW-B15 installed	6

Agile sequencing (R&S®SMW-K506 option)

Agile sequencing allows external control and fast arbitrary switching of prestored ARB segments by streaming of ARB descriptor words (ADW) including a waveform ID to the R&S®SMW200A. The R&S®SMW-K506 option enhances the R&S®SMW-B9 wideband baseband generator option by adding ADW streaming via a dedicated, low latency 10 Gbit/s LAN interface over an existing QSFP+ interface.

In addition to ARB segment sequencing, the interface provides agile switching of frequency, phase and amplitude. These variations are applied in real time.

At least one R&S®SMW-B9 wideband baseband generator option must be installed. If two R&S®SMW-B9 options are installed (signal paths A and B), the agile sequencing can be used either on signal path A or B with one R&S®SMW-K506 option. For simultaneous usage on signal paths A and B, two R&S®SMW-K506 options must be installed.

ADW parameters		
ADW format		
Size		32 byte fixed length
Controllable parameters		frequency offset, amplitude offset, phase offset, waveform ID, segment repetitions, segment interrupt
Setting granularity		
Amplitude offset		16 bit (voltage based)
Phase offset		< 0.01°
Frequency offset		0.58 Hz
ARB segments		
Maximum individual segments		16 777 216
Length granularity		32 samples
Time parameters		
Minimum ARB segment playback repetition interval		1.0 µs
Operating modes		
Deterministic		ADW execution on external trigger event
Trigger to RF delay	depends on ARB sample rate	
	sample rate = 37.5 MHz	5.6 µs (meas.)
	sample rate = 75 MHz	4.1 µs (meas.)
	sample rate = 300 MHz	3.4 µs (meas.)
	sample rate = 2.4 GHz	3.1 µs (meas.)
Trigger jitter		±1.67 ns
ARB segment repetitions	looping of ARB segments	1 to 2^{16}
Instant		instant ADW execution after reception
ADW reception to RF delay	depends on ARB sample rate	
	sample rate = 37.5 MHz	7.3 µs (meas.)
	sample rate = 75 MHz	5.5 µs (meas.)
	sample rate = 300 MHz	4.7 µs (meas.)
	sample rate = 2.4 GHz	4.3 µs (meas.)
ARB segment repetitions	looping of ARB segments	1 to 2^{16}
Marker signals		
Number of marker signals		3
Operating modes		pulse, restart, ADW
Marker outputs		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Marker delay		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Interface parameters		
LAN interface		
Connector	HS DIG I/Q 1, 2 on rear panel	QSFP+/QSFP 28 (note the extras at the end of this table)
Protocol		UDP over Ethernet
Data rate		10 Gbit/s
Trigger input connector		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode
Ready for trigger output connector		see section Wideband baseband generator (R&S®SMW-B9 option) – arbitrary waveform mode

Internal ADW buffer		
Size		512 ADWs
Mandatory extra		40G QSFP+ to 10G SFP+ adapter converter module
Recommended extras		• 10G SFP+ optical cable • 10G SFP+ Ethernet network interface card

Wideband baseband generator (R&S®SMW-B9 option) – real-time operation (custom digital modulation)

See Digital Standards for Signal Generators specifications (PD 5213.9434.22).

Wideband baseband generator for GNSS with high dynamics (R&S®SMW-B9F option)

This wideband baseband generator enables high dynamics with GNSS standards. For details see the GNSS simulation for Rohde & Schwarz vector signal generators specifications (PD 3607.6896.22). Otherwise, the specifications of the wideband baseband generator (R&S®SMW-B9 option) also apply for the R&S®SMW-B9F option. Enhancements of the R&S®SMW-B9 option and software options that run on the R&S®SMW-B9 option also work with the R&S®SMW-B9F option.

Note that R&S®SMW-B9F and R&S®SMW-B9 cannot be mixed, i.e. only the following configurations can be installed:

- 1 × R&S®SMW-B9
- 2 × R&S®SMW-B9
- 1 × R&S®SMW-B9F
- 2 × R&S®SMW-B9F

Baseband enhancements

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

AWGN can be generated either on path A or B with one R&S®SMW-K62 option. For AWGN to be generated on paths A and B simultaneously, two R&S®SMW-K62 must be installed, and the R&S®SMW200A must be equipped with the R&S®SMW-B13T or R&S®SMW-B13XT option.

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		> 15 dB
Periodicity		> $3 \cdot 10^{10}$ s
C/N, E_b/N_0		
Setting range	Depends on the set RF level. The PEP of the sum signal (wanted signal + noise) must not exceed the maximum possible PEP of the respective RF path.	–50 dB to +45 dB
Setting resolution		0.01 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	
Setting range	with R&S®SMW-B13/-B13T options	1 kHz to 160 MHz
	with R&S®SMW-B13XT option	
	system configuration mode: standard	1 kHz to 2000 MHz
	system configuration mode: advanced	1 kHz to 200 MHz
	with R&S®SMW-K822 option	1 kHz to 400 MHz
	with R&S®SMW-K823 option	1 kHz to 800 MHz
Setting resolution		100 Hz

Enhanced noise generation (R&S®SMW-K810 option)

Enhanced noise generation can be used either on signal path A or B with one R&S®SMW-K810 option. For enhanced noise generation to be used on paths A and B simultaneously, two R&S®SMW-K810 must be installed. For each R&S®SMW-K810 option to be installed, an R&S®SMW-K62 option must be installed as prerequisite.

Phase noise simulation

Phase noise		
Injection		after fading
Profiles	user-defined	user
	predefined PLL phase noise profiles (simulation of typical PLL circuits)	PLL 1, PLL 2
	predefined VCXO phase noise profiles (simulation of typical oscillator circuits)	crystal 1 to 5
	predefined DVB-S2 phase noise profiles, based on EN 302307, DIRECTV	DVB-S2 P1, DVB-S2 P2, DVB-S2 D1, DVB-S2 A1, DVB-S2 A2
	predefined ATSC phase noise profiles, based on ATSC A.74	ATSC A.74
File format		text files, editable
Graphical user interface		
Entry		by curve table
Number of nodes		5 independent points
Calculation		internal
Amplitude at $f_{carrier}$ ± 100 Hz		
Setting range	measurement bandwidth = 1 Hz	–110.00 dBc to 0.00 dBc
Setting resolution	measurement bandwidth = 1 Hz	0.01 dB
Maximum phase angle		±180°
Density distribution function		Gaussian
Frequency response		depends on phase noise profile
System bandwidth		10 MHz

Impulsive noise simulation

This function allows to add a pulsed AWGN signal to the wanted signal with settable number of pulses per frame and within settable limits of randomly distributed pulse intervals.

Impulsive noise		
AWGN signal data		see R&S®SMW-K62 option
C/I		
Setting range	Depends on the set RF level. The PEP of the sum signal (wanted signal + noise) must not exceed the maximum possible PEP of the respective RF path.	–35 dB to +60 dB
Setting resolution		0.01 dB
Frame duration		0.1 ms to 1000.0 ms
Pulse duration	fixed	0.25 µs
Pulses per frame		1 to 40000
Minimum pulse interval	for pulses per frame > 1	
Setting range		0.25 µs to 16 ms
Setting resolution		0.25 µs
Maximum pulse interval	for pulses per frame > 1	
Setting range		0.25 µs to 16 ms
Setting resolution		0.25 µs
Distribution of pulse intervals		PRBS

Availability of phase noise and impulsive noise for different baseband configurations

Baseband main module	Fading/baseband configuration		Phase noise	Impulsive noise
R&S®SMW-B13	standard		●	●
R&S®SMW-B13T	standard		●	●
	advanced	up to 4 streams	–	●
		more than 4 streams	–	–
R&S®SMW-B13XT	standard		●	●
	advanced	up to 4 streams	●	●
		more than 4 streams	●	●

Envelope tracking (R&S®SMW-K540 option)

With this option, the analog I/Q outputs can be used to generate an analog signal corresponding to the envelope of the I/Q signal to test envelope tracking modulators.

This option can be installed once if the instrument is equipped with the R&S®SMW-B13 or R&S®SMW-B13XT option. If the instrument is equipped with the R&S®SMW-B13T option, envelope tracking can be used either on signal path A or B with one R&S®SMW-K540 option. For envelope tracking to be used on signal paths A and B simultaneously, two R&S®SMW-K540 and one R&S®SMW-B13T must be installed.

Instruments equipped with the R&S®SMW-B13 or R&S®SMW-B13T option: For each R&S®SMW-K540 option to be installed, an R&S®SMW-K16 option must be installed, and the instrument must be equipped with at least one standard baseband generator (R&S®SMW-B10 option).

Instruments equipped with the R&S®SMW-B13XT option: For R&S®SMW-K540 option to be installed, the R&S®SMW-K17 option must be installed, and the instrument must be equipped with at least one wideband baseband generator (R&S®SMW-B9 option).

General		
Envelope voltage adaptation		auto normalized, auto power, manual
Output type		single-ended, differential
Bias voltage	see section Differential analog I/Q outputs or Wideband differential analog I/Q outputs	
Offset voltage	see section Differential analog I/Q outputs or Wideband differential analog I/Q outputs	
Envelope to RF delay		
Setting range		–1 µs to +1 µs
Setting resolution		1 ps
Shaping		off, linear, from table, polynomial, detroughing
Envelope voltage adaptation modes: auto normalized and auto power		
Power amplifier input power P_{in}		
Setting range		–145.00 dB to +30.00 dB
Setting resolution		0.01 dB
Power amplifier supply voltage V_{CC}	V_{CC} = envelope voltage · DC modulator gain + $V_{CC, Offset}$	
DC modulator gain		–20.00 dB to +20.00 dB
Power amplifier offset voltage $V_{CC, Offset}$		0 V to 30 V
Envelope voltage adaptation mode: manual		
Pregain		
Setting range		–20.00 dB to 0.00 dB
Setting resolution		0.01 dB
Postgain		
Setting range		–3.00 dB to +20.00 dB
Setting resolution		0.01 dB
Clipping level	upper and lower limit can be set separately	0 % to 100 %
Maximum output voltage	see Output voltage in section Differential analog I/Q outputs	

AM/AM, AM/PM predistortion (R&S®SMW-K541 option)

Instruments with wideband baseband (R&S®SMW-B13XT):

Each R&S®SMW-K541 option to be installed requires a wideband baseband generator (R&S®SMW-B9 option) and an RF path. If the instrument is equipped with two baseband generators and two RF paths, predistortion can be used either on signal path A or B with one R&S®SMW-K541 option. To allow AM/AM, AM/PM predistortion to be used on signal paths A and B simultaneously, two R&S®SMW-K541 must be installed; furthermore, the instrument must be equipped with two R&S®SMW-B9 options and two RF paths, i.e. an R&S®SMW-B2xx frequency option for path B must be installed.

Instruments with standard baseband (R&S®SMW-B13/-B13T):

Each R&S®SMW-K541 option to be installed requires a standard baseband generator (R&S®SMW-B10 option) and an RF path. If the instrument is equipped with two baseband generators and two RF paths, predistortion can be used either on signal path A or B with one R&S®SMW-K541 option. To allow AM/AM, AM/PM predistortion to be used on signal paths A and B simultaneously, two R&S®SMW-K541 must be installed; furthermore, the instrument must be equipped with two R&S®SMW-B10 options, the R&S®SMW-B13T option and two RF paths, i.e. an R&S®SMW-B2xx frequency option for path B must be installed.

State		on/off
Maximum input power (PEP_{in} max.)		
Setting range		–145.00 dB to +30.00 dB
Setting resolution		0.01 dB
Shaping		polynomial, from table

Digital Doherty (R&S®SMW-K546 option)

The Digital Doherty option only applies to instruments equipped with two RF paths and two baseband generators.
Two R&S®SMW-K541 options and the R&S®SMW-B90 option (phase coherence) must be installed as prerequisite.

State		on/off
Maximum input power (PEP_{in} max.)		
Setting range		–145.00 dB to +30.00 dB
Setting resolution		0.01 dB
Shaping		polynomial, from table, classic Doherty

User-defined frequency response correction (R&S®SMW-K544 option)

This option can be installed once if the instrument is equipped with the R&S®SMW-B13 option. If the instrument is equipped with the R&S®SMW-B13T or R&S®SMW-B13XT option, user-defined frequency response correction can be used either on signal path A or B with one R&S®SMW-K544 option. For user-defined frequency response correction to be used on signal paths A and B simultaneously, two R&S®SMW-K544 must be installed.

State		on/off
Scattering parameters		
File format		*.s<n>p (e.g. *.s2p)
Maximum number of points		16384
Number of cascadable datasets		up to 10
Additional frequency response		
File format		*.fres, *.ucor
Number of files		up to 5
Absolute level correction at center frequency	based on S-parameter data	on/off
Minimum compensation bandwidth	with R&S®SMW-B13/-B13T options	8 MHz
	with R&S®SMW-B13XT option	100 MHz

Automated RF port alignment (R&S®SMW-K545 option)

Instruments with wideband baseband (R&S®SMW-B13XT):
For each installed RF path, R&S®SMW-B9, R&S®SMW-K61 and R&S®SMW-K544 must be installed as prerequisite. Furthermore, the instrument must be equipped with the R&S®SMW-B90 option.

The option cannot be installed if an R&S®SMW-B1044O, R&S®SMW-B2044O, R&S®SMW-B1056O or R&S®SMW-B1067O option is installed.

To run this option a setup should be defined and generated using the R&S®RFPAL software. At least two signal paths should be provided. In case of a setup with multiple instruments, an instrument is designated as primary instrument and should be used to control the option.

State		on/off
Align		aligned, not aligned
Setup file	setup file including alignment data is generated by R&S®RFPAL	*.rfsa
Additional S-parameter files		
File format		*.s<n>p (e.g. *.s2p)
Maximum number of points		16384
Number of cascadable datasets	recommended ≤ 2	up to 10

Crest factor reduction (R&S®SMW-K548 option)

Each R&S®SMW-K548 option requires a standard baseband generator (R&S®SMW-B10 option) or a wideband baseband generator (R&S®SMW-B9 option). If two baseband generators are installed, crest factor reduction can be applied either on path A or B with one R&S®SMW-K548 option. For crest factor reduction to be applied on paths A and B simultaneously, two R&S®SMW-K548 must be installed.

Crest factor reduction can be applied to any waveform loaded in the arbitrary waveform generator.

State		on/off
Algorithm		clipping and filtering
Desired crest factor delta		–20 dB to 0 dB
Maximum iterations		1 to 10
Filter mode “simple”		
Signal bandwidth		0 Hz to input file sample rate
Channel spacing		0 Hz to input file sample rate
Filter mode “enhanced”		
Passband frequency		0 Hz to ½ of input file sample rate
Stopband frequency		0 Hz to ½ of input file sample rate
Maximum filter order		21 to 300

Slow I/Q (R&S®SMW-K551 option)

In slow I/Q mode, the generated signal’s clock rate can be reduced (e.g. a 20 MHz LTE signal is generated with a clock rate of 240 kHz instead of the original 30.72 MHz). This feature can be used to run tests on hardware emulation platforms not yet capable of full-speed signal processing. The signal and fading characteristics are comparable to those of a system running at full speed. The actual clock rate of the generated signal is controlled by the device connected to the digital I/Q output connectors of the R&S®SMW200A.

R&S®SMW-K551 on instruments with wideband baseband (R&S®SMW-B9, R&S®SMW-B13XT)

At least one R&S®SMW-B9 wideband baseband generator option and one R&S®SMW-K19 digital baseband output for wideband baseband option must be installed.

Note:
Only available for system configuration mode: advanced and signal outputs: digital only (HS).
All digital I/Q outputs need to run at the same clock rate.
The minimum clock rate is limited by the external controlling device only.
The R&S®SMW200A can handle varying clock rates.
With activated slow I/Q mode, marker signals are only available via the digital I/Q interface, and not via USER or T/M/C connectors.
With activated slow I/Q mode, no digital baseband inputs are available.

R&S®SMW-K551 on instruments with standard baseband (R&S®SMW-B10, R&S®SMW-B13/-B13T)

At least one R&S®SMW-B10 standard baseband generator option and one R&S®SMW-K18 digital baseband output option must be installed.

Note:
All digital I/Q outputs need to run at the same clock rate.
The minimum clock rate is limited by the external controlling device only.
The R&S®SMW200A can handle varying clock rates.
In digital only/digital only multiplexed mode, marker signals are only available via the digital I/Q interface, and not via USER or T/M/C connectors.
In digital only/digital only multiplexed mode with activated slow I/Q, no digital baseband inputs are available.

Bandwidth extension (R&S®SMW-K555 option)

The R&S®SMW-K555 option requires two R&S®SMW-B9 wideband baseband generator options and two R&S®SMW-K527 baseband extension to 2 GHz RF bandwidth options. Single and dual unit operation is supported.

Bandwidth extension enhances the usable clock rate of the arbitrary waveform generator up to 4.8 GHz and can be used with any waveform loaded int the arbitrary waveform generator. To run this option, an external power combiner and a measurement device is needed. The measurement device can be either an analyzer or a power meter.

Supported standards and modulation systems	with R&S®SMW-B9 option – arbitrary waveform mode	ARB
	with R&S®SMW-K414 option	OFDM
	with R&S®SMW-K261 option	multicarrier CW
	with R&S®SMW-K477 option	IEEE 802.11ay
State		on, off
Setup file	setup file including alignment data is generated by bandwidth extension option	*.bwsa
Clock rate		200 MHz to 4.8 GHz
Bandwidth		up to 4 GHz
Waveform sample length		513 sample to 256 Msample
	with R&S®SMW-K515 option	513 sample to 2 Gsample

Linearize RF (R&S®SMW-K575 option)

The R&S®SMW-K575 option requires at least one R&S®SMW-B10 standard baseband generator or R&S®SMW-B9 wideband baseband generator.

Linearize RF improves the EVM and ACLR performance for high output powers over the whole RF frequency range of the device.

State		auto/off

Notched signals (R&S®SMW-K811 option)

At least one R&S®SMW-B10 standard baseband generator option or R&S®SMW-B9 wideband baseband generator option must be installed. If two baseband generators are installed, notched signals can be generated either on path A or B with one R&S®SMW-K811 option. For notched signals to be generated on paths A and B simultaneously, two R&S®SMW-K811 must be installed.

Up to 25 band-stop filters can be applied to the baseband signal.
Center frequency and bandwidth can be set independently for each band-stop filter.

Supported standards and modulation systems	with R&S®SMW-B9 or R&S®SMW-B10 option – arbitrary waveform mode	ARB
	with R&S®SMW-K55 option	LTE
	with R&S®SMW-K115 option	cellular IoT
	with R&S®SMW-K114 option	custom OFDM
	with R&S®SMW-K130 or R&S®SMW-K355 option	OneWeb
	with R&S®SMW-K52 option	DVB-H/DVB-T
	with R&S®SMW-K116 option	DVB-S2/DVB-S2X
Number of notches		1 to 25
Notch width		0 Hz to 0.1 · clock frequency
Notch center frequency		–0.5 · clock frequency to +0.5 · clock frequency

Customized digital input (R&S®SMW-K556 option)

With the R&S®SMW-K556 option, I/Q data from an existing hardware can be fed into the BBIN HS DIG I/Q inputs. This option can be installed once or twice. Each R&S®SMW-K556 option to be installed requires a R&S®SMW-B9 wideband baseband generator option. The existing hardware requires a AMD/Xilinx Virtex [22] FPGA and the corresponding Rohde & Schwarz IP core.

Interface		
Technical specifications	HS DIG I/Q interface input parameters	see section Digital baseband inputs/outputs for wideband baseband
Interface parameters		
Connector	HS DIG I/Q 1 and HS DIG I/Q 2 on rear panel	QSFP+
Protocol		R&S®Digital I/Q Interface HS
Data rate	50 Gbit/s	sample rate up to 1.25 GHz

BER measurement (R&S®SMW-K80 option)

At least one R&S®SMW-B10 standard baseband generator option or R&S®SMW-B9 wideband baseband generator option must be installed.

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

Clock		supplied by DUT; a clock pulse is required for each valid bit
Clock rate		100 Hz to 100 MHz
Data	PRBS	
	sequence length	9, 11, 15, 16, 20, 21, 23
	pattern ignore	off, All 0, All 1
	data enable	external
	modes	off, high, low
	restart	external
	modes	on/off
Synchronization time		28 clock cycles
Interface	4 BNC connectors, selectable from USER 1 to 6	
Clock, data, enable and restart inputs	input impedance	1 kΩ, 50 Ω
	trigger threshold	
	setting range	0.1 V to 2.0 V
	setting resolution	0.1 V
Polarity	data, clock, data enable	normal, inverted
Measurement time		selectable by means of maximum number of data bits or bit errors (max. 2^{31} bit each), continuous measurement
Measurement result	if selected number of data bits or bit errors is attained	BER in ppm, % or decade values
Status displays		not synchronized, no clock, no data

[22] Virtex is a registered trademark of AMD.

BLER measurement (R&S®SMW-K80 option)

At least one R&S®SMW-B10 standard baseband generator option or R&S®SMW-B9 wideband baseband generator option must be installed.

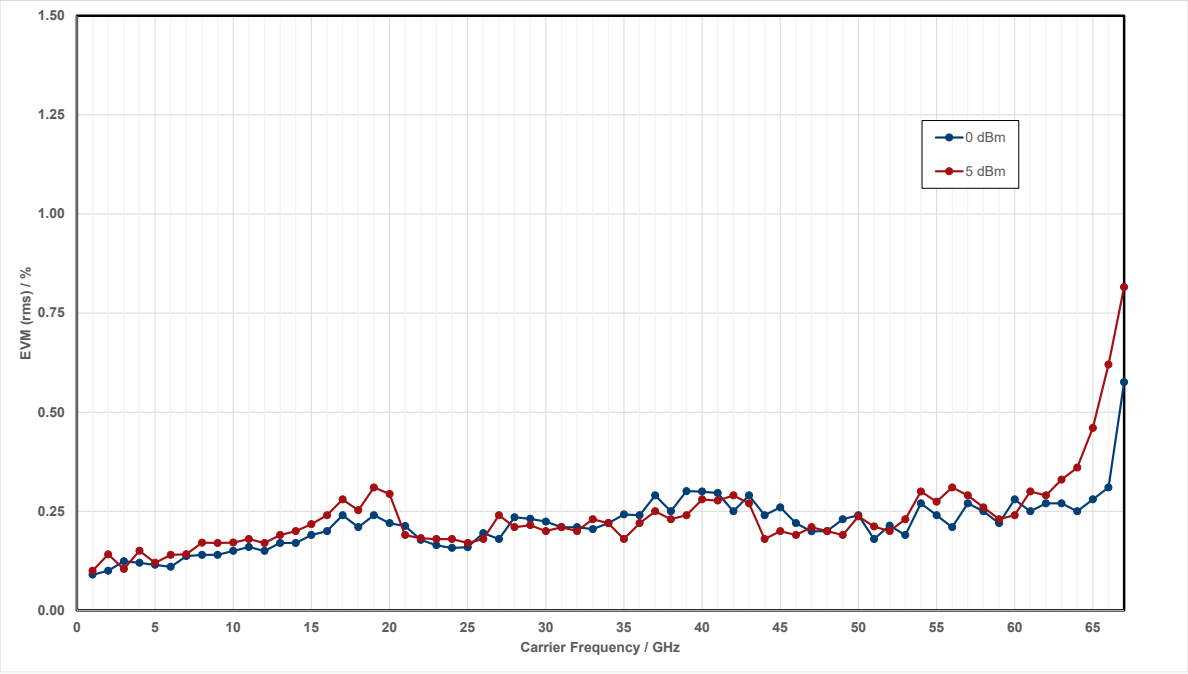
In BLER measurement mode, arbitrary data can be provided by the DUT. A signal marking the block's CRC has to be provided on the data enable connector of the BER/BLER option.

Clock		supplied by DUT; a clock pulse is required for each valid bit
Clock rate		100 Hz to 100 MHz
Data	input data	arbitrary
	data enable (marking the block's CRC)	external
	modes	high, low
CRC	CRC type	CCITT CRC16 ($x^{16} + x^{12} + x^5 + 1$)
	CRC bit order	MSB first, LSB first
Synchronization time		1 block
Interface	4 BNC connectors, selectable from USER 1 to 6	
Clock, data, and enable inputs	input impedance	1 kΩ, 50 Ω
	trigger threshold	
	setting range	0.1 V to 2.0 V
	setting resolution	0.1 V
Polarity	data, clock, data enable	normal, inverted
Measurement time	selectable by means of maximum number of received blocks or errors (max. 2^{31} blocks each), continuous measurement	
Measurement result	if selected number of received blocks or errors is attained	BLER in ppm, % or decade values
Status displays		not synchronized, no clock, no data

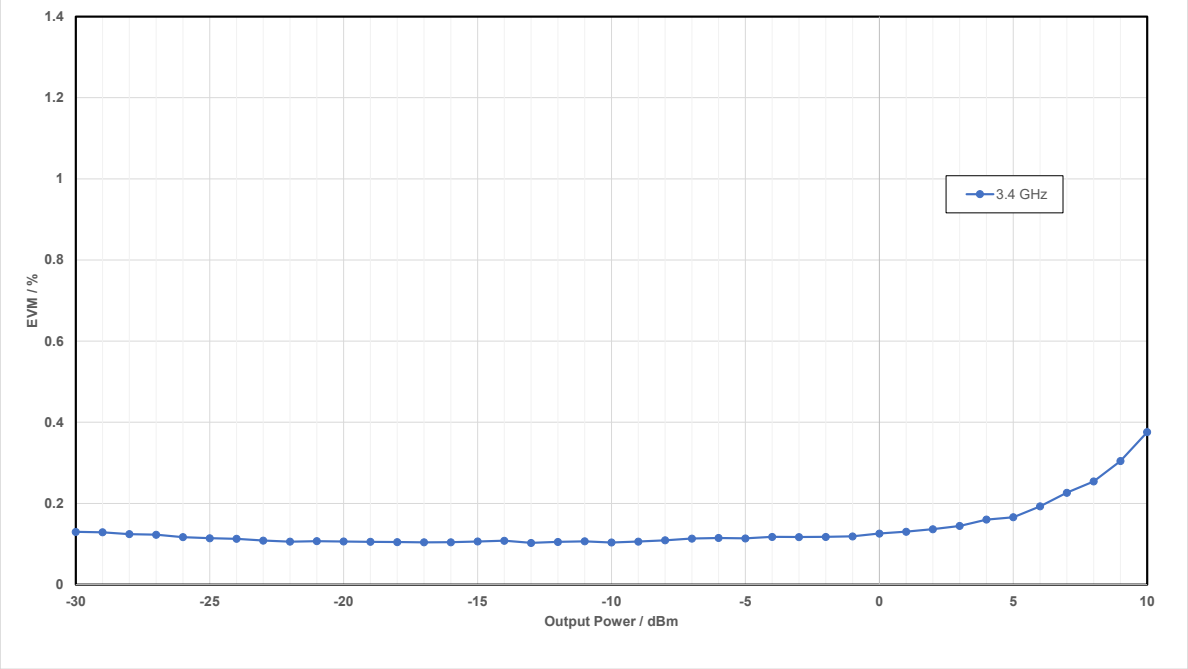
Signal performance for digital standards and modulation systems

5G NR (R&S®SMW-K144 option)

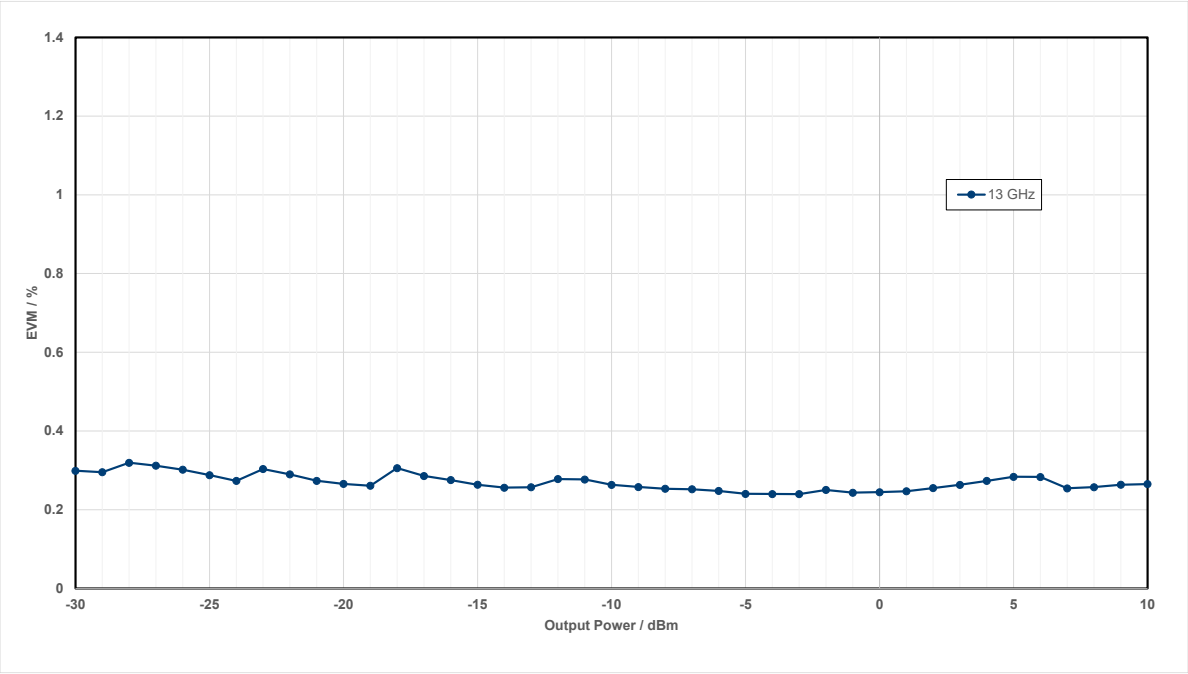
Error vector magnitude



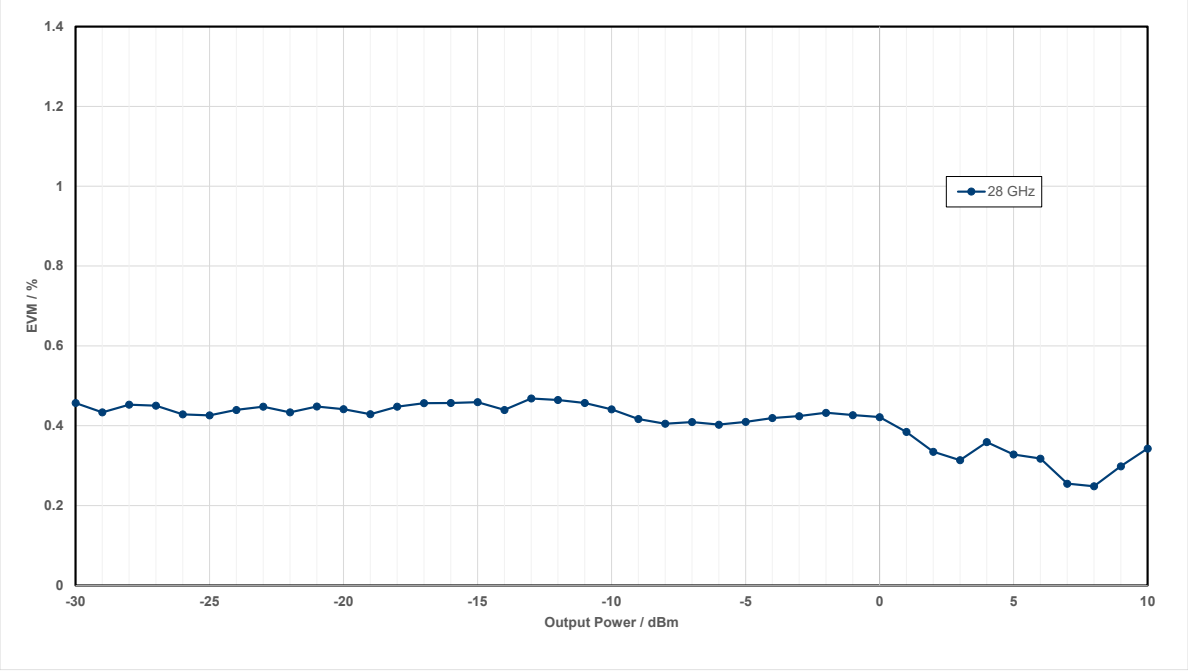
Measured EVM versus carrier frequency for 5G NR, 100 MHz, linearize RF active



Measured EVM versus output power at f = 3.4 GHz for 5G NR, 100 MHz, 64QAM, 60 kHz SCS, linearize RF active



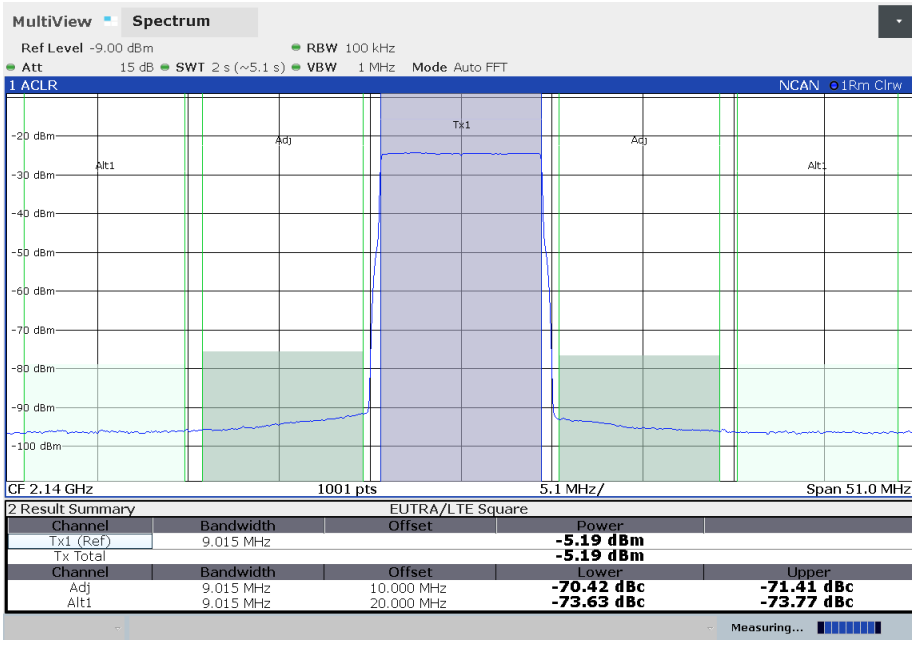
Measured EVM versus output power at f = 13 GHz for 5G NR, 200 MHz, 64QAM, 60 kHz SCS, linearize RF active



Measured EVM versus output power at f = 28 GHz for 5G NR, 400 MHz, 64 QAM, 120 kHz SCS, linearize RF active

EUTRA/LTE (R&S®SMW-K55 option)

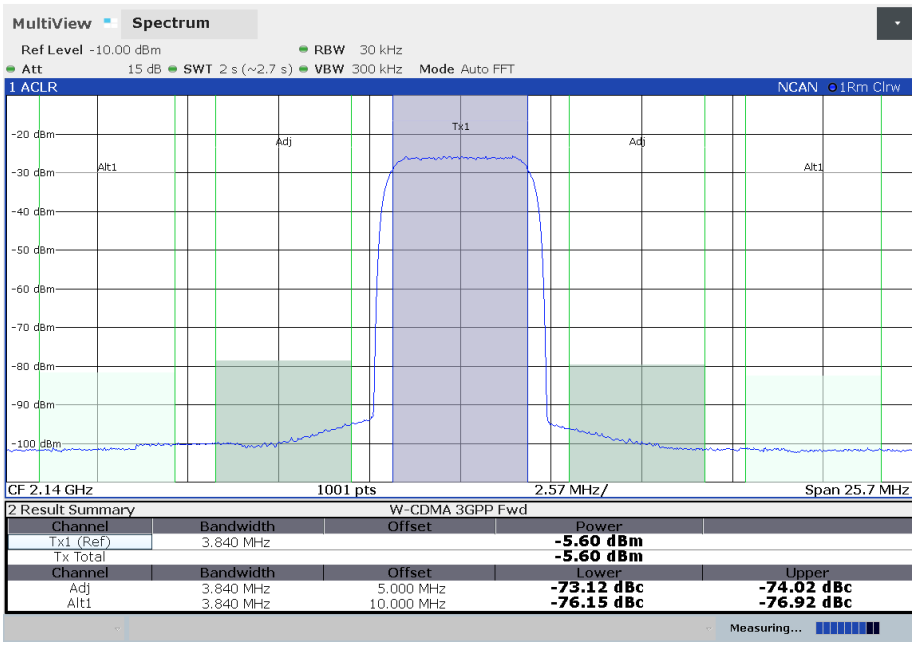
Adjacent channel power ratio



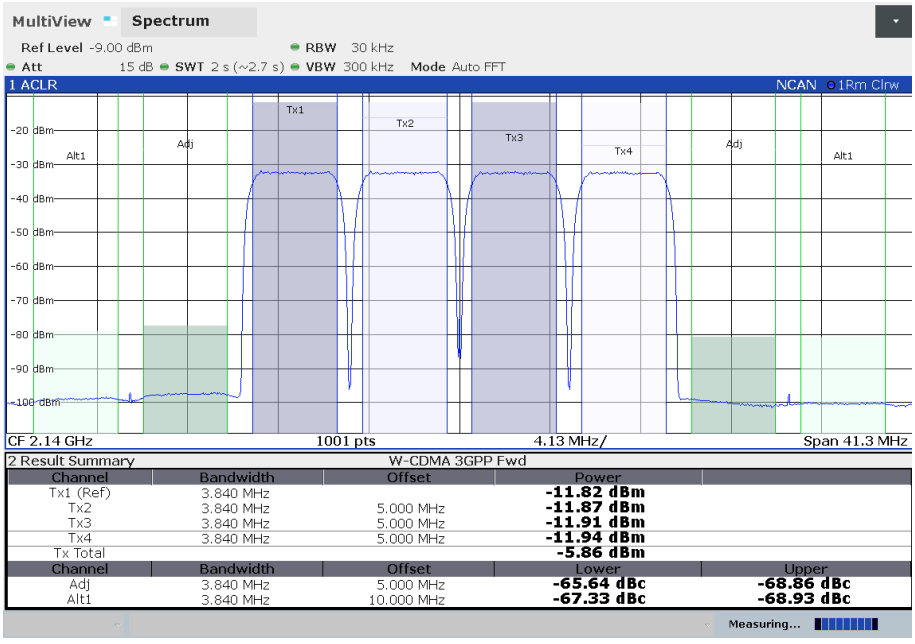
Measured ACPR for a 10 MHz LTE test model E-TM1_1

3GPP FDD (R&S®SMW-K42 option)

Error vector magnitude	1 DPCH, RMS, frequency = 1800 MHz to 2200 MHz	< 0.8 %, 0.3 % (meas.)
Adjacent channel leakage ratio (ACLR)	test model 1, 64 DPCH, frequency = 1800 MHz to 2200 MHz, average channel power ≤ 3 dBm, with R&S®SMW-B1003, R&S®SMW-B2003, R&S®SMW-B1006, R&S®SMW-B2006 frequency options, with R&S®SMW-B13/-B13T options	
	5 MHz offset	> 70 dB
	10 MHz offset	> 72 dB
	test model 1, 64 DPCH, frequency = 1800 MHz to 2200 MHz, average channel power ≤ 0 dBm, with R&S®SMW-B1007, R&S®SMW-B2007, R&S®SMW-B1012, R&S®SMW-B2012 frequency options, with R&S®SMW-B13/-B13T options	
	5 MHz offset	> 68 dB
	10 MHz offset	> 70 dB
	test model 1, 64 DPCH, frequency = 1800 MHz to 2200 MHz, average channel power ≤ –2 dBm, with R&S®SMW-B1020, R&S®SMW-B2020, R&S®SMW-B1031, R&S®SMW-B2031, R&S®SMW-B1040, R&S®SMW-B1040N, R&S®SMW-B1044, R&S®SMW-B2044, R&S®SMW-B1044N, R&S®SMW-B2044N, R&S®SMW-B1044O, R&S®SMW-B2044O frequency options, with R&S®SMW-B13/-B13T options	
	5 MHz offset	> 70 dB
	10 MHz offset	> 72 dB
	test model 1, 64 DPCH, frequency = 1800 MHz to 2200 MHz, average channel power ≤ –5 dBm, with R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O frequency options, with R&S®SMW-B13/-B13T options	
	5 MHz offset	> 70 dB
	10 MHz offset	> 72 dB

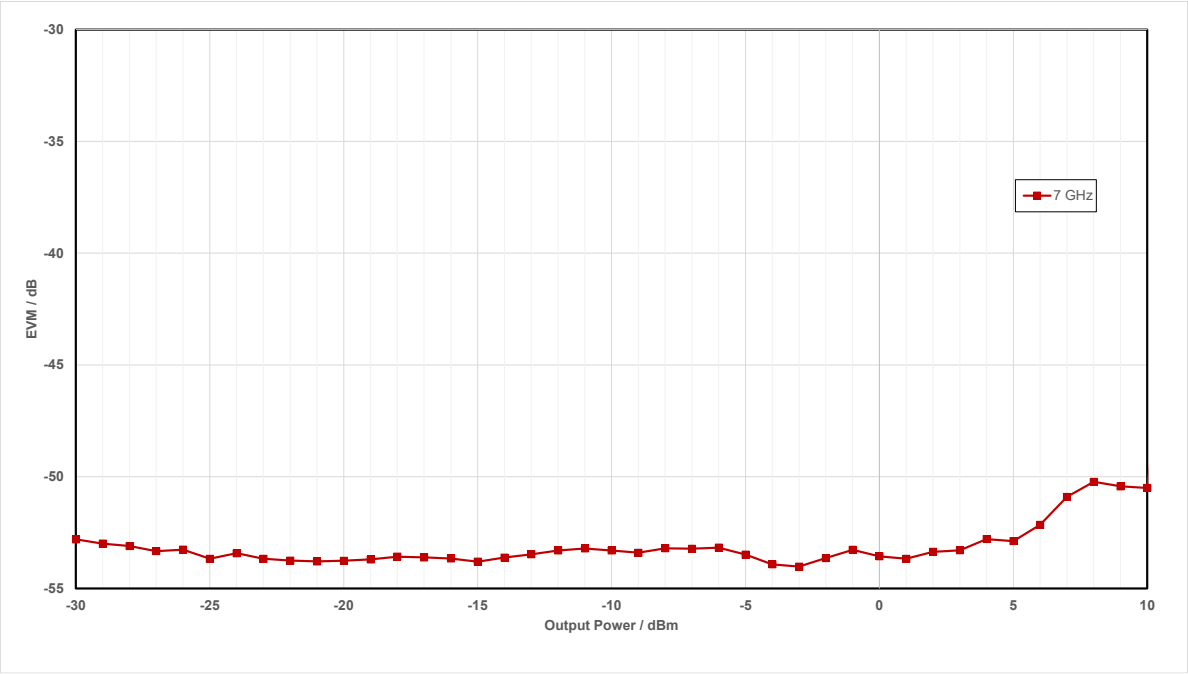


Measured ACPR for 3GPP test model 1, 64 DPCH



Measured ACPR for a 3GPP four-carrier signal with test model 1, 64 DPCH on each carrier

IEEE 802.11be (R&S®SMW-K147 option)



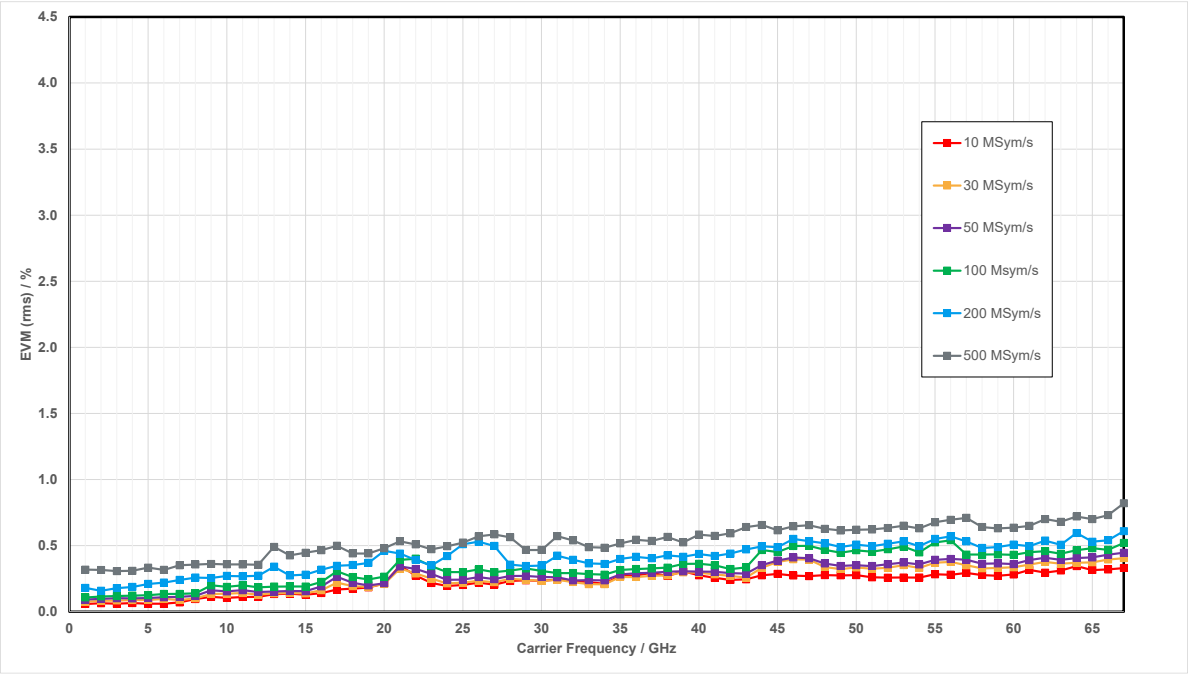
Measured EVM versus output power at f = 7 GHz for IEEE 802.11be (320 MHz, MCS13, 300 µs, Ch Estimation Seq only), linearize RF active

IEEE 802.11ad (R&S®SMW-K141 option)

Measured EVM for an IEEE 802.11ad signal with 1.76 GHz bandwidth (MCS12, at 15 GHz IF)

Custom digital modulation (R&S®SMW-B9/-B10 options, real-time mode)

Deviation error with 2FSK, 4FSK	deviation 0.2 to 0.7 · symbol rate	
	Gaussian filter with B × T = 0.2 to 0.7, f = 1 GHz	
	symbol rate up to 2 MHz	0.25 % (meas.)
	symbol rate up to 10 MHz	0.75 % (meas.)
Phase error with MSK	Gaussian filter with B × T = 0.2 to 0.7, f = 1 GHz	
	bit rate up to 2 MHz	0.15° (meas.)
	bit rate up to 10 MHz	0.3° (meas.)



Measured EVM versus carrier frequency for 16QAM

Health and utilization monitoring service (HUMS) (R&S®SMW-K980 option)

Interfaces	protocols and interfaces supported for data readout and display	• SNMP (v1, v2c, v3) • REST (JSON) • SCPI • device web
Services	information provided	• device information (model, serial number, BIOS, date, time, system, HUMS and software information) • user-defined information tags (e.g. for asset management) • equipment information (hardware, options, software, licenses) • system operating status • instrument security information • service related information (due dates etc.) • mass storage related information • instrument utilization data • device history (event log)

Remote control

Interfaces	remote control	IEC 60625 (GPIB IEEE-488.2)
	Ethernet/LAN	10/100/1000BASE-T
	USB	3.0 (super speed)
	serial	RS-232 [23]
Command set		SCPI 1999.5 or compatible command sets
IEC/IEEE bus address		0 to 30
Ethernet/LAN protocols and services		• VISA VXI-11 (remote control) • Telnet/RawEthernet (remote control) • VNC (remote operation with web browser) • FTP (file transfer protocol) • SMB (mapping parts of the instrument to a host file system)
Ethernet/LAN addressing		DHCP, static, support of ZeroConf and M-DNS to facilitate direct connection to a system controller
USB protocol		VISA USB-TMC

[23] Requires the R&S®TS-USB1 serial adapter (recommended extra).

Connectors

Front panel connectors

The following connectors are located on the front panel of the instrument.

RF 50 Ω (path A)	RF output path A	
	R&S®SMW-B1003, R&S®SMW-B1006, R&S®SMW-B1007	N female
	R&S®SMW-B1012, R&S®SMW-B1020, R&S®SMW-B1031, R&S®SMW-B1040, R&S®SMW-B1040N	test port adapter, PC 2.92 mm female (interchangeable port connector system)
	R&S®SMW-B1044, R&S®SMW-B1044N, R&S®SMW-B1044O	PC 1.85 mm male (adapter 1.85 mm female/female included) [24]
	R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O	1.85 mm female (instrument equipped with interchangeable 1.85 mm female/female wear and tear adapter [24])
RF 50 Ω (path B)	RF output path B	
	R&S®SMW-B2003, R&S®SMW-B2006, R&S®SMW-B2007	N female
	R&S®SMW-B2012, R&S®SMW-B2020, R&S®SMW-B2031	test port adapter, PC 2.92 mm female (interchangeable port connector system)
	R&S®SMW-B2044, R&S®SMW-B2044N, R&S®SMW-B2044O	PC 1.85 mm male (1.85 mm female/female adapter included) [24]
I (path A)	I modulation input signal, path A	BNC female
Q (path A)	Q modulation input signal, path A	BNC female
I (path B)	I modulation input signal, path B	BNC female
Q (path B)	Q modulation input signal, path B	BNC female
USER 1, USER 2, USER 3	user-configurable inputs or outputs, e.g. as trigger input or marker output	BNC female
SENSOR	connector for R&S®NRP-Zxx power sensor	6-pin ODU MINI-SNAP series B
USB	USB 2.0 connector for external USB devices such as mouse, keyboard, R&S®NRP-Zxx power sensors (with R&S®NRP-Z4 adapter cable), memory stick for software update and data exchange, or USB serial adapter for RS-232 remote control	USB type A

[24] The factory calibration plane is at the output of the female/female adapter.

Rear panel connectors

REF IN	reference frequency input	BNC female
REF OUT	reference frequency output	BNC female
INST TRG A	trigger input for RF path A, e.g. for frequency or level sweep	BNC female
INST TRG B	trigger input for RF path B, e.g. for frequency or level sweep	BNC female
USER 4, USER 5, USER 6	user-configurable inputs or outputs, e.g. as trigger input or marker output	BNC female
EFC	input for electronic tuning of internal reference frequency	BNC female
LO IN	phase-coherent LO input	SMA female
LO OUT	phase-coherent LO output	SMA female
IEEE 488	remote control of instrument via GPIB	24-pin Amphenol series 57 female
DISPLAY PORT	for future use	
HDMI	for future use	
LAN	provides remote control functionality and other services, see section Remote control	RJ-45
USB DEVICE	USB 3.0 (super speed) remote control of instrument (USB-TMC)	USB type B
USB	USB 3.1 (10 Gbit/s super speed ports) connector for external USB devices such as mouse and keyboard for enhanced operation, R&S®NRP-Zxx power sensors (with R&S®NRP-ZKU USB interface cable) for external power measurements and level adjustment of instrument, memory stick for software update and data exchange, USB serial adapter for RS-232 remote control	USB type A
IEEE 488	remote control of instrument via GPIB	24-pin Amphenol series 57 female
EXT 1, EXT 2	inputs for external analog modulation signals	BNC female
DIG I/Q OUT 1, DIG I/Q OUT 2	digital output connectivity in line with R&S®Digital I/Q Interface	26-pin MDR
HS DIG I/Q OUT 1, HS DIG I/Q OUT 2	high speed digital output connectivity in line with R&S®Digital I/Q Interface (R&S®SMW-B13XT only)	QSFP+/QSFP 28
Analog I/Q outputs		
I/LF OUT 1	analog I output	BNC female
	alternative function: LF generator output	
$\bar{I}$ 1	analog I-bar output	BNC female
Q/LF OUT 2	analog Q output	BNC female
	alternative function: LF generator output	
$\bar{Q}$ 1	analog Q-bar output	BNC female
I, $\bar{I}$, Q, $\bar{Q}$	second set of analog I, I-bar, Q, Q-bar outputs	BNC female
Connectors on standard baseband generator and fading simulator modules		
T/M/C 1, T/M/C 4	multipurpose input/output connectors; configurable as trigger input, marker output or clock input or output	BNC female
T/M 2, T/M 3, T/M 5, T/M 6	multipurpose input/output connectors; configurable as trigger input or marker output	BNC female
DIG IQ IN/OUT 1, DIG IQ IN/OUT 2	digital input or output connectivity in line with R&S®Digital I/Q Interface	26-pin MDR
Connectors on wideband baseband generator modules		
T/M/C 1, T/M/C 3	for future use	BNC female
T/M 2, T/M 4	for future use	BNC female
DIG IQ IN/OUT 1, DIG IQ IN/OUT 2	for future use	26-pin MDR
HS DIG IQ IN/OUT 1, HS DIG IQ IN/OUT 2	high-speed digital input connectivity in line with R&S®Digital I/Q Interface	QSFP+/QSFP 28

General data

Power rating		
Rated voltage		100 V to 240 V AC
Rated current	with R&S®SMW-B13/-B13T options	7.3 A to 4.6 A
	with R&S®SMW-B13XT or R&S®SMW-B94L options	8.9 A to 4.9 A
Rated frequency	with R&S®SMW-B13/-B13T options	50 Hz to 60 Hz, 400 Hz
	with R&S®SMW-B13XT or R&S®SMW-B94L option	
	100 V to 240 V	50 Hz to 60 Hz
	100 V to 120 V	400 Hz
Rated power	when fully equipped	550 W (meas.)
	with R&S®SMW-B94L option, when fully equipped	750 W (meas.)
Environmental conditions		
Temperature range	operating	0 °C to +45 °C
	operating, with R&S®SMW-B1056, R&S®SMW-B1056N, R&S®SMW-B1056O, R&S®SMW-B1067, R&S®SMW-B1067N, R&S®SMW-B1067O options	+5 °C to +45 °C
	storage	–40 °C to +60 °C temperature gradient < 5 K/hour
Damp heat		+40 °C, 90 % rel. humidity, steady state, in line with EN 60068-2-78
Altitude	operating	4600 m
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	8 Hz to 500 Hz, acceleration: 1.2 g RMS, in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I
Product conformity		
Electromagnetic compatibility	EU: in line with EMC directive 2014/30/EU	applied harmonized standards: • EN 61326-1 (for use in industrial environment) • EN 61326-2-1 • EN 55011 (class B) • EN 61000-3-2 • EN 61000-3-3
	EU: in line with EMC directive 2014/30/EU; with R&S®SMW-K18, R&S®SMW-K19 options	applied harmonized standards: • EN 61326-1 (for use in industrial environment) • EN 61326-2-1 • EN 55011 (class A) • EN 61000-3-2 • EN 61000-3-3
Electrical safety	EU: in line with low voltage directive 2014/35/EU	applied harmonized standard: EN 61010-1
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 No. 61010-1
RoHS	EU: in line with directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment	EN IEC 63000
International certifications	VDE – Association for Electrical, Electronic and Information Technologies	VDE mark 40036426
	CSA – Canadian Standard Association	$_{C}$CSA$_{US}$ mark 2571181
EU legislation	EU: in line with Data Act – Regulation (EU) 2023/2854	for details, see user documentation

Dimensions and weight		
Dimensions	W × H × D	435 mm × 192 mm × 460 mm (17.1 in × 7.6 in × 18.1 in)
	with R&S®SMW-B94L option, W × H × D	435 mm × 192 mm × 560 mm (17.1 in × 7.6 in × 22 in)
Weight	when fully equipped	21 kg (46.3 lb)
	with R&S®SMW-B94L option, when fully equipped	30 kg (66.1 lb)
Non-volatile memory		SSD, 512 Gbyte
Calibration interval		
Recommended calibration interval	operation 40 h/week in full range of specified environmental conditions	3 years

Ordering information

R&S®SMW-Bxxx = hardware option
R&S®SMW-Kxxx = software/key code option

Designation	Type	Order No.
Vector signal generator [25] including power cable and quick start guide	R&S®SMW200A	1412.0000.02
Options		
Frequency options, RF path A		
100 kHz to 3 GHz	R&S®SMW-B1003	1428.4700.02
100 kHz to 6 GHz	R&S®SMW-B1006	1428.4800.02
100 kHz to 7.5 GHz	R&S®SMW-B1007	1428.7700.02
100 kHz to 12.75 GHz	R&S®SMW-B1012	1428.4900.02
100 kHz to 20 GHz	R&S®SMW-B1020	1428.5107.02
100 kHz to 31.8 GHz	R&S®SMW-B1031	1428.5307.02
100 kHz to 40 GHz	R&S®SMW-B1040	1428.8506.02
100 kHz to 40 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1040N	1428.8606.02
100 kHz to 44 GHz	R&S®SMW-B1044	1428.5507.02
100 kHz to 44 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1044N	1428.5407.02
100 kHz to 44 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1044O	1442.0144.02
100 kHz to 56 GHz	R&S®SMW-B1056	1438.9357.02
100 kHz to 56 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1056N	1438.9457.02
100 kHz to 56 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1056O	1442.0244.02
100 kHz to 67 GHz	R&S®SMW-B1067	1428.8106.02
100 kHz to 67 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1067N	1428.8306.02
100 kHz to 67 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B1067O	1442.0344.02
Baseband main modules		
Signal routing and baseband main module, one I/Q path to RF	R&S®SMW-B13	1413.2807.02
Signal routing and baseband main module, two I/Q paths to RF	R&S®SMW-B13T	1413.3003.02
Wideband baseband main module, two I/Q paths to RF	R&S®SMW-B13XT	1413.8005.02
Phase noise performance options, RF path A		
Low phase noise, for RF path A	R&S®SMW-B709	1428.7300.02
Improved close-in phase noise performance, for RF path A	R&S®SMW-B710	1428.6503.02
Ultra low phase noise, for RF path A	R&S®SMW-B711	1428.6703.02
Platform options		
Deeper chassis [26]	R&S®SMW-B94L	1438.8150.02
Frequency options, RF path B		
100 kHz to 3 GHz	R&S®SMW-B2003	1428.5707.02
100 kHz to 6 GHz	R&S®SMW-B2006	1428.5807.02
100 kHz to 7.5 GHz	R&S®SMW-B2007	1428.7900.02
100 kHz to 12.75 GHz	R&S®SMW-B2012	1438.8950.02
100 kHz to 20 GHz	R&S®SMW-B2020	1428.6103.02
100 kHz to 31.8 GHz	R&S®SMW-B2031	1438.8750.02
100 kHz to 44 GHz	R&S®SMW-B2044	1438.8350.02

[25] The base unit can only be ordered with an R&S®SMW-B10xx frequency option and an R&S®SMW-B13 or R&S®SMW-B13T or R&S®SMW-B13XT signal routing and baseband main module.

[26] This option is required (and only possible) for RF path combinations 2 × 12.75 GHz, 2 × 31.8 GHz and 2 × 44 GHz; see section Frequency options and RF path combinations.

Designation	Type	Order No.
100 kHz to 44 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B2044N	1438.8550.02
100 kHz to 44 GHz, I/Q modulation bandwidth and minimum pulse width limited	R&S®SMW-B2044O	1442.0444.02
Phase noise performance options, RF path B		
Low phase noise, for RF path B	R&S®SMW-B719	1428.7500.02
Improved close-in phase noise performance, for RF path B	R&S®SMW-B720	1428.6903.02
Ultra low phase noise, for RF path B	R&S®SMW-B721	1428.7100.02
Other RF options		
Phase coherence	R&S®SMW-B90	1413.5841.02
Pulse modulator	R&S®SMW-K22	1413.3249.02
Pulse generator	R&S®SMW-K23	1413.3284.02
Multifunction generator	R&S®SMW-K24	1413.3332.02
Automated RF port alignment	R&S®SMW-K545	1414.6429.02
External frontend control	R&S®SMW-K553	1414.6758.02
External multiplier control	R&S®SMW-K554	1413.7309.02
100 MHz, 1 GHz ultra low noise reference input/output	R&S®SMW-K703	1413.7380.02
Flexible reference input (1 MHz to 100 MHz)	R&S®SMW-K704	1414.6541.02
AM/FM/PM	R&S®SMW-K720	1413.7438.02
Differential analog I/Q inputs	R&S®SMW-K739	1413.7167.02
Standard baseband		
Standard baseband generator with ARB (64 Msample) and digital modulation (real-time), 120 MHz RF bandwidth	R&S®SMW-B10	1413.1200.02
Differential analog I/Q outputs	R&S®SMW-K16	1413.3384.02
Digital baseband output	R&S®SMW-K18	1413.3432.02
Extended sequencing	R&S®SMW-K501	1413.9218.02
ARB memory extension to 512 Msample	R&S®SMW-K511	1413.6860.02
ARB memory extension to 1 Gsample	R&S®SMW-K512	1413.6919.02
Baseband extension to 160 MHz RF bandwidth	R&S®SMW-K522	1413.6960.02
Wideband baseband		
Wideband baseband generator with ARB (256 Msample), 500 MHz RF bandwidth	R&S®SMW-B9	1413.7350.02
Wideband baseband generator with ARB (256 Msample), 500 MHz RF bandwidth	R&S®SMW-B9F	1434.7808.02
Wideband differential analog I/Q outputs	R&S®SMW-K17	1414.2346.02
Digital baseband output, for R&S®SMW200A wideband baseband	R&S®SMW-K19	1414.3865.02
Wideband extended sequencing	R&S®SMW-K502	1413.9260.02
Real-time control interface	R&S®SMW-K503	1414.3620.02
Real-time control interface with enhanced PDW rate	R&S®SMW-K504	1414.3665.02
Agile sequencing	R&S®SMW-K506	1413.3555.02
ARB Ethernet upload	R&S®SMW-K507	1414.6206.02
ARB Ethernet streaming	R&S®SMW-K508	1434.8256.02
ARB memory extension to 2 Gsample	R&S®SMW-K515	1413.9360.02
Baseband extension to 1 GHz RF bandwidth	R&S®SMW-K525	1414.6129.02
Baseband extension to 2 GHz RF bandwidth	R&S®SMW-K527	1414.6158.02
Ethernet streaming with dynamic offset control	R&S®SMW-K573	1434.9146.02
Baseband enhancements		
Additive white gaussian noise (AWGN)	R&S®SMW-K62	1413.3484.02
Bit error rate tester	R&S®SMW-K80	1414.6187.02
Envelope tracking	R&S®SMW-K540	1413.7215.02
AM/AM, AM/PM predistortion	R&S®SMW-K541	1413.7267.02
User-defined frequency response correction	R&S®SMW-K544	1414.3707.02
Digital Doherty	R&S®SMW-K546	1414.6487.02
Crest factor reduction	R&S®SMW-K548	1414.6641.02
Slow I/Q	R&S®SMW-K551	1413.9724.02
Bandwidth extension	R&S®SMW-K555	1414.6229.02
RF linearization	R&S®SMW-K575	1434.8379.02
Customized digital input	R&S®SMW-K556	1434.8310.02
Enhanced noise generation	R&S®SMW-K810	1414.6341.02
Notched signals	R&S®SMW-K811	1414.6364.02

Designation	Type	Order No.
Multichannel, MIMO and fading		
See Multichannel, MIMO and Fading for the R&S®SMW200A Vector Signal Generator specifications (PD 3673.1276.22).		
Digital standards		
See Digital Standards for Signal Generators specifications (PD 5213.9434.22) and GNSS and Avionics Simulation for Rohde & Schwarz Signal Generators specifications (PD 3607.6896.22).		
Digital standards using R&S®WinIQSIM2 [27]		
See Digital Standards for Signal Generators specifications (PD 5213.9434.22).		
Options with external R&S®Pulse Sequencer Software or R&S®Pulse Sequencer (DFS) Software		
See R&S®Pulse Sequencer Software specifications (PD 3607.1388.22).		
Waveform packages, for signals from R&S®WinIQSIM2 [28]		
1 waveform	R&S®SMW-K200	1414.6870.71
5 waveforms	R&S®SMW-K200	1414.6870.72
50 waveforms	R&S®SMW-K200	1414.6870.75
Other options		
Rear panel connectors, for RF path A (3/6 GHz) and I/Q	R&S®SMW-B81	1413.5893.02
Rear panel connectors, for RF path B (3/6 GHz)	R&S®SMW-B82	1413.5941.02
Rear panel connectors, for RF path A (20/31.8/40 GHz) and I/Q	R&S®SMW-B83	1414.0937.02
Rear panel connectors, for RF path B (20 GHz)	R&S®SMW-B84	1414.1033.02
Health and utilization monitoring service (HUMS)	R&S®SMW-K980	1414.6893.02
Recommended extras		
19" rack adapter	R&S®ZZA-KN4B	1703.1346.00
Cable, for connecting Rohde & Schwarz digital baseband interfaces (2 m)		3716.5425.00
Cable, for connecting Rohde & Schwarz digital baseband interfaces (0.5 m)		1208.3213.00
Cable, for HS digital I/Q interface (optical cable, QSFP+ plug)	R&S®DIGIQ-HS	3641.2948.03
USB serial adapter, for RS-232 remote control	R&S®TS-USB1	6124.2531.00
Adapters, for instruments with an R&S®SMW-B1012/-B2012/-B1020/-B2020/-B1031/-B2031/-B1040/-B1040N frequency option		
Test port adapter, 2.92 mm female		1036.4790.00
Test port adapter, 2.92 mm male		1036.4802.00
Test port adapter, N female		1036.4777.00
Test port adapter, N male		1036.4783.00
Adapters, for instruments with an R&S®SMW-B1044/-B2044/-B1044N/-B2044N/-B1044O/-B2044O frequency option		
Coaxial adapter 1.85 mm (f) to 1.85 mm (f)		3588.9654.00
Coaxial adapter 1.85 mm (f) to 2.92 mm (f)		3628.4728.02
Adapter, for instruments with an R&S®SMW-B1056/-B1056N/-B1056O/-B1067/-B1067N/-B1067O frequency option		
1.85 mm female/female wear and tear adapter		3588.9654.00
Power combiner kits and cables for instruments with an R&S®SMW-K555 option		
Combiner kit, 40 GHz	R&S®SMW-ZKK	1434.7908.02
Combiner kit, 67 GHz	R&S®SMW-ZKV	1434.7989.02
Cable, 2.92 mm (m) to 2.92 mm (m) (multi-instrument setup)	R&S®ZV-Z195	1306.4536.36
Cable, 1.85 mm (m) to 1.85 mm (m) (multi-instrument setup)	R&S®ZV-Z196	1306.4559.25
Documentation		
Documentation of calibration values	R&S®DCV-2	0240.2193.18

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

[28] A maximum of 250 waveforms per instrument can be registered.

Warranty and service

Warranty		
Base unit		1 year
All other items		1 year
Service options		
	Service plans	**On demand**
Calibration	up to five years [29]	pay per calibration
Accredited calibration	up to five years [29]	pay per accredited calibration
Warranty and repair	up to five years [29]	standard price repair
Contact your Rohde & Schwarz sales office for further details.		

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[29] For extended periods, contact your Rohde & Schwarz sales office.

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