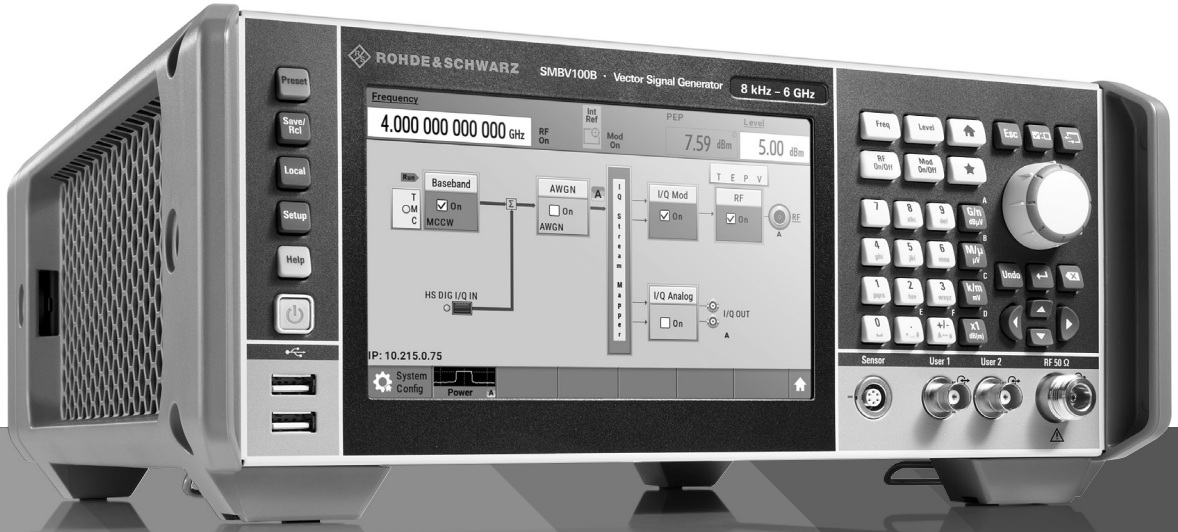
R&S®SMBV100B
VECTOR SIGNAL GENERATOR

Specifications



Specifications
Version 09.02

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At a glance

The state-of-the-art R&S®SMBV100B vector signal generator sets new standards in its class. Ultra high output power, fully calibrated wideband signal generation and intuitive touchscreen operation make the R&S®SMBV100B ideal for all kinds of applications.

The R&S®SMBV100B vector signal generator combines superior performance characteristics such as high output power, wide modulation bandwidth and excellent signal quality. With a frequency range from 8 kHz to 6 GHz, the instrument covers all important RF bands for digital wireless communications. The wide RF modulation bandwidth of up to 1 GHz satisfies the challenging requirements of fourth and fifth generation communications standards. In A&D applications, the wide bandwidth allows the generation of complex pulsed signals.

In many test setups, such as for RF component verification, it is important to provide signals at high power levels. The R&S®SMBV100B offers best-in-class signal quality up to very high power levels. No extra amplifier is needed, which simplifies the test setup.

The R&S®SMBV100B has an intuitive touchscreen GUI and is therefore very ergonomic and practical to use. The customizable instrument is also prepared to meet future requirements. Options can be added via software keycodes, making it easy to enhance the instrument with additional functionality, e.g. by extending frequency, bandwidth and output power.

Key facts

- Frequency range from 8 kHz to 3 GHz or 6 GHz
- Ultra high output power up to +33 dBm
- 1 GHz modulation bandwidth with perfect accuracy
- Excellent EVM and ACPR results up to high power levels
- Internal signal generation for all major digital communications standards
- Fully-fledged GNSS simulator for GPS, GLONASS, Galileo, BeiDou and QZSS/SBAS
- Convenient operation via 7" touchscreen

Perfect for signal quality

- New real-time, user-defined frequency response correction to compensate for the effect of test fixtures
- Very low single-sideband (SSB) phase noise: < –134 dBc (meas.) at 1 GHz and 20 kHz offset
- Wide modulation bandwidth with perfect accuracy: modulation frequency response of < 0.3 dB (meas.) across 1 GHz bandwidth
- Excellent EVM and ACPR up to high power levels

Perfect for output power

- Ultra high output power: up to +33 dBm at 1 GHz
- Excellent level accuracy for CW and modulated signals: level linearity of < 0.2 dB (meas.)

Perfect for use

- Convenient operation via 7" touchscreen
- Automation made easy with context-sensitive help system and SCPI recording
- Internal real-time signal generation
- Protecting user data

Perfect for upgrading

- Easy upgrading of instrument at customer premises via software keycodes
- Time-limited licenses and waveform package for software options

Perfect for GNSS testing

- Take control over your GNSS scenarios
- Signals, systems and scenario configuration

R&S®LegacyPro: refresh your T&M equipment

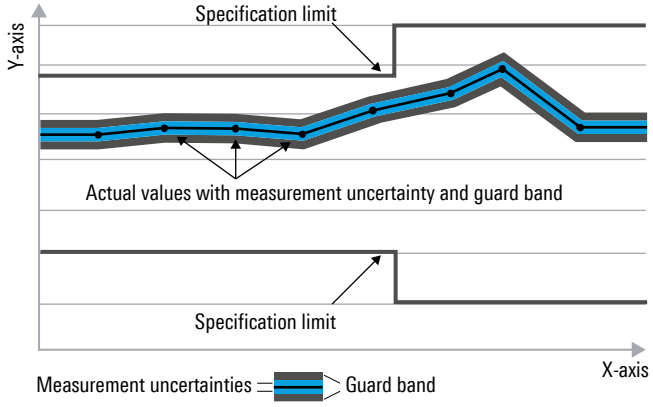
- Replace your legacy signal generators: emulation of generators from Rohde & Schwarz and other vendors (e.g. R&S®SMBV100A, Keysight MXG/EXG, Aeroflex, Anritsu)

Definitions

General
Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes 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 indicated as follows: “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.

RF characteristics

Frequency

Range	with R&S®SMBVB-B103 option (mandatory)	
	CW mode	8 kHz to 3 GHz
	I/Q mode	1 MHz to 3 GHz
	with R&S®SMBVB-B103 and R&S®SMBVBKB106 options	
	CW mode	8 kHz to 6 GHz
	I/Q mode	1 MHz to 6 GHz
Resolution of setting		0.001 Hz
Resolution of synthesis	f = 1 GHz	0.163 µHz (nom.)
Settling time	to within < 1×10^{-7} for f > 200 MHz or < 20 Hz for f ≤ 200 MHz with GUI update stopped, I/Q optimization mode: fast	
	after IEC/IEEE bus delimiter (without LAN connection), level setting characteristic: auto	< 1.3 ms
Range and resolution of phase offset setting		–36 000° to +36 000°, 0.001° resolution

Reference frequency

Frequency error	at time of calibration in production	
	standard	< 1×10^{-7}
	with R&S®SMBVB-B1 or R&S®SMBVB-B1H option	< 1×10^{-8}
Aging	after 30 days of uninterrupted operation	
	standard	≤ 1×10^{-6}/year
	with R&S®SMBVB-B1 option	≤ 1×10^{-9}/day, ≤ 1×10^{-7}/year
	with R&S®SMBVB-B1H option	≤ 5×10^{-10}/day, ≤ 3×10^{-8}/year
Temperature effect	in temperature range from 0 °C to +55 °C	
	standard	±2×10^{-6}
	with R&S®SMBVB-B1 option	±1×10^{-7}
	with R&S®SMBVB-B1H option	±1×10^{-8}
Warm-up time	to nominal thermostat temperature, with R&S®SMBVB-B1 or R&S®SMBVB-B1H option	≤ 10 min
Source		internal, external
External reference frequency modes	standard	10 MHz
	R&S®SMBVB-B3 option required	100 MHz
	R&S®SMBVB-B3 option required	1 GHz
	R&S®SMBVB-K704 option required	variable
Reference frequency input		
Connector type	REF IN on rear panel	BNC female
Input frequency	ext. reference frequency mode: 10 MHz	10 MHz
	ext. reference frequency mode: 100 MHz	100 MHz
	ext. reference frequency mode: variable	1 MHz to 100 MHz
Input frequency setting resolution	ext. reference frequency mode: variable	0.1 Hz
Minimum frequency locking range	ext. reference frequency modes: 10 MHz, 100 MHz	±100×10^{-6}
	ext. reference frequency mode: variable	
	without R&S®SMBVB-B1/-B1H option	±6×10^{-6}
	with R&S®SMBVB-B1/-B1H option	±0.3×10^{-6}
Input level range		0 dBm to +16 dBm
Input impedance		50 Ω (nom.)

Reference frequency output		
Connector type	REF OUT on rear panel	BNC female
Output frequency	sine wave	
	source mode: internal	10 MHz
	source mode: external	
	ext. reference frequency modes: 10 MHz, 1 GHz	10 MHz
	ext. reference frequency mode: 100 MHz	100 MHz
	ext. reference frequency mode: variable	10 MHz, applied external reference frequency [1]
Output level		+7 dBm to +13 dBm, +10 dBm (typ.)
Source impedance		50 Ω (nom.)
1 GHz reference frequency input (R&S®SMBVB-B3 option)		
Connector type	REF 1G IN on rear panel	SMA female
Input frequency		1 GHz
Minimum frequency locking range		$\pm 100 \times 10^{-6}$
Input level range		0 dBm to +16 dBm
Input impedance		50 Ω (nom.)
1 GHz reference frequency output (R&S®SMBVB-B3 option)		
Connector type	REF 1G OUT on rear panel	SMA female
Output frequency	sine wave	1 GHz
Output level		0 dBm to +13 dBm, +10 dBm (typ.)
Source impedance		50 Ω (nom.)

Reference frequency option concept

		Without option	With R&S®SMBVB-K704 flexible reference input option	With R&S®SMBVB-B3 100 MHz/1 GHz reference option
INPUT	10 MHz input frequency	•	•	•
	100 MHz input frequency	–	–	•
	1 MHz to 100 MHz input frequency	–	•	–
	1 GHz input frequency	–	–	•
OUTPUT	10 MHz output frequency [2]	•	•	•
	Loopthrough of input to output [2]	•	•	•
	1 GHz output frequency	–	–	•

R&S®SMBVB-K704 option (flexible reference input from 1 MHz to 100 MHz)
When this option is installed, the user can set the variable reference input frequency in 0.1 Hz steps between 1.0 MHz and 100 MHz.

The signal generator will lock its internal 10 MHz reference oscillator on the input frequency.

R&S®SMBVB-B3 option (100 MHz, 1 GHz ultra low noise reference input/output)
When this option is installed, the user can apply a 1 GHz reference signal to the dedicated SMA connector. The signal generator will lock its internal 500 MHz reference oscillator on the 1 GHz reference. This option should be used if a very high phase stability between multiple generators is required.

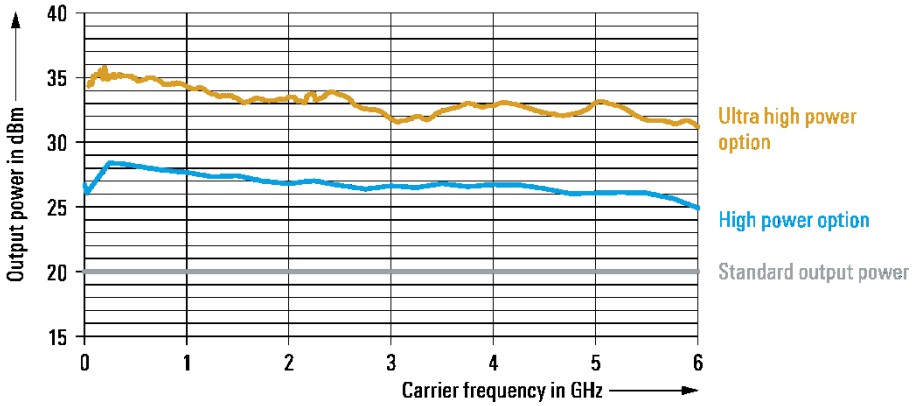
Also, the 100 MHz input frequency mode is only available with this option. The signal generator will lock its internal 500 MHz reference oscillator on the 100 MHz reference.

[1] Works only within the input frequency ranges from 5 MHz to 13 MHz and from 95 MHz to 100 MHz.

[2] Not available with all external input reference frequencies.

Level

Setting range		
R&S®SMBVB-B103/ R&S®SMBVBKB106	standard	
	8 kHz ≤ f < 100 kHz	–145 dBm to +8 dBm
	100 kHz ≤ f < 300 kHz	–145 dBm to +13 dBm
	300 kHz ≤ f < 1 MHz	–145 dBm to +18 dBm
	1 MHz ≤ f < 6 GHz	–145 dBm to +20 dBm
	with R&S®SMBVB-K31 option	
	8 kHz ≤ f < 100 kHz	–145 dBm to +8 dBm
	100 kHz ≤ f < 300 kHz	–145 dBm to +13 dBm
	300 kHz ≤ f < 1 MHz	–145 dBm to +18 dBm
	1 MHz ≤ f ≤ 6 GHz	–145 dBm to +30 dBm
	with R&S®SMBVB-B32 option	
	8 kHz ≤ f < 100 kHz	–145 dBm to +23 dBm
	100 kHz ≤ f < 300 kHz	–145 dBm to +27 dBm
	300 kHz ≤ f < 1 MHz	–145 dBm to +31 dBm
	1 MHz ≤ f ≤ 6 GHz	–145 dBm to +36 dBm
Setting resolution		0.01 dB
Specified level range	CW, I/Q (f ≥ 1 MHz), peak envelope power (PEP)	
R&S®SMBVB-B103/ R&S®SMBVBKB106	standard	
	8 kHz < f ≤ 100 kHz	–90 dBm to +5 dBm
	100 kHz < f ≤ 200 kHz	–110 dBm to +5 dBm
	200 kHz < f ≤ 1 MHz	–110 dBm to +13 dBm
	1 MHz < f ≤ 10 MHz	–110 dBm to +18 dBm
	10 MHz < f ≤ 6 GHz	–127 dBm to +18 dBm
	with R&S®SMBVB-K31 option	
	8 kHz < f ≤ 100 kHz	–90 dBm to +5 dBm
	100 kHz < f ≤ 200 kHz	–110 dBm to +5 dBm
	200 kHz < f ≤ 1 MHz	–110 dBm to +13 dBm
	1 MHz < f ≤ 10 MHz	–110 dBm to +21 dBm
	10 MHz < f ≤ 4 GHz	–127 dBm to +21 dBm
	4 GHz < f ≤ 6 GHz	–127 dBm to +20 dBm
	with R&S®SMBVB-B32 option	
	8 kHz < f ≤ 100 kHz	–90 dBm to +17 dBm
	100 kHz < f ≤ 200 kHz	–110 dBm to +17 dBm
	200 kHz < f ≤ 10 MHz	–127 dBm to +21 dBm
	10 MHz < f ≤ 6 GHz	–127 dBm to +25 dBm
Level accuracy	level setting characteristic: auto, temperature range from +18 °C to +33 °C	
	level > –90 dBm	
	8 kHz < f ≤ 200 kHz	< 1.2 dB
	200 kHz < f ≤ 3 GHz	< 0.5 dB
	f > 3 GHz	< 0.7 dB
	level ≤ –90 dBm	
	100 kHz < f ≤ 200 kHz	< 1.5 dB
	200 kHz < f ≤ 10 MHz	< 1.2 dB
	10 MHz < f ≤ 3 GHz	< 0.8 dB
	f > 3 GHz	< 1.1 dB
Additional level error	I/Q modulation	< 0.3 dB
	pulse modulation	< 0.5 dB
	ALC state: off (table)	< 0.5 dB
Settling time	to < 0.1 dB deviation from final value, GUI update stopped, temperature range: +18 °C to +33 °C, f > 10 MHz, I/Q optimization mode: fast; IQ modulation: external; after IEC/IEEE bus delimiter (without LAN connection)	
	level setting characteristic: auto	< 1.1 ms
Interruption-free level range	level setting characteristic: uninterrupted level setting	> 20 dB



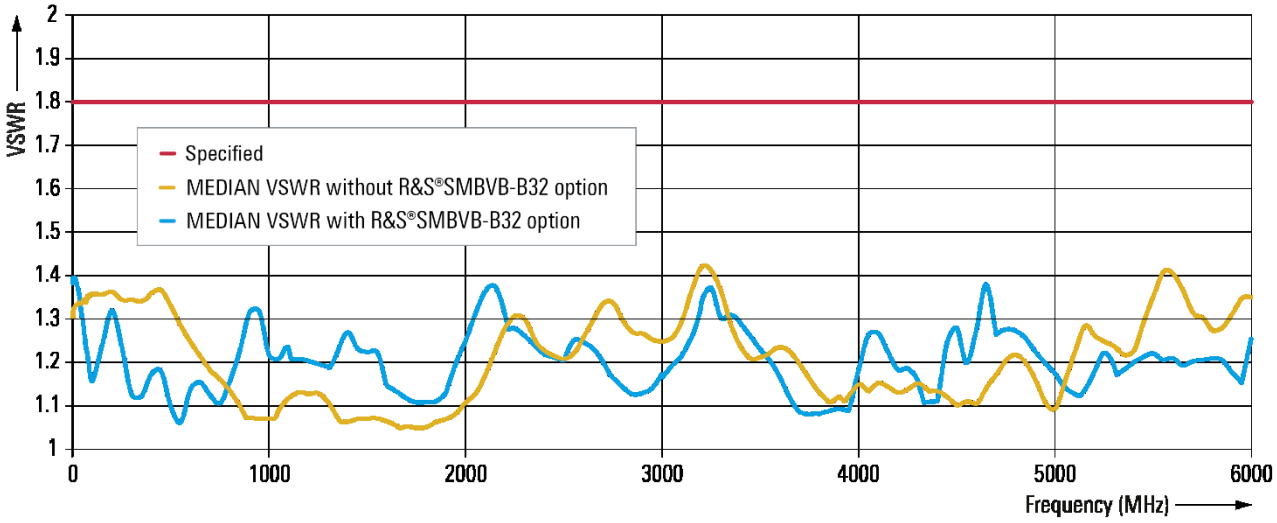
Maximum output power (meas.) for the base unit, with the R&S®SMBVB-K31 high power option and with the additional R&S®SMBVB-B32 ultra high power option

Reverse power

Reverse power [3]	maximum permissible RF power in output frequency range of RF path, from 50 Ω source; in case of too high reverse power, the RF output is switched off	
	1 MHz < f ≤ 1 GHz	50 W
	1 GHz < f ≤ 2 GHz	25 W
	2 GHz < f ≤ 6 GHz	10 W
Maximum permissible DC voltage		50 V (nom.)

VSWR

Output impedance VSWR in 50 Ω system	level setting characteristic: auto, f > 200 kHz	< 1.8



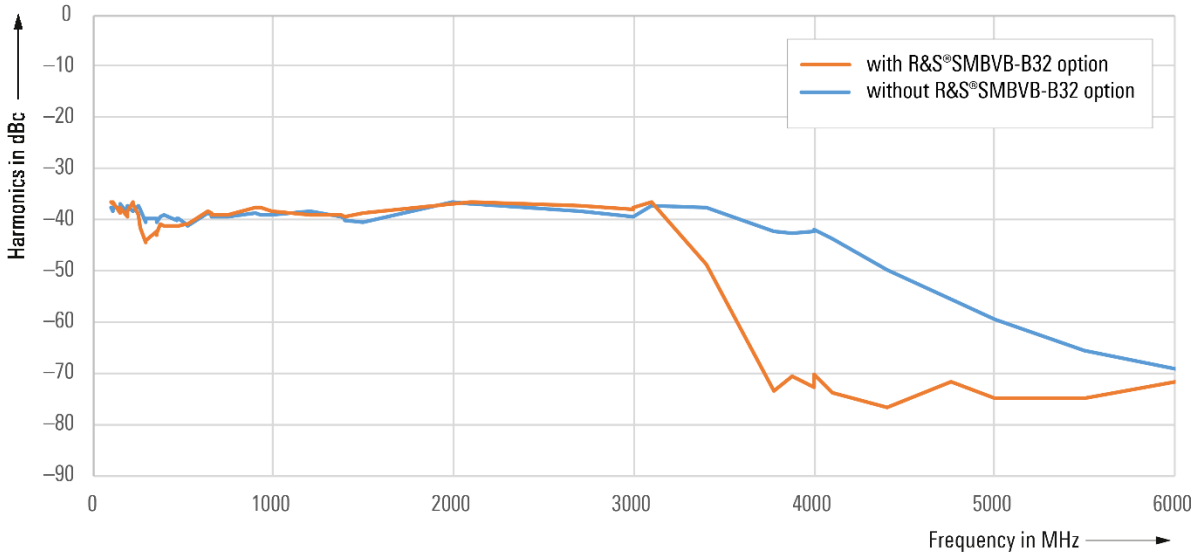
Measured VSWR versus frequency (calculated median VSWR of several R&S®SMBV100B instruments)

[3] Measured output power for the base unit, with the R&S®SMBVB-K31 high power option and with the additional R&S®SMBVB-B32 ultra high power option.

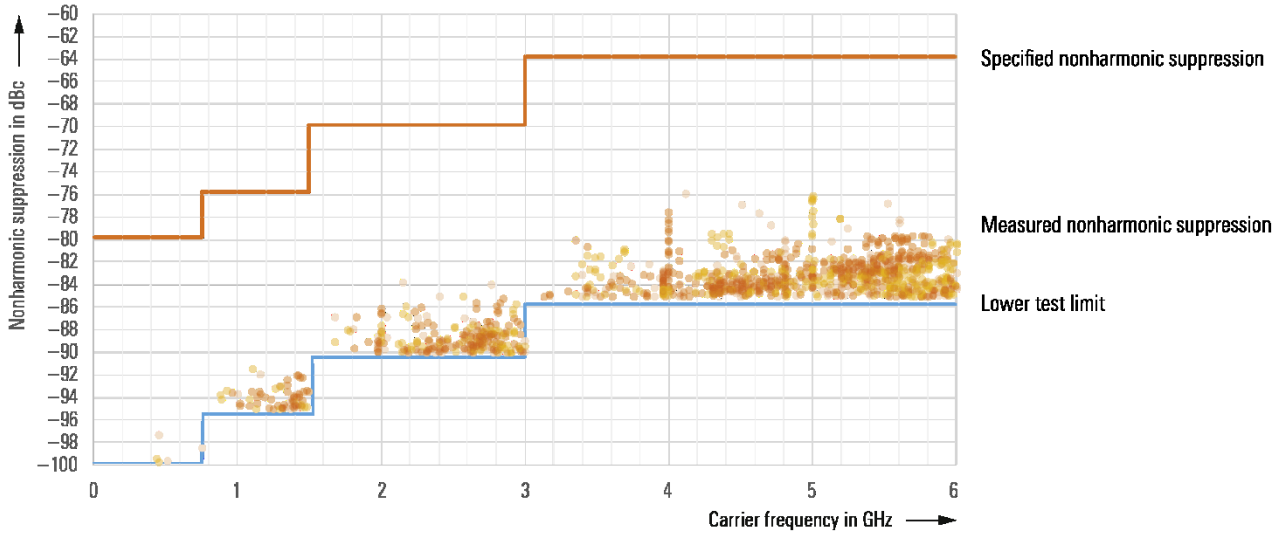
Spectral purity

Harmonics	CW, I/Q mode (full-scale DC input), level ≤ +13 dBm	
	1 MHz < f ≤ 6 GHz	< –30 dBc [4]
Nonharmonics	CW, I/Q mode (full-scale DC input), level > +10 dBm or maximum specified output power, whichever is lower, offset > 10 kHz from carrier and outside the modulation spectrum, reference frequency internal	
	f ≤ 750 MHz	< –80 dBc
	750 MHz < f ≤ 1500 MHz	< –76 dBc
	1500 MHz < f ≤ 3 GHz	< –70 dBc
	3 GHz < f ≤ 6 GHz	< –64 dBc
Subharmonics	CW, I/Q mode (full-scale DC input), level > +10 dBm or maximum specified output power, whichever is lower	
	f ≤ 3.00 GHz	< nonharmonic specification
	3 GHz < f ≤ 6 GHz	< –75 dBc, < –90 dBc (meas.)
Wideband noise	carrier offset = 30 MHz, measurement bandwidth: 1 Hz, level setting characteristic: auto	
	CW, level = +10 dBm	
	15 MHz ≤ f ≤ 6 GHz	< –146 dBc, –153 dBc (typ.)
	I/Q modulation with full-scale internal single carrier signal, level = +10 dBm, I/Q input gain (GUI setting) = +4 dB	
	20 MHz ≤ f ≤ 80 MHz	< –139 dBc, –144 dBc (typ.)
	80 MHz < f ≤ 200 MHz	< –135 dBc, –142 dBc (typ.)
	200 MHz < f ≤ 1 GHz	< –141 dBc, –144 dBc (typ.)
	1 GHz < f ≤ 3 GHz	< –142 dBc, –147 dBc (typ.)
	3 GHz < f ≤ 6 GHz	< –140 dBc, –147 dBc (typ.)
SSB phase noise	carrier offset = 20 kHz, measurement bandwidth: 1 Hz, level = +10 dBm	
	f = 100 MHz	
	CW mode	< –142 dBc, –150 dBc (typ.)
	I/Q mode	< –121 dBc, –140 dBc (typ.)
	CW and I/Q mode	
	f = 1 GHz	< –126 dBc, –132 dBc (typ.)
	f = 2 GHz	< –120 dBc, –126 dBc (typ.)
	f = 3 GHz	< –116 dBc, –123 dBc (typ.)
	f = 4 GHz	< –114 dBc, –120 dBc (typ.)
	f = 6 GHz	< –110 dBc, –117 dBc (typ.)
RMS jitter	standard, CW	
	f = 155 MHz, bandwidth: 100 Hz to 1.5 MHz	49 fs (meas.)
	f = 622 MHz, bandwidth: 1 kHz to 5 MHz	12 fs (meas.)
	f = 1 GHz, bandwidth: 1 Hz to 10 MHz	11 ps (meas.)
	f = 2.488 GHz, bandwidth: 5 kHz to 20 MHz	26 fs (meas.)
	with R&S®SMBVB-B1 option, CW	
	f = 155 MHz, bandwidth: 100 Hz to 1.5 MHz	40 fs (meas.)
	f = 622 MHz, bandwidth: 1 kHz to 5 MHz	12 fs (meas.)
	f = 1 GHz, bandwidth: 1 Hz to 10 MHz	225 fs (meas.)
	f = 2.488 GHz, bandwidth: 5 kHz to 20 MHz	26 fs (meas.)
	with R&S®SMBVB-B1H option, CW	
	f = 155 MHz, bandwidth: 100 Hz to 1.5 MHz	39 fs (meas.)
	f = 622 MHz, bandwidth: 1 kHz to 5 MHz	13 fs (meas.)
	f = 1 GHz, bandwidth: 1 Hz to 10 MHz	109 fs (meas.)
	f = 2.488 GHz, bandwidth: 5 kHz to 20 MHz	26 fs (meas.)
Residual FM	CW, RMS values at f = 1 GHz	
	300 Hz to 3 kHz, weighted (ITU-T)	< 2 Hz, 0.22 Hz (typ.)
	20 Hz to 23 kHz	< 4 Hz, 1.9 Hz (typ.)
Residual AM	CW, f > 10 MHz, RMS value (20 Hz to 20 kHz), level = 12 dBm	< 0.02 %

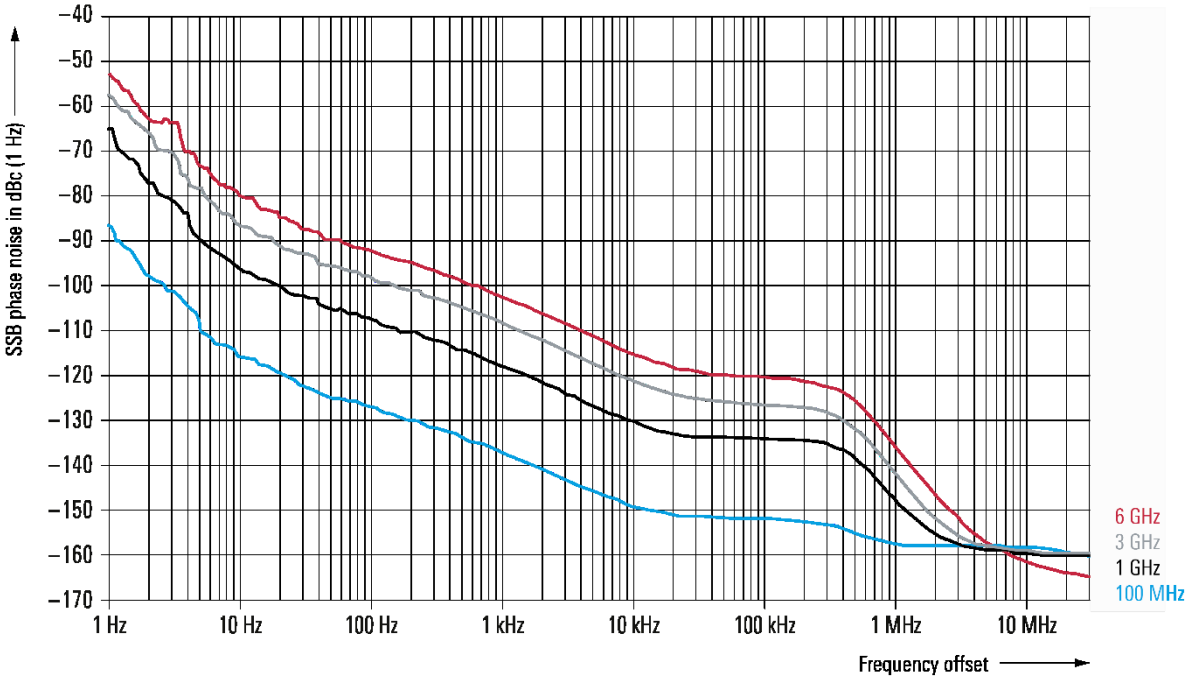
[4] Not valid in I/Q wideband mode.



Measured harmonics second order, CW, level = +13 dBm



Spurious emissions (CW, carrier offset > 10 kHz) – several R&S®SMBV100B instruments measured



Measured SSB phase noise with R&S®SMBVB-B1H option

Frequency and level sweep

Operating mode		digital sweep in discrete steps
Sweep parameters		RF frequency, RF level
Trigger modes	execute sweep continuously with internal trigger source	auto
	execute one full sweep	single, extern single
	execute one step	step, extern step
	sweep start and stop controlled by external trigger signal	extern start/stop
Trigger source		external trigger signal (INST TRIG at rear), rotary knob, touch panel, remote control
Sweep range		fully specified frequency and level range
	interruption-free level sweep with level setting characteristic: uninterrupted level setting	0.01 dB to 20 dB
Sweep shape		sawtooth, triangle
Step size setting resolution	frequency sweep linear	0.001 Hz
	frequency sweep logarithmic	0.01 %
	level sweep	0.01 dB
Dwell time setting range		5 ms to 100 s
Dwell time setting resolution		0.1 ms

List mode

Frequency and level values can be stored in a list and triggered by an internal timer or an external trigger.

Run mode		live
Operating modes	internal trigger	auto
	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 setting range	can be set individually for each step	1 ms to 100 s
Dwell time setting resolution		0.1 ms
Setting time	run mode: learned, after external trigger	see frequency and level data

Phase coherence

The R&S®SMBVB-K90 option enables phase-coherent RF outputs of two or more instruments in I/Q mode.

Frequency range	limited to the common frequency range of all coupled RF paths	
	R&S®SMBVB-B103	80 MHz < f ≤ 3 GHz
	R&S®SMBVBKB106	80 MHz < f ≤ 6 GHz
LO coupling modes	This mode corresponds to internal LO operation. The LO OUT connector can provide the internal LO oscillator signal to enable phase-coherent coupling with other instruments.	internal
	This mode corresponds to external LO operation, provided at the LO IN connector. The LO OUT connector can provide the external LO oscillator signal to enable phase-coherent coupling with additional instruments.	external
LO OUT states	The active local oscillator signal 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 of external LO signal	R&S®SMBVB-B103, for RF setting: 80 MHz < f ≤ 3 GHz	1.0 × f
	R&S®SMBVBKB106, for RF setting: 80 MHz < f ≤ 6 GHz	1.0 × f
Output of phase coherence signal		
Connector type	LO OUT on rear panel	SMA female
Output impedance		50 Ω (nom.)
Output level range		+7 dBm to +13 dBm
Frequency of internal LO signal	R&S®SMBVB-B103, for RF setting: 80 MHz < f ≤ 3 GHz	1.0 × f
	R&S®SMBVBKB106, for RF setting: 80 MHz < f ≤ 6 GHz	1.0 × f

Simultaneous modulation

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

● = compatible, – = incompatible
○ = compatible with limitations: No specification applies to level accuracy, AM distortion, AM depth error and on/off ratio with pulse modulation.

Analog modulation

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

Specifications apply for f > 200 kHz, level setting characteristics: auto, level (PEP) = 0 dBm.

Modulation source		internal, external, internal + external
External coupling		AC, DC
AM depth		
Setting range	at high levels, modulation is clipped when the maximum PEP is reached	0 % to 100 %
Setting resolution		0.1 %
AM depth (m) error	f_{mod} = 1 kHz and m < 80 %	
	f ≤ 80 MHz	< (1 % of reading + 1 %)
	f > 80 MHz	< (3 % of reading + 1 %)
AM distortion	f_{mod} = 1 kHz	
	f ≤ 80 MHz	
	m = 30 %	< 0.25 %
	m = 80 %	< 0.5 %
	f > 80 MHz	
	m = 30 %	< 1.5 %
	m = 80 %	< 3 %
Modulation frequency response	m = 60 %, DC coupling: 0 Hz to 50 kHz, AC coupling: 10 Hz to 50 kHz	< 3 dB
Incidental φM at AM	m = 30 %, f_{mod} = 1 kHz, ± peak/2	< 0.2 rad

Frequency bands for frequency and phase modulation

Multiplier N is used to define FM and φM specifications within this document.

Multiplier N for different frequency ranges	FM mode: low noise, φM mode: low noise	
	f ≤ 80 MHz	1
	80 MHz < f ≤ 93.75 MHz	1/16
	93.75 MHz < f ≤ 187.5 MHz	1/8
	187.5 MHz < f ≤ 375 MHz	1/4
	375 MHz < f ≤ 750 MHz	1/2
	750 MHz < f ≤ 1500 MHz	1
	1500 MHz < f ≤ 3 GHz	2
	3 GHz < f ≤ 6 GHz	4
	FM mode: high bandwidth, φM mode: high bandwidth, high deviation	
	f ≤ 250 MHz (mixer mode)	1
	250 MHz < f ≤ 375 MHz	1/4
	375 MHz < f ≤ 750 MHz	1/2
	750 MHz < f ≤ 1.5 GHz	1
	1.5 MHz < f ≤ 3 GHz	2
	3 GHz < f ≤ 6 GHz	4

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

Specifications apply for f > 200 kHz.

Modulation source		internal, external, internal + external
External coupling		AC, DC
FM modes		low noise, high bandwidth
Maximum deviation	FM mode: high bandwidth	N × 10 MHz
	FM mode: low noise	N × 1 MHz
Resolution of setting		< 0.02 % of set deviation or N × 0.1 Hz, whichever is greater, min. 0.01 Hz
FM deviation error	f_{mod} = 2 kHz, deviation ≤ N × 1 MHz	
	modulation source: internal	< (2 % of setting + 20 Hz)
	modulation source: external	< (3 % of setting + 20 Hz)
FM distortion	f_{mod} = 2 kHz, deviation = N × 1 MHz	< 0.2 %
Modulation frequency response	FM mode: high bandwidth, coupling: DC/AC, input impedance: 50 Ω	
	DC coupling: 0 Hz to 7 MHz, AC coupling: 10 Hz to 7 MHz	< 3 dB
	FM mode: low noise, coupling: DC/AC, input impedance: 50 Ω	
	DC coupling: 0 Hz to 100 kHz, AC coupling: 10 Hz to 100 kHz	< 3 dB
Synchronous AM with FM	40 kHz deviation, f_{mod} = 1 kHz, f > 10 MHz	< 0.2 %
Carrier frequency offset with FM DC	after FM offset adjustment, FM source external, input impedance 50 Ω	< 0.2 % of set deviation

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

Specifications only valid for f > 200 kHz and main PLL bandwidth normal.

Modulation source		internal, external, internal + external
External coupling		AC, DC
φM modes		high deviation, high bandwidth, low noise
Maximum deviation	φM mode: high bandwidth	N × 1 rad
	φM mode: high deviation	N × 40 rad
	φM mode: low noise	N × 10 rad
Resolution of setting	φM modes: high deviation, low noise	< 0.02 % of set deviation or N × 20 µrad, whichever is greater, min. 1 µrad
	φM mode: high bandwidth	< 0.1 % of set deviation, min. N × 20 µrad
φM deviation error	f_{mod} = 1 kHz, deviation ≤ half of max. deviation	
	modulation source: internal	< (2 % of setting + 0.003 rad)
	modulation source: external	< (3 % of setting + 0.003 rad)
φM distortion	f_{mod} = 10 kHz, half of max. deviation	< 0.2 %
Modulation frequency response	φM mode: high bandwidth, coupling: DC/AC, input impedance: 50 Ω	
	DC coupling: 0 Hz to 7 MHz, AC coupling: 10 Hz to 7 MHz	< 3 dB
	φM mode: high deviation, coupling: DC/AC, input impedance: 50 Ω	
	DC coupling: 0 Hz to 250 kHz, AC coupling: 10 Hz to 250 kHz	< 1 dB
	φM mode: low noise, coupling: DC/AC, input impedance: 50 Ω	
	DC coupling: 0 Hz to 100 kHz, AC coupling: 10 Hz to 100 kHz	< 3 dB

Pulse modulation (R&S®SMBVB-K22 option)

Modulation source		external
	with R&S®SMBVB-K23 option	external, internal
On/off ratio		> 80 dB, > 92 dB (typ.)
Rise/fall time	10 % to 90 % of RF amplitude, f > 80 MHz	
	transition type: fast	< 15 ns, < 5 ns (meas.)
	transition type: smoothed	< 200 ns
Minimum pulse width	50 %/50 % of RF amplitude, transition type: fast	< 20 ns
Pulse repetition frequency		0 Hz to 25 MHz
Video feedthrough	level < 10 dBm	< 10 % of RF, < 200 mV (peak-to-peak value)
Pulse overshoot		< 10 %
Pulse delay	pulse external trigger to RF, transition type: fast	90 ns (nom.)

Input for external modulation signals

Modulation input EXT for AM/FM/φM		
Connector type	MOD EXT on rear panel	BNC female
Input impedance	selectable	>100 kΩ, 600 Ω, 50 Ω (nom.)
Input sensitivity	peak value for set modulation factor or deviation	1 V (nom.)
Input damage voltage		±7 V
Pulse modulation input PULSE EXT		
Connector type	PULSE EXT on rear panel	BNC female
Input impedance	selectable	10 kΩ, 50 Ω (nom.)
Input voltage	TTL, CMOS compatible, threshold low	0.8 V (nom.)
	TTL, CMOS compatible, threshold high	1.3 V (nom.)
Input damage voltage		±6 V
Input polarity	selectable	normal, inverse

Sources for analog modulation

Internal modulation generator

Signal types		sine
Frequency setting range		0.1 Hz to 1 MHz
Frequency setting resolution		0.01 Hz
Frequency error		< (0.001 Hz + relative deviation of reference frequency × modulation frequency)

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

Signal types	LF generator 1	sine, pulse, triangle, trapezoid
	LF generator 2	sine, pulse, triangle, trapezoid
	noise generator (noise amplitude distribution)	Gaussian, equal
Frequency setting range	sine	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	0.01 Hz
	pulse, triangle, trapezoid	10 ns
	noise bandwidth	100 kHz
Frequency error		< (0.001 Hz + relative deviation of reference frequency × modulation frequency)

LF 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 TRIG at rear), rotary knob, touch panel, remote control
Sweep range		fully specified frequency range
Sweep shape		triangle, sawtooth
Step size	linear	full frequency range
	logarithmic	0.01 % to 100 % per step
Dwell time setting range		5 ms to 100 s
Dwell time setting resolution		0.1 ms

LF output

Monitoring of resulting modulation signal for		AM, FM, φM
Source		LF generator 1, LF generator 2, noise generator, external
Output voltage	V_p at LF connector, open circuit voltage EMF	
Setting range		0 mV to 4 V
Setting resolution		1 mV
Setting error	f = 1 kHz, R_L > 50 kΩ	< (1 % of reading + 1 mV)
Output impedance		50 Ω or 600 Ω (nom.)
DC offset		–4.0 V to +4.0 V
Damage voltage		± 7 V
Frequency response	up to 1 MHz	< 0.5 dB
	up to 10 MHz	< 1.5 dB
Distortion	f < 100 kHz, at R_L > 50 Ω, level (V_{EMF}) < 1 V	< 0.1 %

Pulse generator (R&S®SMBVB-K23 option)

Pulse modes		single pulse, double pulse
Trigger modes	free run, internally triggered	auto
		external trigger
		external gate
Pulse period		
Setting range		40 ns to 100 s
Setting resolution		10 ns
Pulse width	pulse widths of double pulses can be set independently	
Setting range		10 ns to 1 s
Setting resolution		10 ns
Pulse delay		
Setting range		0 ns to 100 s
Setting resolution		10 ns
Double-pulse delay		
Setting range		20 ns to 1 s
Setting resolution		10 ns
External trigger		
Delay	trigger to video output	70 ns (meas.)
Jitter		< 10 ns (nom.)

Pulse train (R&S®SMBB-K27 option)

The R&S®SMBVB-K27 option extends the functionality of the pulse generator (R&S®SMBVB-K23 option). With this option, pulses and sequences of pulse can be individually defined by the user to generate jittered or staggered pulse scenarios which are widely used in radar applications.

Prerequisite: R&S®SMBVB-K23 option must be installed.

Pulse modes	setting of pulse width, pulse spacing and pulse sequences	train
Trigger modes	free run, internally triggered	auto
		external trigger
Number of bursts		1 to 2047
Number of identical pulses per burst		1 to 65535
Pulse on time setting range		0 ns to 5 ms
Pulse off time setting range		5 ns to 5 ms
Pulse on and off time setting resolution		5 ns

Pulse generator output

PULSE VIDEO output	output of pulse generator signal	
Connector type	PULSE VIDEO output on rear panel	BNC female, 50 Ω
Output level	without load	digital signal 0 V/3.3 V (nom.)

I/Q modulation

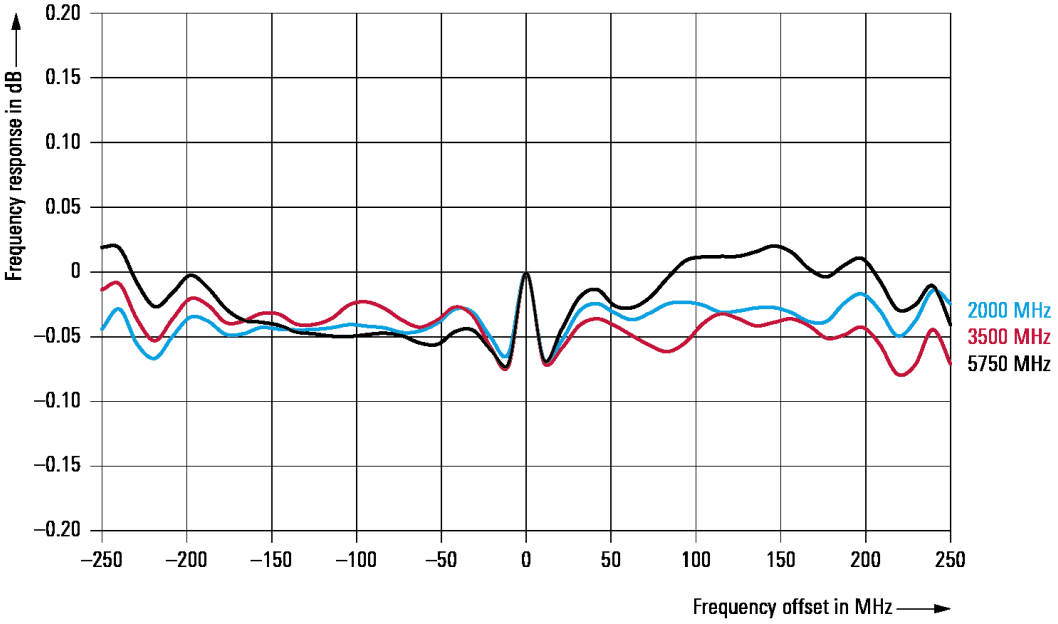
I/Q modulation performance

I/Q modulation is usable but not specified for frequencies below 1 MHz.

Operating modes		external wideband I/Q, internal baseband I/Q
RF modulation bandwidth	with external wideband I/Q inputs, I/Q wideband: on	
	1 MHz ≤ f ≤ 4 GHz	±25 % of carrier frequency
	f > 4 GHz	±1 GHz
	with external wideband I/Q inputs, I/Q wideband: off	
	f ≤ 2500 MHz	±10 % of carrier frequency
	f > 2500 MHz	±250 MHz
	with internal baseband I/Q, I/Q wideband: on	
	1 MHz < f ≤ 2000 MHz	±25 % of carrier frequency
	f > 2000 MHz	±500 MHz
RF frequency response in specified RF modulation bandwidth	with external wideband I/Q inputs	
	I/Q wideband: on	< 9 dB, < 6 dB (meas.)
	I/Q wideband: off	< 5 dB, < 4 dB (meas.)
	with internal baseband I/Q	
	I/Q wideband: on, optimization mode: high quality	< 1.0 dB, < 0.3 dB (meas.)
Carrier leakage [5]	mode: internal baseband I/Q, referenced to full-scale input	< –55 dBc
Suppression of image sideband for entire instrument in modulation bandwidth	mode: internal baseband I/Q, up to 1000 MHz RF modulation bandwidth	> 50 dB, > 55 dB (typ.)

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

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 %
Resolution		0.01 %
Gain imbalance		
Setting range		–1.0 dB to +1.0 dB
Resolution		0.01 dB
Quadrature offset		
Setting range		–10° to +10°
Resolution		0.01°



Measured RF frequency response with internal baseband I/Q at different carrier frequencies

Analog I/Q inputs

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®SMBV100B.

Input mode		single-ended
Connector types	I, Q on rear panel	BNC female
Input impedance		50 Ω (nom.)
VSWR	up to 200 MHz	< 1.2
	200 MHz to 500 MHz	< 1.35
	500 MHz to 1 GHz	< 1.45
Nominal input voltage for full-scale input		$\sqrt{V_i^2 + V_q^2}$ = 0.5 V
Damage voltage		±2 V

Baseband characteristics

Internal baseband characteristics

D/A converter		
Data rate		1200 MHz
Resolution		16 bit
Sampling rate		2400 MHz (internal interpolation × 2)
Aliasing filter	with amplitude, group delay and sin(x)/x correction	
Bandwidth, rolloff to –0.1 dB		500 MHz (nom.)
I/Q impairments (digital baseband)	These impairments are set in the digital baseband section of the R&S®SMBV100B. 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 %
Resolution		0.01 %
I ≠ Q (imbalance)		
Setting range		–1 dB to +1 dB
Resolution		0.01 dB
Quadrature offset		
Setting range		–10° to +10°
Resolution		0.01°

Analog I/Q outputs

Output impedance		50 Ω (nom.)
Output voltage	EMF (output voltage depends on set modulation signal)	1 V (V_p)
Offset	EMF	< 1 mV
Frequency response	at R_L = 50 Ω	
Magnitude	up to 50 MHz	0.15 dB (meas.)
	up to 500 MHz	0.30 dB (meas.)
I/Q balance [6]	at R_L = 50 Ω	
Magnitude	up to 50 MHz	0.15 dB (meas.)
	up to 250 MHz	0.30 dB (meas.)
	up to 500 MHz	0.75 dB (meas.)
Spectral purity	at R_L = 50 Ω	
SFDR (sine)	up to 20 MHz	75 dB (meas.)
	up to 500 MHz	58 dB (meas.)
Wideband noise	10 MHz sine wave at 1 MHz offset	< –153 dBc, –158 dBc (typ.)

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

Digital baseband inputs/outputs

Depending on the installed software and hardware options, the R&S®SMBV100B 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®SMBV100B to the digital I/Q input/output of other Rohde & Schwarz instruments.

Digital baseband outputs: one R&S®SMBVB-K19 option must be installed.

Output parameters

Digital I/Q interface		
Interface		
Standard		Dig. I/Q, in line with R&S®Digital I/Q Interface PAD-R [7], 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	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
Physical signal level		
Setting range		0 to –60 dBFS
Resolution		0.01 dBFS
Bandwidth (RF)		0.83 × sample rate
Control signals	markers	3
HS Dig. I/Q interface		
Standard		HS Dig. I/Q, in line with R&S®Digital I/Q Interface 40G PAD-R [8] (DIG I/Q 40G), I/Q data and control signals
Level		LVDS
Connector		QSFP+/QSFP 28
I/Q sample rate		
Sample rate	40G	up to 1.05 GHz
	50G	up to 1.2 GHz
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)		0.83 × sample rate
Control signals	markers	2

[7] 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.

[8] 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.

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	
Interface		
Standard		Dig. I/Q, in line with R&S®Digital I/Q Interface PAD-R [8], I/Q data and control signals, data and interface clock
Level		LVDS
Connector		26-pin MDR
I/Q sample rate	with source “user-defined”	sample rate must be entered via the parameter “sample rate”
	with source “Digital I/Q In”	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)		0.83 × 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 [9] (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	40G	up to 1.05 GHz
	50G	up to 1.2 GHz
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)		0.83 × sample rate
Control signals	markers	2

[9] 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.

Differential analog I/Q outputs (R&S®SMBVB-K17 option)

Output voltage	EMF, output voltage depends on set modulation signal	
Single-ended	up to 250 MHz	0.02 V to 2 V (V_p)
Resolution	up to 500 MHz	0.02 V to 1 V (V_p)
Differential	up to 250 MHz	0.04 V to 4 V (V_p)
Resolution	up to 500 MHz	0.04 V to 2 V (V_p)
Bias voltage (single-ended and differential)	EMF	–3.6 V to +3.6 V [10]
Resolution		0.1 mV
Uncertainty		1 % + 4 mV
Offset voltage		
Differential	EMF	–300 mV to +300 mV
Resolution		0.02 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 50 MHz	0.15 dB (meas.)
	up to 500 MHz	0.30 dB (meas.)
Frequency response	at R_L = 50 Ω, output voltage > 0.5 V (V_p)	
Magnitude	up to 50 MHz	0.15 dB (meas.)
	up to 500 MHz	0.30 dB (meas.)
Wideband noise	10 MHz sine wave at 1 MHz offset	–162 dBc (meas.)

I/Q baseband generator – arbitrary waveform mode

Waveform length	standard	1 sample to 64 Msample, in 1-sample steps
	with R&S®SMBVB-K511 option	1 sample to 512 Msample, in 1-sample steps
	with R&S®SMBVB-K511 and R&S®SMBVB-K512 options	1 sample to 1 Gsample, in 1-sample steps
	with R&S®SMBVB-K511 and R&S®SMBVB-K512 and R&S®SMBVB-K513 options	1 sample to 2 Gsample, in 1-sample steps
Sample rate	standard	400 Hz to 150 MHz
	with R&S®SMBVB-K523 option	400 Hz to 300 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	400 Hz to 600 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	400 Hz to 1200 MHz
Sample resolution	equivalent to D/A converter	16 bit
Sample clock source		internal
Sample frequency error	internal clock	< 4 × 10^{-11} Hz + relative deviation of reference frequency × sample rate (nom.)
Bandwidth (RF)	using the maximum sample rate, rolloff to –0.1 dB	120 MHz
	using a reduced sample rate, rolloff to –0.1 dB	0.83 × sample rate
Bandwidth (RF) with R&S®SMBVB-K523 option	using the maximum sample rate, rolloff to –0.1 dB	240 MHz
	using a reduced sample rate, rolloff to –0.1 dB	0.83 × sample rate
Bandwidth (RF) with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	using the maximum sample rate, rolloff to –0.1 dB	500 MHz
	using a reduced sample rate, rolloff to –0.1 dB	0.83 × sample rate
Bandwidth (RF) with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	using the maximum sample rate, rolloff to –0.1 dB	1000 MHz
	using a reduced sample rate, rolloff to –0.1 dB	0.83 × sample rate

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

Frequency offset setting range	standard	–60 MHz to 60 MHz
	with R&S®SMBVB-K523 option	–120 MHz to 120 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	–250 MHz to 250 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	–500 MHz to 500 MHz
Frequency offset setting resolution		0.01 Hz
Frequency offset error		< 3 × 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 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, 4, 5
Connector type	USER 1, 2, 3, 4, 5	BNC female
Input level		0 V to 3 V (nom.)
Threshold	USER 1, 2, 3, 4, 5	settable between 0.1 V and 2.0 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 × 10^9 sample
Setting resolution		3.3 ns
External trigger inhibit		
Setting range		0 sample to (21.47 s × sample rate) sample
Setting resolution		3.3 ns
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, 4, 5
Connector type	USER 1, 2, 3, 4, 5	BNC female
Level		LVTTL
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 samples
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
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. 1048575

Multicarrier waveform mode		
Number of carriers		max. 512
Total RF bandwidth	standard	max. 120 MHz
	with R&S®SMBVB-K523 option	max. 240 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	max. 500 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	max. 1000 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

I/Q baseband generator – real-time operation (custom digital modulation) (R&S®SMBVB-K520 option)

Types of modulation		
ASK		
Modulation index		0 % to 100 %
Resolution		0.1 %
FSK		2FSK, 4FSK, MSK
Deviation		1 Hz to 15 × f_{sym}
Maximum	standard	30 MHz
	with R&S®SMBVB-K523 option	60 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	120 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	240 MHz
Resolution		0.1 Hz
Variable FSK		4FSK, 8FSK, 16FSK
Deviations		–15 × f_{sym} to +15 × f_{sym}
Maximum	standard	30 MHz
	with R&S®SMBVB-K523 option	60 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	120 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	240 MHz
Resolution		0.1 Hz
PSK		BPSK, QPSK, QPSK 45° offset, QPSK EDGE, AQPSK, OQPSK, π/4-QPSK, π/2-DBPSK, π/4-DQPSK, π/8-D8PSK, 8PSK, 8PSK EDGE, 16APSK, 32APSK
QAM		16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 1024QAM, 4096QAM π/4-16QAM, –π/4-32QAM (for EDGE+)

Symbol rate		
Operating mode		internal
Setting range	standard	
	ASK, PSK and QAM	50 Hz to 100 MHz
	FSK	50 Hz to 100 MHz
	with R&S®SMBVB-K523 option	
	ASK, PSK and QAM	50 Hz to 200 MHz
	FSK	50 Hz to 200 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	
	ASK, PSK and QAM	50 Hz to 300 MHz
	FSK	50 Hz to 300 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	
	ASK, PSK and QAM	50 Hz to 600 MHz
	FSK	50 Hz to 600 MHz
Resolution		0.001 Hz
Frequency uncertainty (internal)		< 4 × 10^{-11} Hz + relative deviation of reference frequency × sample rate (nom.)
Baseband filter	any filter can be used with any type of modulation	
Filter types		cosine, root cosine, Gaussian, cdmaOne, cdmaOne + equalizer, cdmaOne 705 kHz, cdmaOne 705 kHz + equalizer, CDMA2000® 3x, APCO25 C4FM, EDGE narrow pulse, EDGE wide pulse rectangular, split phase, EUTRA/LTE
Filter parameter		
Setting range	cosine, root cosine (filter parameter α)	0.05 to 1.00
	Gaussian (filter parameter B × T)	0.15 to 2.50
	split phase (filter parameter B × T)	0.15 to 2.50
Setting resolution		0.01
Coding	Not all coding methods can be used with every type of modulation.	off, differential, diff. + Gray, Gray, NADC, PDC, PHS, TETRA, APCO25 (PSK), APCO25 (8PSK), PWT, TFTS, VDL, APCO25(FSK), ICO, CDMA2000®, WCDMA
Data sources		PRBS: 9, 11, 15, 16, 20, 21, 23, All 0, All 1, pattern (length: 1 bit to 64 bit), data lists
Data lists		
Output memory		8 bit to 2 Gbit
Nonvolatile memory	standard	internal mSATA module
	with R&S®SMBVB-B80 option	removable CFAST module
Predefined settings	modulation, filter, symbol rate and coding (if available) in line with standard	
Standards		APCO, Bluetooth®, CW in baseband, DECT, ETC, GSM, GSM EDGE, NADC, PDC, PHS, TETRA, WCDMA 3GPP, TD-SCDMA, CDMA2000® Forward, CDMA2000® Reverse, Worldspace
Frequency offset	With the aid of the frequency offset, the center frequency of the wanted baseband signal can be shifted. The restrictions caused by the modulation bandwidth still apply.	
Frequency offset setting range	standard	–60 MHz to +60 MHz
	with R&S®SMBVB-K523 option	–120 MHz to +120 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	–250 MHz to +250 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	–500 MHz to +500 MHz
Frequency offset setting resolution		0.01 Hz
Frequency offset error		< 3 × 10^{-6} Hz+ relative deviation of reference frequency × frequency offset (nom.)

Triggering		
Trigger source	event triggered via GUI or remote command	internal
	event triggered by external trigger signal	external
Trigger modes	signal is generated continuously	auto
	signal is generated continuously; a trigger event causes a restart	retrig
	signal is started only when a trigger event occurs; subsequent trigger events are ignored	armed auto
	signal is started only when a trigger event occurs; every subsequent trigger event causes a restart	armed retrig
	signal is started only when a trigger event occurs; the signal is generated once	single
External trigger input		selectable from USER 1, 2, 3, 4, 5
Connector type	USER 1, 2, 3, 4, 5	BNC female
Input level		0 V to 3 V (nom.)
Threshold	USER 1, 2, 3, 4, 5	settable between 0.1 V and 2.0 V
Input impedance	selectable	1 kΩ or 50 Ω (nom.)
Trigger jitter		±1.67 ns
External trigger delay		
Setting range		0 symbol to (2.147×10^9) symbol
Setting resolution		3.3 ns
External trigger inhibit		
Setting range		0 symbol to (21.47 s × symbol rate) symbol
Setting resolution		1 symbol
External trigger pulse width		> 7.5 ns
Marker signals		
Number of marker signals		3
Operating modes		control list, pulse, pattern, ratio
Marker outputs		selectable from USER 1, 2, 3, 4, 5
Connector type	USER 1, 2, 3, 4,5	BNC female
Level		LVTTL
Marker delay		
Setting range		0 symbol to ($2^{24} - 1$) symbol
Setting resolution		1 symbol
Marker duration		
Minimum value		1 symbol

Baseband enhancements

Additive white Gaussian noise (AWGN, R&S®SMBVB-K62 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 × 10^{10} s
C/N, E_b/N_0		
Setting range	depending on the set RF level; the PEP of the sum signal (wanted signal + noise) must not exceed the maximum possible PEP of the 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	standard	1 kHz to 120 MHz
	with R&S®SMBVB-K523 option	1 kHz to 240 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	1 kHz to 500 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	1 kHz to 1000 MHz
Setting resolution		100 Hz

BER measurement (R&S®SMBVB-K80 option)

In bit error rate (BER) measurement mode, 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 5	
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

BLER measurement (R&S®SMBVB-K80 option)

In block error rate (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 5
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

Envelope tracking (R&S®SMBVB-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.

Prerequisite: R&S®SMBVB-K17 option must be installed.

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/φM predistortion (R&S®SMBVB-K541 option)

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

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

State		on/off
Scattering parameters		
File format		*.s<n>p (e.g. *.s2p)
Maximum number of points		16384
Number of datasets to be cascaded		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		25 MHz
Total compensation bandwidth	standard	max. 120 MHz
	with R&S®SMBVB-K523 option	max. 240 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 options	max. 500 MHz
	with R&S®SMBVB-K523 and R&S®SMBVB-K524 and R&S®SMBVB-K525 options	max. 1000 MHz

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

State		on/off
Algorithm		clipping and filtering
Desired crest factor delta		–20 dB to 0 dB
Max 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

Notched signals (R&S®SMBVB-K811 option)

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	arbitrary waveform mode	ARB
	with R&S®SMBVB-K55 option	LTE
	with R&S®SMBVB-K115 option	cellular IoT
	with R&S®SMBVB-K114 option	custom OFDM
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

Digital modulation systems

The specified data applies together with the parameters of the respective standard. The entire frequency range, the filter parameters and the symbol rates can be set by the user.

Internal digital standards

Digital standards that run on the internal baseband generator. The R&S®SMBVB-K520 option must be installed. The options are described in the Digital Standards for Signal Generators specifications (PD 5213.9434.22).

Cellular standards
5G NR Release 15 (R&S®SMBVB-K144 option)
5G NR Release 16 (R&S®SMBVB-K148 option)
5G NR Release 17 (R&S®SMBVB-K171 option)
5G NR Sidelink (R&S®SMBVB-K170 option)
U-plane generation (R&S®SMBVB-K175 option, R&S®SMBVB-K144 or R&S®SMBVB-K55 required)
LTE Release 8 (R&S®SMBVB-K55 option)
LTE Release 9 (R&S®SMBVB-K84 option, R&S®SMBVB-K55 required)
LTE Release 10 (R&S®SMBVB-K85 option, R&S®SMBVB-K55 required)
LTE Release 11 (R&S®SMBVB-K112 option, R&S®SMBVB-K55 required)
LTE Release 12 (R&S®SMBVB-K113 option, R&S®SMBVB-K55 required)
LTE Release 13/14/15 (R&S®SMBVB-K119 option, R&S®SMBVB-K55 required)
Cellular IoT Release 13 (R&S®SMBVB-K115 option)
Cellular IoT Release 14 (R&S®SMBVB-K143 option, R&S®SMBVB-K115 required)
Cellular IoT Release 15 (R&S®SMBVB-K146 option, R&S®SMBVB-K115 required)
3GPP FDD (R&S®SMBVB-K42 option)
3GPP FDD/HSPA/HSPA+, enhanced BS/MS tests (R&S®SMBVB-K83 option, R&S®SMBVB-K42 required)
GSM/EDGE (R&S®SMBVB-K40 option)
EDGE Evolution (R&S®SMBVB-K41 option, R&S®SMBVB-K40 required)
CDMA2000® (R&S®SMBVB-K46 option)
1xEV-DO (R&S®SMBVB-K47 option)
1xEV-DO Rev. B (R&S®SMBVB-K87 option, R&S®SMBVB-K47 required)
TD-SCDMA (3GPP TDD LCR) (R&S®SMBVB-K50 option)
TD-SCDMA (3GPP TDD LCR) enhanced BS/MS test including HSDPA (R&S®SMBVB-K51 option, R&S®SMBVB-K50 required)
Wireless connectivity standards
IEEE 802.11a/b/g/n/j/p (R&S®SMBVB-K54 option)
IEEE 802.11ac (R&S®SMBVB-K86 option, R&S®SMBVB-K54 required)
IEEE 802.11ax (R&S®SMBVB-K142 option, R&S®SMBVB-K54 required)
IEEE 802.11be (R&S®SMBVB-K147 option, R&S®SMBVB-K54 required)
Bluetooth® EDR/Low Energy (R&S®SMBVB-K60 option)
Bluetooth® 5.x (R&S®SMBVB-K117 option, R&S®SMBVB-K60 option required)
UWB HRP (R&S®SMBVB-K149 option)
Other standards and modulation systems
OFDM signal generation (R&S®SMBVB-K114 option)
Multicarrier CW signal generation (R&S®SMBVB-K61 option)
NFC A/B/F (R&S®SMBVB-K89 option)
LoRa® (R&S®SMBVB-K131 option)

Digital standards with R&S®WinIQSIM2

R&S®WinIQSIM2 requires an external PC.

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

Cellular standards
5G NR Release 15 (R&S®SMBVB-K444 option)
5G NR Release 16 (R&S®SMBVB-K448 option)
5G NR Release 17 (R&S®SMBVB-K471 option)
5G NR Sidelink (R&S®SMBVB-K470 option)
Verizon 5GTF signals (R&S®SMBVB-K418 option)
LTE Release 8 (R&S®SMBVB-K255 option)
LTE Release 9 (R&S®SMBVB-K284 option, R&S®SMBVB-K255 required)
LTE Release 10 (R&S®SMBVB-K285 option, R&S®SMBVB-K255 required)
LTE Release 11 (R&S®SMBVB-K412 option, R&S®SMBVB-K255 required)
LTE Release 12 (R&S®SMBVB-K413 option, R&S®SMBVB-K255 required)
LTE Release 13/14/15 (R&S®SMBVB-K419 option, R&S®SMBVB-K255 required)
Cellular IoT Release 13 (R&S®SMBVB-K415 option)
Cellular IoT Release 14 (R&S®SMBVB-K443 option, R&S®SMBVB-K415 required)
Cellular IoT Release 15 (R&S®SMBVB-K446 option, R&S®SMBVB-K415 required)
3GPP FDD (R&S®SMBVB-K242 option)
3GPP FDD/HSPA/HSPA+, enhanced BS/MS tests (R&S®SMBVB-K283 option, R&S®SMBVB-K242 required)
GSM/EDGE (R&S®SMBVB-K240 option)
EDGE Evolution (R&S®SMBVB-K241 option, R&S®SMBVB-K240 required)
CDMA2000® (R&S®SMBVB-K246 option)
1xEV-DO Rev. A (R&S®SMBVB-K247 option)
1xEV-DO Rev. B (R&S®SMBVB-K287 option, R&S®SMBVB-K247 required)
TD-SCDMA (3GPP TDD LCR) (R&S®SMBVB-K250 option)
TD-SCDMA (3GPP TDD LCR) enhanced BS/MS test including HSDPA (R&S®SMBVB-K251 option, R&S®SMBVB-K250 required)
Wireless connectivity standards
IEEE 802.11a/b/g/n (R&S®SMBVB-K254 option)
IEEE 802.11ac (R&S®SMBVB-K286 option, R&S®SMBVB-K254 required)
IEEE 802.11ax (R&S®SMBVB-K442 option, R&S®SMBVB-K254 required)
Bluetooth® EDR/Low Energy (R&S®SMBVB-K260 option)
Bluetooth® 5.x (R&S®SMBVB-K417 option, R&S®SMBVB-K260 required)
UWB HRP (R&S®SMBVB-K449 option)
Navigation standards
GPS 1 satellite (R&S®SMBVB-K244 option)
Galileo 1 satellite (R&S®SMBVB-K266 option)
GLONASS 1 satellite (R&S®SMBVB-K294 option)
NAVIC/IRNSS 1 satellite (R&S®SMBVB-K297 option)
Modernized GPS (R&S®SMBVB-K298 option)
BeiDou 1 satellite (R&S®SMBVB-K407 option)
Modernized GLONASS (R&S®SMBVB-K423 option)
Broadcast standards
DVB-H/DVB-T (R&S®SMBVB-K252 option)
DAB/T-DMB (R&S®SMBVB-K253 option)
Other standards and modulation systems
OFDM signal generation (R&S®SMBVB-K414 option)
Multicarrier CW signal generation (R&S®SMBVB-K261 option)
NFC A/B/F (R&S®SMBVB-K289 option)
LoRa® (R&S®SMBVB-K431 option)

Options with external R&S®Pulse Sequencer software or R&S®Pulse Sequencer (DFS) software

The options are described in the R&S®Pulse Sequencer Software specifications (PD 3607.1388.22).

Pulse sequencing (R&S®SMBVB-K300 option)
Enhanced pulse sequencing (R&S®SMBVB-K301 option)
Direction finding (R&S®SMBVB-K308 option)
DFS signal generation (R&S®SMBVB-K350 option)

Options for GNSS and avionics

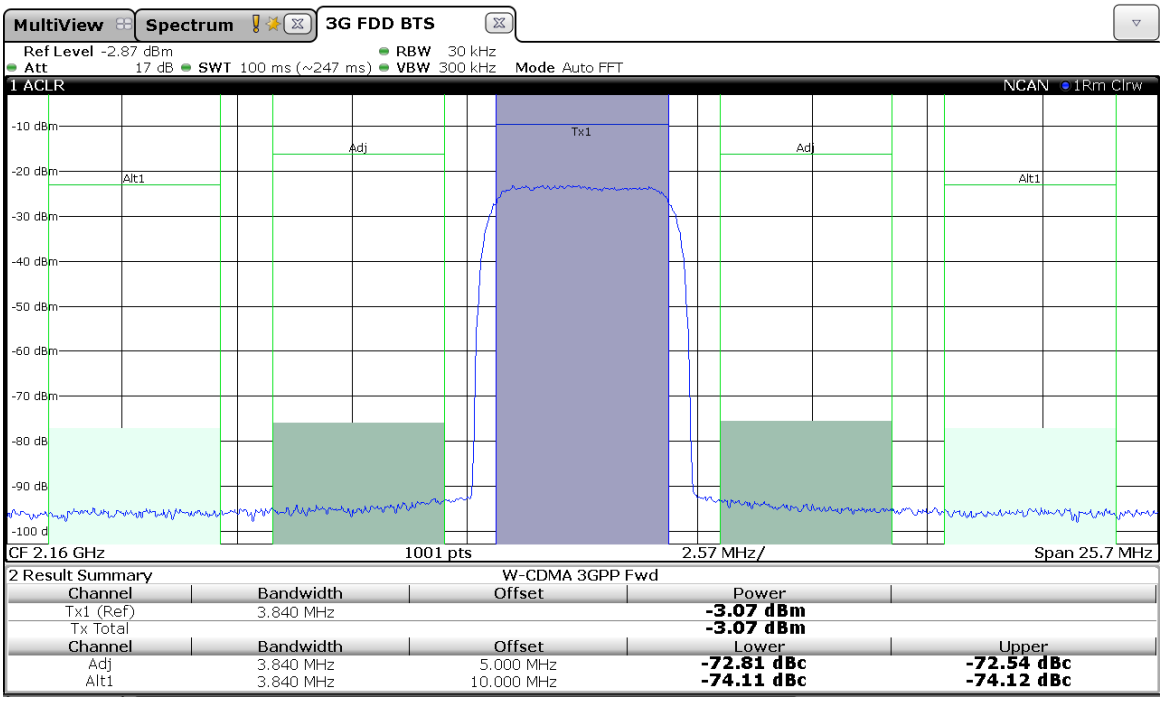
The options are described in the GNSS and Avionics Simulation for Rohde & Schwarz Signal Generators specifications (PD 3607.6896.22).

GPS (R&S®SMBVB-K44 option)
Galileo (R&S®SMBVB-K66 option)
GLONASS (R&S®SMBVB-K94 option)
NAVIC/IRNSS (R&S®SMBVB-K97 option)
Modernized GPS (R&S®SMBVB-K98 option)
SBAS/QZSS (R&S®SMBVB-K106 option)
BeiDou (R&S®SMBVB-K107 option)
GNSS real world simulation (R&S®SMBVB-K108 option)
GNSS real-time interface (R&S®SMBVB-K109 option)
GBAS (R&S®SMBVB-K111 option)
RTK virtual reference station (R&S®SMBVB-K122 option)
Modernized GLONASS (R&S®SMBVB-K123 option)
Modernized BeiDou (R&S®SMBVB-K132 option)
Single-satellite GNSS (R&S®SMBVB-K133 option)
Upgrade to dual-frequency GNSS (R&S®SMBVB-K134 option)
Upgrade to triple-frequency GNSS (R&S®SMBVB-K135 option)
Add 6 GNSS channels (R&S®SMBVB-K136 option)
Add 12 GNSS channels (R&S®SMBVB-K137 option)
ILS (R&S®SMBVB-K151 option)
VOR (R&S®SMBVB-K152 option)
DME (R&S®SMBVB-K153 option)
ERA-GLONASS test suite (R&S®SMBVB-K360 option)
eCall test suite (R&S®SMBVB-K361 option)
GNSS test suite (R&S®SMBVB-K362 option)

Signal performance for digital standards and modulation systems

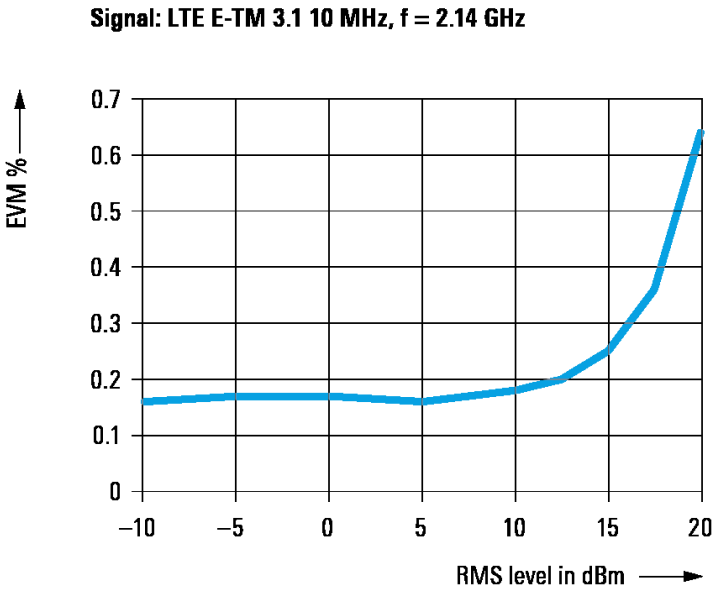
3GPP FDD (with R&S®SMBVB-K42 option)

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 ≤ 0 dBm, I/Q input gain (GUI setting) = +4 dB, optimization mode: high quality, temperature range from +18 °C to +33 °C	
	5 MHz offset	> 69 dB (typ. 72 dB)
	10 MHz offset	> 71 dB (typ. 74 dB)



Measured ACLR for 3GPP test model 1, 64 DPCH

EUTRA/LTE (with R&S®SMBVB-K55 option)

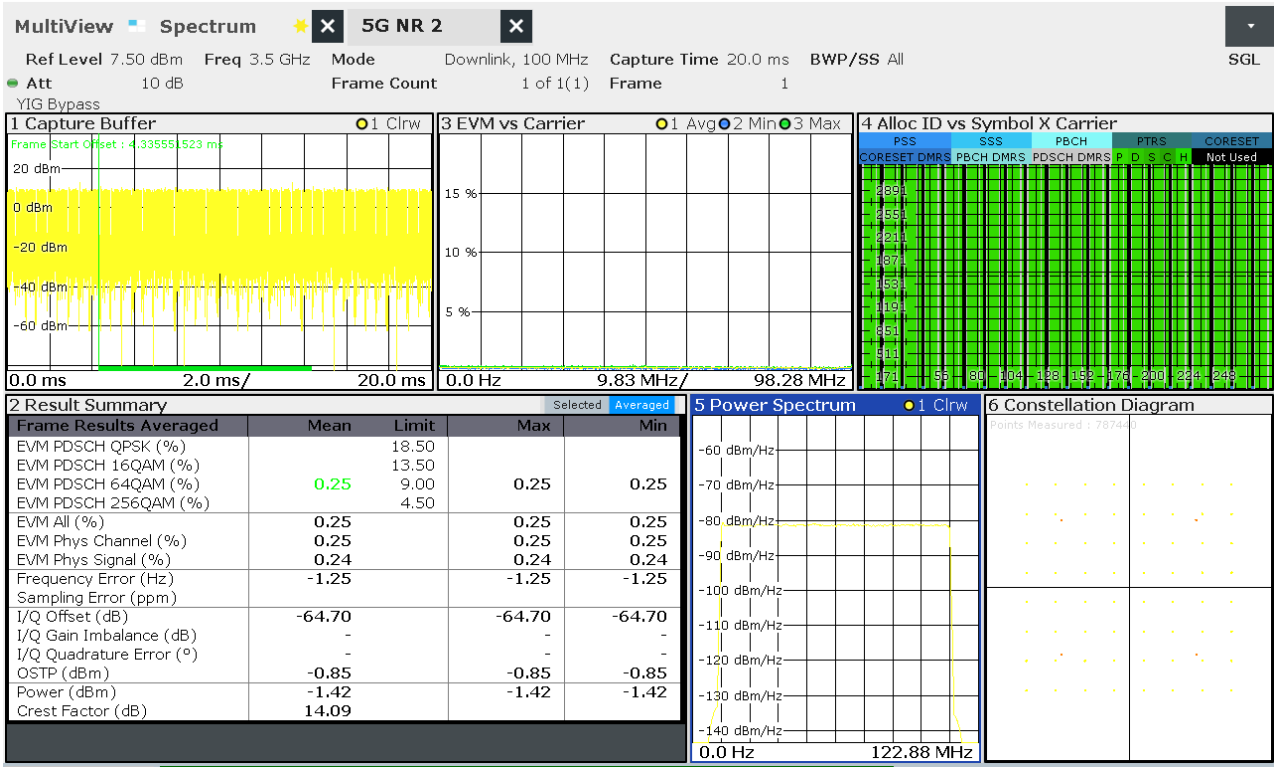


Measured EVM performance versus RMS level
(R&S®SMBV100B equipped with R&S®SMBVB-K31 and R&S®SMBVB-B32 options)

IEEE 802.11ac (with R&S®SMBVB-K86 option)

Measured EVM for an IEEE 802.11ac signal with 160 MHz bandwidth

5G NR (with R&S®SMBVB-K144 option)



Measured EVM for a 100 MHz 5G NR test model NR-TM3.1

Custom digital modulation (with R&S®SMBVB-K520 option, 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, 0 dBm	
	symbol rate up to 2 MHz	0.4 % (meas.)
	symbol rate up to 10 MHz	1.2 % (meas.)
Phase error with MSK	Gaussian filter with B × T: 0.2 to 0.7, f = 1 GHz, 0 dBm	
	bit rate up to 10 MHz	0.3° (meas.)
EVM with QPSK, OQPSK, π/4-DQPSK, 8PSK, 16QAM, 32QAM, 64QAM	cosine, root cosine filter with α: 0.2 to 0.7, f = 1 GHz, 0 dBm	
	symbol rate up to 5 MHz	0.5 % RMS (meas.)
	symbol rate up to 20 MHz	0.7 % RMS (meas.)

Health and utilization monitoring service (HUMS) (R&S®SMBVB-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/systems	standard	Ethernet/LAN 10/100/1000BASE-T
		IEC 60625 (GPIB IEEE-488.2), USB 2.0 (in line to VISA USB-TMC), serial (RS-232) [11]
Command set		SCPI 1999.5 or compatible command sets
Compatible command sets	These command sets can be selected in order to emulate another instrument. A subset of common commands is supported. For each emulated instrument, the *IDN? and *OPT? strings can be configured to meet the specific requirements. This is particularly useful for the Aeroflex/IFR/Marconi instruments since the manufacturer ID changed over time and for the Hewlett-Packard/Agilent/ Keysight instruments to adapt to a specific suffix and configuration.	**Hewlett Packard** • HP 8340, HP 8341 • HP 8360 • HP 83620, HP 83622, HP 83623, HP 83624 • HP 83630, HP 83640, HP 83650 • HP 8373 • HP 83711, HP 83712 • HP 83731, HP 83732 • HP 8642, HP 8643, HP 8644, HP 8645 • HP 8647, HP 8648 • HP 8656, HP 8657 • HP 8662, HP 8664, HP 8665 • HP 8673 **Agilent/Keysight Technologies** • E4421, E4422, E4428, E4438 • E8257, E8663 • N5161, N5162 • N5171, N5172B, N5173 • N5181, N5182A, N5182B **Aeroflex (IFR/Marconi)** • 2023, 2024 • 2030, 2031, 2032 • 2040, 2041, 2042 • 2050, 2051, 2052 • 3416 **Anritsu** • 68017, 68037 **Panasonic** • VP-8303A **Racal Dana** • 3102, 9087 **Rohde & Schwarz** • R&S®SMBV100A • R&S®SME02/03/06 • R&S®SMG/SMH • R&S®SMGU/SMHU • R&S®SML01/02/03 • R&S®SMP02/03/04 • R&S®SMR20/27/30/40 • R&S®SMT02/03/06 • R&S®SMY01/02
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

[11] Requires recommended extra R&S®TS-USB1 USB serial adapter for RS-232 remote control.

Connectors

Front-panel connectors

RF 50 Ω	RF output	N female
Sensor	connector for R&S®NRP-Zxx power sensor	6-pin ODU MINI-SNAP® series B
USB	USB 2.0 (high speed) connector for external USB devices, mouse and keyboard for enhanced operation, R&S®NRP power sensors (with R&S®NRP-Z4 or R&S®NRP-ZKU adapter cable) for external power measurements and level adjustment of instrument, memory stick for software update and data exchange	2 connectors, USB type A
USER 1, USER 2	user-configurable inputs or outputs, e.g. as trigger input or marker output	BNC female

Rear-panel connectors

RF 50 Ω	RF output with R&S®SMBVB-B81 option	N female
REF 1G IN	1 GHz reference frequency input	SMA female
REF 1G OUT	1 GHz reference frequency output	SMA female
REF IN	(variable) reference frequency input	BNC female
REF OUT	reference frequency output	BNC female
LF	modulation generator output	BNC female
MOD EXT	input for external analog modulation	BNC female
PULSE VIDEO	pulse generator output	BNC female
INST TRIG	trigger input for RF path, e.g. for frequency or level sweep, TTL 5 V compatible	BNC female
SIGNAL VALID	high state indicates that the instrument has settled to its final value	BNC female
LO IN	phase-coherent LO input	SMA female
LO OUT	phase-coherent LO output	SMA female
USB IN	USB 2.0 (high speed) remote control of instrument (USB-TMC)	USB type B micro USB
USB	USB 3.0 (high speed) connector for external USB devices, mouse and keyboard for enhanced operation, R&S®NRP power sensors (with R&S®NRP-Z4 or R&S®NRP-ZKU adapter cable) for external power measurements and level adjustment of instrument, memory stick for software update and data exchange	USB type A
LAN	provides remote control functionality and other services, see section “Remote control”	RJ-45
IEEE-488	remote control of instrument via GPIB	24-pin Amphenol series 57 female
I, $\overline{\text{I}}$	baseband output I, $\overline{\text{I}}$	BNC female
Q, $\overline{\text{Q}}$	baseband output Q, $\overline{\text{Q}}$	BNC female
I	I modulation input signal	BNC female
Q	Q modulation input signal	BNC female
USER 3, USER 4, USER 5	user-configurable inputs or outputs, e.g. as trigger input or marker output	BNC female
DIG IQ IN/OUT	digital input or output connectivity in line with R&S®Digital I/Q Interface	26-pin MDR
HS DIG IQ IN/OUT	high-speed digital input connectivity in line with R&S®Digital I/Q Interface	QSFP+/QSFP 28

General data

Environmental conditions		
Temperature	operating temperature range	0 °C to +55 °C
	storage temperature range	–40 °C to +71 °C
Damp heat		+40 °C, 90 % rel. humidity steady state, in line with EN 60068-2-78
Altitude	operating, linear derating of max. ambient temperature to +45 °C starting at altitude = 3000 m	up to 4600 m (15000 ft)
	storage	up to 4600 m (15000 ft)
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 516.4, procedure I
Power rating		
Rated voltage		100 V to 240 V AC (± 10 %)
Rated frequencies		50 Hz to 60 Hz (± 5 %), 400 Hz (± 5 %)
Rated current		3.5 A to 1.6 A (50 Hz to 60 Hz), 3.5 A to 2.9 A (400 Hz)
Rated power	fully equipped, baseband on, RF on, +23 °C ambient temperature	160 W (meas.)
Power factor correction		in line with EN 61000-3-2
Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EU	applied harmonized standards: EN 61326-1 (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 safety approvals	VDE – Association for Electrical, Electronic and Information Technologies	40046635
	CSA – Canadian Standards Association	70133349
Acoustic noise emission	sound power level, +23 °C ambient temperature, equipped with R&S®SMBVB-B32 option	42 dB(A) (meas.), DIN EN 3744:1994.1995
Display		7" color display with capacitive touch functionality
Non-volatile memory	standard	mSATA, 64 Gbyte
	with R&S®SMBVB-B80 option	CFAST, 64 Gbyte, removable (no internal mSATA)
Calibration interval		
Recommended calibration interval	when operated 40 h/week in the full range of the specified environmental conditions	3 years
Dimensions	W × H × D	344 mm × 153 mm × 372 mm (13.54 in × 6.03 in × 14.65 in)
Weight	when fully equipped	10.5 kg (23.15 lb)

Ordering information

R&S®SMBVB-Bxxx = hardware option

R&S®SMBVB-Kxxx/KBxxx = software/keycode option

Designation	Type	Order No.
Base unit		
Vector signal generator [12] including baseband generator with ARB (64 Msamples, 120 MHz RF bandwidth), power cable and quick start guide	R&S®SMBV100B	1423.1003.02
Frequency options		
8 kHz to 3 GHz	R&S®SMBVB-B103	1423.6270.02
Frequency extension to 6 GHz	R&S®SMBVBKB106	1423.6370.02
RF options		
OCXO reference oscillator	R&S®SMBVB-B1	1423.6470.02
High performance OCXO reference oscillator	R&S®SMBVB-B1H	1423.6570.02
1 GHz reference	R&S®SMBVB-B3	1423.7260.02
Flexible reference input from 1 MHz to 100 MHz	R&S®SMBVB-K704	1423.7618.02
High output power	R&S®SMBVB-K31	1423.6670.02
Ultra high output power	R&S®SMBVB-B32	1423.6711.02
Phase coherence	R&S®SMBVB-K90	1423.7601.02
Pulse modulator	R&S®SMBVB-K22	1423.7560.02
Pulse generator	R&S®SMBVB-K23	1423.7576.02
Pulse train	R&S®SMBVB-K27	1423.9279.02
Multifunction generator	R&S®SMBVB-K24	1423.7582.02
AM/FM/φM	R&S®SMBVB-K720	1423.7599.02
Baseband		
Differential analog I/Q outputs	R&S®SMBVB-K17	1423.7624.02
Digital baseband output	R&S®SMBVB-K19	1423.7630.02
ARB memory extension to 512 Msample	R&S®SMBVB-K511	1423.7653.02
ARB memory extension to 1 Gsample	R&S®SMBVB-K512	1423.7660.02
ARB memory extension to 2 Gsample	R&S®SMBVB-K513	1423.8589.02
Baseband real-time extension	R&S®SMBVB-K520	1423.7676.02
Baseband extension to 240 MHz RF bandwidth	R&S®SMBVB-K523	1423.7682.02
Baseband extension to 500 MHz RF bandwidth	R&S®SMBVB-K524	1423.7699.02
Baseband extension to 1 GHz RF bandwidth	R&S®SMBVB-K525	1423.8920.02
Baseband enhancements		
Additive white Gaussian noise (AWGN)	R&S®SMBVB-K62	1423.7876.02
Bit error rate tester	R&S®SMBVB-K80	1423.7647.02
Envelope tracking	R&S®SMBVB-K540	1423.7701.02
AM/AM, AM/φM predistortion	R&S®SMBVB-K541	1423.7718.02
User-defined frequency response correction	R&S®SMBVB-K544	1423.8150.02
Crest factor reduction	R&S®SMBVB-K548	1423.8820.02
Notched signals	R&S®SMBVB-K811	1423.8972.02
Digital standards		
GSM/EDGE	R&S®SMBVB-K40	1423.7724.02
EDGE Evolution	R&S®SMBVB-K41	1423.7730.02
3GPP FDD	R&S®SMBVB-K42	1423.7747.02
CDMA2000®	R&S®SMBVB-K46	1423.7760.02
1xEV-DO	R&S®SMBVB-K47	1423.7776.02
TD-SCDMA	R&S®SMBVB-K50	1423.7782.02
TD-SCDMA enhanced BS/MS tests	R&S®SMBVB-K51	1423.7799.02
IEEE 802.11 (a/b/g/n/j/p)	R&S®SMBVB-K54	1423.7824.02
LTE Release 8	R&S®SMBVB-K55	1423.7830.02
Bluetooth® EDR	R&S®SMBVB-K60	1423.7853.02
Multicarrier CW signal generation	R&S®SMBVB-K61	1423.7860.02
3GPP FDD HSPA/HSPA+, enhanced BS/MS tests	R&S®SMBVB-K83	1423.7899.02
LTE Release 9	R&S®SMBVB-K84	1423.7901.02
LTE Release 10	R&S®SMBVB-K85	1423.7918.02
IEEE 802.11ac	R&S®SMBVB-K86	1423.7924.02
1xEV-DO Rev. B	R&S®SMBVB-K87	1423.7930.02
NFC A/B/F	R&S®SMBVB-K89	1423.7947.02

[12] The base unit can only be ordered with an R&S®SMBVB-B103 frequency option.

Designation	Type	Order No.
LTE Release 11	R&S®SMBVB-K112	1423.8037.02
LTE Release 12	R&S®SMBVB-K113	1423.8043.02
OFDM signal generation	R&S®SMBVB-K114	1423.8050.02
Cellular IoT Release 13	R&S®SMBVB-K115	1423.8066.02
Bluetooth® 5.x	R&S®SMBVB-K117	1423.8089.02
LTE Release 13/14/15	R&S®SMBVB-K119	1423.8108.02
LoRa®	R&S®SMBVB-K131	1423.8720.02
IEEE 802.11ax	R&S®SMBVB-K142	1423.8114.02
Cellular IoT Release 14	R&S®SMBVB-K143	1423.8637.02
5G NR Release 15	R&S®SMBVB-K144	1423.8608.02
Cellular IoT Release 15	R&S®SMBVB-K146	1423.8808.02
IEEE 802.11be	R&S®SMBVB-K147	1423.8950.02
5G NR Release 16	R&S®SMBVB-K148	1423.8843.02
UWB HRP	R&S®SMBVB-K149	1423.8889.02
5G NR Sidelink	R&S®SMBVB-K170	1423.8937.02
5G NR Release 17	R&S®SMBVB-K171	1423.9085.02
U-plane generation	R&S®SMBVB-K175	1423.8989.02
Digital standards using R&S®WinIQSIM2 [13]		
GSM/EDGE	R&S®SMBVB-K240	1423.8166.02
EDGE Evolution	R&S®SMBVB-K241	1423.8172.02
3GPP FDD	R&S®SMBVB-K242	1423.8189.02
GPS	R&S®SMBVB-K244	1423.8195.02
CDMA2000®	R&S®SMBVB-K246	1423.8208.02
1xEV-DO Rev A	R&S®SMBVB-K247	1423.8214.02
TD-SCDMA	R&S®SMBVB-K250	1423.8220.02
TD-SCDMA enhanced BS/MS tests	R&S®SMBVB-K251	1423.8237.02
DVB-H	R&S®SMBVB-K252	1423.8243.02
DAB/T-DMB	R&S®SMBVB-K253	1423.8250.02
IEEE 802.11a/b/g/n	R&S®SMBVB-K254	1423.8266.02
LTE Release 8	R&S®SMBVB-K255	1423.8272.02
Bluetooth® EDR	R&S®SMBVB-K260	1423.8295.02
Multicarrier CW signal generation	R&S®SMBVB-K261	1423.8308.02
Additive white Gaussian noise (AWGN)	R&S®SMBVB-K262	1423.8314.02
Galileo	R&S®SMBVB-K266	1423.8320.02
3GPP FDD HSPA/HSPA+, enhanced BS/MS tests	R&S®SMBVB-K283	1423.8337.02
LTE Release 9	R&S®SMBVB-K284	1423.8343.02
LTE Release 10	R&S®SMBVB-K285	1423.8350.02
IEEE 802.11ac	R&S®SMBVB-K286	1423.8366.02
1xEV-DO Rev. B	R&S®SMBVB-K287	1423.8372.02
NFC A/B/F	R&S®SMBVB-K289	1423.8389.02
GLONASS 1 satellite	R&S®SMBVB-K294	1423.8395.02
NAVIC/IRNSS 1 satellite	R&S®SMBVB-K297	1423.8695.02
Modernized GPS	R&S®SMBVB-K298	1423.8408.02
BeiDou	R&S®SMBVB-K407	1423.8489.02
LTE Release 11	R&S®SMBVB-K412	1423.8495.02
LTE Release 12	R&S®SMBVB-K413	1423.8508.02
OFDM signal generation	R&S®SMBVB-K414	1423.8595.02
Cellular IoT Release 13	R&S®SMBVB-K415	1423.8514.02
DVB-S2/DVB-S2X	R&S®SMBVB-K416	1423.8520.02
Bluetooth® 5.x	R&S®SMBVB-K417	1423.8537.02
Verizon 5GTF signals	R&S®SMBVB-K418	1423.8543.02
LTE Release 13/14/15	R&S®SMBVB-K419	1423.8550.02
Modernized GLONASS	R&S®SMBVB-K423	1423.9110.02
LoRa®	R&S®SMBVB-K431	1423.8737.02
Modernized BeiDou	R&S®SMBVB-K432	1423.8837.02
IEEE 802.11ax	R&S®SMBVB-K442	1423.8566.02
Cellular IoT Release 14	R&S®SMBVB-K443	1423.8643.02
5G NR Release 15	R&S®SMBVB-K444	1423.8614.02
Cellular IoT Release 15	R&S®SMBVB-K446	1423.8814.02
IEEE 802.11be	R&S®SMBVB-K447	1423.8966.02
5G NR Release 16	R&S®SMBVB-K448	1423.8850.02
UWB HRP	R&S®SMBVB-K449	1423.8850.02

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

Designation	Type	Order No.
5G NR Sidelink	R&S®SMBVB-K470	1423.8943.02
5G NR Release 17	R&S®SMBVB-K471	1423.9091.02
Waveform package for signals from R&S®WinIQSIM2, R&S®Pulse Sequencer, R&S®Pulse Sequencer (DFS) [14]		
1 waveform	R&S®SMBVB-K200	1423.8714.71
5 waveforms	R&S®SMBVB-K200	1423.8714.72
50 waveforms	R&S®SMBVB-K200	1423.8714.75
Options with external R&S®Pulse Sequencer software or R&S®Pulse Sequencer (DFS) software		
Pulse sequencing	R&S®SMBVB-K300	1423.8414.02
Enhanced pulse sequencing	R&S®SMBVB-K301	1423.8420.02
DF	R&S®SMBVB-K308	1423.8437.02
DFS signal generation	R&S®SMBVB-K350	1423.8443.02
GNSS and avionics		
GPS	R&S®SMBVB-K44	1423.7753.02
Galileo	R&S®SMBVB-K66	1423.7882.02
GLONASS	R&S®SMBVB-K94	1423.7953.02
NAVIC/IRNSS	R&S®SMBVB-K97	1423.8708.02
Modernized GPS	R&S®SMBVB-K98	1423.7960.02
SBAS/QZSS	R&S®SMBVB-K106	1423.7982.02
BeiDou	R&S®SMBVB-K107	1423.7999.02
GNSS real world simulation	R&S®SMBVB-K108	1423.8008.02
GNSS real-time interface	R&S®SMBVB-K109	1423.8014.02
RTK virtual reference station	R&S®SMBVB-K122	1423.8914.02
Modernized GLONASS	R&S®SMBVB-K123	1423.9104.02
Modernized BeiDou	R&S®SMBVB-K132	1423.8789.02
Single-satellite GNSS	R&S®SMBVB-K133	1423.8743.02
Upgrade to dual-frequency GNSS	R&S®SMBVB-K134	1423.8750.02
Upgrade to triple-frequency GNSS	R&S®SMBVB-K135	1423.8766.02
Add 6 GNSS channels	R&S®SMBVB-K136	1423.8772.02
Add 12 GNSS channels	R&S®SMBVB-K137	1423.8795.02
GBAS	R&S®SMBVB-K111	1423.8020.02
ILS	R&S®SMBVB-K151	1423.8120.02
VOR	R&S®SMBVB-K152	1423.8137.02
DME	R&S®SMBVB-K153	1423.8143.02
ERA-GLONASS test suite	R&S®SMBVB-K360	1423.8650.02
eCall test suite	R&S®SMBVB-K361	1423.8666.02
GNSS test suite	R&S®SMBVB-K362	1423.8672.02
Other options		
Removable mass storage	R&S®SMBVB-B80	1423.7160.02
Rear panel connector for RF path	R&S®SMBVB-B81	1423.7360.02
Health and utilization monitoring service (HUMS)	R&S®SMBVB-K980	1423.8872.02
Recommended extras		
Spare CFAST card	R&S®SMBVB-Z10	3639.9910.02
19" rack adapter	R&S®ZZA-KNA33	1177.8090.00
USB serial adapter for RS-232 remote control	R&S®TS-USB1	6124.2531.00
Documentation of calibration values	R&S®DCV-2	0240.2193.18
R&S®SMBV100B accredited calibration (ISO 17025, ISO 9000)	R&S®ACASMBV100	3598.1027.03

[14] Maximum 250 waveforms per instrument can be registered.

Warranty		
Base unit		3 years
All other items [15]		1 year
Service options		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

Extended warranty with a term of one and two years (WE1 and WE2)
Repairs carried out during the contract term are free of charge [16]. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration coverage (CW1 and CW2)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [16] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

Extended warranty with accredited calibration (AW1 and AW2)
Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs [16] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

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[15] For options installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

[16] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

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