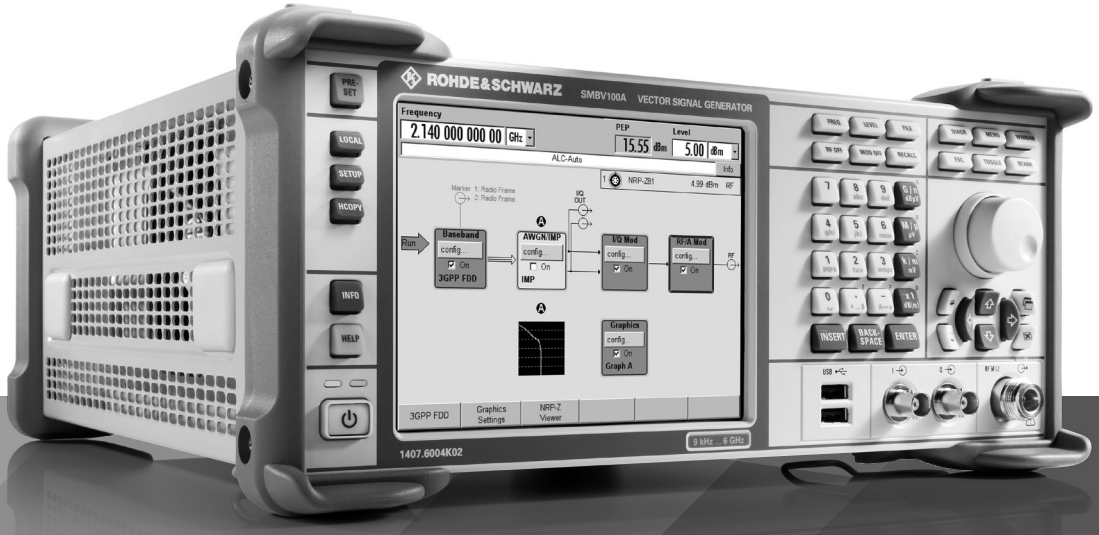
# R&S®SMBV100A
# VECTOR SIGNAL GENERATOR

## Specifications




Data Sheet
Version 10.00

ROHDE&SCHWARZ
Make ideas real

# CONTENTS

## Key features

### Ready for future applications today

- Future-ready hardware concept
- RF section with high output level up to 6 GHz
- Wide RF signal bandwidth of up to 160 MHz during internal signal generation
- Maximum RF bandwidth of I/Q modulator exceeds 500 MHz
- Always up-to-date with software upgrades

### Customized internal signal generation with optional baseband

- Baseband coder with realtime capabilities for direct signal generation
- Integrated ARB for playback of precalculated waveforms
- ARB-only versions with different bandwidths
- Memory depth of up to 1 Gsample for long test sequences

### Support of all important state-of-the-art digital standards

- Straightforward signal configuration due to easy-to-use GUI
- 2G/3G/4G mobile radio standards
- Wireless standards incl. WLAN IEEE 802.11ac, Bluetooth®, LORA and NFC
- GNSS: GPS, GLONASS, Galileo and BeiDou

### High-performance RF for all kinds of applications

- Excellent phase noise ensures low EVM with digital signals
- High output level compensates for losses in the test/system setup
- Fast settling time for quicker measurements
- Analog modulation for basic measurements

### Flexible signal processing and baseband connectivity

- CW interference and AWGN simulation
- Analog and digital baseband outputs
- Support for R&S®EX-IQ-Box digital interface module

### Low cost of ownership due to service concept

- Fast on-site servicing
- Long calibration interval (three years) minimizes service costs
- Straightforward modular design for short repair times

### Allrounder and specialist at the same time

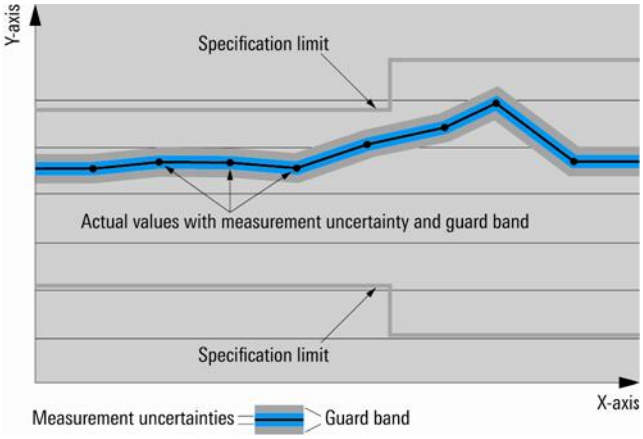
- Optimized for high production throughput
  - Multisegment waveform mode for fast switchover between test sequences
  - High level repeatability for stable test conditions
- Prepared for aerospace and defense applications
  - Versatile capabilities for generating unmodulated as well as complex modulated pulses
  - Coupling of multiple instruments for phase-coherent RF generation

# 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.




**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”.

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

# Specifications

## RF performance

### Frequency

| | | |
|---|---|---|
| Range | R&S®SMBV-B103 | |
| | CW mode | 9 kHz to 3.2 GHz |
| | I/Q mode | 1 MHz to 3.2 GHz |
| | R&S®SMBV-B106 | |
| | CW mode | 9 kHz to 6 GHz |
| | I/Q mode | 1 MHz to 6 GHz |
| Resolution of setting | | 0.001 Hz |
| Resolution of synthesis | f = 1 GHz | 0.44 µHz (nom.) |
| Settling time | to within < $1 \times 10^{-7}$ for f > 200 MHz or < 20 Hz for f ≤ 200 MHz | |
| | after IEC/IEEE bus delimiter | |
| | ALC state On, CW mode | < 1.5 ms |
| | ALC state On, I/Q mode | < 3 ms |
| | ALC state Table | < 2.5 ms |
| | ALC state S&H | < 3.5 ms |
| | after trigger pulse in List mode [1] | < 1.0 ms |
| Resolution of phase offset setting | | 0.1° |

### 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 | internal | timer |
| | external | external trigger signal (INST TRIG at rear), rotary knob, remote control |
| Trigger slope | external trigger signal | positive, negative |
| Sweep range | | full frequency range |
| Sweep shape | | triangle, sawtooth |
| Step spacing | | linear, logarithmic |
| Step size | linear | full frequency range, minimum 0.001 Hz |
| | logarithmic | 0.01 % to 100 % |
| Dwell time range | | 10 ms to 100 s |
| Dwell time resolution | | 0.1 ms |

### Reference frequency

| | | |
|---|---|---|
| Frequency error | at time of calibration in production | < $1 \times 10^{-7}$ |
| | with R&S®SMBV-B1, R&S®SMBV-B1H option | < $1 \times 10^{-8}$ |
| Aging (after 10 days of uninterrupted operation) | | < $1 \times 10^{-6}$/year |
| | with R&S®SMBV-B1 option | < $1 \times 10^{-9}$/day, < $1 \times 10^{-7}$/year |
| | with R&S®SMBV-B1H option | < $5 \times 10^{-10}$/day, < $3 \times 10^{-8}$/year |
| Temperature effect (0 °C to +50 °C) | | < $2 \times 10^{-6}$ |
| | with R&S®SMBV-B1 option | < $1 \times 10^{-7}$ |
| | with R&S®SMBV-B1H option | < $1 \times 10^{-8}$ |
| Warm-up time | to nominal thermostat temperature, with R&S®SMBV-B1, R&S®SMBV-B1H option | ≤ 10 min |
| **Output of internal reference** | | |
| Connector type | REF OUT on rear panel | BNC female |
| Output frequency | sinewave | 10 MHz or external input frequency |
| Output level | | +7 dBm to +13 dBm, +10 dBm (typ.) |
| Source impedance | | 50 Ω (nom.) |

[1] ALC state Sample & Hold (S&H) or ALC state Table.

| **Input for external reference** | | |
|---|---|---|
| Connector type | REF IN on rear panel | BNC female |
| Input frequency | | 5 MHz, 10 MHz |
| Frequency locking range | | ± 3 × $10^{-6}$ |
| Input level range | | 0 dBm to +16 dBm |
| Input impedance | | 50 Ω (nom.) |

## Level

### Level setting modes

The R&S®SMBV100A offers two different operating modes for level setting:

- AUTO MODE: The step attenuator is switched over automatically
- FIXED MODE: The level is set without changing the step attenuator. The step attenuator is thus fixed to the current setting. If ALC is on, level changes are performed without interruption. The maximum interruption-free setting range is limited

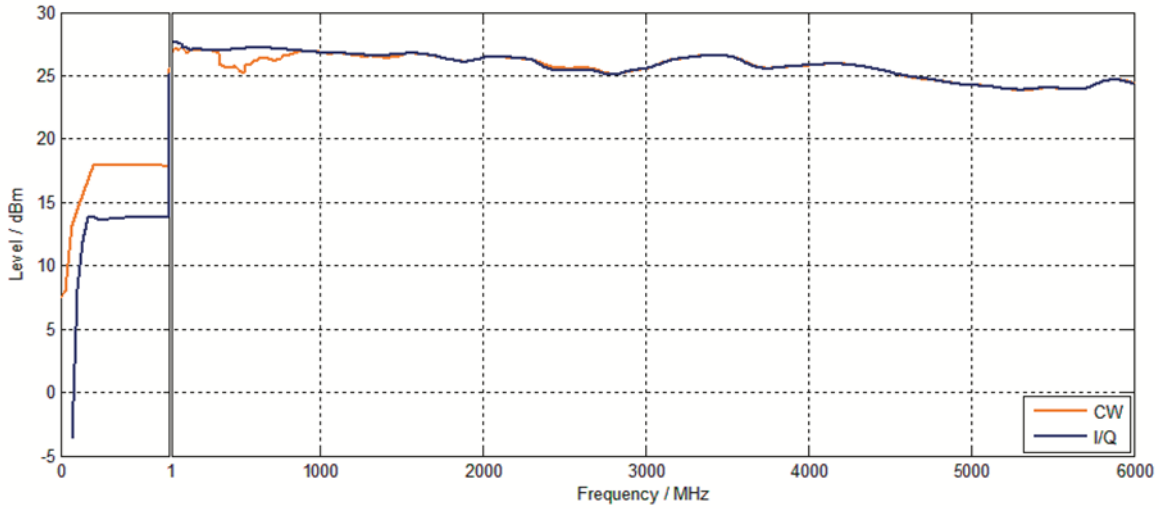
### ALC modes

The R&S®SMBV100A has four different automatic level control (ALC) modes:

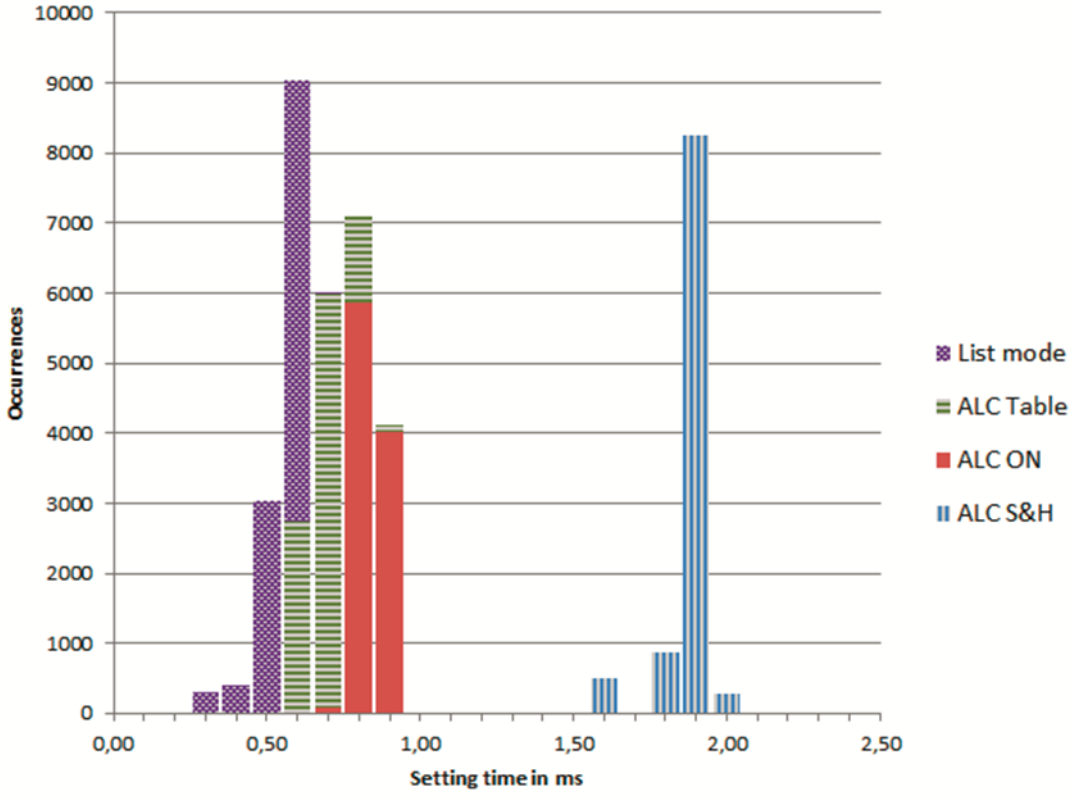
- ALC state Auto: The best suited ALC mode is set automatically
- ALC state On: The level control loop is closed. This mode is suitable for CW, AM and modulation signals with constant envelope
- ALC state Sample & Hold (S&H): At every frequency and level change, the level control loop is closed for about 1 ms and the level control voltage is sampled. The level control voltage is then clamped. This mode is used internally while in ALC state Auto for I/Q and pulse modulation
- ALC state Table: The level control voltage is obtained during a learning cycle as a function of level and frequency at discrete points. At normal operation the level control voltage is interpolated between the obtained values and set. This mode is suitable for I/Q and pulse modulation. The setting times are significantly faster than in the S&H mode, but the absolute level accuracy is slightly inferior due to the interpolation error and temperature changes after the learning cycle

| | | |
|---|---|---|
| Setting range | 1 MHz ≤ f ≤ 6 GHz | –145 dBm to +30 dBm |
| | 300 kHz ≤ f < 1 MHz | –145 dBm to +18 dBm |
| | 100 kHz ≤ f < 300 kHz | –145 dBm to +13 dBm |
| | 9 kHz ≤ f < 100 kHz | –145 dBm to +8 dBm |
| Specified level range | CW mode | |
| | 1 MHz ≤ f ≤ 6 GHz | –120 dBm to +18 dBm (PEP) [2] |
| | 200 kHz ≤ f < 1 MHz | –120 dBm to +13 dBm (PEP) |
| | I/Q mode | |
| | 1 MHz ≤ f ≤ 6 GHz | –120 dBm to +18 dBm (PEP) |
| Resolution of setting | | 0.01 dB |
| Level error | ALC state On,<br>temperature range +18 °C to +33 °C in specified level range | |
| | 200 kHz ≤ f ≤ 3 GHz | < 0.5 dB |
| | f > 3 GHz | < 0.9 dB |
| Additional level error | ALC state S&H | < 0.25 dB |
| | ALC state Table | < 0.5 dB |
| Output impedance VSWR in 50 Ω system | f > 200 kHz | < 1.8 |
| Setting time | to < 0.1 dB deviation from final value, with GUI update stopped,<br>temperature range +18 °C to +33 °C | |
| | after IEC/IEEE bus delimiter | |
| | ALC state On | |
| | CW mode | < 1.5 ms |
| | I/Q mode | < 3 ms |
| | ALC state Table | < 1.0 ms |
| | ALC state S&H | < 3.5 ms |
| | in List mode after trigger pulse | < 1.0 ms |
| Interruption-free level setting range | fixed mode, ALC state On | 0 dB to +20 dB |
| Reverse power (from 50 Ω source) | maximum permissible RF power in output frequency range of RF path for f ≥ 1 MHz | |
| | 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 |

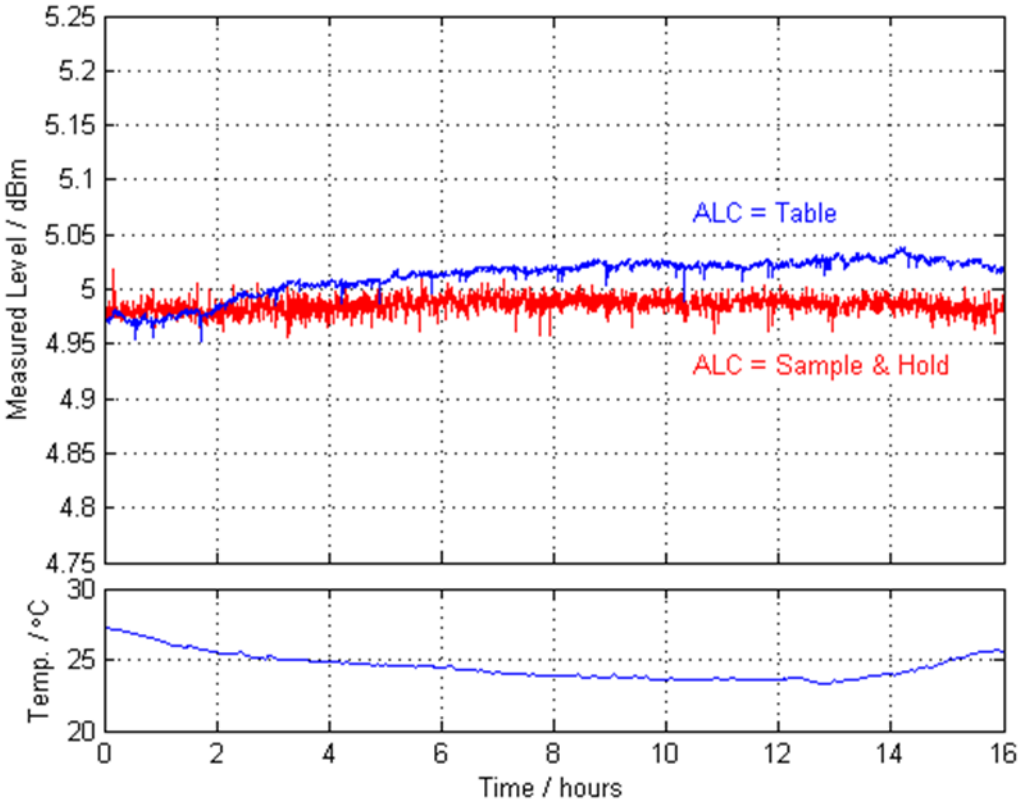
[2] PEP = peak envelope power.




*Maximum available output level versus frequency (meas.)*




*Histogram of frequency setting times in I/Q mode for different ALC states and List mode (meas.)*



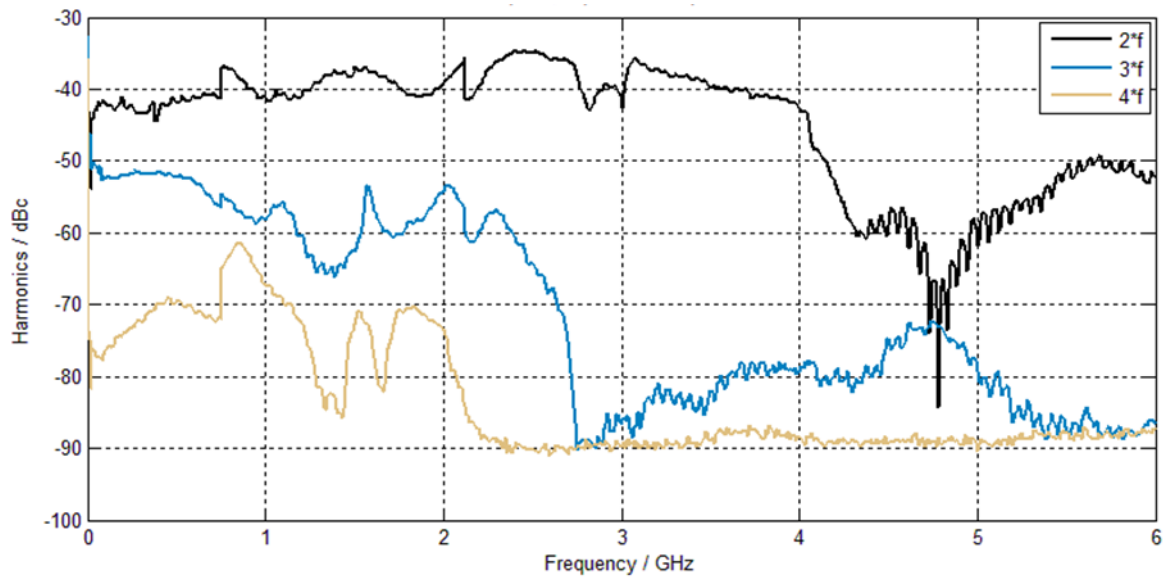

*Level repeatability 3GPP test model 1, 64 DPCHs, at 2.16 GHz, 5 dBm, ALC = Table and ALC = Sample & Hold (meas.)*

## Level 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 | internal | timer |
| | external | external trigger signal (INST TRIG at rear), rotary knob, remote control |
| Trigger slope | with external trigger | positive, negative |
| Sweep range | | full specified level range |
| | interruption-free | –20 dB to +20 dB |
| Sweep shape | | triangle, sawtooth |
| Step spacing | | logarithmic |
| Step size setting resolution | | 0.01 dB |
| Dwell time setting range | | 10 ms to 100 s |
| Dwell time setting resolution | | 0.1 ms |

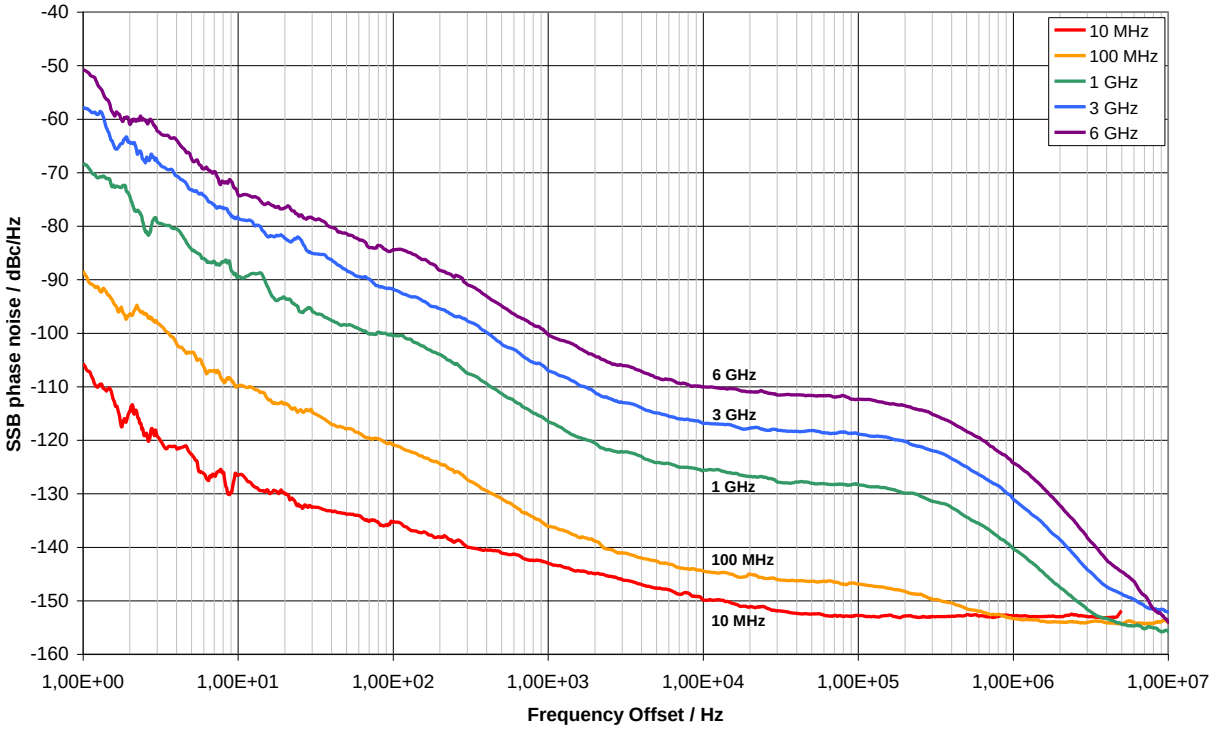
## Spectral purity

| | | |
|---|---|---|
| Harmonics | CW, I/Q mode (full-scale DC input),<br>f > 1 MHz, level ≤ 8 dBm | < –30 dBc [3] |
| Nonharmonics | CW, I/Q mode (full-scale DC input), level > –10 dBm, carrier offset > 10 kHz | |
| | f ≤ 1500 MHz | < –70 dBc, < –84 dBc (typ.) |
| | 1500 MHz < f ≤ 3 GHz | < –64 dBc, < –78 dBc (typ.) |
| | f > 3 GHz | < –58 dBc, < –72 dBc (typ.) |
| Wideband noise | level operating mode auto<br>level > 5 dBm, carrier offset > 10 MHz<br>measurement bandwidth 1 Hz, CW | < –142 dBc |
| SSB phase noise | carrier offset 20 kHz, measurement bandwidth 1 Hz | |
| | f = 100 MHz | |
| | CW mode | < –141 dBc, –148 dBc (typ.) |
| | I/Q mode | < –121 dBc, –127 dBc (typ.) |
| | CW and I/Q mode | |
| | f = 1 GHz | < –122 dBc, –128 dBc (typ.) |
| | f = 2 GHz | < –116 dBc, –122 dBc (typ.) |
| | f = 3 GHz | < –112 dBc, –118 dBc (typ.) |
| | f = 4 GHz | < –110 dBc, –116 dBc (typ.) |
| | f = 6 GHz | < –106 dBc, –112 dBc (typ.) |
| RMS jitter | f = 1 GHz,<br>bandwidth = 1 Hz to 10 MHz, CW | 3.9 ps (meas.), (3.9 mUI) |
| | with R&S®SMBV-B1 option | 1.1 ps (meas.), (1.1 mUI) |
| | f = 155 MHz,<br>bandwidth = 100 Hz to 1.5 MHz, CW | 83 fs (meas.), (12.9 µUI) |
| | f = 622 MHz,<br>bandwidth = 1 kHz to 5 MHz, CW | 63 fs (meas.), (39.2 µUI) |
| | f = 2.488 GHz,<br>bandwidth = 5 kHz to 15 MHz, CW | 55 fs (meas.), (137 µUI) |
| Residual FM | RMS value at f = 1 GHz, CW | |
| | 0.3 kHz to 3 kHz | < 4 Hz, 0.25 Hz (typ.) |
| | 0.03 kHz to 23 kHz | < 10 Hz, 1.3 Hz (typ.) |
| Residual AM | RMS value (0.03 kHz to 20 kHz)<br>level = 8 dBm | < 0.02 % |

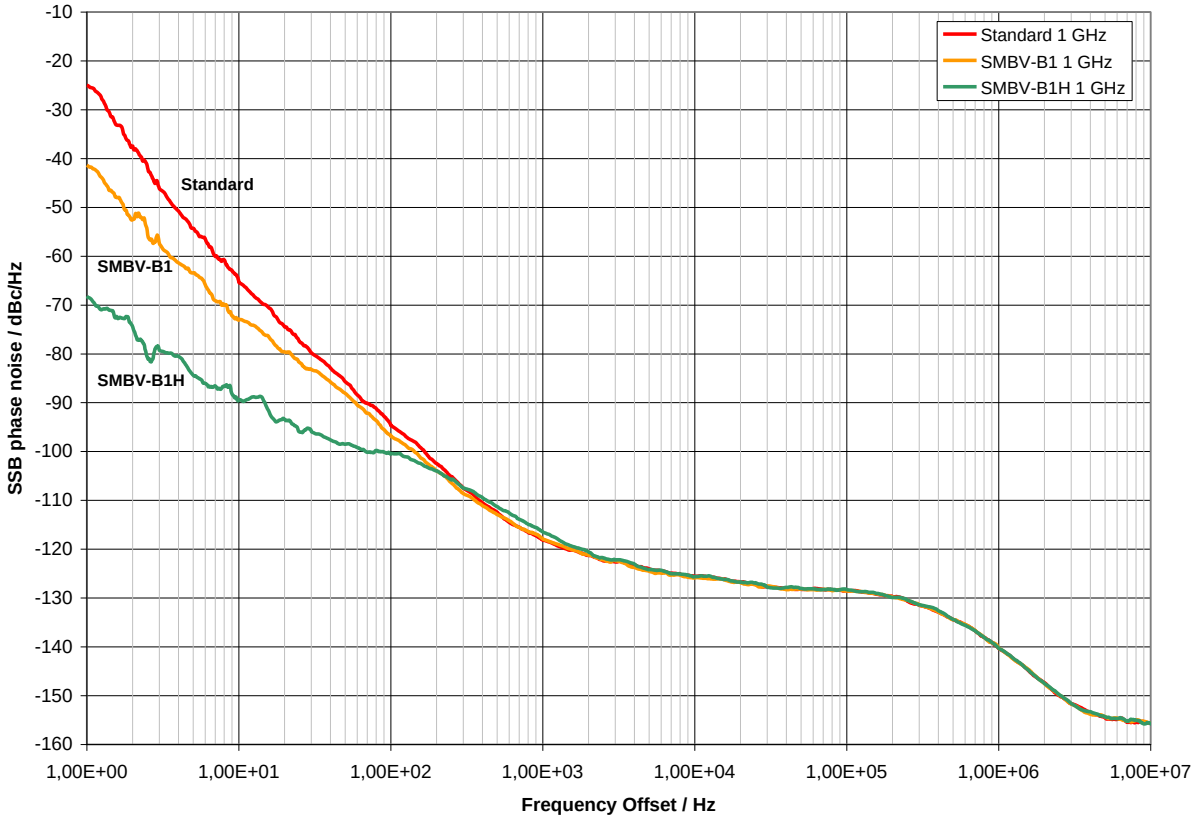



*Harmonics versus carrier frequency at +18 dBm output level (meas.)*

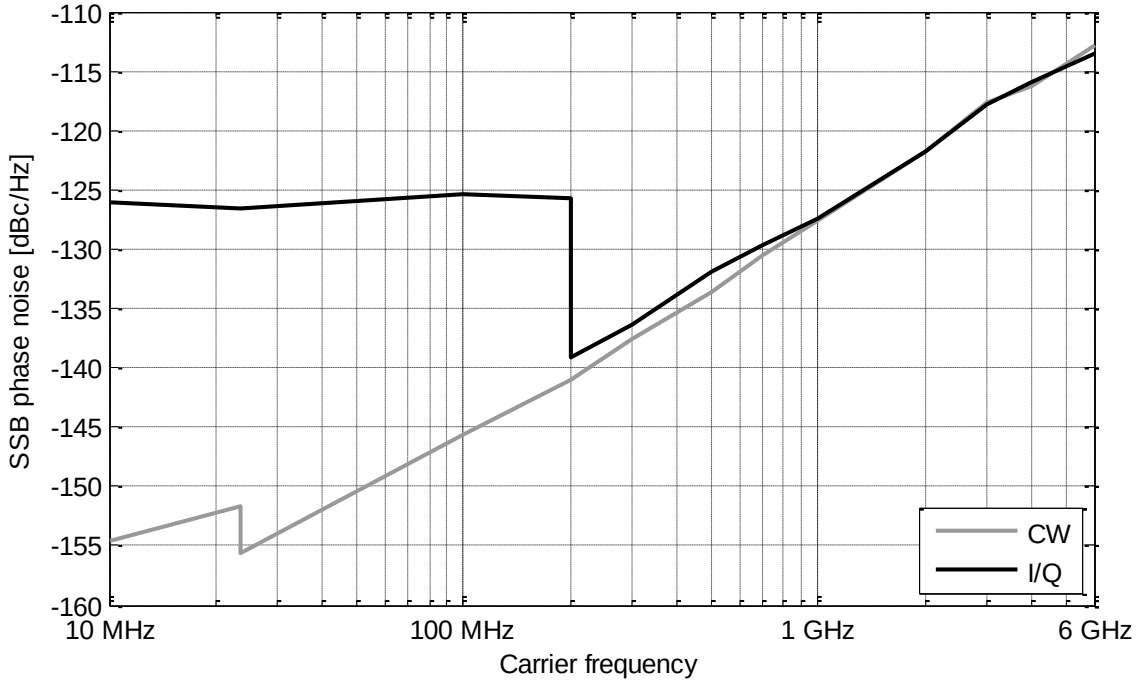
[3] Not valid in I/Q wideband mode.




*SSB phase noise with R&S®SMBV-B1H option (meas.)*




*SSB phase noise comparison with standard internal reference, R&S®SMBV-B1, R&S®SMBV-B1H (meas.)*




*SSB phase noise at 20 kHz offset versus carrier frequency (meas.)*

### List mode

Frequency and level pairs can be stored in a list and set in an extremely short amount of time.

| | | |
|---|---|---|
| Trigger mode | free run | automatic |
| | full sweep | single |
| | execute one step | step |
| Trigger source | | keyboard, external trigger, remote control |
| Max. number of stored settings | | 2000 |
| Dwell time setting range | | 1 ms to 100 s |
| Dwell time setting resolution | | 0.1 ms |
| Setting time | after external trigger | see frequency and level data |

## Phase coherence (R&S®SMBV-B90 option)

The R&S®SMBV-B90 option enables phase-coherent RF outputs of two or more instruments in I/Q mode.

| | | |
|---|---|---|
| Frequency range | R&S®SMBV-B103 | 200 MHz < f ≤ 3.2 GHz |
| | R&S®SMBV-B106 | 200 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 |
| Phase drift over temperature | when changing ambient temperature by +1 °C, f = 1.3 GHz, level = 0 dBm | 0.075° (meas.) |
| Phase drift over time | f = 1.3 GHz, level = 0 dBm | 0.02°/h (meas.) |
| Phase drift over level | attenuator mode fixed, f = 6 GHz | 0.12°/dB (meas.) |

| | | |
|---|---|---|
| Phase setting range | using the baseband phase offset (not available for analog wideband I/Q input) | 0.00° to 359.99° |
| Phase setting resolution | | 0.01° |
| **Input of phase coherence signal** | | |
| Connector type | LO IN on rear panel | SMA female |
| Input impedance | | 50 Ω (nom.) |
| Input level range of external local oscillator signal | | +7 dBm to +13 dBm |
| **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 |

# 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 AM distortion, AM depth error and on/off ratio with pulse modulation.

# Analog modulation

## Amplitude modulation

For f ≥ 100 kHz, level setting mode auto, level (PEP) within specified level range.

| | | |
|---|---|---|
| Modulation source | | internal, external, internal and external |
| External coupling | | AC, DC |
| AM depth setting range | At high levels, modulation is clipped when the maximum PEP is reached. | 0 % to 100 % |
| Resolution of setting | | 0.1 % |
| AM depth (m) error | $f_{mod}$ = 1 kHz and m < 80 % | |
| | f ≤ 23.4375 MHz | < (1 % of setting + 1 %) |
| | f > 23.4375 MHz | < (4 % of setting + 1 %) |
| AM distortion | $f_{mod}$ = 1 kHz, f ≤ 23.4375 MHz | |
| | m = 30 % | < 0.25 % |
| | m = 80 % | < 0.5 % |
| | $f_{mod}$ = 1 kHz, f > 23.4375 MHz | |
| | m = 30 % | < 1.5 % |
| | m = 80 % | < 3 % |
| Modulation frequency response | m = 60 %,<br>DC coupling: 0 Hz to 50 kHz,<br>AC coupling: 10 Hz to 50 kHz | < 3 dB |
| Synchronous φM at AM | m = 30 %, $f_{mod}$ = 1 kHz, ±peak/2 | < 0.2 rad |

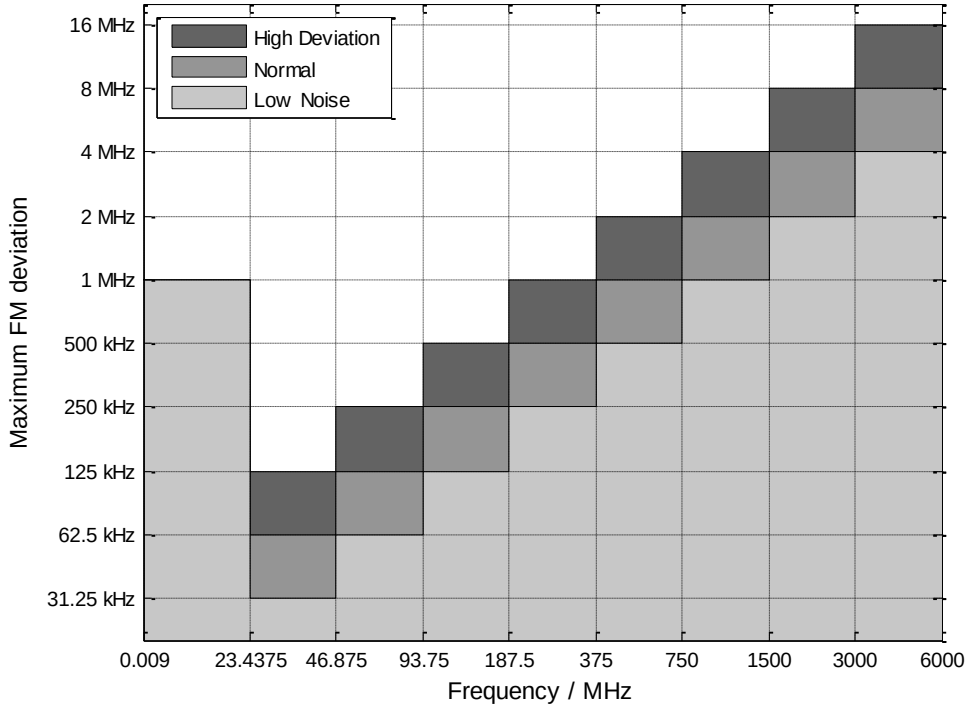
## Frequency bands for frequency and phase modulation

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

| | | |
|---|---|---|
| Multiplier N for different frequency ranges | f ≤ 23.4375 MHz | 1/4 |
| | 23.4375 MHz < f ≤ 46.875 MHz | 1/32 |
| | 46.875 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 |

## Frequency modulation

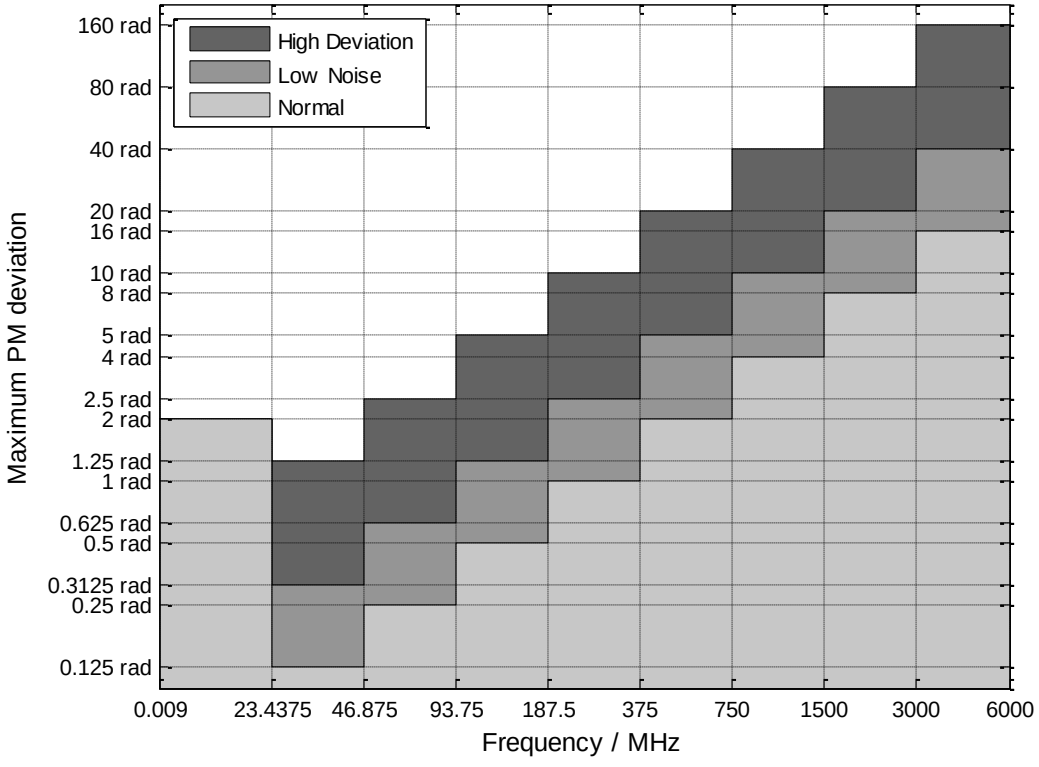
| | | |
|---|---|---|
| Modulation source | | internal, external, internal and external |
| External coupling | | AC, DC |
| Operating modes | | FM mode low noise |
| | | FM mode normal |
| | | FM mode high deviation |
| Maximum deviation | f ≤ 23.4375 MHz | 1 MHz |
| | f > 23.4375 MHz | |
| | FM mode normal | N × 2 MHz |
| | FM mode low noise | N × 1 MHz |
| | FM mode high deviation | N × 4 MHz |
| Resolution | | < 0.02 % of set deviation,<br>min. N × 0.1 Hz |
| FM deviation error | $f_{mod}$ = 1 kHz, deviation ≤ N × 1 MHz | |
| | internal | < (2 % of setting + 20 Hz) |
| | external | < (3 % of setting + 20 Hz) |
| FM distortion | $f_{mod}$ = 2 kHz, deviation = N × 1 MHz | < 0.2 % |
| Modulation frequency response | FM modes low noise and high deviation | |
| | DC coupling: 0 Hz to 100 kHz,<br>AC coupling: 10 Hz to 100 kHz | < 3 dB |
| | FM mode normal | |
| | DC coupling: 0 Hz to 500 kHz,<br>AC coupling: 10 Hz to 500 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 | < 0.2 % of set deviation |




*FM deviation versus frequency and operating mode*

## Phase modulation

| | | |
|---|---|---|
| Modulation source | | internal, external, internal and external |
| External coupling | | AC, DC |
| Operating modes | | φM mode low noise |
| | | φM mode normal |
| | | φM mode high deviation |
| Maximum deviation | f ≤ 23.4375 MHz | 2 rad |
| | f > 23.4375 MHz | |
| | φM mode normal | N × 4 rad |
| | φM mode low noise | N × 10 rad |
| | φM mode high deviation | N × 40 rad |
| Resolution | | <0.02 % of set deviation,<br>min. N × 20 µrad |
| φM deviation error | $f_{mod}$ = 1 kHz, deviation ≤ half of max. deviation | |
| | internal | < (2 % of setting + 0.003 rad) |
| | external | < (3 % of setting + 0.003 rad) |
| φM distortion | $f_{mod}$ = 10 kHz, half of max. deviation | < 0.2 % |
| Modulation frequency response | φM modes low noise and high deviation | |
| | DC coupling: 0 Hz to 100 kHz,<br>AC coupling: 10 Hz to 100 kHz | < 3 dB |
| | φM mode normal | |
| | DC coupling: 0 Hz to 500 kHz,<br>AC coupling: 10 Hz to 500 kHz | < 3 dB |




*φM deviation versus frequency and operating mode*

### Pulse modulation (R&S®SMBV-K22 option)

When pulse modulation is activated, the R&S®SMBV100A automatically switches to the ALC mode S&H. In this case, the ALC loop is opened and the output level is set directly. In order to set the correct level, an S&H measurement is performed prior to each frequency and level setting.

| | | |
|---|---|---|
| Modulation source | | external, internal |
| On/off ratio | | > 80 dB |
| Rise/fall time | 10 % to 90 % of RF amplitude,<br>f > 23.4375 MHz | < 20 ns, < 5 ns (typ.) |
| Pulse repetition frequency | | 0 Hz to 25 MHz |
| Video crosstalk | spectral line of fundamental of 100 kHz pulse repetition frequency | < –25 dBc |

### Input for external analog modulation signals

| | | |
|---|---|---|
| **Modulation input EXT for AM/FM/φM** | | |
| Connector type | MOD EXT on rear panel | BNC female |
| Input impedance | selectable | 220 kΩ or 600 Ω (nom.) |
| Input sensitivity | peak value for set modulation factor or deviation | 1 V (nom.) |
| Maximum input voltage | | 1 V (nom.) |
| Input damage voltage | | ±10 V |
| **Modulation input PULSE EXT** | | |
| Connector type | PULSE EXT on rear panel | BNC female |
| Input impedance | selectable | 10 kΩ or 50 Ω (nom.) |
| Input voltage | TTL, CMOS compatible | |
| | threshold low | 0.5 V (nom.) |
| | threshold high | 1.5 V (nom.) |
| Input damage voltage | | ±5 V |
| Input polarity | selectable | normal, inverse |

## Modulation sources

### Internal modulation generator (LF)

| | | |
|---|---|---|
| Waveform | | sine wave, square wave |
| Frequency range | sine wave | 0.1 Hz to 1 MHz |
| | square wave | 0.1 Hz to 20 kHz |
| Resolution of frequency setting | | 0.1 Hz |
| Frequency error | | < (0.005 Hz + relative error of reference frequency × modulation frequency) |
| Frequency response | sine wave,<br>0.1 Hz to 1 MHz | < 1 dB |
| Frequency settling time | to within < $1 \times 10^{-7}$, after IEC/IEEE bus delimiter | < 5 ms (meas.) |
| Distortion | sine wave,<br>f ≤ 100 kHz at $R_L$ > 200 Ω, $V_p$ = 1 V | < 0.1 % |
| Output voltage range | $V_p$ at LF connector, open circuit voltage | 1 mV to 3 V |
| Resolution of output voltage setting | | 1 mV |
| Output voltage setting error | at 1 kHz, $R_L$ ≥ 10 kΩ | < (1 % of setting + 1 mV) |
| Output impedance | | 10 Ω (nom.) |

### LF frequency sweep

| | | |
|---|---|---|
| Operating mode | | digital sweep in discrete steps |
| Trigger mode | 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 | internal | timer |
| | external | external trigger signal (INST TRIG at rear), rotary knob, remote control |
| Trigger slope | external trigger signal | positive, negative |
| Sweep range | | full frequency range, minimum 0.1 Hz |
| Sweep shape | | triangle, sawtooth |
| Step spacing | | linear, logarithmic |
| Step size setting resolution | linear | 0.1 Hz |
| | logarithmic | 0.01 % |
| Dwell time setting range | | 10 ms to 10 s |
| Dwell time setting resolution | | 0.1 ms |

### Pulse generator (R&S®SMBV-K23 option)

The pulse generator is fully digital; the clock is derived directly from the instrument's reference frequency.

| | | |
|---|---|---|
| Pulse mode | | single pulse, double pulse |
| Trigger mode | free run, internally triggered | automatic |
| | | externally triggered |
| | | externally gated |
| Active trigger edge | | positive or negative |
| Pulse period setting range | | 40 ns to 85 s |
| Pulse period setting resolution | | 10 ns |
| Pulse width setting range | pulse widths of double pulses can be set independently | 10 ns to 1 s |
| Pulse width setting resolution | pulse widths of double pulses can be set independently | 10 ns |
| Pulse delay setting range | with external trigger | 10 ns to 1 s |
| Pulse delay setting resolution | with external trigger | 10 ns |
| Double-pulse spacing setting range | | 20 ns to 1 s |
| Double-pulse spacing setting resolution | | 10 ns |
| External trigger delay | | 50 ns (meas.) |
| External trigger jitter of delay | | < 10 ns |
| PULSE/VIDEO output signal | without load | digital signal 0 V/3.3 V (nom.) |

# I/Q modulation

### I/Q modulator

| | | |
|---|---|---|
| Operating modes | | external I/Q, internal I/Q |
| RF frequency response | up to ±264 MHz at 3432 MHz, 3960 MHz and 4488 MHz, I/Q mode wideband | < 10 dB |
| | up to ±60 MHz | < 6 dB |
| | up to ±10 MHz | < 2 dB |
| | up to ±5 MHz | < 1 dB |
| Carrier leakage | without input signal, referenced to full-scale input [4] | < –50 dBc, < –65 dBc (typ.) |
| Suppression of image sideband (external I/Q) | up to ±10 MHz | 60 dB (meas.) |
| | up to ±60 MHz | 48 dB (meas.) |
| Suppression of image sideband (internal I/Q) | up to ±10 MHz | 70 dB (meas.) |
| | up to ±80 MHz | 60 dB (meas.) |
| External I/Q inputs | input impedance | 50 Ω (nom.) |
| | VSWR up to 60 MHz | < 1.2 |
| | nominal input voltage for full-scale input | $\sqrt{V_i^2 + V_q^2} = 0.5\ V$ |

[4] Value applies after internal readjustment.

| | | |
|---|---|---|
| Error vector | measured with 16QAM, filter root cosine α = 0.5, symbol rate 10 kHz RMS value | |
| | f ≤ 200 MHz | < 0.6 % |
| | f > 200 MHz | < (0.4 % + 0.2 % × f [in GHz]) |
| | peak value | |
| | f ≤ 200 MHz | < 1.2 % |
| | f > 200 MHz | < (0.8 % + 0.4 % × f [in GHz]) |
| 3GPP FDD digital standard, adjacent channel leakage ratio (ACLR) | test model 1, 64 DPCHs, level ≤ 13 dBm PEP, frequency 1800 MHz to 2200 MHz | |
| | offset 5 MHz | > 65 dB, 69 dB (typ.) |
| | offset 10 MHz | > 67 dB, 70.5 dB (typ.) |
| I/Q impairments | I offset, Q offset | |
| | setting range | –10 % to +10 % |
| | resolution | 0.05 % |
| | gain imbalance | |
| | setting range | –1 dB to +1 dB |
| | resolution | 0.01 dB |
| | quadrature offset | |
| | setting range | –8° to +8° |
| | resolution | 0.05° |

## I/Q inputs

| | | |
|---|---|---|
| Connector types | I, Q on front panel | BNC female |
| Input impedance | | 50 Ω (nom.) |
| VSWR | up to 60 MHz | < 1.2 |
| Nominal input voltage for full-scale input | | $\sqrt{V_i^2 + V_q^2} = 0.5\ V$ |
| Input damage voltage | | ±5 V |

## Internal baseband I/Q (with R&S®SMBV-B10/-B10F/-B51 option)

These values apply to all digital modulations including arbitrary waveform mode and custom digital modulation.
R&S®SMBV-B10/-B10F requires the R&S®SMBV-B92 option (hard disk).

| | | |
|---|---|---|
| D/A converter | resolution | 16 bit |
| Aliasing filter | with amplitude, group-delay and Si correction | |
| | bandwidth (drop to –0.1 dB) | 80 MHz (nom.) |
| | D/A converter interpolation spectra | |
| | up to 10 MHz | < –80 dBc |
| | up to 80 MHz | < –60 dBc |
| I/Q impairments | I offset, Q offset | |
| | setting range | –10 % to +10 % |
| | resolution | 0.01 % |
| | gain imbalance | |
| | setting range | –1 dB to +1 dB |
| | resolution | 0.001 dB |
| | quadrature offset | |
| | setting range | –10° to +10° |
| | resolution | 0.01° |

## I/Q outputs (with R&S®SMBV-B10/-B10F/-B51 option)

R&S®SMBV-B10/-B10F requires the R&S®SMBV-B92 option (hard disk).

| | | |
|---|---|---|
| Output impedance | single-ended | 50 Ω (nom.) |
| | differential | 100 Ω (nom.) |
| Output voltage | EMF (output voltage depends on set modulation signal) | |
| | single-ended | |
| | setting range | 20 mV to 1.50 V ($V_p$) |
| | resolution | 1 mV |
| | differential | |
| | setting range | 40 mV to 3.00 V ($V_p$) |
| | resolution | 1 mV |
| Bias voltage | EMF | |
| | single-ended and differential | |
| | setting range | –3.6 V to +3.6 V |
| | resolution | 2 mV |
| | uncertainty | 1 % + 4 mV |
| Offset voltage | EMF | |
| | differential | |
| | setting range | –300 mV to +300 mV |
| | resolution | 0.1 mV |
| | uncertainty | 1 % + 0.1 % × bias voltage + 1 mV |
| Frequency response | at $R_L$ = 50 Ω (referenced to 1 MHz) | |
| | magnitude | |
| | up to 10 MHz | < 0.15 dB |
| | up to 30 MHz (R&S®SMBV-B51) | < 0.3 dB |
| | up to 60 MHz (R&S®SMBV-B10/ -B10F/-B51 with R&S®SMBV-K521) | < 0.3 dB |
| | up to 80 MHz (R&S®SMBV-K522) | < 0.3 dB |
| | nonlinear phase | |
| | up to 10 MHz | 200 ps (meas.) |
| | up to 30 MHz (R&S®SMBV-B51) | 500 ps (meas.) |
| | up to 60 MHz (R&S®SMBV-B10/ -B10F/-B51 with R&S®SMBV–K521) | 500 ps (meas.) |
| | up to 80 MHz (R&S®SMBV-K522) | 500 ps (meas.) |
| I/Q imbalance [5] | at $R_L$ = 50 Ω | |
| | magnitude | |
| | up to 10 MHz | < 0.05 dB |
| | up to 30 MHz (R&S®SMBV-B51) | < 0.15 dB |
| | up to 60 MHz (R&S®SMBV-B10/ -B10F/-B51 with R&S®SMBV–K521) | < 0.15 dB |
| | up to 80 MHz (R&S®SMBV-K522) | < 0.15 dB |
| | nonlinear phase | |
| | up to 10 MHz | 100 ps (meas.) |
| | up to 30 MHz (R&S®SMBV-B51) | 300 ps (meas.) |
| | up to 80 MHz (R&S®SMBV-B10/ -B10F/-B51 with R&S®SMBV-K521) | 300 ps (meas.) |
| | up to 80 MHz (R&S®SMBV-K522) | 300 ps (meas.) |
| Spectral purity | SFDR (sine) | |
| | up to 2 MHz | > 70 dB, 74 dB (typ.) |
| | up to 20 MHz | > 60 dB, 68 dB (typ.) |
| | phase noise | |
| | 10 MHz sine wave at 20 kHz offset | –135 dBc (meas.) |
| | wideband noise | |
| | 10 MHz sine wave at 1 MHz offset | < –153 dBc, –162 dBc (typ.) |

[5] "Optimize internal I/Q impairments for RF output" mode is switched off.

## I/Q baseband generator (R&S®SMBV-B10/-B10F/-B51 option) – arbitrary waveform mode

| | | |
|---|---|---|
| Waveform length | without R&S®SMBV-K511 [6] | 1 sample to 32 Msample<br>in one-sample steps |
| | with R&S®SMBV-K511 [6] | 1 sample to 256 Msample<br>in one-sample steps |
| | with R&S®SMBV-K511 and<br>R&S®SMBV-K512 [6] | 1 sample to 1 Gsample<br>in one-sample steps |
| Nonvolatile memory | with R&S®SMBV-B92 | hard disk, 80 Gbyte |
| Waveform loading time | 1 Msample | 10 s (meas.) |
| Sample rate | R&S®SMBV-B51 | 400 Hz to 90 MHz |
| | R&S®SMBV-B10/-B10F or<br>R&S®SMBV-B51 with R&S®SMBV-K521 | 400 Hz to 195 MHz |
| | R&S®SMBV-K522 | 400 Hz to 200 MHz |
| Sample resolution | equivalent to D/A converter | 16 bit |
| Sample clock source | | internal, external |
| Sample frequency error | internal clock | < (5 × $10^{-14}$ + reference frequency error)<br>× sample rate (nom.) |
| Bandwidth (RF) using the maximum sample rate | R&S®SMBV-B51 | 60 MHz (nom.) |
| | R&S®SMBV-B10/-B10F or<br>R&S®SMBV-B51 with R&S®SMBV-K521 | 120 MHz (nom.) |
| | R&S®SMBV-K522 | 160 MHz (nom.) |
| Bandwidth (RF) using a reduced sample rate (drop to –0.1 dB) | The waveform is automatically interpolated to the internal sample rate of 200 MHz. | |
| | R&S®SMBV-B10/-B10F | 0.62 × sample rate (nom.) |
| | R&S®SMBV-B51 | 0.66 × sample rate (nom.) |
| Frequency offset setting range | R&S®SMBV-B51 | –30 MHz to 30 MHz |
| | R&S®SMBV-B10/-B10F or<br>R&S®SMBV-B51 with R&S®SMBV-K521 | –60 MHz to 60 MHz |
| | R&S®SMBV-K522 | –80 MHz to 80 MHz |
| Frequency offset resolution | | 0.01 Hz |
| Frequency offset error | | < (5 × $10^{-10}$ + reference frequency error)<br>× frequency offset (nom.) |
| Triggering | source | internal, external |
| | operating modes | auto, retrig, armed auto, armed retrig, single, next |
| | external trigger delay (in sample) | |
| | setting range | 0 to ($2^{16}$ – 1) |
| | resolution | 0.01 |
| | jitter | ±3.3 ns (nom.) |
| | external trigger inhibit (in sample) | |
| | setting range | 0 to ($2^{26}$ – 1) |
| | resolution | 1 |
| | external trigger pulse width | > 20 ns (nom.) |
| Marker outputs | number | 2 |
| | level | LVTTL |
| | operating modes | unchanged, restart, pulse, pattern, ratio, trigger |
| | marker delay (in sample) | |
| | setting range | 0 to (waveform length – 1) |
| | setting range without recalculation | 0 to 2000 |
| | resolution of setting | 1 |

[6] R&S®SMBV-K511 requires the R&S®SMBV-B92 option (hard disk).

# Multisegment and multicarrier arbitrary waveform mode

| | | |
|---|---|---|
| Multisegment waveform | number of segments | max. 100 segments |
| | changeover modes | GUI, remote control, external trigger |
| | extended trigger modes | same segment, next segment,<br>next segment seamless, sequencer |
| | changeover time at 50 MHz clock rate (external trigger, without clock change) | 5 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. 65535 |
| Multicarrier waveform | number of carriers | max. 512 |
| | carrier spacing | |
| | setting range | depends on number of carriers and bandwidth (RF) |
| | 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 |
| | resolution | 0.01 dB |
| | single carrier start phase | |
| | setting range | 0° to 360° |
| | resolution | 0.01° |
| | single carrier delay | |
| | setting range | 0 s to 1 s |
| | resolution | 1 ns |

Operation with R&S®WinIQSIM2™:
The software supports download of I/Q data and control of the R&S®SMBV-B10/-B10F/-B51.

## I/Q baseband generator (R&S®SMBV-B10/-B10F option) – custom digital modulation

| | | |
|---|---|---|
| Types of modulation | ASK | |
| | modulation index | 0 % to 100 % |
| | resolution | 0.1 % |
| | FSK | 2FSK, 4FSK, MSK |
| | deviation | up to 15 × $f_{sym}$ |
| | maximum | 50 MHz |
| | minimum | 1 Hz |
| | resolution | 0.1 Hz |
| | variable FSK | 4FSK, 8FSK, 16FSK |
| | deviations | –15 × $f_{sym}$ to +15 × $f_{sym}$ |
| | maximum | 50 MHz |
| | minimum | 1 Hz |
| | resolution | 0.1 Hz |
| | PSK | BPSK, QPSK,<br>QPSK 45° offset, OQPSK,<br>π/4-QPSK, π/2-DBPSK,<br>π/4-DQPSK, π/8-D8PSK,<br>8PSK, 8PSK EDGE |
| | QAM | 16QAM, 32QAM, 64QAM, 256QAM, 1024QAM |
| | APSK | 16APSK, 32APSK |
| | gamma/gamma1 16APSK | 3.15 (DVB-S2 2/3), 2.85 (DVB-S2 3/4), 2.75 (DVB-S2 4/5), 2.70 (DVB-S2 5/6), 2.60 (DVB-S2 8/9), 2.57 (DVB-S2 9/10) |
| | gamma/gamma1 32APSK | 2.84 (DVB-S2 3/4), 2.72 (DVB-S2 4/5), 2.64 (DVB-S2 5/6), 2.54 (DVB-S2 8/9), 2.53 (DVB-S2 9/10) |
| Coding | Not all coding methods can be used with every type of modulation. | off, differential, differential phase, differential and Gray, Gray, GSM, NADC, PDC, PHS, TETRA, APCO25 (PSK), PWT, TFTS, INMARSAT, VDL, EDGE, APCO25(FSK), ICO, CDMA2000®, WCDMA |

| | | |
|---|---|---|
| Baseband filter | Any filter can be used with any type of modulation. The maximum bandwidth of the modulation signal is 45 MHz. | |
| | cosine, root cosine | |
| | filter parameter α | 0.05 to 1.00 |
| | Gaussian | |
| | filter parameter B × T | 0.15 to 2.50 |
| | cdmaOne, cdmaOne + equalizer | |
| | cdmaOne 705 kHz | |
| | cdmaOne 705 kHz + equalizer | |
| | CDMA2000® 3x | |
| | APCO25 C4FM | |
| | rectangular | |
| | split phase | |
| | filter parameter B × T | 0.15 to 2.5 |
| | resolution of filter parameter | 0.01 |
| Symbol rate | If an external clock is used, the applied data rate may deviate from the set clock rate by ±2 %. | |
| | clock source | internal, external |
| | setting range | |
| | ASK, PSK, APSK and QAM | 50 Hz to 60 MHz |
| | FSK | 50 Hz to 50 MHz |
| | resolution | 0.001 Hz |
| | frequency error (internal) | < (5 × $10^{-14}$ + reference frequency error) × symbol rate (nom.) |
| | external clock modes | symbol, K × symbol |
| | clock divider K | 1 to 64 |
| | external clock rate | max. 195 MHz |
| | with R&S®SMBV-K522 | max. 200 MHz |
| Frequency offset | With the aid of the frequency offset, the center frequency of the modulation signal in the baseband can be shifted. The restrictions caused by the modulation bandwidth apply. | |
| | setting range | –60 MHz to 60 MHz |
| | with R&S®SMBV-K522 | –80 MHz to 80 MHz |
| | resolution | 0.01 Hz |
| | frequency error | < (5 × $10^{-10}$ + reference frequency error) × frequency offset (nom.) |
| Data sources | All 0, All 1 | |
| | PRBS | |
| | sequence length | 9, 11, 15, 16, 20, 21, 23 |
| | pattern | |
| | length | 1 bit to 64 bit |
| | data lists | |
| | output memory | 8 bit to 2 Gbit |
| | nonvolatile memory | hard disk (with R&S®SMBV-B92 option) |
| Triggering | A trigger event restarts I/Q generation. The I/Q signal is then synchronous with the trigger (with a specific timing jitter). | |
| | source | internal, external |
| | operating modes | auto, retrig, armed auto, armed retrig, single, next |
| | external trigger delay (in symbol) | |
| | setting range | 0 to ($2^{16}$ – 1) |
| | resolution | 0.01 |
| | jitter | ±3.3 ns (nom.) |
| | external trigger inhibit (in symbol) | |
| | setting range | 0 to ($2^{26}$ – 1) |
| | resolution | 1 |
| | external trigger pulse width | > 20 ns (nom.) |
| Marker outputs | number | 2 |
| | level | LVTTL |
| | operating modes | control list, pulse, pattern, ratio, trigger |
| | marker delay (in symbol) | |
| | setting range | 0 to $2^{24}$ – 1 |
| | setting range without recalculation | 0 to 2000 |
| | resolution of setting | 1 |

| | | |
|---|---|---|
| Level reduction | internal, using Control List:<br>The signal switches between nominal and reduced level (without edge shaping). | |
| | setting range | 0 dB to +60 dB |
| | additional level error in case of reduction | |
| | up to 30 dB | < 1 dB |
| | up to 50 dB | < 3 dB |
| Burst | internal, using Control List:<br>The signal triggers the beginning of a power ramp. The positive edge starts power ramping from blank to full level, the negative edge ramping in the opposite direction from full level to blanking. | |
| | operating range | |
| | rise/fall time | |
| | setting range | 0.5 symbol to 8 symbol |
| | resolution | ¼ symbol |
| | ramp shape | cosine, linear |
| Trigger/clock inputs | The input impedance can be set separately for the trigger and the clock inputs. | |
| | input impedance | 1 kΩ, 50 Ω (nom.) |
| | trigger/clock threshold | |
| | setting range | 0.00 V to 2.00 V |
| | resolution | 0.01 V |
| Clock output | level | LVTTL |
| Predefined settings | modulation, filter, symbol rate and coding in line with standard | |
| | standards | Bluetooth®, DECT, ETC, GSM, GSM/EDGE, NADC, PDC, PHS, TETRA, WCDMA 3GPP, TD-SCDMA, CDMA2000® Forward, CDMA2000® Reverse, Worldspace, TFTS |

## Modulation performance for custom digital modulation

| | | |
|---|---|---|
| Deviation error with 2FSK, 4FSK | deviation 0.2 to 0.7 × symbol rate,<br>Gaussian filter with B × T = 0.2 to 0.7 | |
| | 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 | |
| | 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 | |
| | symbol rate up to 5 MHz | 0.5 % (meas.) |
| | symbol rate up to 20 MHz | 2.0 % (meas.) |

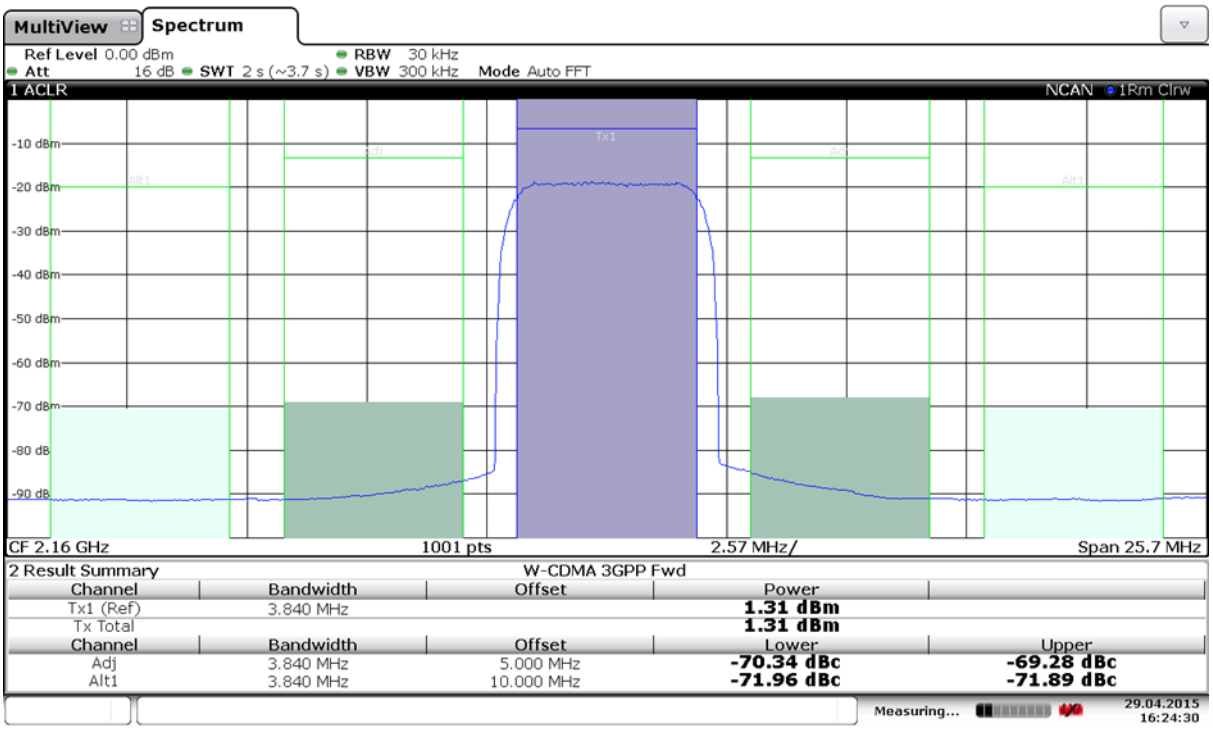
# Modulation performance for main digital standards

Measured values except otherwise stated.

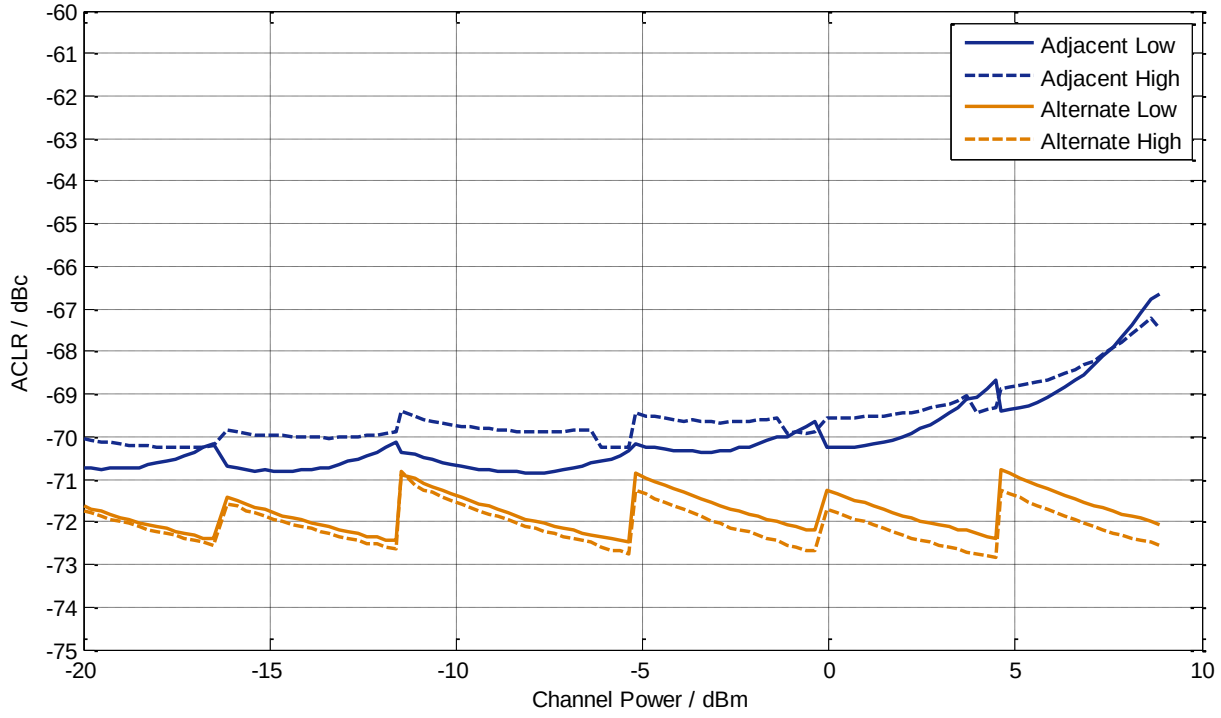
| Standard | GSM | EDGE | WCDMA 3GPP | | CDMA2000® | IEEE 802.11a/g | IEEE 802.11ac | WiMAX™ | LTE |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1DPCH | TM1-64 | | | | BW = 10 MHz | |
| Frequency | 400 MHz to 2000 MHz | 400 MHz to 2000 MHz | 1800 MHz to 2200 MHz | 1800 MHz to 2200 MHz | 800 MHz | 2400 MHz to 2485 MHz; 5150 MHz to 5825 MHz | 2400 MHz to 2485 MHz; 5150 MHz to 5825 MHz | 5000 MHz | 1800 MHz to 2200 MHz |
| EVM | – | 0.25 % (typ.) | 0.4 % (typ.) | 0.4 % | 0.4 % | 0.6 % | 0.44 % | 0.4 % | 0.4 % |
| Phase error | 0.15° | – | – | – | – | – | – | – | – |
| **Adjacent channel power ratio (ACPR) in dB** | | | | | | | | | |
| Channel spacing | 200 kHz | 200 kHz | 5 MHz | 5 MHz | 30 kHz | 20 MHz | 160 MHz | – | – |
| In adjacent channel | –38 | –38 | –69 | –67 (typ.) | –79 at 0.75 MHz | –42 | –50 | – | – |
| In alternate channel | –70 | –70 | –74 | –71 (typ.) | –91 at 1.98 MHz | –55 | –56 | – | – |
| In 2ndalternate channel | –78 | –78 | – | – | – | –56 | –56 | – | – |

# Modulation performance for GSM/EDGE and 3GPP FDD digital standards

| | | |
|---|---|---|
| **GSM/EDGE** | with R&S®SMBV-K40 option,<br>level ≤ 13 dBm PEP,<br>frequency range from 400 MHz to 2000 MHz | |
| Burst on/off ratio | | 100 dB (meas.) |
| Phase error | MSK, Gaussian filter B × T = 0.3 | |
| | RMS | < 0.4°, 0.15° (typ.) |
| | peak | 0.4° (meas.) |
| Error vector magnitude | 8PSK EDGE, Gaussian linearized filter, RMS | < 0.5 %, 0.25 % (typ.) |
| Power density spectrum | values measured with 30 kHz resolution bandwidth, referenced to level in band center without power ramping | |
| | 200 kHz offset | < –34 dB, –38 dB (typ.) |
| | 400 kHz offset | < –66 dB, –70 dB (typ.) |
| | 600 kHz offset | < –74 dB, –78 dB (typ.) |
| **3GPP FDD** | with R&S®SMBV-K42 option,<br>level ≤ 13 dBm PEP,<br>frequency range from 1800 MHz to 2200 MHz | |
| Error vector magnitude | 1 DPCH, RMS | < 0.8 %, 0.4 % (typ.) |
| Adjacent channel leakage ratio (ACLR) | test model 1, 64 DPCHs | |
| | offset 5 MHz | > 65 dB, 67 dB (typ.) |
| | offset 10 MHz | > 67 dB, 71 dB (typ.) |



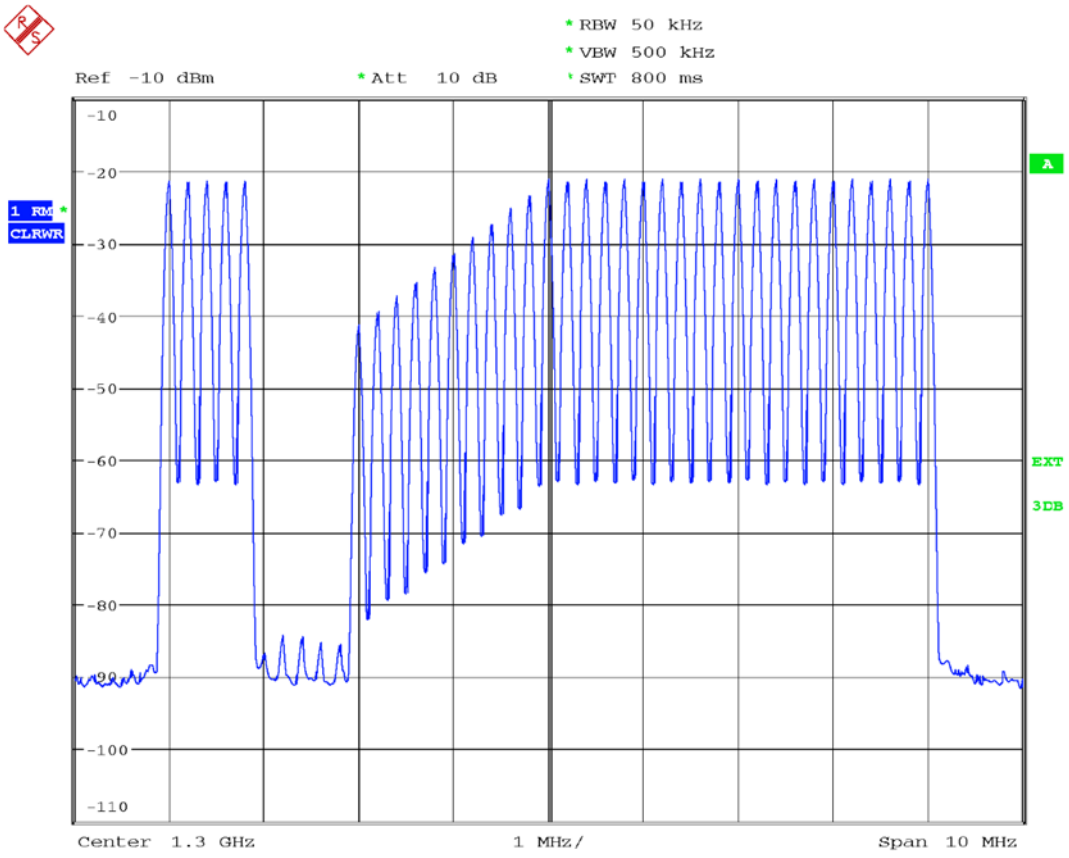

*Digital standard 3GPP FDD test model 1, 64 DPCHs ACLR (meas.)*




*Digital standard 3GPP FDD test model 1, 64 DPCHs, ACLR as a function of carrier level at 2 GHz (meas.)*

# Modulation performance for multicarrier CW

| **Multicarrier CW** | with R&S®SMBV-K61 option | |
|---|---|---|
| RF frequency response | up to 10 MHz | 0.7 dB (meas.) |
| | up to 80 MHz | 2.0 dB (meas.) |
| Suppression of unwanted carriers | up to 10 MHz | 50 dB (meas.) |
| | up to 80 MHz | 40 dB (meas.) |




*Example of multicarrier CW, with different carrier powers and some carriers switched off in the left half of the spectrum, I/Q level 0.5 V (meas.)*

# Internal digital standards (for R&S®SMBV-B10/-B10F)

The options are described in the Digital Standards data sheet (PD 5213.9434.22) and in the GNSS data sheet (PD 5214.5284.22).

| Standard | Option |
|---|---|
| GSM/EDGE | R&S®SMBV-K40 |
| EDGE Evolution | R&S®SMBV-K41 |
| 3GPP FDD | R&S®SMBV-K42 |
| 3GPP FDD enhanced BS/MS test including HSDPA | R&S®SMBV-K43 |
| GPS | R&S®SMBV-K44 |
| 3GPP FDD enhanced BS/MS test including HSUPA | R&S®SMBV-K45 |
| CDMA2000® | R&S®SMBV-K46 |
| 1xEV-DO | R&S®SMBV-K47 |
| IEEE 802.11a/b/g | R&S®SMBV-K48 |
| IEEE 802.16 WiMAX™ including IEEE 802.16e | R&S®SMBV-K49 |
| TD-SCDMA (3GPP TDD LCR) | R&S®SMBV-K50 |
| TD-SCDMA (3GPP TDD LCR) enhanced BS/MS test including HSDPA | R&S®SMBV-K51 |
| DVB-H/DVB-T | R&S®SMBV-K52 |
| DAB/T-DMB | R&S®SMBV-K53 |
| IEEE 802.11a/b/g/n/j/p | R&S®SMBV-K54 |
| EUTRA/LTE | R&S®SMBV-K55 |
| XM Radio™ | R&S®SMBV-K56 |
| FM stereo/RDS | R&S®SMBV-K57 |
| SIRIUS radio | R&S®SMBV-K58 |
| 3GPP FDD HSPA+ | R&S®SMBV-K59 |
| Bluetooth® EDR | R&S®SMBV-K60 |
| Multicarrier CW signal generation | R&S®SMBV-K61 |
| Assisted GPS | R&S®SMBV-K65 |
| Galileo | R&S®SMBV-K66 |
| Assisted Galileo | R&S®SMBV-K67 |
| TETRA release 2 | R&S®SMBV-K68 |
| EUTRA/LTE release 9 | R&S®SMBV-K84 |
| EUTRA/LTE release 10 | R&S®SMBV-K85 |
| IEEE 802.11 ac | R&S®SMBV-K86 |
| 1xEV-DO Rev. B | R&S®SMBV-K87 |
| NFC A/B/F | R&S®SMBV-K89 |
| GNSS extension to 12 satellites | R&S®SMBV-K91 |
| GNSS enhanced (e.g. moving scenarios, multipath) | R&S®SMBV-K92 |
| GPS P-Code | R&S®SMBV-K93 |
| GLONASS | R&S®SMBV-K94 |
| Assisted GLONASS | R&S®SMBV-K95 |
| GNSS extension to 24 satellites | R&S®SMBV-K96 |
| GNSS extension: obscuration and automatic multipath | R&S®SMBV-K101 |
| GNSS extension for antenna pattern | R&S®SMBV-K102 |
| GNSS extension for spinning and attitude simulation | R&S®SMBV-K103 |
| Quasi-zenith satellite system (QZSS) | R&S®SMBV-K105 |
| BeiDou | R&S®SMBV-K107 |
| SBAS | R&S®SMBV-K110 |
| Ground-based augmentation system (GBAS) | R&S®SMBV-K111 |
| LTE Release 11 and enhanced features | R&S®SMBV-K112 |
| LTE Release 12 | R&S®SMBV-K113 |
| DVB-S2/DVB-S2X | R&S®SMBV-K116 |
| Bluetooth® 5.0 | R&S®SMBV-K117 |
| EUTRA/LTE Release 13/14 | R&S®SMBV-K119 |
| LORA | R&S®SMBV-K131 |
| IEEE 802.11ax digital standard | R&S®SMBV-K142 |
| ILS | R&S®SMBV-K151 |
| VOR | R&S®SMBV-K152 |
| DME | R&S®SMBV-K153 |

# Digital system with external PC software (for R&S®SMBV-B10/-B10F/-B51)

The options are described in the Digital Standards data sheet (PD 3607.1388.22).

| Standard | Option |
|---|---|
| Pulse sequencing | R&S®SMBV-K300 |
| Enhanced pulse sequencing | R&S®SMBV-K301 |
| Direction finding | R&S®SMBV-K308 |
| DFS signal generation | R&S®SMBV-K350 |

The R&S®SMBV-K352 option is described in the HD Radio data sheet (PD 5214.2591.22).

The R&S®SMBV-K353 option is described in the DAB+ streams data sheet (PD 3606.6470.22).

The R&S®SMBV-K354 option is described in the DAB streams data sheet (PD 3606.6486.22).

| Standard | Option |
|---|---|
| Playback of XM Radio™ waveforms [7] | R&S®SMBV-K256 |
| Playback of HD Radio™ waveforms [8] | R&S®SMBV-K352 |
| DAB+ streams | R&S®SMBV-K353 |
| DAB streams | R&S®SMBV-K354 |

# Digital standards with R&S®WinIQSIM2™ (for R&S®SMBV-B10/-B10F/-B51 ARB)

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

| Standard | Option |
|---|---|
| GSM/EDGE | R&S®SMBV-K240 |
| EDGE Evolution | R&S®SMBV-K241 |
| 3GPP FDD | R&S®SMBV-K242 |
| 3GPP FDD enhanced BS/MS test including HSDPA | R&S®SMBV-K243 |
| GPS | R&S®SMBV-K244 |
| 3GPP FDD enhanced BS/MS test including HSUPA | R&S®SMBV-K245 |
| CDMA2000® | R&S®SMBV-K246 |
| 1xEV-DO | R&S®SMBV-K247 |
| IEEE 802.11a/b/g | R&S®SMBV-K248 |
| IEEE 802.16 WiMAX™ standard including IEEE 802.16e | R&S®SMBV-K249 |
| TD-SCDMA (3GPP TDD LCR) | R&S®SMBV-K250 |
| TD-SCDMA (3GPP TDD LCR) enhanced BS/MS test including HSDPA | R&S®SMBV-K251 |
| DVB-H/DVB-T | R&S®SMBV-K252 |
| DAB/T-DMB | R&S®SMBV-K253 |
| IEEE 802.11a/b/g/n/j/p | R&S®SMBV-K254 |
| EUTRA/LTE | R&S®SMBV-K255 |
| 3GPP FDD HSPA+ | R&S®SMBV-K259 |
| Bluetooth® EDR | R&S®SMBV-K260 |
| Multicarrier CW signal generation | R&S®SMBV-K261 |
| Additive white Gaussian noise (AWGN) | R&S®SMBV-K262 |
| Galileo | R&S®SMBV-K266 |
| TETRA release 2 | R&S®SMBV-K268 |
| EUTRA/LTE Release 9 | R&S®SMBV-K284 |
| EUTRA/LTE Release 10 | R&S®SMBV-K285 |
| IEEE 802.11 ac | R&S®SMBV-K286 |
| 1xEV-DO Rev. B | R&S®SMBV-K287 |
| NFC A/B/F | R&S®SMBV-K289 |
| GLONASS | R&S®SMBV-K294 |
| BeiDou | R&S®SMBV-K407 |
| LTE Release 11 and enhanced features | R&S®SMBV-K412 |
| LTE Release 12 | R&S®SMBV-K413 |
| OFDM signal generation | R&S®SMBV-K414 |
| Cellular IoT Release 13 | R&S®SMBV-K415 |
| DVB-S2/DVB-S2X | R&S®SMBV-K416 |
| Bluetooth® 5.1 | R&S®SMBV-K417 |

[7] Signal generation requires waveforms from XM Radio.

[8] HD Radio™ is a proprietary trademark of iBiquity Digital Corp., requires license from iBiquity Digital Corp.

| | |
|---|---|
| VERIZON 5GTF | R&S®SMBV-K418 |
| EUTRA/LTE Release 13/14/15 | R&S®SMBV-K419 |
| LORA | R&S®SMBV-K431 |
| IEEE 802.11ax digital standard | R&S®SMBV-K442 |
| Cellular IoT Release 14 | R&S®SMBV-K443 |
| 5G-NR Release 15 | R&S®SMBV-K444 |
| Cellular IoT Release 15 | R&S®SMBV-K446 |

# Digital baseband input/output (R&S®SMBV-K18 option)

The R&S®SMBV-K18 makes digital I/Q signals available on the rear panel of the instrument if set to output mode. External digital I/Q signals can be fed in to the baseband section at the same connector if set to input mode. The digital I/Q input/output can be used for the lossless connection of the R&S®SMBV100A to the digital I/Q input/output of other Rohde & Schwarz instruments (e.g. R&S®AMU200A baseband signal generator and fading simulator). One R&S®SMBV-K18 can be installed.

## Output parameters

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

## Input parameters

| | | |
|---|---|---|
| Input level | peak level | |
| | setting range | –60 dB to +3 dB referenced to full scale |
| | resolution | 0.01 dB |
| | crest factor | |
| | setting range | 0 dB to +30 dB |
| | resolution | 0.01 dB |
| | The adjust level function automatically determines the peak level and crest factor of the input signal. | |
| Frequency offset | With the aid of the frequency offset, the center frequency of the input signal can be shifted in the baseband. The restrictions caused by the modulation bandwidth apply. | |
| | setting range | –60 MHz to +60 MHz |
| | resolution | 0.01 Hz |
| | frequency accuracy | < 5 × 10 – 10 × frequency offset + reference frequency error |
| I/Q swap | I and Q signals swapped | on/off |
| Interface | standard | in line with Rohde & Schwarz TVR290, I/Q data and control signals, data and interface clock |
| | level | LVDS |
| | connector | 26-pin MDR |
| | data rate | 66 MHz to 100 MHz |

| | | |
|---|---|---|
| I/Q sample rate | With source “user-defined”, the sample rate must be entered via the parameter “sample rate”, no I/Q data clock being necessary. With source “digital I/Q in”, the sample rate will be estimated on the basis of the applied I/Q data clock. | |
| | source | user-defined, digital I/Q in |
| | sample rate | 400 Hz to 100 MHz,<br>max. sample rate depending on interface data rate |
| | resolution (user-defined) | 0.001 Hz |
| | frequency uncertainty (user-defined) | $< 5 \times 10^{-14}$ |
| I/Q data | resolution | 18 bit |
| | logic format | two’s complement |
| | bandwidth | |
| | sample rate = 100 MHz<br>(no interpolation, user-defined) | 60 MHz |
| | sample rate < 100 MHz (interpolation) | 0.31 × sample rate |
| Control signals | markers | 4 |
| | data valid | valid samples marked in data stream |

## Internal additive white Gaussian noise (AWGN, R&S®SMBV-K62 option)

As prerequisite, R&S®SMBV-B10/-B10F/-B51 must be installed.

Addition of an AWGN signal of settable bandwidth and settable C/N ratio or $E_b/N_0$ to a wanted signal.

| | | |
|---|---|---|
| Noise | distribution density | Gaussian, statistical, separate for I and Q |
| | crest factor | > 15 dB |
| | periodicity | $> (2^{800} – 1)/200$ MHz |
| C/N, $E_b/N_0$ | setting range | –30 dB to +30 dB |
| | resolution | 0.1 dB |
| | uncertainty for system bandwidth = symbol rate,<br>–24 dB < C/N < 30 dB and<br>crest factor < 12 dB | < 0.1 dB |
| System bandwidth | bandwidth for determining noise power | |
| | setting range | |
| | R&S®SMBV-B51 | 1 kHz to 60 MHz |
| | R&S®SMBV-B10/-B10F or<br>R&S®SMBV-B51 with<br>R&S®SMBV-K521 | 1 kHz to 120 MHz |
| | R&S®SMBV-K522 | 1 kHz to 160 MHz |
| | setting resolution | 100 Hz |

## BER measurement (R&S®SMBV-K80 option)

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

| | | |
|---|---|---|
| Clock | | supplied by DUT; a clock pulse is required for each valid bit |
| Clock rate | | 100 Hz to 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 rear-panel connectors (TRIG or MARKER 1, NEXT, CLK IN and MARKER 2) | |
| Clock, data, enable and restart inputs | input impedance | 1 kΩ, 50 Ω |
| | trigger threshold | |
| | setting range | 0 V to 2.00 V |
| | resolution | 0.01 V |
| Polarity | data, clock, data enable | normal, inverted |
| Measurement time | | selectable by means of maximum number of data bits or bit errors (max. $2^{31}$ bit each), continuous measurement |
| Measurement result | if selected number of data bits or bit errors is attained | BER in ppm, %, or decade values |

| | | |
|---|---|---|
| Status displays | | not synchronized, no clock, no data |
| Compatible standards | | R&S®SMBV-K40,<br>R&S®SMBV-K41,<br>R&S®SMBV-K42,<br>R&S®SMBV-K43,<br>R&S®SMBV-K45,<br>R&S®SMBV-K46,<br>R&S®SMBV-K47,<br>R&S®SMBV-K48,<br>R&S®SMBV-K49,<br>R&S®SMBV-K50,<br>R&S®SMBV-K51,<br>R&S®SMBV-K52,<br>R&S®SMBV-K54,<br>R&S®SMBV-K55,<br>R&S®SMBV-K58,<br>R&S®SMBV-K59,<br>R&S®SMBV-K60,<br>R&S®SMBV-K61,<br>R&S®SMBV-K62,<br>R&S®SMBV-K68,<br>R&S®SMBV-K84,<br>R&S®SMBV-K85,<br>R&S®SMBV-K86,<br>R&S®SMBV-K87,<br>R&S®SMBV-K89,<br>R&S®SMBV-K112,<br>R&S®SMBV-K113 |

## BLER measurement (R&S®SMBV-K80 option)

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

| | | |
|---|---|---|
| Clock | | supplied by DUT; a clock pulse is required for each valid bit |
| Clock rate | | 100 Hz to 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 rear-panel connectors (TRIG or MARKER 1, NEXT, CLK IN and MARKER 2) | |
| Clock, data, and enable inputs | input impedance | 1 kΩ, 50 Ω |
| | trigger threshold | |
| | setting range | 0 V to 2.00 V |
| | resolution | 0.01 V |
| Polarity | data, clock, data enable | normal, inverted |
| Measurement time | selectable by means of maximum number of received blocks or errors (max. $2^{31}$ blocks each), continuous measurement | |
| Measurement result | if selected number of received blocks or errors is attained | BLER in ppm, %, or decade values |
| Status displays | | not synchronized, no clock, no data |

| | | |
|---|---|---|
| Compatible standards | | R&S®SMBV-K40,<br>R&S®SMBV-K41,<br>R&S®SMBV-K42,<br>R&S®SMBV-K43,<br>R&S®SMBV-K45,<br>R&S®SMBV-K46,<br>R&S®SMBV-K47,<br>R&S®SMBV-K48,<br>R&S®SMBV-K49,<br>R&S®SMBV-K50,<br>R&S®SMBV-K51,<br>R&S®SMBV-K52,<br>R&S®SMBV-K54,<br>R&S®SMBV-K55,<br>R&S®SMBV-K58,<br>R&S®SMBV-K59,<br>R&S®SMBV-K60,<br>R&S®SMBV-K61,<br>R&S®SMBV-K62,<br>R&S®SMBV-K68,<br>R&S®SMBV-K84,<br>R&S®SMBV-K85,<br>R&S®SMBV-K86,<br>R&S®SMBV-K87,<br>R&S®SMBV-K89,<br>R&S®SMBV-K112,<br>R&S®SMBV-K113 |

## Remote control

| | | |
|---|---|---|
| Interfaces | | IEC 60625 (GPIB IEEE 488.2),<br>Ethernet/LAN (1000BaseT),<br>USB 2.0 (high speed),<br>serial (RS-232) [9] |
| Command set | | SCPI 1999.5 or compatible command sets |
| Compatible command sets | These command sets can be selected in order to emulate another instrument. | Agilent/HP 8642/3,<br>Agilent/HP 8644A/B,<br>Agilent/HP 8645/7A,<br>Agilent/HP 8648A/B/C/D,<br>Agilent/HP 8656A/B,<br>Agilent/HP 8657A/B,<br>Agilent/HP 8664/5,<br>Agilent/HP E44xx ESG,<br>Agilent N51xx MXG,<br>Aeroflex/IFR 2023/4,<br>Aeroflex/IFR 2030/1/2,<br>Aeroflex/IFR 2050/1/2,<br>R&S®SML01, R&S®SML02, R&S®SML03,<br>R&S®SMT02/03/06,<br>R&S®SMY01/02 |
| IEC/IEEE bus address | | 0 to 30 |
| Ethernet/LAN protocols and services | | VISA VXI-11 (remote control),<br>Telnet/RawEthernet (remote control),<br>VNC (remote operation with web browser),<br>FTP (file transfer protocol),<br>SMB (mapping parts of instrument to host file system) |
| Ethernet/LAN addressing | | DHCP, static,<br>support of ZeroConf and M-DNS to ease the direct connection to a system controller |
| USB protocol | | VISA USB-TMC |

[9] Requires recommended extra R&S®TS-USB1.

# Connectors

## Front-panel connectors

| | | |
|---|---|---|
| RF 50 Ω | RF output | N female |
| I | I modulation input signal | BNC female |
| Q | Q modulation input signal | BNC female |
| USB (2 connectors) | USB 2.0 (high speed) connector for external USB devices,<br>mouse and keyboard for enhanced operation,<br>R&S®NRP-Zxx power sensors (with R&S®NRP-Z4 adapter cable) for external power measurements and level adjustment of instrument,<br>memory stick for software update and data exchange,<br>USB serial adapter for RS-232 remote control | USB type A |

## Rear-panel connectors

| | | |
|---|---|---|
| LF | modulation generator output | BNC female |
| MOD EXT | input for external analog modulation | BNC female |
| REF IN | reference frequency input | BNC female |
| REF OUT | reference frequency output | BNC female |
| PULSE EXT | input for external pulse modulation | BNC female |
| PULSE VIDEO | pulse generator output | BNC female |
| INST TRIG | trigger input | BNC female |
| SIGNAL VALID | output for triggering external devices<br>(low 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)<br>remote control of instrument (USB-TMC) | USB type B |
| USB | USB 2.0 (high speed) connector for external USB devices, mouse and keyboard for enhanced operation,<br>R&S®NRP-Zxx power sensors (with R&S®NRP-Z4 adapter cable) for external power measurements and level adjustment of instrument,<br>memory stick for software update and data exchange,<br>USB serial adapter for RS-232 remote control | 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 |
| Sensor | connector for R&S®NRP-Zxx power sensors with trigger functionality | six-pole ODU Mini-Snap® series B |
| I, $\overline{I}$ | baseband output I, $\overline{I}$ | BNC female |
| Q, $\overline{Q}$ | baseband output Q, $\overline{Q}$ | BNC female |
| MARKER 1, MARKER 2 | marker from baseband | BNC female |
| BASEBAND DIGITAL | input or output for digital baseband signals | 26-pin LVDS in line with Rohde & Schwarz TVR290 (not supported yet) |
| CLK OUT | clock output from baseband | BNC female |
| CLK IN | clock input for baseband | BNC female |
| NEXT | trigger for baseband multisegment mode | BNC female |
| TRIG | trigger for baseband | BNC female |
| DIGITAL IQ IN/OUT | digital input or output connectivity in line with R&S®Digital I/Q Interface to connect to the R&S®EX-IQ-Box, for example | 26-pin MDR |

# General data

| | | |
|---|---|---|
| **Power supply** | | |
| AC input voltage range | | 90 V to 264 V |
| AC supply frequency | | 45 Hz to 66 Hz |
| Max. input current | | 1.4 A (100 V) to 0.6 A (240 V) |
| Power consumption | when fully equipped | < 150 W |
| Power factor correction | | in line with EN 61000-3-2 |
| **Electrical safety** | | |
| Compliance | | in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1 |
| Test mark | | VDE-GS, $_{C}$CSA$_{US}$ |
| **EMC** | | |
| Electromagnetic compatibility | emissions | in line with EN 55011 class B |
| | immunity to interfering field strength | in line with EN 61326-1 (industrial environment), EN 61326-2-1 |
| **Mechanical resistance** | | |
| Vibration | sinusoidal | 5 Hz to 150 Hz, max. 2 g at 55 Hz, const. 0.5 g at 55 Hz to 150 Hz, in line with EN 60068-2-6 |
| | random | 10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64 |
| Shock | | 40 g shock spectrum, in line with MIL-STD-810E, method 516.4, proc. I |
| **Environmental conditions** | | |
| Temperature range | operating temperature range | 0 °C to +55 °C, in line with EN 60068-2-1, EN 60068-2-2 |
| | operating temperature range when equipped with R&S®SMBV-B92 | 0 °C to +45 °C, in line with EN 60068-2-1, EN 60068-2-2 |
| | storage temperature range | –40 °C to +71 °C |
| | storage temperature range when equipped with R&S®SMBV-B92 | –40 °C to +60 °C |
| Climatic resistance | +40 °C/95 % rel. humidity | in line with EN 60068-2-78, EN 61010 relative humidity 80 % for temperatures up to +31 °C, decreasing linearity to 50 % at +55 °C |
| Altitude | operating altitude | up to 4600 m |
| | operating altitude when equipped with R&S®SMBV-B92 | up to 3000 m |
| | storage altitude | up to 4600 m |
| **Dimensions and weight** | | |
| Dimensions | W × H × D | 344 mm × 155 mm × 368 mm (13.54 in × 6.10 in × 14.49 in) |
| Weight | when fully equipped | 7.9 kg (17.4 lb) |
| **Calibration interval** | | |
| Recommended calibration interval | when operated 40 h/week in the full range of the specified environmental conditions | 3 years |

# Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| Vector signal generator [10] (including power cable, quick start guide and CD-ROM, with operating and service manual) | R&S®SMBV100A | 1407.6004.02 |
| **Options** | | |
| RF | | |
| 9 kHz to 3.2 GHz | R&S®SMBV-B103 | 1407.9603.02 |
| 9 kHz to 6 GHz | R&S®SMBV-B106 | 1407.9703.02 |
| Reference oscillator OCXO [11] | R&S®SMBV-B1 | 1407.8407.02 |
| Reference oscillator OCXO high performance [11] | R&S®SMBV-B1H | 1419.1602.02 |
| Phase coherence | R&S®SMBV-B90 | 1407.9303.02 |
| Pulse modulator | R&S®SMBV-K22 | 1415.8019.02 |
| Pulse generator | R&S®SMBV-K23 | 1415.8025.02 |
| Baseband | | |
| Baseband generator with digital modulation (realtime) and ARB (32 Msample), 120 MHz RF bandwidth [12] | R&S®SMBV-B10 | 1407.8607.04 |
| Baseband generator for GNSS with high dynamics, digital modulation (realtime) and ARB (32 Msample), 120 MHz RF bandwidth [12, 13] | R&S®SMBV-B10F | 1419.2009.02 |
| Baseband generator with ARB (32 Msample), 60 MHz RF bandwidth | R&S®SMBV-B51 | 1407.9003.04 |
| Hard disk (removable) | R&S®SMBV-B92 | 1407.9403.02 |
| Digital baseband connectivity | R&S®SMBV-K18 | 1415.8002.02 |
| Memory extension for ARB to 256 Msample [12] | R&S®SMBV-K511 | 1419.2544.02 |
| Memory extension for ARB to 1 Gsample | R&S®SMBV-K512 | 1419.2567.02 |
| RF bandwidth extension to 120 MHz | R&S®SMBV-K521 | 1419.2580.02 |
| RF bandwidth extension to 160 MHz | R&S®SMBV-K522 | 1419.2609.02 |
| Bit error rate tester | R&S®SMBV-K80 | 1415.8890.02 |
| Internal digital standards [14] | | |
| GSM/EDGE | R&S®SMBV-K40 | 1415.8031.02 |
| EDGE Evolution | R&S®SMBV-K41 | 1415.8460.02 |
| 3GPP FDD | R&S®SMBV-K42 | 1415.8048.02 |
| 3GPP FDD enhanced MS/BS tests incl. HSDPA | R&S®SMBV-K43 | 1415.8054.02 |
| GPS | R&S®SMBV-K44 | 1415.8060.02 |
| 3GPP FDD HSUPA | R&S®SMBV-K45 | 1415.8077.02 |
| CDMA2000® incl. 1xEV-DO | R&S®SMBV-K46 | 1415.8083.02 |
| 1xEV-DO Rev. A | R&S®SMBV-K47 | 1415.8090.02 |
| IEEE 802.11 (a/b/g) | R&S®SMBV-K48 | 1415.8102.02 |
| IEEE 802.16 | R&S®SMBV-K49 | 1415.8119.02 |
| TD-SCDMA | R&S®SMBV-K50 | 1415.8125.02 |
| TD-SCDMA enhanced BS/MS tests | R&S®SMBV-K51 | 1415.8131.02 |
| DVB-H/DVB-T | R&S®SMBV-K52 | 1415.8148.02 |
| DAB/T-DMB | R&S®SMBV-K53 | 1415.8154.02 |
| IEEE 802.11 a/b/g/n/j/p | R&S®SMBV-K54 | 1415.8160.02 |
| EUTRA/LTE | R&S®SMBV-K55 | 1415.8177.02 |
| XM Radio™ | R&S®SMBV-K56 | 1415.8183.02 |
| FM Stereo/RDS | R&S®SMBV-K57 | 1415.8190.02 |
| SIRIUS Radio | R&S®SMBV-K58 | 1415.8202.02 |
| HSPA+ | R&S®SMBV-K59 | 1415.8219.02 |
| Bluetooth® EDR | R&S®SMBV-K60 | 1415.8477.02 |
| Multicarrier CW signal generation | R&S®SMBV-K61 | 1415.8225.02 |
| Assisted GPS | R&S®SMBV-K65 | 1415.8560.02 |
| Galileo | R&S®SMBV-K66 | 1415.8590.02 |
| Assisted Galileo | R&S®SMBV-K67 | 1419.2509.02 |
| TETRA Release 2 | R&S®SMBV-K68 | 1415.8490.02 |
| EUTRA/LTE Release 9 | R&S®SMBV-K84 | 1415.8602.02 |

[10] The base unit must be ordered with an R&S®SMBV-B10x frequency option.

[11] Only one of the reference oscillator options (R&S®SMBV-B1 or R&S®SMBV-B1H) can be installed.

[12] Requires the R&S®SMBV-B92 option (hard disk).

[13] May be subject to export restrictions and therefore not available in all countries and to all customers.

[14] Requires the R&S®SMBV-B10 or R&S®SMBV-B10F option (realtime baseband generator).

| Designation | Type | Order No. |
|---|---|---|
| EUTRA/LTE Release 10 | R&S®SMBV-K85 | 1415.8619.02 |
| IEEE 802.11 ac | R&S®SMBV-K86 | 1415.8648.02 |
| 1xEV-DO Rev. B | R&S®SMBV-K87 | 1415.8719.02 |
| NFC A/B/F | R&S®SMBV-K89 | 1419.1690.02 |
| GNSS extension to 12 satellites | R&S®SMBV-K91 | 1415.8577.02 |
| GNSS enhanced (e.g. moving scenarios, multipath) | R&S®SMBV-K92 | 1415.8583.02 |
| GPS P-code | R&S®SMBV-K93 | 1415.8660.02 |
| GLONASS | R&S®SMBV-K94 | 1415.8677.02 |
| Assisted GLONASS | R&S®SMBV-K95 | 1419.2521.02 |
| GNSS extension to 24 satellites | R&S®SMBV-K96 | 1415.8790.02 |
| GNSS extension: obscuration and automatic multipath | R&S®SMBV-K101 | 1415.8802.02 |
| GNSS extension for antenna pattern | R&S®SMBV-K102 | 1415.8819.02 |
| GNSS extension for spinning and attitude simulation | R&S®SMBV-K103 | 1415.8825.02 |
| Quasi-zenith satellite system (QZSS L1 C/A) | R&S®SMBV-K105 | 1419.2350.02 |
| BeiDou | R&S®SMBV-K107 | 1419.2709.02 |
| SBAS | R&S®SMBV-K110 | 1419.2373.02 |
| Ground-based augmentation system (GBAS) | R&S®SMBV-K111 | 1419.2396.02 |
| LTE Release 11 and enhanced features | R&S®SMBV-K112 | 1419.1719.02 |
| LTE Release 12 | R&S®SMBV-K113 | 1419.2921.02 |
| Cellular IoT | R&S®SMBV-K115 | 1419.1583.02 |
| DVB-S2/DVB-S2X | R&S®SMBV-K116 | 1427.8002.02 |
| Bluetooth® 5.0 | R&S®SMBV-K117 | 1427.8083.02 |
| EUTRA/LTE Release 13/14 | R&S®SMBV-K119 | 1427.8148.02 |
| LORA | R&S®SMBV-K131 | 1419.1783.02 |
| IEEE 802.11ax digital standard | R&S®SMBV-K142 | 1427.8048.02 |
| ILS | R&S®SMBV-K151 | 1419.2621.02 |
| VOR | R&S®SMBV-K152 | 1419.2644.02 |
| DME | R&S®SMBV-K153 | 1419.2667.02 |
| ERA-GLONASS test suite | R&S®SMBV-K360 | 1419.1890.02 |
| eCall test suite | R&S®SMBV-K361 | 1419.2980.02 |
| GNSS test suite | R&S®SMBV-K362 | 3639.9455.02 |
| Digital modulation systems using R&S®WinIQSIM2™ [15] | | |
| GSM/EDGE | R&S®SMBV-K240 | 1415.8231.02 |
| EDGE Evolution | R&S®SMBV-K241 | 1415.8454.02 |
| 3GPP FDD | R&S®SMBV-K242 | 1415.8248.02 |
| 3GPP FDD enhanced BS/MS tests incl. HSDPA | R&S®SMBV-K243 | 1415.8254.02 |
| GPS | R&S®SMBV-K244 | 1415.8260.02 |
| 3GPP FDD HSUPA | R&S®SMBV-K245 | 1415.8277.02 |
| CDMA2000® incl. 1xEV-DO | R&S®SMBV-K246 | 1415.8283.02 |
| 1xEV-DO Rev. A | R&S®SMBV-K247 | 1415.8290.02 |
| IEEE 802.11 (a/b/g) | R&S®SMBV-K248 | 1415.8302.02 |
| IEEE 802.16 | R&S®SMBV-K249 | 1415.8319.02 |
| TD-SCDMA | R&S®SMBV-K250 | 1415.8325.02 |
| TD-SCDMA enhanced BS/MS tests | R&S®SMBV-K251 | 1415.8331.02 |
| DVB-H/DVB-T | R&S®SMBV-K252 | 1415.8348.02 |
| DAB/T-DMB | R&S®SMBV-K253 | 1415.8525.02 |
| IEEE 802.11 a/b/g/n/j/p | R&S®SMBV-K254 | 1415.8354.02 |
| EUTRA/LTE | R&S®SMBV-K255 | 1415.8360.02 |
| HSPA+ | R&S®SMBV-K259 | 1415.8377.02 |
| Bluetooth® EDR | R&S®SMBV-K260 | 1415.8483.02 |
| Multicarrier CW signal generation | R&S®SMBV-K261 | 1415.8383.02 |
| Additive white Gaussian noise (AWGN) | R&S®SMBV-K262 | 1415.8425.02 |
| Galileo | R&S®SMBV-K266 | 1415.8683.02 |
| TETRA Release 2 | R&S®SMBV-K268 | 1415.8502.02 |
| EUTRA/LTE Release 9 | R&S®SMBV-K284 | 1415.8625.02 |
| EUTRA/LTE Release 10 | R&S®SMBV-K285 | 1415.8631.02 |
| IEEE 802.11 ac | R&S®SMBV-K286 | 1415.8654.02 |
| 1xEV-DO Rev. B | R&S®SMBV-K287 | 1415.8725.02 |
| NFC A/B/F | R&S®SMBV-K289 | 1419.1677.02 |
| GLONASS | R&S®SMBV-K294 | 1415.8690.02 |
| BeiDou | R&S®SMBV-K407 | 1419.2721.02 |
| LTE Release 11 and enhanced features | R&S®SMBV-K412 | 1419.1719.02 |

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

| Designation | Type | Order No. |
|---|---|---|
| LTE Release 12 | R&S®SMBV-K413 | 1419.2921.02 |
| OFDM signal generation | R&S®SMBV-K414 | 1419.2873.02 |
| Cellular IoT Release 13 | R&S®SMBV-K415 | 1419.2880.02 |
| DVB-S2/DVB-S2X | R&S®SMBV-K416 | 1427.8025.02 |
| Bluetooth® 5.1 | R&S®SMBV-K417 | 1427.8102.02 |
| VERIZON 5GTF | R&S®SMBV-K418 | 1427.8125.02 |
| EUTRA/LTE Release 13/14/15 | R&S®SMBV-K419 | 1427.8160.02 |
| LORA | R&S®SMBV-K431 | 1419.1790.02 |
| IEEE 802.11ax digital standard | R&S®SMBV-K442 | 1427.8060.02 |
| Cellular IoT Release 14 | R&S®SMBV-K443 | 1419.2321.02 |
| 5G-NR Release 15 | R&S®SMBV-K444 | 1419.2496.02 |
| Cellular IoT Release 15 | R&S®SMBV-K446 | 1419.2021.02 |
| Digital modulation systems using an external PC software or waveforms | | |
| Playback of XM Radio™ waveforms [16] | R&S®SMBV-K256 | 1415.8402.02 |
| Pulse sequencing [17] | R&S®SMBV-K300 | 1419.2744.02 |
| Enhanced pulse sequencing | R&S®SMBV-K301 | 1419.2780.02 |
| Direction finding | R&S®SMBV-K308 | 1419.2973.02 |
| DFS signal generation | R&S®SMBV-K350 | 1419.2767.02 |
| Playback of HD Radio™ waveforms [18] | R&S®SMBV-K352 | 1415.8431.02 |
| DAB+ streams | R&S®SMBV-K353 | 1415.8702.02 |
| DAB streams | R&S®SMBV-K354 | 1415.8783.02 |
| Noise generation | | |
| Additive white Gaussian noise (AWGN) | R&S®SMBV-K62 | 1415.8419.02 |
| **Recommended extras** | | |
| Documentation of calibration values | R&S®DCV-2 | 0240.2193.18 |
| R&S®SMBV100B accredited calibration (ISO 17025, ISO 9000) | R&S®ACASMBV100 | 3596.6938.03 |
| 19" rack adapter | R&S®ZZA-S334 | 1109.4487.00 |

| **Warranty** | | |
|---|---|---|
| Base unit | | 3 years |
| All other items | | 1 year |
| 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 a term of one and two years (WE1 to WE2)**
Repairs carried out during the contract term are free of charge [19]. 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 [19] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.



[16] Signal generation requires waveforms from XM Radio™.

[17] Pulse sequencing requires an external PC.

[18] Requires license from iBiquity Digital Corp.

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

# License information

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

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Data without tolerance limits is not binding | Subject to change


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