R&S® SMBV100B
VECTOR SIGNAL GENERATOR

Perfect combination of performance and usability
The state-of-the-art R&S®SMBV100B vector signal generator sets 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, incl. 5G NR, LTE and WLAN
- Fully-fledged GNSS simulator for GPS, GLONASS, Galileo, Beidou, IRNSS and QZSS/SBAS
- Convenient operation via 7" touchscreen

**APPLICATIONS**
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- GNSS testing ► page 14

**BENEFITS**
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- R&S®LegacyPro refresh your T&M equipment ► page 12

**Rohde & Schwarz R&S®SMBV100B Vector Signal Generator**
PERFECT FOR SIGNAL QUALITY

When developing electronic products, it is very important to choose the right test instruments.

For all key RF parameters, the R&S®SMBV100B offers outstanding specifications that clearly outperform the values of typical DUTs. This ensures that measurement results are not influenced by the signal generator. The instrument serves as a "golden reference", providing a dependable signal for all receiver tests.

Engineers can focus on core development tasks without having to worry about the performance of their signal generator.

Real-time, user-defined frequency response correction to compensate for the effect of test fixtures

As with almost any other test instrument, the reference plane of the R&S®SMBV100B is at the RF connector. This means that the specifications for all parameters apply at this point. In most cases, however, there are also cables and other components (e.g. amplifiers) connected between the generator and the DUT. Especially when working with wide bandwidths, these test fixtures influence the modulated signal, degrading the amplitude and phase accuracy at the DUT input.

To take the influence of an external test fixture into account, the fixture can be characterized in terms of amplitude and phase, and the results can be saved to a Touchstone® .s2p file.

With the R&S®SMBVB-K544 option, this information can be used to precorrect the generator signal in real time to compensate for the influence of the external test fixture. This method provides the user with a test solution that delivers an extremely precise measurement signal at the DUT input, unaffected by the test setup used between the generator and the DUT.

Very low single-sideband (SSB) phase noise

SSB phase noise is a key parameter when it comes to RF generator signal quality. This parameter is not only important in CW applications such as LO substitution, it also plays a significant role in the case of digitally modulated signals as it has a direct influence on the error vector magnitude (EVM).

The R&S®SMBV100B exhibits very low SSB phase noise of < –134 dBc (measured) at 1 GHz and 20 kHz offset. The close-in SSB phase noise can be reduced using the R&S®SMBVB-B1 OCXO option. The option reduces the phase noise from < –37 dBc (1 Hz) at 1 GHz and 1 Hz offset by 13 dB to < –50 dBc (1 Hz). Using the R&S®SMBVB-B1H high performance OCXO option, the close-in SSB phase noise can be further reduced by more than 20 dB compared with the standard instrument specifications, resulting in a value of < –65 dBc (1 Hz).

In addition, the R&S®SMBVB-B1 and R&S®SMBVB-B1H options significantly improve long-term stability for the reference frequency and mitigate the generator’s frequency temperature drift.

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PERFECT FOR OUTPUT POWER

Many applications call for very high output powers. This means that in many cases an amplifier is required in addition to the signal generator. Here, the R&S®SMBV100B offers a better alternative. The ultra high output power option provides users with a calibrated test solution, saving space and money, all in a single box.

Ultra high output power
When equipped with the appropriate options, the R&S®SMBV100B can produce output power of up to +33 dBm at 1 GHz and up to +31 dBm at 6 GHz (measured values). In addition, the specified level increases to +25 dBm across almost the entire frequency range.

Excellent level accuracy for CW and modulated signals
To describe the nonlinear characteristics of amplifier circuits (e.g. to determine the 1 dB compression point), the signal source must exhibit very high level accuracy. In many cases, the overall system is calibrated prior to the measurements to take into account the influence of test fixtures connected between the generator and the DUT.

After calibration, it is critical that the generator sets the level values for each test sequence repeatedly and with high precision. Here, the R&S®SMBV100B delivers top performance with a measured level repeatability of < 0.09 dB.

Another critical parameter is level linearity. It is crucial for the generator to keep deviation from nominal values extremely low across a wide amplitude range. With an accuracy of < 0.2 dB (measured), the R&S®SMBV100B excels also in this respect.

The generator’s very high level accuracy simplifies the calibration procedure, enabling the generator to deliver extremely precise measurements.

Excellent EVM and ACPR up to high power levels
A receiver’s data throughput is directly influenced by the input signal quality. As a result, a good EVM value for the test signal is an important prerequisite in order to reliably assess the performance of a DUT.

The R&S®SMBV100B combines large RF bandwidth and excellent signal quality and is therefore ideal for testing and characterizing wideband receivers and multicarrier amplifiers. With measured EVM values of less than 0.2% for LTE signals and less than 0.4% for 160 MHz IEEE 802.11ac signals, the R&S®SMBV100B offers far better EVM performance than is required for measuring a DUT.

A feature unique to the R&S®SMBV100B is its excellent EVM performance even at high output power levels. An EVM value of less than 0.4% is achieved for an LTE signal with +18 dBm (RMS) output power. The R&S®SMBV100B thus outperforms conventional signal generators in terms of EVM, while at the same time simplifying the test setup since in most cases no extra amplifier is needed.

The R&S®SMBV100B was designed with a focus on delivering a practically distortion-free signal in addition to good EVM performance. This is a prerequisite for achieving a good adjacent channel power ratio (ACPR). The R&S®SMBV100B attains impressive values of < -72 dB ACPR (WCDMA test model 1, 64 DPCH, measured).

Measured EVM performance vs. RMS level
R&S®SMBV100B equipped with R&S®SMBVB-K31 and R&S®SMBVB-B32 options

Excellent level accuracy simplifies the calibration procedure, enabling the generator to deliver extremely precise measurements.

Measured output power for the base unit
With the high power option (R&S®SMBVB-K31) and with the additional ultra high power option (R&S®SMBVB-B32)

Ultra high power option
High power option
Standard output power

Measured ACPR for WCDMA test model 1, 64 DPCH

Measured level linearity for an internally generated LTE downlink signal at various test frequencies
Perfect for use

Its intuitive operating concept makes the R&S®SMBV100B very ergonomic and practical to use. The customizable instrument is also prepared to meet future requirements.

Convenient operation via 7" touchscreen

The R&S®SMBV100B has a clearly structured graphical user interface with a high-resolution 7" touchscreen for efficient, intuitive operation. The functional block diagram of the R&S®SMBV100B provides a clear overview at all times. The user can immediately see the signal flow and the status of all inputs and outputs. The built-in graphics function displays the generated signals in real time.

Automation made easy with context-sensitive help system and SCPI recording

Context-sensitive online help offers comprehensive information. It describes each parameter and setup menu in detail, states the setting range and shows the associated remote control commands. Moreover, users can search for specific parameters in the user manual installed on the instrument.

The R&S®SMBV100B helps users quickly and correctly create remote control programs. The instrument’s built-in SCPI macro recorder with code generator can automatically record all manual settings and create an executable MATLAB® script. The R&S®SMBV100B therefore helps minimize the time required for test automation, saving development resources.

Internal real-time signal generation

The internal baseband of the R&S®SMBV100B offers impressive real-time capabilities. Users can generate signals for all major digital communications standards right on the instrument – no external signal generation software is needed. This simplifies operation of the instrument and helps to speed up measurement tasks.

Protecting user data

To meet requirements for secured areas, the R&S®SMBV100B can be configured to prevent user data from being saved to the instrument’s nonvolatile memory. An easy-to-use erase and sanitizing procedure is also available that removes user data from the instrument. Furthermore, the R&S®SMBV100B can be equipped with a removable solid-state drive (R&S®SMBVB-B80 option). A dedicated password can be used to disable the LAN and USB ports. The display can be disabled as well. These precautions ensure that no sensitive data will leave secured areas.

Perfect for upgrading

The R&S®SMBV100B is a flexible platform that can be custom-tailored to specific needs at any time.

Easy upgrading of instrument at user premises via software keycodes

As to the instrument’s hardware configuration, only a few decisions need to be made. Six hardware options are available. Software options can be added at the user premises via keycodes. The instrument is fully calibrated at the factory. There is no downtime for servicing the instrument after an upgrade, e.g. after an extension of the frequency range, bandwidth or output power. This flexibility minimizes investment risks, saves time and maximizes system uptime.

Time-limited licenses and waveform package for software options

If specific functions are not permanently needed, users can acquire licenses for R&S®SMBV100B software options for a limited period of time (e.g. 1 month or 6 months). This alternative is offered for all of the R&S®SMBV100B software options. It allows users to configure their R&S®SMBV100B platform as needed for the project at hand.

Characterizing DUTs often requires using test signals from a number of different standards. The waveform package is the ideal solution when it comes to inexpensively providing a signal for each standard. A waveform package for five signals, for example, can license one WCDMA and LTE signal and three different 5G NR signals.

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Overview of important software and hardware options
PERFECT FOR GNSS TESTING

The R&S®SMBV100B can be equipped with a multitude of GNSS options, turning the instrument into a full-featured GNSS constellation simulator.

Take control over your GNSS scenarios

Using signal generators for GNSS testing has some major advantages over using a live GNSS signal. When using live signals, test conditions are expected to change permanently and unpredictably, so that it is very unlikely that two successive test runs can be performed under identical conditions. Repeatable testing – maybe the most critical test requirement – is impossible when using live GNSS signals.

With the R&S®SMBV100B, GNSS simulations can be performed under well-defined, controlled and realistic conditions. It offers fully customizable and repeatable scenarios, so that one and the same test scenario can be replayed as often as needed and produce the same signals with the same characteristics.

Application fields/modes of operation

- **Constellation simulation**
  In this mode, the R&S®SMBV100B simulates a realistic constellation of GNSS satellites with correct Doppler shifts and ICD-compliant signals. This includes realistic modeling of GNSS orbits, signal propagation effects and system errors like orbit and clock errors.

- **Hardware in the loop (HIL) operation**
  Externally generated trajectory data can be streamed in real time to the R&S®SMBV100B. By using a special set of SCPI commands, vehicle position, velocity, acceleration and vehicle attitude data can be fed to the instrument. This makes it possible to operate the R&S®SMBV100B in a hardware in the loop environment with high update rates and low latencies.

- **Receiver prototyping and production testing**
  Instead of being used as a GNSS constellation simulator, the R&S®SMBV100B can also be operated in a mode that is based on static (nonmoving) satellites. The signals generated this way do not exhibit any signal dynamics. Alternatively, constant Doppler shifts or customizable Doppler profiles can be applied to the signals.

- **Automated GNSS testing**
  Together with the test sequencer software R&S®CMWrun, the R&S®SMBV100B can be turned into a fully automated test system for verifying the positioning performance of eCall and ERA-GLONASS modules against the test cases defined in the standards EU2017/79/Annex VI (eCall) and COST 33471 (ERA-GLONASS).

- **Realistic GNSS scenarios**
  All GNSS signals are generated in real-time taking into account signal propagation, user environment and system characteristics like:
  - Orbit errors, clock errors, atmospheric effects
  - Signal obscuration and multipath
  - Antenna gain and phase patterns
  - Vehicle motion and vehicle attitude
  - Pseudorange steps/ramps for RAIM testing

GNSS plus interferer in one box

The R&S®SMBV100B can be equipped with an internal noise generator adding well-defined noise or a CW interferer to the GNSS signals. This allows to test the receiver’s resilience against unwanted interference or jamming attacks.

Signals and systems

The R&S®SMBV100B supports signal generation for all global satellite navigation systems as well as for satellite-based augmentation systems. Key capabilities are:

- Support of GPS, GLONASS, BeiDou, Galileo, SBAS and QZSS, including GPS P-Code
- Simultaneous signal generation in the GNSS frequency bands L1, L2 and L5 with up to 102 GNSS channels

Scenario configuration made easy

The R&S®SMBV100B comes with an integrated GNSS simulation software, which allows user-friendly simulation configuration, monitoring and interactive control using the instrument’s large touch screen. No external PC is required for scenario configuration. Scenario generation can be fully automated making use of the extensive remote control capabilities of the R&S®SMBV100B.
**R&S®LegacyPro**
**REFRESH YOUR T&M EQUIPMENT**

Replace your legacy signal generators
For older test systems, obsolescence is a common topic. When individual pieces of equipment become obsolete before the entire ATE system does, regular calibration and repair of obsolete equipment is an expensive, time-consuming and challenging task. Replacing obsolete test equipment with equivalent, state-of-the-art instruments should be straightforward and require minimal hardware and software changes.

The R&S®SMBV100B with R&S®LegacyPro code emulation fulfills these requirements, reducing the workload and eliminating risks. R&S®LegacyPro enables the R&S®SMBV100B to reliably emulate a wide range of legacy generators from vendors such as Keysight, Agilent, HP, Aeroflex, Anritsu and Rohde & Schwarz. As a result, the R&S®SMBV100B can be deployed in legacy ATE systems without major software changes, effectively increasing uptime, lowering the cost of ownership and extending the test system’s useful life.

Enjoy plug & play replacement of your legacy signal generators with R&S®LegacyPro and the R&S®SMBV100B.

**SIMPLIFY YOUR ENVELOPE TRACKING SYSTEM**

An increasing number of power amplifiers support envelope tracking (ET) in order to reduce power consumption and improve efficiency, for example in smartphones and tactical radios. Typical test setups for measuring power amplifiers comprise at least one signal generator and one spectrum analyzer. Envelope tracking requires an additional generator to deliver the envelope signal for the DC modulator.

**RF and envelope signal out of one box**
Equipped with the R&S®SMBVB-K540 envelope tracking option, the R&S®SMBV100B generates both the RF signal and the corresponding envelope signal. The envelope signal is generated from the baseband signal in real time. This means that any user-specific I/Q signals and any supported wireless communications signals, such as LTE or wireless LAN, can be used.

Generating the RF signal and the envelope signal in a single instrument makes it possible to precisely adjust the delay between the two signals.

The R&S®SMBV100B adjusts the delay in picosecond steps in real time, meeting tight requirements, for example accuracy better than 1 ns for a 20 MHz LTE signal.

The envelope signal is shaped to optimize the power amplifier for efficiency or linearity. The R&S®SMBV100B offers various shaping methods, such as look-up table and polynomial, which are applied in real time. For power sweeps, the R&S®SMBV100B automatically calculates the amplitude of the envelope signal, eliminating time-consuming manual calculations. It is also possible to adjust additional parameters, such as the gain and impedance of the DC modulator.

**Real-time digital predistortion**
With envelope tracking, the amplifier is operated close to or even in saturation, causing distortion at the amplifier output. To compensate for this effect, envelope tracking is often used in combination with digital predistortion (DPD). Equipped with the R&S®SMBVB-K541 digital predistortion option, the R&S®SMBV100B can apply real-time amplitude and phase correction to each complex I/Q sample using the values in the DPD tables. As a result, users can quickly verify the effect of predistortion, even for different power levels, without having to manually calculate the original waveform.

Digital predistortion user interface with the R&S®SMBVB-K541 option

![Digital predistortion user interface with the R&S®SMBVB-K541 option](image)

Compact Rohde & Schwarz setup for power amplifier tests including envelope tracking

![Compact Rohde & Schwarz setup for power amplifier tests including envelope tracking](image)
GNSS TESTING

The extensive GNSS simulation capabilities of the R&S®SMBV100B make it possible to cover a multitude of single- and multi-frequency GNSS applications.

Typical GNSS tests include the determination of the receiver’s time to first fix, acquisition and tracking sensitivity, reacquisition time or its ability to provide an accurate positioning solution for both static and moving receivers. In addition to these standard tests, it is often required to test the receiver’s performance under special conditions such as interference or in the presence of multipath. Other applications include RAIM (receiver autonomous integrity monitoring) testing, ionospheric monitoring or atmospheric sounding.

Positioning accuracy

Determination of the receiver’s ability to provide an accurate navigation solution for both static and moving receivers under ideal conditions.

Positioning accuracy in the presence of multipath

Determination of the receiver’s positioning performance when multipath is present.

RAIM testing

Receiver autonomous integrity monitoring is a special feature that allows a GNSS receiver to check whether the computed position is influenced by unusually high ranging errors. The objective of such tests is to verify that a DUT is able to identify affected observations and exclude them from the position solution.

Ionospheric monitoring

Monitoring ionospheric conditions like total electron content (TEC) or anomalies caused by scintillation based on multi-frequency GNSS observations.

Simulation of multipath propagation for SV 1 with the R&S®SMBV100B. In addition to the line of sight, three reflections with different relative delays, relative amplitudes and relative Doppler shifts are present.

Simulation of a pseudorange ramp for SV 3 with the R&S®SMBV100B for testing the RAIM capabilities of a GNSS receiver.

Configuration and simulation of ionospheric path delays with the R&S®SMBV100B.
STATE-OF-THE-ART USER INTERFACE

- High-resolution touchscreen
  - With easy-to-use graphical user interface and block diagram

- Context-sensitive help system

- Signal monitoring with graphical result display for practically every point in the signal flow

- Favorite key
  - For simplified and fast operation via customizable user menu

- RF output connector
  - N female

- User-configurable connectors
  - E.g. trigger, marker, CLK

- Connector
  - For an R&S® NRP power sensor
Single-ended and differential analog I/Q outputs
R&S®SMBVB-K17 option

Removable solid-state drive to store sensitive information
R&S®SMBVB-B80 option

Remote control via GPIB, USB or LAN

Input for external pulse modulation signal
R&S®SMBVB-K22 option

Standard and high-speed digital I/Q interfaces (I/Q in/out)
R&S®SMBVB-K19 option

LO in/out for phase coherence application
► R&S®SMBVB-K30 option
► LO frequency equals RF frequency

Analog I/Q input

1 GHz reference input/output
R&S®SMBVB-B3 option

Flexible reference input/output from 1 MHz to 100 MHz
R&S®SMBVB-K704 option
## SPECIFICATIONS IN BRIEF

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<td>with R&amp;S®SMBVB-K523 options</td>
<td>pulse modulation</td>
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<td>8-bit error rate tester</td>
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<td>User-defined frequency response correction</td>
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### Always up to date: The firmware can be updated using a USB storage device or the LAN port. Free firmware updates are available for download from the Internet at [www.rohde-schwarz.com](http://www.rohde-schwarz.com).
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**Digital standards using R&S®WinIQSIM2**

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**Waveform package for signals from R&S®WinIQSIM2, R&S®Pulse Sequencer, R&S®Pulse Sequencer (DFS) software**

1. waveform
2. pulse forms
3. 50 waveforms

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

- Pulse sequencing
- Enhanced pulse sequencing
- DFS
- DFS signal generation

**GNSS and avionics**

- GPS
- Galileo
- GLONASS
- NAVIC
- Modernized GPS
- SBAS/GNSS
- BeiDou
- Single satellite GNSS
- Upgrade to dual-frequency GNSS
- Upgrade to triple-frequency GNSS
- Add 6 GNSS channels
- Add 12 GNSS channels
- GNSS real-time interface
- GNSS real world simulation
- GNSS reconfigurability
- GNSS GNSS real world simulation

**Other options**

- Software license for main storage
- Rear panel connector for RF path
- Recommended extras

- Spare CRT card
- Rear panel connector for RF path
- Recommended extras

- 10" touch display
- USB adapter for RS-232 remote control
- Documentation of calibration values
- R&S®SMBV100B accredited calibration (ISO 17025, ISO 9000)

**Designation**

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

2. R&S®WinIQSIM2™ requires an external PC.

3. Maximum 250 waveforms per instrument can be registered.

4. Maximum 250 waveforms per instrument can be registered.
The Rohde & Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts.

User risks are reduced to a minimum at all stages of a project:
► Solution finding/purchase
► Technical startup/application development/integration
► Training
► Operation/calibration/repair

Warranty

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Service options

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<td>Extended warranty, two years</td>
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<td>Extended warranty with calibration coverage, one year</td>
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<td>Extended warranty with calibration coverage, two years</td>
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* For options that are installed, the remaining base-unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

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

Warranty

- Base unit: 3 years
- All other items: 1 year

Service options

- Extended warranty, one year: R&S®WE1
- 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

* For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.
Rohde & Schwarz

The Rohde & Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks & cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

► Environmental compatibility and eco-footprint
► Energy efficiency and low emissions
► Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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