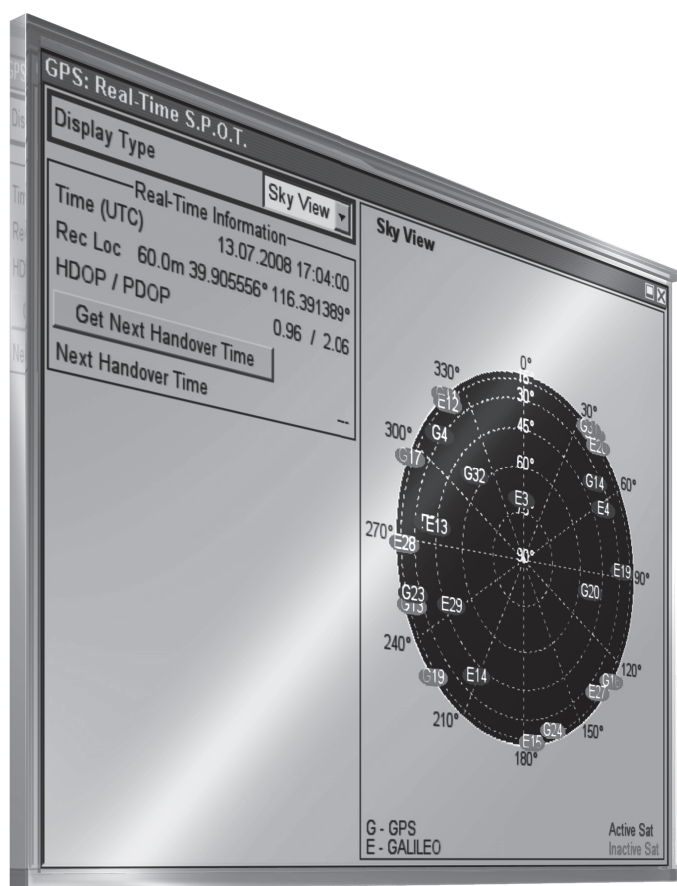


Global Navigation Satellite System (GNSS) Simulator in the R&S®SMBV100A Vector Signal Generator Specifications



CONTENTS

Definitions	3
Overview	4
Abbreviations	4
Minimum hardware configuration	4
Key features	5
GPS (R&S®SMBV-K44 option)	5
Assisted GPS (R&S®SMBV-K65 option)	5
GPS P code (R&S®SMBV-K93 option)	5
Galileo (R&S®SMBV-K66 option)	5
Glonass (R&S®SMBV-K94 option)	5
GNSS extension to 12 satellites (R&S®SMBV-K91 option)	6
GNSS extension to 24 satellites (R&S®SMBV-K96 option)	6
GNSS enhanced (e.g. moving scenarios, multipath) (R&S®SMBV-K92 option)	6
Global navigation satellite system (GNSS)	7
GPS (R&S®SMBV-K44 option)	7
Assisted GPS (R&S®SMBV-K65 option)	9
GPS P code (R&S®SMBV-K93 option)	9
Galileo (R&S®SMBV-K66 option)	12
Glonass (R&S®SMBV-K94 option)	14
GNSS extension to 12 satellites (R&S®SMBV-K91 option)	16
GNSS extension to 24 satellites (R&S®SMBV-K96 option)	16
GNSS enhanced (e.g. moving scenarios, multipath) (R&S®SMBV-K92 option)	17
Ordering information	18

Definitions

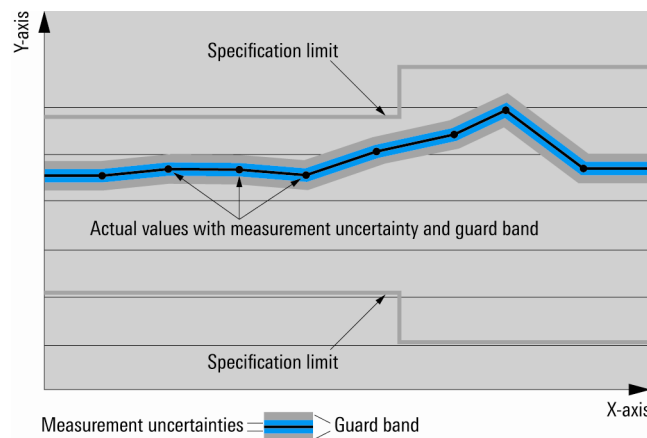
General

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 $<$, \leq , $>$, \geq , \pm , 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.

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

Overview

With the GNSS simulator solution for the R&S®SMBV100A, dynamic scenarios with up to 24 GPS, Galileo and Glonass satellite signals can be generated in realtime including moving scenarios, multipath, dynamic power control and atmospheric modeling.

Above and beyond GNSS signal generation, the R&S®SMBV100A is a flexible vector signal generator with excellent RF performance. It offers options for generating standard-compliant signals for all important digital communications standards (GSM, WCDMA, HSPA+, LTE, WiMAX™, WLAN, etc.) and radio standards (DAB, Sirius | XM Satellite Radio, HD Radio™, FM stereo).

This versatility allows mobile phone or car infotainment system manufacturers that integrate GNSS modules into their products to test the GNSS functionality and the normal functionality of their products with only one instrument.

This document contains the functional specifications of the GNSS-related software options for the R&S®SMBV100A:

- R&S®SMBV-K44 GPS
- R&S®SMBV-K65 assisted GPS
- R&S®SMBV-K93 GPS P code
- R&S®SMBV-K66 Galileo
- R&S®SMBV-K94 Glonass
- R&S®SMBV-K91 GNSS extension to 12 satellites
- R&S®SMBV-K96 GNSS extension to 24 satellites
- R&S®SMBV-K92 GNSS enhanced (e.g. moving scenarios, multipath)

For information on other digital standards or signal quality such as phase noise or spurious, see the following Rohde & Schwarz documents:

- R&S®SMBV100A data sheet, PD 5214.1114.22
- R&S®SMBV100A product brochure, PD 5214.1114.12
- Digital Standards for Signal Generators data sheet, PD 5213.9434.22

Abbreviations

The following abbreviations are used in this document:

- The R&S®SMBV-K44 is referred to as K44
- The R&S®SMBV-K65 is referred to as K65
- The R&S®SMBV-K66 is referred to as K66
- The R&S®SMBV-K91 is referred to as K91
- The R&S®SMBV-K92 is referred to as K92
- The R&S®SMBV-K93 is referred to as K93
- The R&S®SMBV-K94 is referred to as K94
- The R&S®SMBV-K96 is referred to as K96

Minimum hardware configuration

The following minimum hardware configuration is required for the R&S®SMBV100A as a prerequisite for testing GNSS functionality:

R&S®SMBV100A	vector signal generator
R&S®SMBV-B103	frequency range from 9 kHz to 3.2 GHz
R&S®SMBV-B10	baseband generator with digital modulation (realtime) and ARB (32 Msample), 120 MHz RF bandwidth
R&S®SMBV-B92	hard disk (removable)

“WiMAX Forum” is a registered trademark of the WiMAX Forum. “WiMAX”, the WiMAX Forum logo, “WiMAX Forum Certified”, and the WiMAX Forum Certified logo are trademarks of the WiMAX Forum.

Key features

GPS (R&S® SMBV-K44 option)

- Simulation of up to 6 GPS satellites with C/A code at frequencies L1 and L2
- Static mode and localization mode
- User-definable almanac file (SEM/YUMA) with real navigation data
- User-definable location and start time
- Automatic setup of GPS scenario with optimum satellite constellation
- Unlimited simulation time with automatic, on-the-fly exchange of satellites based on configurable elevation masks
- Dynamic power control of individual satellites in realtime
- Hybrid GNSS satellite constellations with up to 6 satellites (requires additional R&S® SMBV-K66 Galileo option and/or R&S® SMBV-K94 Glonass option)

Assisted GPS (R&S® SMBV-K65 option)

- Support of predefined and user-defined A-GPS test scenarios
- Generation of A-GPS assistance data for predefined and user-defined scenarios
- Fully user-defined configuration of navigation message (manually or via import of RINEX ephemeris files)
- Requires the R&S® SMBV-K44 option

GPS P code (R&S® SMBV-K93 option)

- Simulation of up to 6 GPS satellites with P codes or combined civilian C/A and military P codes
- Requires the R&S® SMBV-K44 option
- Static mode and localization mode
- User-definable almanac file (SEM/YUMA) with real navigation data
- User-definable location and start time
- Automatic setup of GPS scenarios with optimum satellite constellation
- Unlimited simulation time with automatic, on-the-fly exchange of satellites based on configurable elevation masks
- Dynamic power control of individual satellites in realtime
- Hybrid GNSS satellite constellations with up to 6 satellites (requires additional R&S® SMBV-K66 Galileo option and/or R&S® SMBV-K94 Glonass option)

Galileo (R&S® SMBV-K66 option)

- Simulation of up to 6 Galileo satellites at frequency E1
- Static mode and localization mode
- User-definable almanac file (SEM/YUMA) with real navigation data
- User-definable location and start time
- Automatic setup of Galileo scenario with optimum satellite constellation
- Unlimited simulation time with automatic, on-the-fly exchange of satellites based on configurable elevation masks
- Dynamic power control of individual satellites in realtime
- Hybrid GNSS satellite constellations with up to 6 satellites (requires additional R&S® SMBV-K44 GPS option and/or R&S® SMBV-K94 Glonass option)

Glonass (R&S® SMBV-K94 option)

- Simulation of up to 6 Glonass satellites (FDMA) with civilian codes at frequencies L1 and L2
- Static mode and localization mode
- User-definable almanac file (.agl) with real navigation data
- User-definable location and start time
- Automatic setup of Glonass scenario with optimum satellite constellation
- Unlimited simulation time with automatic, on-the-fly exchange of satellites based on configurable elevation masks
- Dynamic power control of individual satellites in realtime
- Hybrid GNSS satellite constellations with up to 6 satellites (requires additional R&S® SMBV-K44 GPS option and/or R&S® SMBV-K66 Galileo option)

GNSS extension to 12 satellites (R&S®SMBV-K91 option)

- Simulation of civilian signals from up to 12 GNSS satellites (8 to 12 satellites depending on the configuration, if GPS P code is active)
- Requires the R&S®SMBV-K44, R&S®SMBV-K66 or R&S®SMBV-K94 option

GNSS extension to 24 satellites (R&S®SMBV-K96 option)

- Simulation of GPS C/A and Glonass signals from up to 24 GNSS satellites
- Enhances the multipath budget of GPS C/A and Glonass signals to 24 if R&S®SMBV-K92 is additionally installed
- Requires the R&S®SMBV-K91 option

GNSS enhanced (e.g. moving scenarios, multipath) (R&S®SMBV-K92 option)

- Moving scenarios (import of NMEA waypoint)
- User-definable multipath
- Configurable atmospheric models
- Configurable system time transformation parameters
- Configurable leap second simulation
- Requires the R&S®SMBV-K44, R&S®SMBV-K66 or R&S®SMBV-K94 option

Global navigation satellite system (GNSS)

GPS (R&S® SMBV-K44 option)

GPS		in line with ICD-GPS-200 revision D
General settings		
Frequency		based on the RF band and GNSS hybrid configuration user-selectable in entire frequency range depending on installed RF option (see R&S® SMBV100A data sheet)
Output power		based on the selected power mode and the individual satellite power parameters user-selectable in entire output power range depending on installed RF option (see R&S® SMBV100A data sheet)
RF bands		L1/E1, L2 default: L1/E1
Simulation modes		
Static mode		generation of up to 6 satellites in realtime with user-definable satellite time shift, power, Doppler and initial carrier phase, e.g. for sensitivity measurements
Auto localization mode		automatic dynamic simulation of up to 6 satellites at a receiver location based on user-definable almanac, location and time; simulation is not time-limited due to automatic dynamic exchange of simulated satellites based on visibility and when required for better position dilution of precision (PDOP); constellation and satellite power variation are automatically simulated
User localization mode		dynamic simulation of up to 6 satellites at a receiver location based on user-definable almanac, location and time; a complete user-definable constellation, satellite exchange in realtime and satellite power configuration in realtime are supported
GNSS hybrid configuration	available if K66 or K94 is additionally installed	hybrid GNSS constellation with up to 6 satellites, e.g. 2 GPS satellites and 4 Galileo satellites, possible whenever the base option of the other GNSS standard is installed
User space coordinates	available in auto localization mode and user localization mode	geodetic coordinates in ECEF WGS84 coordinate system: <ul style="list-style-type: none"> • altitude: –10000 m to +1600000 m in steps of 0.1 m • latitude: –90° to +90° in steps of 0.000001° • longitude: –180° to +180° in steps of 0.000001°
System time basis		GPS, UTC default: GPS
Simulation time		flexible date and time or GPS time configuration with a resolution of 1 ms
Current leap seconds	static mode and auto localization mode user localization mode	automated user-configurable
Elevation mask	available in auto localization mode and user localization mode	2.5°, 5°, 7.5°, 10°; filtering of all satellites below a specific threshold
Get optimal constellation	available in user localization mode	optimal constellation search based on the real navigation data and the maximum number of satellites with minimized PDOP and an elevation above the elevation mask

Realtime satellites and position online tracker (SPOT) display	available in auto localization mode and user localization mode	dynamic constellation, user location, satellite absolute power and trajectory views in addition to HDOP/PDOP display; the time of the next satellite handover can be polled in auto localization mode
Power modes		
User power mode	available in static mode and user localization mode	21 dB dynamic range, user-configurable in realtime
Auto power mode	available in auto localization mode and in user localization mode	automatic simulation of satellite power values based on: <ul style="list-style-type: none"> • satellite-to-user distance • interstandard power tuning parameters (only in case of a hybrid GNSS configuration)
Interstandard power tuning	available in auto power mode and if K66 is installed	simulates the nominal power difference between different standards
Marker	two markers if "Maximum Number of Satellites" is less than or equal to 12 or "Use Military GPS" is active; otherwise only one marker	1 PPS
		1 PP2S
		10 PPS
		pulse pattern
		on/off ratio
triggering		trigger
Triggering		see R&S [®] SMBV100A data sheet, "I/Q baseband generator" section
Navigation data source	identical for each satellite	All 0
		All 1
		pattern (up to 64 bit)
		PN 9 to PN 23
		data lists
		real navigation data: almanac file as source for ephemeris and almanac subframes; ephemeris subframes are projected from the almanac subframes
Use spreading code	available in static mode	on/off
GPS satellite configuration (separately settable for each satellite)		
Signals (chip rates)		coarse acquisition C/A (1.023 MHz)
Modulation		BPSK (CDMA)
State		on/off
Space vehicle ID		C/A codes: 37 Gold codes, 1023 chips each
Initial code phase	configurable in case of static and no real navigation data	0.00 chips to 20459.99 chips in steps of 0.01 chips
Pseudo-range	configurable in static mode	0 m to 30000 km
Pseudo-range bias		-1000 m to +1000 m, updated in realtime without restarting the simulation
Satellite relative power	configurable in user power mode	-21 dB to 0 dB, updated in realtime without restarting the simulation
Doppler shift	configurable in static mode	-100 kHz to +100 kHz in steps of 0.01 Hz
Initial carrier phase	configurable in static mode	0 to 2 π in steps of 0.01 rad
Navigation data format		GPS NAV
Data rate		50 Hz
Number of ephemeris pages		1
Ephemeris realtime projection	configurable in user localization mode	off/on, a projection (reference time shifted and ephemeris set tuned accordingly) will be made whenever the ephemeris set approaches the 2 h validity threshold
Project navigation message	configurable in user localization mode	projects the ephemeris and satellite clock correction to the current simulation time
Dynamics		
Pseudo-range error	RMS	± 0.01 m
Max. velocity		10000 m/s
Max. acceleration		300 m/s ²
Max. jerk		45 m/s ³ (as impulse)

Assisted GPS (R&S®SMBV-K65 option)

The R&S®SMBV-K44 option must be installed on the respective instrument.

General settings		
A-GPS test scenarios		
GSM	in line with 3GPP TS 51.010-1 v.7.7.0	signaling test scenario performance test scenario 1 performance test scenario 2 performance test scenario 3 (requires K92)
3GPP FDD	in line with 3GPP TS 34.108 v.8.0.0 and 3GPP TS 34.123-3 v.6.4.0	signaling test scenario
	in line with 3GPP TS 34.108 v.8.0.0 and 3GPP TS 34.171 v.7.0.1	performance test scenario 1 performance test scenario 2 performance test scenario 3 (requires K92)
3GPP2	in line with 3GPP2 C.S0036-0 V1.0	static test scenario moving test scenario (requires K91 and K92)
User-definable		additional test scenarios can be defined by the user
Simulation modes (in addition to the K44 functionality)		
Static mode		satellite navigation parameters can be manually adjusted
User localization mode		satellite navigation parameters can be manually adjusted or imported from a GPS RINEX file
Generation of assistance data		<ul style="list-style-type: none"> • almanac file • ionospheric file • navigation file • UTC file • acquisition file in comma separated values (CSV) format; for navigation file, also in standard RINEX format
Real navigation data (in addition to the K44 functionality)		ephemeris subframes can be configured manually or imported from a GPS RINEX file
Configuration of navigation data (separately settable for each satellite/each satellite ephemeris page)		
Number of ephemeris pages	user localization mode	1 to 12 (manual configuration or import from a GPS RINEX file)
	static mode and auto localization mode	1
Ephemeris parameters		range as defined in ICD-GPS-200 revision D, navigation message
Satellite clock correction parameters		range as defined in ICD-GPS-200 revision D, navigation message

GPS P code (R&S®SMBV-K93 option)

The R&S®SMBV-K44 option must be installed on the respective instrument.

Allows the simulation of up to 6 GPS satellites with P codes or combined civilian C/A and P codes or the legacy C/A signal type provided by K44.

GPS P code		in line with ICD-GPS-200 revision D (antispoofing disabled)
General settings		
Frequency		based on the RF band and GNSS hybrid configuration
		user-selectable in entire frequency range depending on installed RF option (see R&S®SMBV100A data sheet)
Output power		based on the selected power mode and the individual satellite power parameters
		user-selectable in entire output power range depending on installed RF option (see R&S®SMBV100A data sheet)

RF bands		L1/E1, L2 default: L1/E1
Simulation modes		
Static mode		generation of up to 6 GPS C/A, P or C/A + P satellites in realtime with user-definable satellite time shift, power, Doppler and initial carrier phase, e.g. for sensitivity measurements
Auto localization mode		automatic dynamic simulation of up to 6 GPS C/A, P or C/A + P satellites at a receiver location based on user-definable almanac, location and time; simulation is not time-limited due to automatic dynamic exchange of simulated satellites based on visibility and when required for better position dilution of precision (PDOP); constellation and satellite power variation are automatically simulated
User localization mode		dynamic simulation of up to 6 GPS C/A, P or C/A + P satellites at a receiver location based on user-definable almanac, location and time; a complete user-definable constellation, satellite exchange in realtime and satellite power configuration in realtime are supported
GNSS hybrid configuration	available if K66 or K94 is additionally installed	hybrid GNSS constellation with up to 6 satellites, e.g. 4 GPS (C/A + P) satellites and 2 Galileo satellites, possible whenever the base option of the other GNSS standard is installed
User space coordinates	available in auto localization mode and user localization mode	geodetic coordinates in ECEF WGS84 coordinate system: <ul style="list-style-type: none"> • altitude: -10000 m to +1600000 m in steps of 0.1 m • latitude: -90° to +90° in steps of 0.000001° • longitude: -180° to +180° in steps of 0.000001°
System time basis		GPS, UTC default: GPS
Simulation time		flexible date and time or GPS time configuration with a resolution of 1 ms
Current leap seconds	static mode and auto localization mode user localization mode	automated user-configurable
Elevation mask	available in auto localization mode and user localization mode	2.5°, 5°, 7.5°, 10°; filtering of all satellites below a specific threshold
Get optimal constellation	available in user localization mode	optimal constellation search based on the real navigation data and the maximum number of satellites with minimized PDOP and an elevation above the elevation mask
Realtime satellites and position online tracker (SPOT) display	available in auto localization mode and user localization mode	dynamic constellation, user location, satellite absolute power and trajectory views in addition to HDOP/PDOP display; the time of the next satellite handover can be polled in auto localization mode
Power modes		
User power mode	available in static mode and user localization mode	21 dB dynamic range, user-configurable in realtime
Auto power mode	available in auto localization mode and in user localization mode	automatic simulation of satellite power values based on: <ul style="list-style-type: none"> • satellite-to-user distance • interstandard power tuning parameters (only in case of a hybrid GNSS configuration)

Global signal configuration	available in auto localization mode	configures the signals of all possible GPS space vehicles to C/A, P or C/A + P
Intrastandard power tuning		configures the nominal power difference between the civilian and P code signal components of a GPS satellite
Interstandard power tuning	available in auto power mode and if K66 or K94 is installed	configures the nominal power difference between different standards
Marker	two markers if "Maximum Number of Satellites" is less than or equal to 12 or "Use Military GPS" is active; otherwise only one marker	1 PPS
		1 PP2S
		10 PPS
		pulse
		pattern
Triggering		on/off ratio
		trigger
Navigation data source	identical for each satellite	see R&S®SMBV100A data sheet, "I/Q baseband generator" section
		All 0
		All 1
		pattern (up to 64 bit)
		PN 9 to PN 23
Use spreading code	available in static mode	data lists
		real navigation data: almanac file as source for ephemeris and almanac subframes; ephemeris subframes are projected from the almanac subframes
GPS satellite configuration (separately settable for each satellite)		
Signals (chip rates)		coarse acquisition C/A (1.023 MHz) and P (10.23 MHz)
Modulation		BPSK (CDMA)
State		on/off
Space vehicle ID		C/A codes: 37 Gold codes, 1023 chips each P codes: 37 orthogonal codes, one week long each
Initial code phase	configurable in case of static and no real navigation data	0.00 chips to 20459.99 chips in steps of 0.01 chips
Pseudo-range	configurable in static mode	0 m to 30000 km
Pseudo-range bias		-1000 m to +1000 m, updated in realtime without restarting the simulation
Satellite relative power	configurable in user power mode	-21 dB to 0 dB, updated in realtime without restarting the simulation
Doppler shift	configurable in static mode	-100 kHz to +100 kHz in steps of 0.01 Hz
Initial carrier phase	configurable in static mode	0 to 2π in steps of 0.01 rad
Navigation data format		GPS NAV
Data rate		50 Hz
Number of ephemeris pages		1
Ephemeris realtime projection	configurable in user localization mode	off/on, a projection (reference time shifted and ephemeris set tuned accordingly) will be made whenever the ephemeris set approaches the 2 h validity threshold
Project navigation message	configurable in user localization mode	projects the ephemeris and satellite clock correction to the current simulation time
Dynamics		
Pseudo-range error	RMS	± 0.01 m
Max. velocity		10000 m/s
Max. acceleration		300 m/s^2
Max. jerk		45 m/s^3 (as impulse)

Galileo (R&S® SMBV-K66 option)

Galileo		in line with OD SIS ICD, E1 band
General settings		
Frequency		based on the RF band and GNSS hybrid configuration user-selectable in entire frequency range depending on installed RF option (see R&S® SMBV100A data sheet)
Output power		based on the selected power mode and the individual satellite power parameters user-selectable in entire output power range depending on installed RF option (see R&S® SMBV100A data sheet)
RF bands		L1/E1
Simulation modes		
Static mode		generation of up to 6 satellites in realtime with user-definable satellite time shift, power, Doppler and initial carrier phase, e.g. for sensitivity measurements
Auto localization mode		automatic dynamic simulation of up to 6 satellites at a receiver location based on user-definable almanac, location and time; simulation is not time-limited due to automatic dynamic exchange of simulated satellites based on visibility and when required for better position dilution of precision (PDOP); constellation and satellite power variation are automatically simulated
User localization mode		dynamic simulation of up to 6 satellites at a receiver location based on user-definable almanac, location and time; a complete user-definable constellation, satellite exchange in realtime and satellite power configuration in realtime are supported
GNSS hybrid configuration	available if K44 or K94 is additionally installed	hybrid GNSS constellation with up to 6 satellites, e.g. 2 GPS satellites and 4 Galileo satellites possible whenever the base option of the other GNSS standard is installed
User space coordinates	available in auto localization mode and user localization mode	geodetic coordinates in ECEF WGS84 coordinate system: <ul style="list-style-type: none"> • altitude: -10000 m to +1600000 m in steps of 0.1 m • latitude: -90° to +90° in steps of 0.000001° • longitude: -180° to +180° in steps of 0.000001°
System time basis		GST, UTC, default: GST
Simulation time		flexible date and time or GST time configuration with a resolution of 1 ms
Current leap seconds	static mode and auto localization mode user localization mode	automated user-configurable
Elevation mask	available in auto localization mode and user localization mode	2.5°, 5°, 7.5°, 10°; filtering of all satellites below a specific threshold
Get optimal constellation	available in user localization mode	optimal constellation search based on the real navigation data and the maximum number of satellites with minimized PDOP and an elevation above the elevation mask

Realtime satellites and position online tracker (SPOT) display	available in auto localization mode and user localization mode	dynamic constellation, user location, satellite absolute power and trajectory views in addition to HDOP/PDOP display; the time of the next satellite handover can be polled in auto localization mode
Power modes		
User power mode	available in static mode and user localization mode	21 dB dynamic range, user-configurable in realtime
Auto power mode	available in auto localization mode and user localization mode	automatic simulation of satellite power values based on: <ul style="list-style-type: none"> • satellite-to-user distance • interstandard power tuning parameters (only in case of a hybrid GNSS configuration)
Interstandard power tuning	available in auto power mode and if K44 is installed	simulation of the nominal power difference between different standards
Marker	two markers if "Maximum Number of Satellites" is less than or equal to 12 or "Use Military GPS" is active; otherwise only one marker	1 PPS
		1 PP2S
		10 PPS
		pulse
		pattern
Triggering		on/off ratio
		trigger
Navigation data source	identical for each satellite	see R&S®SMBV100A data sheet, "I/Q baseband generator" section
		All 0
		All 1
		pattern (up to 64 bit)
		PN 9 to PN 23
		data lists
Use spreading code	available in static mode	real navigation data: almanac file as source for ephemeris and almanac subframes; ephemeris subframes are projected from the almanac subframes
Galileo satellite configuration (separately settable for each satellite)		
Signals (chip rates)		on/off
Modulation		E1 default (1.023 MHz)
State		CBOC(6,1) + CDMA
Space vehicle ID		E1 codes: 36 memory codes, 4092 chips each
Initial code phase	configurable in case of static and no real navigation data	0.00 chips to 20459.99 chips in steps of 0.01 chips
Pseudo-range	configurable in static mode	0 m to 30000 km
Pseudo-range bias		-25 m to +25 m, updated in realtime without restarting the simulation
Satellite relative power	configurable in user power mode	-21 dB to 0 dB, updated in realtime without restarting the simulation
Doppler shift	configurable in static mode	-100 kHz to +100 kHz in steps of 0.01 Hz
Initial carrier phase	configurable in static mode	0 to 2π in steps of 0.01 rad
Navigation data format		Galileo INAV
Data rate		250 Hz
Number of ephemeris pages		1
Realtime projection	configurable in user localization mode	off/on, a projection (reference time shifted and ephemeris set tuned accordingly) will be made whenever the ephemeris set approaches the 2 h validity threshold
Project navigation message	configurable in user localization mode	projects the ephemeris and satellite clock correction to the current simulation time
Dynamics		
Pseudo-range error	RMS	± 0.01 m
Max. velocity		10000 m/s
Max. acceleration		300 m/s ²
Max. jerk		45 m/s ³ (as impulse)

Glonass (R&S[®] SMBV-K94 option)

Glonass		in line with GLONASS ICD version 5.0
General settings		
Frequency		based on the RF band and GNSS hybrid configuration user-selectable in entire frequency range depending on installed RF option (see R&S [®] SMBV100A data sheet)
Output power		based on the selected power mode and the individual satellite power parameters user-selectable in entire output power range depending on installed RF option (see R&S [®] SMBV100A data sheet)
RF bands		L1/E1, L2 default: L1/E1
Simulation modes		
Static mode		generation of up to 6 satellites in realtime with user-definable satellite time shift, power, Doppler and initial carrier phase, e.g. for sensitivity measurements
Auto localization mode		automatic dynamic simulation of up to 6 satellites at a receiver location based on user-definable almanac, location and time; simulation is not time-limited due to automatic dynamic exchange of simulated satellites based on visibility and when required for better position dilution of precision (PDOP); constellation and satellite power variation are automatically simulated
User localization mode		dynamic simulation of up to 6 satellites at a receiver location based on user-definable almanac, location and time; a complete user-definable constellation, satellite exchange in realtime and satellite power configuration in realtime are supported
GNSS hybrid configuration	available if K44 or K66 is additionally installed	hybrid GNSS constellation with up to 6 satellites, e.g. 4 Glonass satellites and 2 GPS satellites, possible whenever the base option of the other GNSS standard is installed
User space coordinates	available in auto localization mode and user localization mode	geodetic coordinates in ECEF WGS84 coordinate system: <ul style="list-style-type: none"> • altitude: -10000 m to +1600000 m in steps of 0.1 m • latitude: -90° to +90° in steps of 0.000001° • longitude: -180° to +180° in steps of 0.000001°
System time basis		GLO, UTC default: GLO
Simulation time		flexible date and time or GLO time configuration with a resolution of 1 ms
Current leap seconds	static mode and auto localization mode user localization mode	automated user-configurable
Elevation mask	available in auto localization mode and user localization mode	2.5°, 5°, 7.5°, 10°; filtering of all satellites below a specific threshold
Get optimal constellation	available in user localization mode	optimal constellation search based on the real navigation data and the maximum number of satellites with minimized PDOP and an elevation above the elevation mask

Realtime satellites and position online tracker (SPOT) display	available in auto localization mode and user localization mode	dynamic constellation, user location, satellite absolute power and trajectory views in addition to HDOP/PDOP display; the time of the next satellite handover can be polled in auto localization mode
Power modes		
User power mode	available in static mode and user localization mode	21 dB dynamic range, user-configurable in realtime
Auto power mode	available in auto localization mode and in user localization mode	automatic simulation of satellite power values based on: <ul style="list-style-type: none"> • satellite-to-user distance • interstandard power tuning parameters (only in case of a hybrid GNSS configuration)
Interstandard power tuning	available in auto power mode and if K66 is installed	simulates the nominal power difference between different standards
Marker	two markers if "Maximum Number of Satellites" is less than or equal to 12 or "Use Military GPS" is active; otherwise only one marker	1 PPS
		1 PP2S
		10 PPS
		pulse pattern
		on/off ratio
Triggering		trigger
Triggering		see R&S®SMBV100A data sheet, "I/Q baseband generator" section
Navigation data source	identical for each satellite	All 0
		All 1
		pattern (up to 64 bit)
		PN 9 to PN 23
		data lists
		real navigation data: almanac file as source for ephemeris and almanac subframes; ephemeris automatically generated from .agl almanac file
Use spreading code	available in static mode	on/off
Glonass satellite configuration (separately settable for each satellite)		
Signals (chip rates)		coarse acquisition R-C/A (511 kHz)
Frequency number	configurable in static mode with no real navigation data	-7 to +13
Modulation		BPSK (CDMA)
State		on/off
Space vehicle ID		1 CDMA code shared by all Glonass satellites, 511 chips per repetition
Initial code phase	configurable in case of static and no real navigation data	0.00 chips to 20459.99 chips in steps of 0.01 chips
Pseudo-range	configurable in static mode	0 m to 30000 km
Pseudo-range bias		-1000 m to +1000 m, updated in realtime without restarting the simulation
Satellite relative power	configurable in user power mode	-21 dB to 0 dB, updated in realtime without restarting the simulation
Doppler shift	configurable in static mode	-100 kHz to +100 kHz in steps of 0.01 Hz
Initial carrier phase	configurable in static mode	0 to 2π in steps of 0.01 rad
Navigation data format		Glonass NAV
Data rate		50 Hz, 100 Hz (after applying the meander code)
Number of ephemeris pages		1
Ephemeris realtime projection	configurable in user localization mode	off/on, a projection (reference time shifted and ephemeris set tuned accordingly) will be made every 30, 45 or 60 minutes
Project navigation message	configurable in user localization mode	projects the ephemeris and satellite clock correction to the current simulation time

Dynamics		
Pseudo-range error	RMS	±0.01 m
Max. velocity		10000 m/s
Max. acceleration		300 m/s ²
Max. jerk		45 m/s ³ (as impulse)

GNSS extension to 12 satellites (R&S® SMBV-K91 option)

The R&S® SMBV-K44, R&S® SMBV-K66 or R&S® SMBV-K94 option must be installed on the respective instrument.

GNSS extension to 12 satellites	GPS P code not activated	simulation of up to 12 GNSS satellites, e.g. 8 GPS and 4 Galileo satellites (if K44 and K66 are both installed)
	GPS P code activated (K44 and K93 required)	8 satellites can at least be configured, e.g. 8 (C/A + P) GPS satellites; 12 can be reached depending on the configuration, e.g. 4 (C/A + P) GPS and 8 Glonass satellites (K94 additionally needed) or 2 (C/A + P) GPS, 2 Galileo E1 and 8 Glonass satellites on L1/E1 (K66 and K94 additionally needed)

GNSS extension to 24 satellites (R&S® SMBV-K96 option)

The R&S® SMBV-K91 option must be installed on the respective instrument.

GNSS extension to 24 satellites		simulation of up to 24 GPS C/A and/or Glonass satellites, e.g. 12 GPS C/A and 12 Glonass satellites (if K44 and K94 are additionally installed)
---------------------------------	--	---

GNSS enhanced (e.g. moving scenarios, multipath) (R&S®SMBV-K92 option)

The R&S®SMBV-K44, R&S®SMBV-K66 or R&S®SMBV-K94 option must be installed on the respective instrument.

Enhances any available GNSS base option, e.g. K44, to be able to configure system time conversion, atmospheric modeling, moving scenario, user-defined multipath and leap second simulation parameters.

Moving scenario	available in auto localization mode and user localization mode	minimum duration of 12 hours before waypoint repetition and up to 4 days if R&S®SMBV-B55 is installed; supported formats: <ul style="list-style-type: none"> • comma separated waypoints • movement script • NMEA
Ionospheric navigation parameters		configuration of the ionospheric navigation parameters as they will be transmitted in the navigation message
Ionospheric model	available in auto localization mode and user localization mode	none, Klobuchar for GPS none for Galileo none for Glonass
Tropospheric model	available in auto localization mode and user localization mode	none, STANAG
Time conversion parameters	static mode and user localization mode	manual configuration or import from RINEX files, e.g. GPS to UTC, GST to UTC and GLO to UTC(SU)
	auto localization mode	set to 0
Leap second simulation	available in user localization mode	leap second transition at a definable date with a definable sign
Multipath (available in user localization mode; parameters separately settable for each satellite/tap)		
State		on/off
Channel budget	GPS C/A (GPS P code not activated)	
	“Maximum Number of Satellites” is less than or equal to 12	16 channels
	“Maximum Number of Satellites” is greater than 12	24 channels
	GPS (C/A + P) (GPS P code activated)	8 channels
	Glonass	
	“Maximum Number of Satellites” is less than or equal to 12	16 channels
	“Maximum Number of Satellites” is greater than 12	24 channels
	Galileo	12 channels
Number of taps	hybrid constellations (GPS P code not activated)	12 channels to 24 channels
	hybrid constellations (GPS P code activated)	8 channels to 16 channels
Additional time shift		1 to 10 depending on the remaining channel budget
Additional power		0 chips to 9.99999 chips in steps of 0.00001 chips
Additional Doppler shift		-10 dB to 0 dB in steps of 0.01 dB
Additional carrier phase		-10 kHz to +10 kHz in steps of 0.01 Hz
		0 to 2 π in steps of 0.01 rad

Ordering information

Designation	Type	Order No.
Base unit (including power cable, quick start guide and CD-ROM, with operating and service manual)		
Vector Signal Generator ¹	R&S [®] SMBV100A	1407.6004.02
Hardware options (GNSS related configuration) ²		
Frequency Range 9 kHz to 3.2 GHz	R&S [®] SMBV-B103	1407.9603.02
Baseband Generator with Digital Modulation (realtime) and ARB (32 Msample), 120 MHz RF bandwidth	R&S [®] SMBV-B10	1407.8607.02
Hard Disk (removable)	R&S [®] SMBV-B92	1407.9403.02
ARB Memory Extension to 256 Msample (requires R&S [®] SMBV-B92 option)	R&S [®] SMBV-B55	1407.9203.02
Software options (GNSS related only) ²		
GPS	R&S [®] SMBV-K44	1415.8060.02
Assisted GPS	R&S [®] SMBV-K65	1415.8560.02
Galileo	R&S [®] SMBV-K66	1415.8590.02
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
GNSS Extension to 24 Satellites	R&S [®] SMBV-K96	1415.8790.02
Recommended extras		
Hardcopy manuals (in English, UK)		1407.6062.32
Hardcopy manuals (in English, US)		1407.6062.39
19" Rack Adapter	R&S [®] ZZA-S334	1109.4487.00
Power Sensor, 9 kHz to 6 GHz	R&S [®] NRP-Z92	1171.7005.02
Keyboard with USB Interface (US character set)	R&S [®] PSL-Z2	1157.6870.04
Mouse with USB Interface, optical	R&S [®] PSL-Z10	1157.7060.03
USB Serial Adapter, for RS-232-C remote control	R&S [®] TS-USB1	6124.2531.00
Accessories		
Documentation of Calibration Values	R&S [®] DCV-2	0240.2193.18
DAkkS (formerly DKD) Calibration in line with ISO 17025 and ISO 9000 calibration	R&S [®] SMBV-DKD	1415.8448.02

Service options		
Extended Warranty, one year	R&S [®] WE1SMBV100A	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S [®] WE2SMBV100A	
Extended Warranty, three years	R&S [®] WE3SMBV100A	
Extended Warranty, four years	R&S [®] WE4SMBV100A	
Extended Warranty with Calibration Coverage, one year	R&S [®] CW1SMBV100A	
Extended Warranty with Calibration Coverage, two years	R&S [®] CW2SMBV100A	
Extended Warranty with Calibration Coverage, three years	R&S [®] CW3SMBV100A	
Extended Warranty with Calibration Coverage, four years	R&S [®] CW4SMBV100A	

Extended warranty with a term of one to four years (WE1 to WE4)

Repairs carried out during the contract term are free of charge ³. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

Extended warranty with calibration (CW1 to CW4)

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 ³ and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

For product brochure, see PD 5214.5284.12 and www.rohde-schwarz.com

¹ The base unit must be ordered with an R&S[®]SMBV-B10x frequency option.

² For further options, see the R&S[®]SMBV100A product brochure (PD 5214.1114.12), data sheet (PD 5214.1114.22) and www.rohde-schwarz.com.

³ Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service you can rely on

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
- | Long-term dependability

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- | Energy-efficient products
- | Continuous improvement in environmental sustainability
- | ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

Rohde & Schwarz GmbH & Co. KG

www.rohde-schwarz.com

Regional contact

- | Europe, Africa, Middle East | +49 89 4129 12345
customersupport@rohde-schwarz.com
- | North America | 1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
- | Latin America | +1 410 910 79 88
customersupport.la@rohde-schwarz.com
- | Asia/Pacific | +65 65 13 04 88
customersupport.asia@rohde-schwarz.com
- | China | +86 800 810 8228/+86 400 650 5896
customersupport.china@rohde-schwarz.com

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG
Trade names are trademarks of the owners | Printed in Germany (ch)
PD 5214.5284.22 | Version 03.00 | February 2012 | GNSS in the R&S®SMBV100A
Subject to change

© 2010 - 2012 Rohde & Schwarz GmbH & Co. KG | 81671 München, Germany



5214528422