Rohde & Schwarz

GNSS Solutions

ROHDE&SCHWARZ

PD 5216.1740.32
V1.00

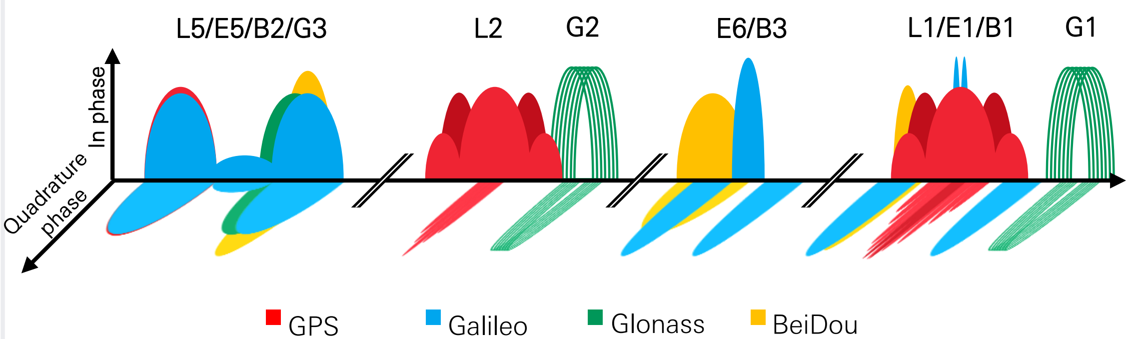
GNSS Signal Generation
GPS/Galileo/Glonass/BeiDou

GPS
Provides free standard positioning service (SPS) and precision positioning service (PPS) for authorized users.

GPS signal plan

Service name	C/A	P(Y)	L1C	L2C	M Code	L5I L5Q
Frequency band	L1	L1 L2	L1	L2	L1 L2	L5
Center frequency [MHz]	1575.42	1575.42 1227.6	1575.42	1227.6	1575.42 1227.6	1176.45
Modulation	BPSK(1)	BPSK(10)	TMBOC (6,1,1/11)	BPSK(1)	BOC(10,5)	QPSK(10)

Power spectral density of most important GNSS signals



Galileo
Provides open service (OS), public regulated service (PRS) restricted to authorized users, commercial service (CS) and search and rescue (SAR)

Galileo signal plan

Service name	E1 OS	PRS	E5a OS E5b OS	E6 CS
Frequency band	E1	E1 E6	E5	E6
Center frequency [MHz]	1575.42	1575.42 1278.75	1176.45 1207.14	1278.75
Modulation	CBOC (6,1,1/11)	BOC(15,2.5) BOC(10,5)	AltBOC (15,10)	BPSK(5)

Glonass
Provides standard precision (C/A) and for authorized users high precision (P) navigation signals

Glonass signal plan

Service name	C/A	P	G3I G3Q
Frequency band	G1 G2	G1 G2	G3
Center frequency [MHz]	$1602 \pm k \cdot 0.5625$ $1246 \pm k \cdot 0.4375$ $k \in [-7,6]$, (FDMA)	$1602 \pm k \cdot 0.5625$ $1246 \pm k \cdot 0.4375$ $k \in [-7,6]$, (FDMA)	1202.025 (CDMA)
Modulation	BPSK(0.5)	BPSK(5)	QPSK(10)

BeiDou
Provides open service (OS) and authorized service (AS)

BeiDou signal plan

Service name	B1I (OS) B1Q (AS)	B2I (OS) B2Q (AS)	B3I B3Q
Frequency band	B1	B2	B3
Center frequency [MHz]	1561.098	1207.14	1268.52
Modulation	QPSK(2)	BPSK(2) BPSK(10)	QPSK(10)

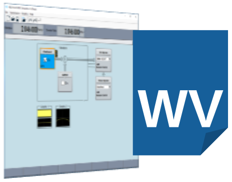
Your challenge

- GNSS technology is found in a wide variety of applications, ranging from car navigation systems to geodetic measurement equipment to personal fitness trackers
- The performance of each newly developed GNSS receiver has to be tested before it is brought to market
- Controlled and realistic conditions are a prerequisite to obtaining conclusive test results
- Tests cannot be performed in a real-world environment since this is time-consuming, costly and impossible to reproduce
- GNSS signals have a complex structure and are difficult to create manually

Our solutions

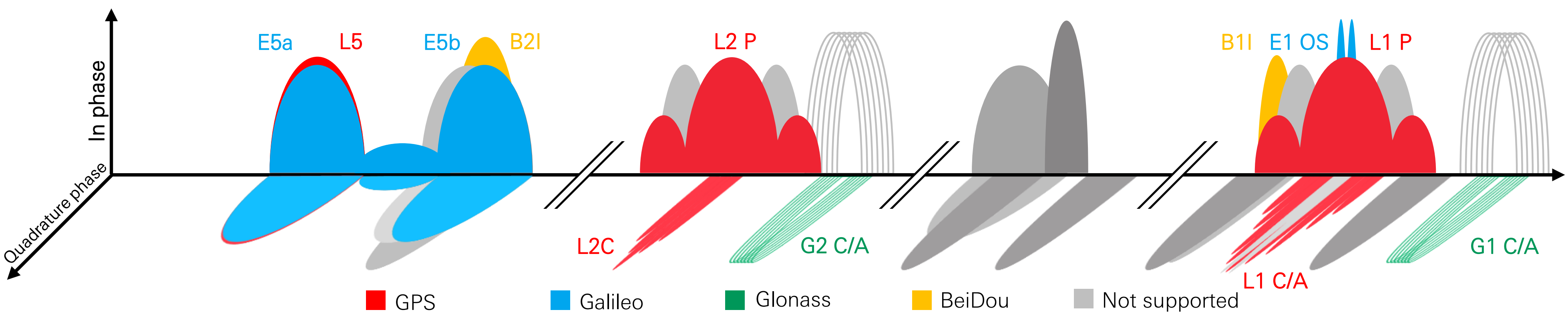
- Use the R&S®SMBV100A or the R&S®SMW200A to simulate complex satellite constellations in realtime with unlimited simulation time
- Perform tests in the lab under controlled and repeatable conditions using an R&S®GNSS simulator
- Perform production tests with the R&S®SMBV-P101 or prerecorded waveforms from R&S®WinIQSIM2
- Generate signals for all available GNSS:
  - GPS (C/A, P, L2C, L5), Galileo (E1 OS, E5a, E5b), Glonass (C/A), BeiDou (B1I,B2I)

Rohde & Schwarz solutions for GNSS signal generation



- High-end GNSS constellation simulator for sophisticated multi-constellation, multi-frequency, multi-antenna and multi-vehicle testing (R&S®SMW200A)
- GNSS constellation simulator for single-frequency receiver characterization (R&S®SMBV100A)
- GNSS production tester (R&S®SMBV-P101)
- GNSS waveforms for basic receiver testing (R&S®WinIQSIM2)

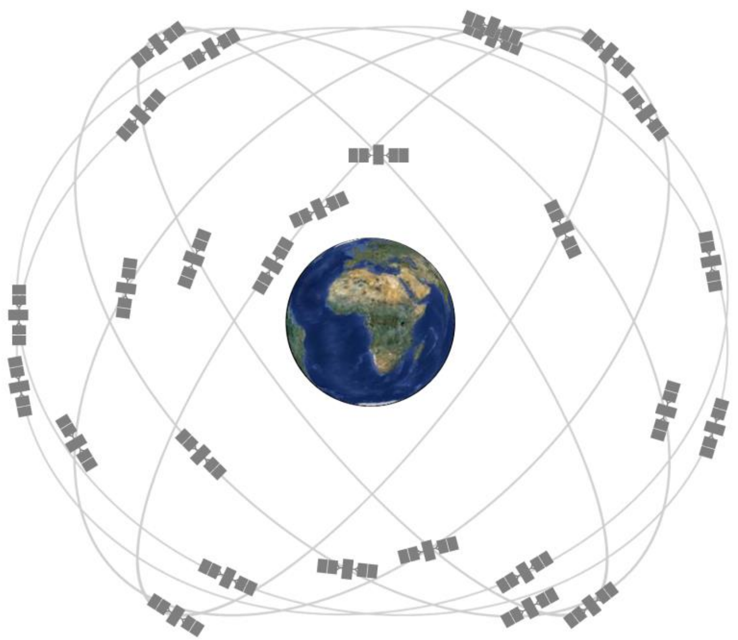
Available GNSS test signals on Rohde & Schwarz GNSS simulators



GNSS Signal Generation

GPS

Facts and figures

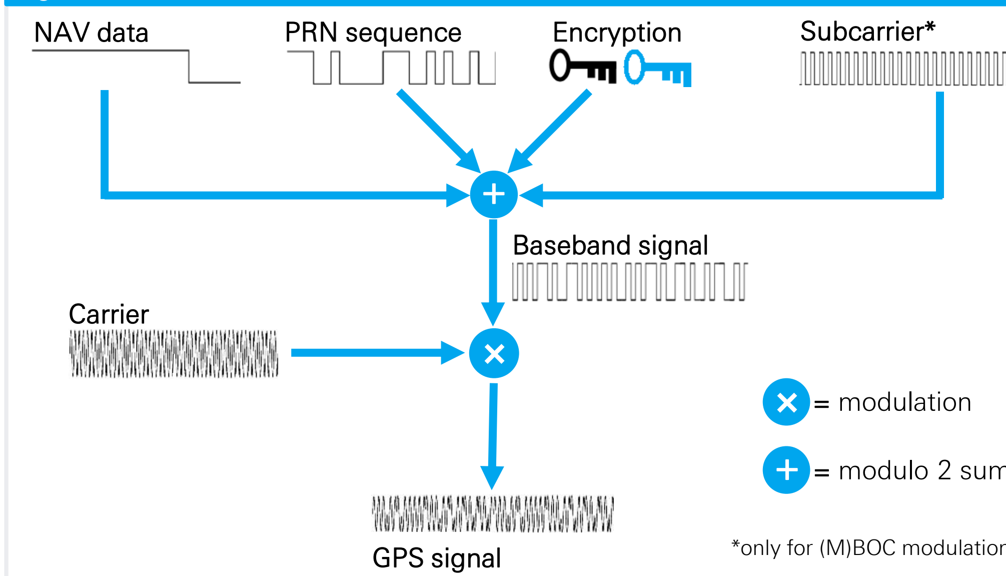


- Operated by the United States government
- Provides free standard positioning service (SPS) and precision positioning service (PPS) for authorized users
- 24 (+3 spare) baseline satellites; currently >30 operational SVs
- 6 orbital planes with an inclination of 55°
- Orbital altitude: ~20.200 km
- Orbital period: 11h 58min (half a sidereal day)
- Ground track repetition period: 23h 56min (one sidereal day)

GPS signal plan

Service name	C/A	P(Y)	L1C	L2CM L2CL	M Code	L5I L5Q
Frequency band	L1	L1 L2	L1	L2	L1 L2	L5
Center frequency [MHz]	1575.42	1575.42 1227.6	1575.42	1227.6	1575.42 1227.6	1176.45
Modulation	BPSK(1)	BPSK(10)	TMBOC (6,1,1/11)	BPSK(1)	BOC(10,5)	QPSK(10)
Access technique	CDMA	CDMA	CDMA	CDMA	CDMA	CDMA
Code frequency [MHz]	1.023	10.23	1.023	0.5115 0.5115	5.115	10.23
PRN code length	1023	$6.19 \cdot 10^{19}$	10230	10230 767250	-	10230
Data rate [bps]	50	50	50	50 -	-	50

Signal modulation



ROHDE&SCHWARZ

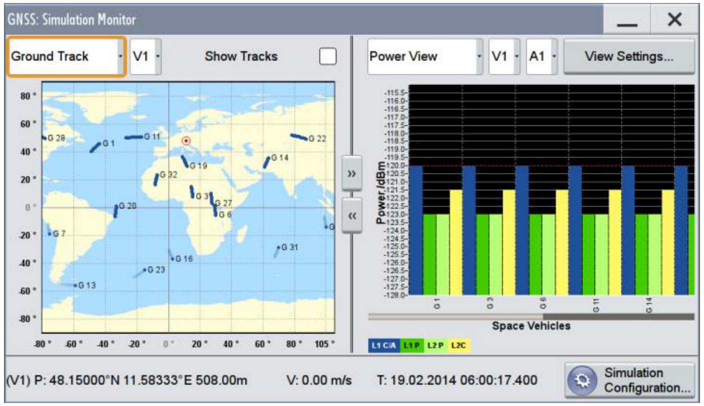
Your challenge

- GPS technology is found in a wide variety of applications, reaching from car navigation systems over geodetic measurement equipment to personal fitness trackers
- The performance of each newly developed GPS receiver has to be tested before it is brought to market
- Controlled and realistic conditions are a prerequisite to get conclusive test results
- GPS receivers cannot be tested in a real-world environment since this is time-consuming, costly and almost impossible to reproduce
- The structure of GPS signals is complex and therefore difficult to create manually

Our solution

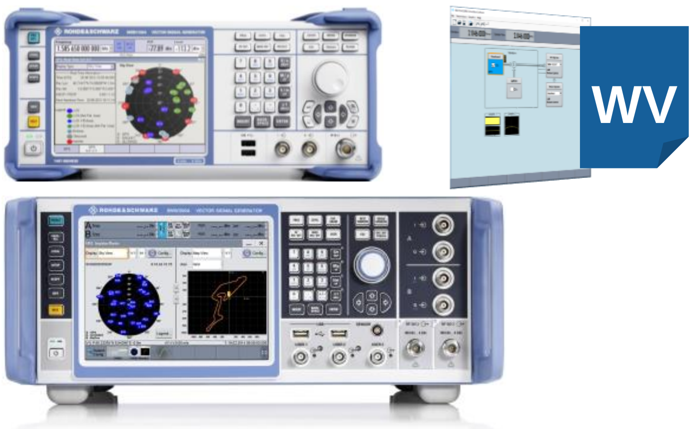
- Use the R&S®SMBV100A or the R&S®SMW200A to simulate complex satellite constellations in real-time and with unlimited simulation time
- Perform tests in the lab under controlled and repeatable conditions using a R&S®GNSS simulator
- Perform production tests with the R&S®SMBV-P101 or prerecorded waveforms from R&S®WinIQSIM2
- Generate signals for all available GNSS systems:
  - GPS (C/A, P, L2C, L5)
  - Galileo (E1 OS), Glonass (C/A), Beidou (B1I,B2I)

GPS simulation in the R&S®SMW200A



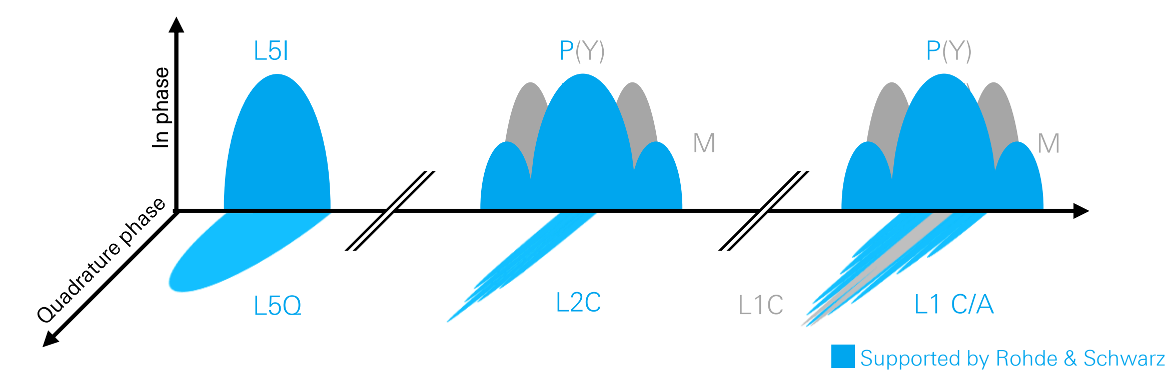
Combined C/A, P and L2C simulation performed by the R&S®SMW200A.

Rohde & Schwarz solutions for GNSS signal generation



- GNSS simulator, R&S®SMBV100A
- GNSS simulator, R&S®SMW200A
- GNSS production tester, R&S®SMBV-P101
- GNSS waveforms with R&S®WinIQSIM2

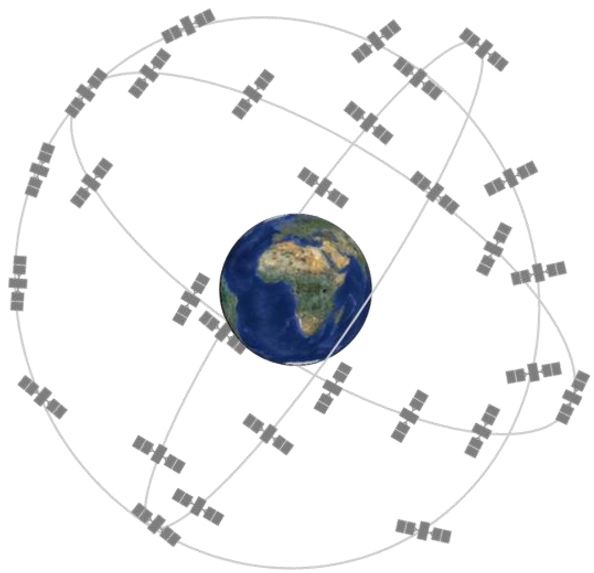
GPS spectrum



GNSS Signal Generation

Galileo

Facts and figures

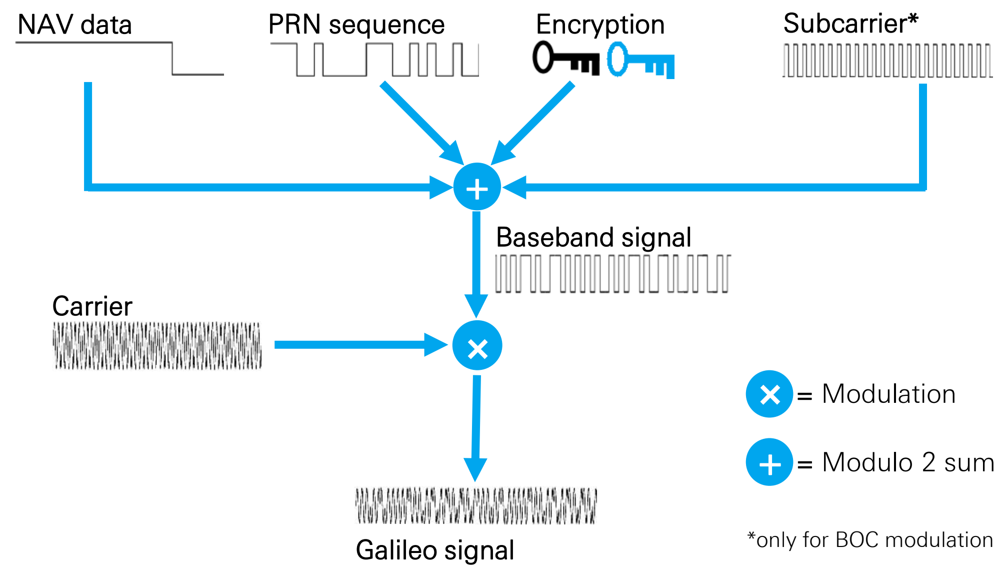


- Joint initiative of the European Commission (EC), the European GNSS Agency (GSA) and the European Space Agency (ESA).
- Provides open service (OS), public regulated service (PRS) restricted to authorized users, commercial service (CS) and search and rescue (SAR) service
- 27 (+3 spare) baseline satellites; currently 22 operational SVs
- 3 orbital planes with an inclination of 56°
- Orbital altitude: ~23.222 km
- Orbital period: ~14h
- Ground track repetition period: 10 sidereal days

Galileo signal plan

Service name	E1 OS	PRS	E5a OS E5b OS	E6 CS
Frequency band	E1	E1 E6	E5	E6
Center frequency [MHz]	1575.42	1575.42 1278.75	1176.45 1207.14	1278.75
Modulation	CBOC(6,1,1/11)	BOC(15,2.5) BOC(10,5)	AltBOC(15,10)	BPSK(5)
Access technique	CDMA	CDMA	CDMA	CDMA
Sub-carrier frequency MHz]	6.138, 1.023	15.345 10.23	15.345	-
Code frequency [MHz]	1.023	2.5575 5.115	10.23	5.115
Primary PRN code length	4092	-	10230	5115
Data rate [bps]	250	-	50 250	1000 -

Signal modulation



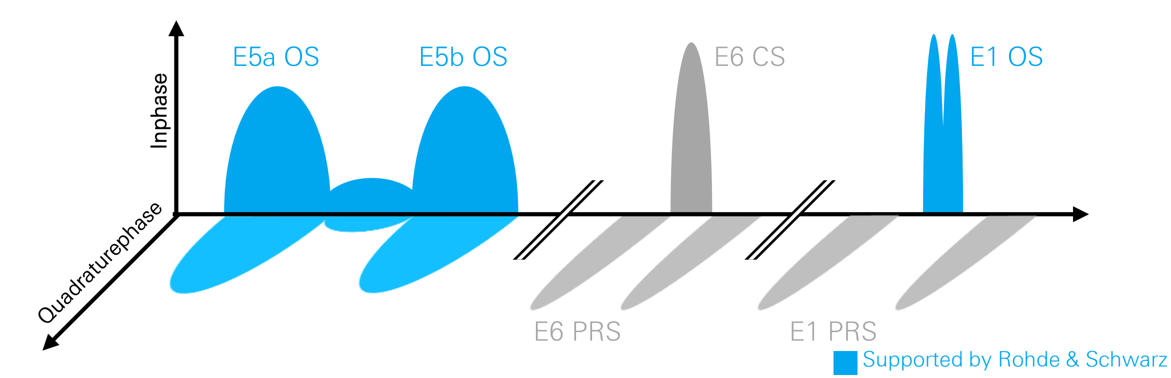
Your challenge

- Galileo is an emerging technology which will be part of a wide variety of applications, reaching from location-based services (LBS) over agriculture to time-reference functions
- The performance of newly developed Galileo receivers has to be tested before they are brought to market
- Controlled and realistic conditions are a prerequisite to get conclusive test results
- Galileo receivers cannot be tested in a real-world environment since this is time-consuming, costly and almost impossible to reproduce
- The structure of Galileo signals is complex and therefore difficult to create manually

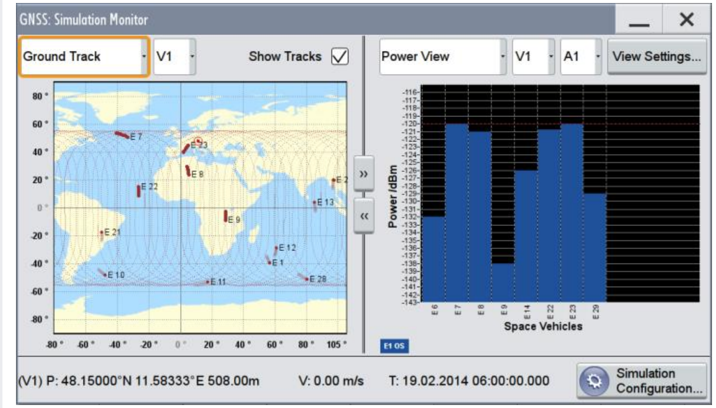
Our solution

- Use the R&S®SMBV100A or the R&S®SMW200A to simulate complex satellite constellations in real-time and with unlimited simulation time
- Perform tests in the lab under controlled and repeatable conditions using a R&S®GNSS simulator
- Perform production tests with the R&S®SMBV-P101 or precomputed waveforms from R&S®WinIQSIM2
- Generate signals for all available GNSS systems:
  - Galileo (E1 OS)
  - GPS (C/A, P, L2C), Glonass (C/A), Beidou (B1I,B2I)

Galileo spectrum



Galileo simulation in the R&S®SMW200A



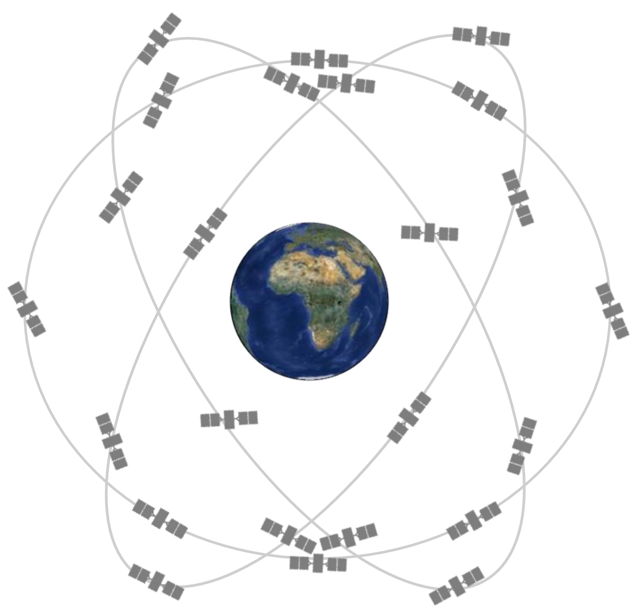
E1 OS simulation performed by the R&S®SMW200A.

Rohde & Schwarz Solutions for GNSS Signal Generation

- GNSS simulator, R&S®SMBV100A
- GNSS simulator, R&S®SMW200A
- GNSS production tester, R&S®SMBV-P101
- GNSS waveforms with R&S®WinIQSIM2

GNSS Signal Generation
GLONASS

Facts and figures

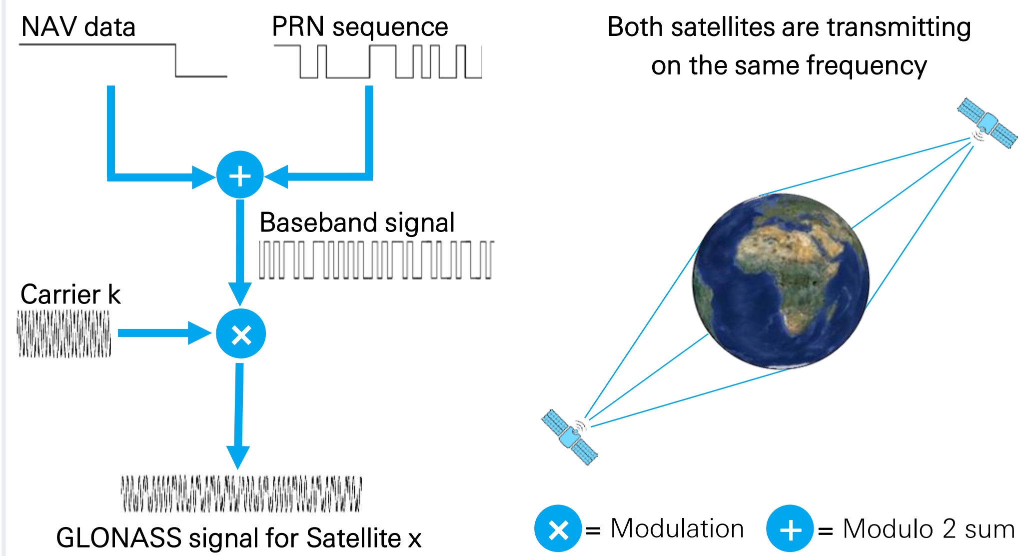


- Operated by the Russian government
- Provides free standard positioning service (ST) and precision positioning service (VT) for authorized users
- 24 baseline satellites; currently 23 operational SVs
- 3 orbital planes with an inclination of 64.8°
- Orbital altitude: ~19.150 km
- Orbital period: 11h 16min
- Ground track repetition period: 8 sidereal days

GLONASS signal plan

Service name	C/A	P	G3I G3Q
Frequency band	G1 G2	G1 G2	G3
Center frequency [MHz]	1602 ± k·0.5625 1246 ± k·0.4375 k ∈ [-7,6]	1602 ± k·0.5625 1246 ± k·0.4375 k ∈ [-7,6]	1202.025
Modulation	BPSK(0.5)	BPSK(5)	QPSK(10)
Access technique	FDMA	FDMA	CDMA
Code frequency [MHz]	0.511	5.11	1.023
PRN code length	511	$5.11\cdot10^6$	10230
Data rate [bps]	50	50	100

Signal modulation



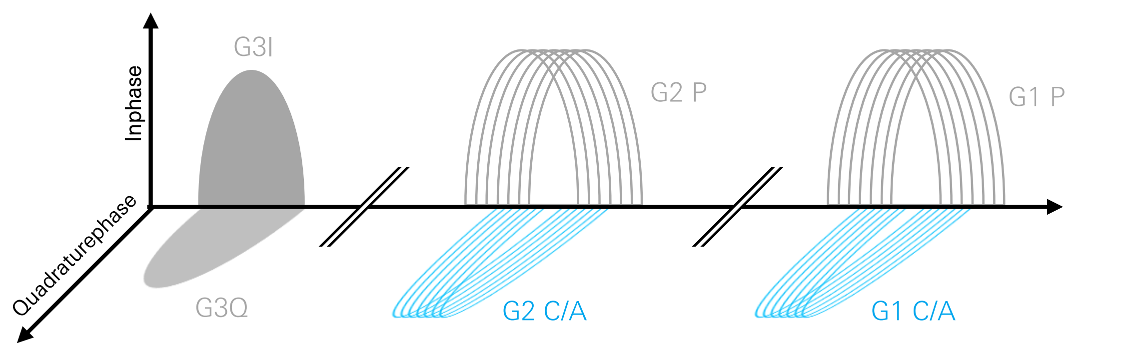
Your challenge

- Glonass technology is found in a wide variety of applications, reaching from car navigation systems over geodetic measurement equipment to personal fitness trackers
- The performance of each newly developed Glonass receiver has to be tested before it is brought to market
- Controlled and realistic conditions are a prerequisite to get conclusive test results
- Glonass receivers cannot be tested in a real-world environment since this is time-consuming, costly and almost impossible to reproduce
- The structure of Glonass signals is complex and therefore difficult to create manually

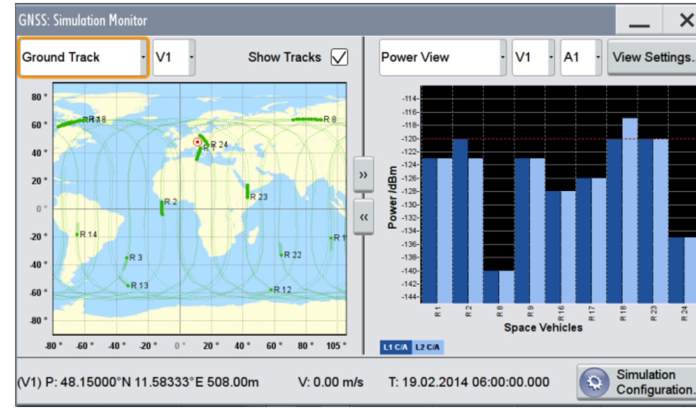
Our solution

- Use the R&S®SMBV100A or the R&S®SMW200A to simulate complex satellite constellations in real-time and with unlimited simulation time
- Perform tests in the lab under controlled and repeatable conditions using a R&S®GNSS simulator
- Perform production tests with the R&S®SMBV-P101 or pre-computed waveforms from R&S®WinIQSIM2
- Generate signals for all available GNSS systems:
  - Glonass (C/A)
  - GPS (C/A, P, L2C), Galileo (E1 OS), Beidou (B1I,B2I)

GLONASS spectrum



GLONASS simulation in the R&S®SMW200A



Combined G1 C/A and G2 C/A simulation performed by the R&S®SMW200A.

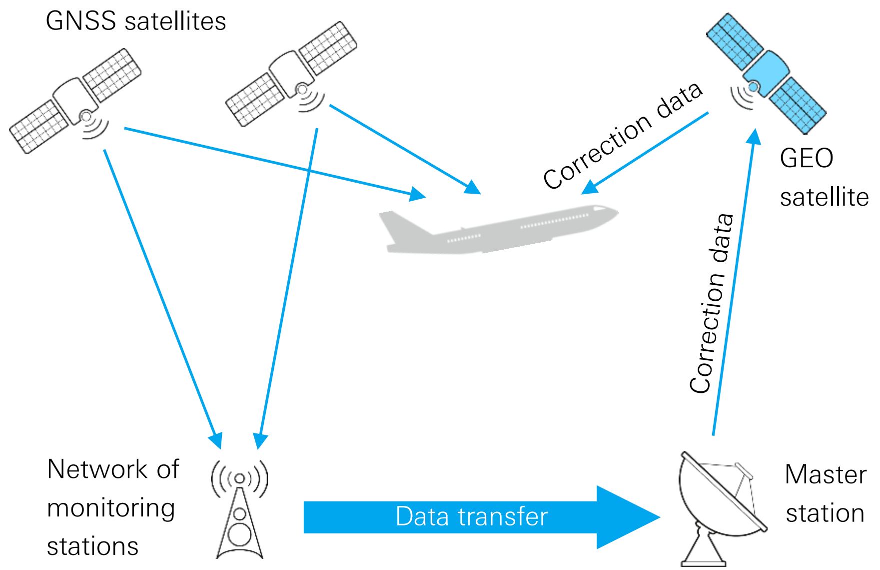
Rohde & Schwarz Solutions for GNSS Signal Generation

- GNSS simulator, R&S®SMBV100A
- GNSS simulator, R&S®SMW200A
- GNSS production tester, R&S®SMBV-P101
- GNSS waveforms with R&S®WinIQSIM2

SBAS/QZSS Augmentation Signal Generation

EGNOS/WAAS/MSAS/GAGAN/QZSS

Principle of SBAS/QZSS



- Monitoring station at an accurately surveyed position receives GNSS signals and performs position estimation; the results are forwarded to the master station
- At the master station, error correction data is calculated from the mismatch between the GNSS position and the actual position of the monitoring station
- Augmentation data, including integrity information about the health status of the GNSS satellites, is transmitted to geostationary (GEO) satellites and provided to the user on L1
- GNSS position estimate can be corrected for GNSS satellite orbit and clock errors as well as ionospheric disturbances at the receiver
- No corrections of local effects, such as tropospheric effects, multipath and receiver inherent errors

Satellite-Based Augmentation Systems (SBAS)

Implementations

- Europe: European Geostationary Navigation Overlay Service (EGNOS)
- North America: Wide Area Augmentation System (WAAS)
- Japan: MTSAT Satellite Augmentation System (MSAS)
- India: GPS Aided Geo Augmented Navigation system (GAGAN)

Features and benefits

- Differential corrections: corrections of GNSS satellite orbit/clock errors and ionospheric disturbances
- GEO ranging (only WAAS): additional GPS-like signals from GEO satellites to increase the number of navigation satellites available to users
- Integrity service: information about the quality of the navigation service, including timely warnings in case the system performance becomes unreliable

Quasi-Zenith Satellite System (QZSS)

Overview

- Covers East Asia and the Oceania region
- Augmentation and complementary system to GPS
- One geostationary and three geosynchronous satellites
- Outlook: extension to a standalone Regional Navigation Satellite System (RNSS) with 7 satellites is under implementation

Signal plan

- GPS signals: L1 C/A, L1C, L2C, L5
- Differential corrections for GPS: L1-SAIF
- Experimental signal: LEX (compatible with Galileo E6)

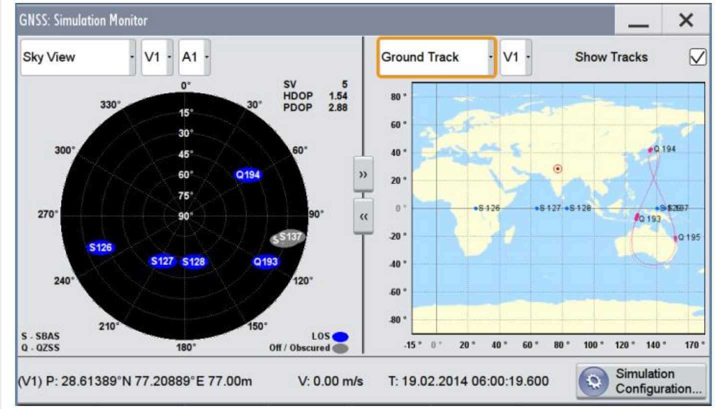
Your challenge

- The SBAS capabilities of each newly developed GNSS receiver have to be tested carefully
- Full characterization of a receiver includes evaluating its ability to decode and apply correction data from SBAS signals
- Testing the GNSS device's response to integrity information and alerts provided by SBAS is also part of the evaluation process
- Controlled and realistic conditions, considering satellite orbit and clock errors as well as ionospheric disturbances, are a prerequisite to obtaining conclusive test results
- Tests cannot be performed in a real-world environment since this is time-consuming, costly and impossible to reproduce
- Augmentation signals have a complex structure and are difficult to create manually

Our solution

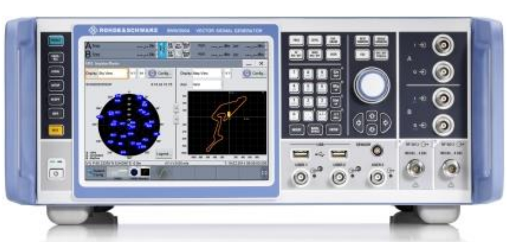
- Use the GNSS simulator in the R&S®SMBV100A or the R&S®SMW200A to simulate complex GPS/SBAS/QZSS scenarios in realtime with unlimited simulation time
- Perform tests in the lab under controlled and repeatable conditions using simulated SBAS/QZSS signals
- Apply accurate models of satellite orbit and clock errors as well as ionospheric disturbances for realistic SBAS scenarios
- Generate signals for the following augmentation systems:
  - EGNOS (C/A), WAAS (C/A), MSAS (C/A), GAGAN (C/A), QZSS (C/A)

SBAS/QZSS simulation in the R&S®SMW200A



Combined SBAS/QZSS simulation performed by the R&S®SMW200A.

Rohde & Schwarz solutions for GNSS signal generation

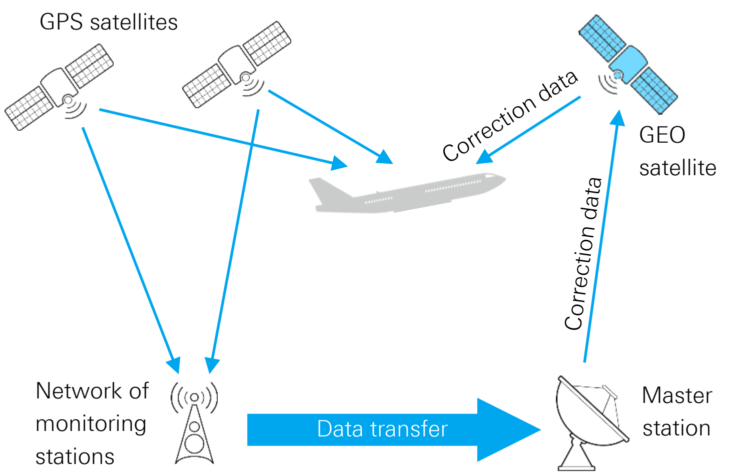


- High-end GNSS constellation simulator for sophisticated multi-constellation, multi-frequency, multi-antenna and multi-vehicle testing (R&S®SMW200A)
- GNSS constellation simulator for single-frequency receiver characterization (R&S®SMBV100A)
- GNSS production tester (R&S®SMBV-P101)
- GNSS waveforms for basic receiver testing (R&S®WinIQSIM2)

SBAS Signal Generation

WAAS

Principle of WAAS



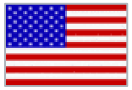
- Monitoring station at an accurately surveyed position receives GPS signals and performs position estimation; the results are forwarded to the master station
- At the master station error correction data is calculated from the mismatch between the GPS position and the actual position of the monitoring station
- Augmentation data, including integrity information about the health status of the GPS satellites, is transmitted to geostationary (GEO) satellites and provided to the user on L1
- The user can correct its GPS position estimate for GPS satellite orbit and clock errors as well as ionospheric disturbances
- No corrections of local effects, such as tropospheric effects, multipath and receiver inherent errors

Wide Area Augmentation System (WAAS)

WAAS is a combination of ground based and space based systems that augments the GPS Standard Positioning Service (SPS). It provides the capability for increased availability and accuracy in position reporting as well as integrity monitoring of GPS Satellites. The development was mainly driven by civil aviation. WAAS is certified for so-called localizer performance with vertical (LPV) guidance approaches.

Typical applications

- Civil aviation
- Precision farming



Features and benefits of WAAS

Differential corrections: Corrections of satellite orbit/clock errors and ionospheric disturbances

GEO ranging: GPS-like L1 signals from GEO satellites to augment the number of navigation satellites available to the users

Integrity service: Information about the quality of the navigation service, including timely warnings in case the system performance becomes unreliable

WAAS accuracy

Accuracy	GPS accuracy Requirements	GPS actual performance*	WAAS LPV-200 accuracy requirements	WAAS LPV-200 actual performance*
Horizontal 95%	36 m	2.9 m	16 m	0.7 m
Vertical 95%	77 m	4.3 m	4 m	1.2 m

*GPS and WAAS performance is monitored and measured by the FAA WAAS Test Team.

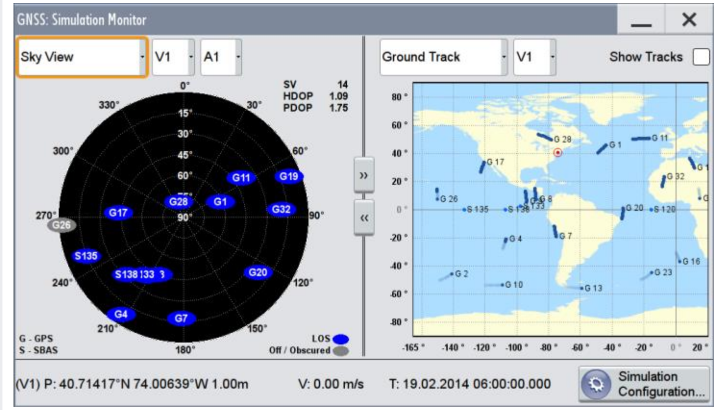
Your challenge

- The GPS/WAAS capabilities of each newly developed GPS receiver have to be tested carefully
- Full characterization of a receiver includes evaluating its ability to decode and apply correction data from WAAS signals
- Testing the GPS device’s response to integrity information and alerts provided by WAAS is also part of the evaluation process
- Controlled and realistic conditions, considering satellite orbit and clock errors as well as ionospheric disturbances, are a prerequisite to obtaining conclusive test results
- Tests cannot be performed in a real-world environment since this is time-consuming, costly and impossible to reproduce
- Augmentation signals have a complex structure and are difficult to create manually

Our solution

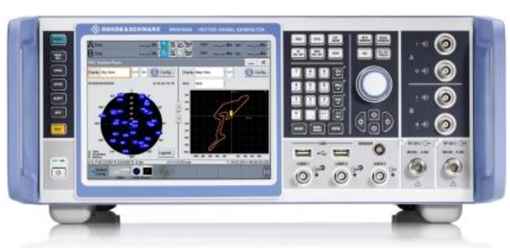
- Use the GNSS simulator in the R&S®SMBV100A or the R&S®SMW200A to simulate complex GPS/WAAS scenarios in realtime with unlimited simulation time
- Perform tests in the lab under controlled and repeatable conditions using simulated WAAS signals
- Apply accurate models of satellite orbit and clock errors as well as ionospheric disturbances for realistic SBAS scenarios
- Generate signals for the following augmentation systems:
  - WAAS (C/A)
  - EGNOS (C/A), MSAS (C/A), GAGAN (C/A), QZSS (C/A)

GPS/WAAS simulation in the R&S®SMW200A



Combined GPS/WAAS simulation performed by the R&S®SMW200A.

Rohde & Schwarz solutions for GNSS signal generation



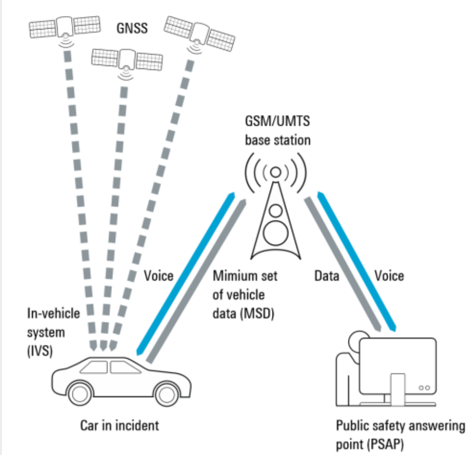
- High-end GNSS constellation simulator for sophisticated multi-constellation, multi-frequency, multi-antenna and multi-vehicle testing (R&S®SMW200A)
- GNSS constellation simulator for single-frequency receiver characterization (R&S®SMBV100A)
- GNSS production tester (R&S®SMBV-P101)
- GNSS waveforms for basic receiver testing (R&S®WinIQSIM2)

GNSS Performance Testing for ERA-Glonass Modules

Automated tests with R&S®CMWrun and the R&S®SMBV-K360

Test challenges

- All newly registered cars, trucks and buses in Russia and the Eurasian Customs Union must be equipped with the ERA-Glonass automatic emergency call system
- Each ERA-Glonass module has to undergo a certification process before being used in a car; this process comprises a series of conformance and performance tests
- The performance of the built-in GNSS receivers has to be tested against the GOST-55534/33471 standards
- Tests cannot be performed in a real-world environment since this is difficult to implement, time-consuming, costly and almost impossible to reproduce



Basic architecture of an automatic emergency call system.

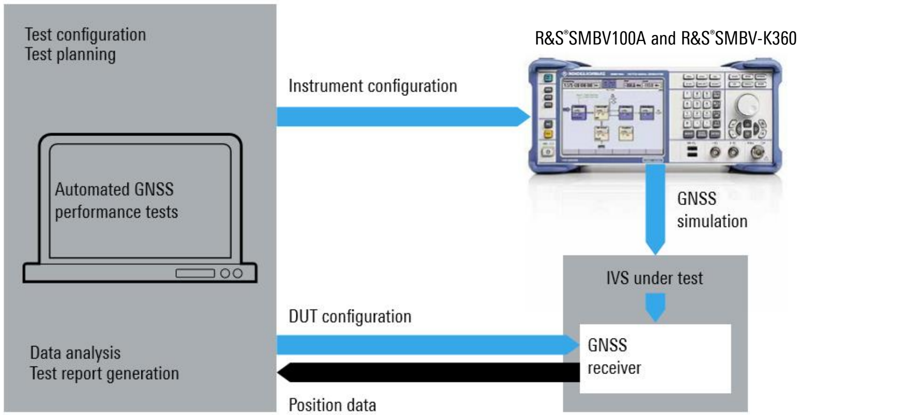
Test solution

- Perform tests in the lab under controlled and repeatable conditions using the GNSS simulator in the R&S®SMBV100A
- Install the R&S®SMBV-K360 and turn the R&S®SMBV100A into a fully automated ERA-Glonass performance tester
- Schedule, configure and analyze your tests using the R&S®CMWrun sequencer software

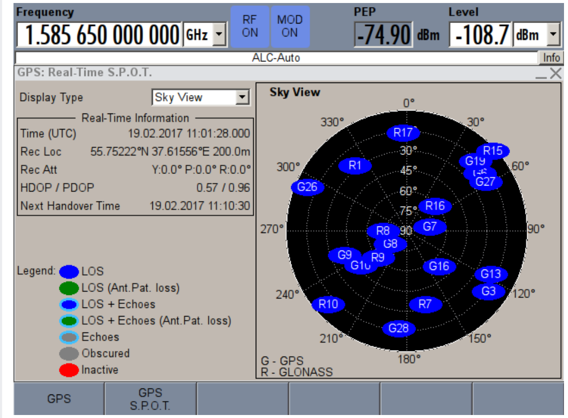
- Required GNSS performance tests include:
  - Tracking sensitivity
  - Acquisition sensitivity
  - Time to first fix (TTFF)
  - Location accuracy

Your benefits	Features
Tests are 100 % reproducible	The GNSS simulator in the **R&S®SMBV100A** makes sure that scenarios are fully reproducible, which makes the solution ideal for validation measurements prior to official certification tests.
Tests are fully automated	The **R&S®SMBV-K360** in combination with the R&S®CMWrun sequencer software automatically configures the signal generator; no manual instrument configuration is required.
Efficiently plan, execute and evaluate validation and certification tests	The test solution features **R&S®CMWrun** for automatic test configuration, scheduling, DUT configuration, data analysis and test report generation.

Test setup for automated GNSS performance tests



GNSS simulator in the R&S®SMBV100A



Combined GPS/Glonass simulation performed by the R&S®SMBV100A.

Instrument configuration

Minimum HW configuration		
R&S®SMBV100A	Vector signal generator	
R&S®SMBV-B103	Frequency up to 3.2 GHz	
R&S®SMBV-B10	Baseband generator	
R&S®SMBV-B92	Hard disk	
Minimum SW configuration		**Test cases according to GOST-R-55534/33471**
R&S®SMBV-K44	GPS	Required for TC 5.1, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8 (location accuracy without obstructed signals), 5.9, 5.10, 5.11, 5.12, 5.13, 5.14
R&S®SMBV-K94	Glonass	
R&S®SMBV-K92	GNSS enhanced	
R&S®SMBV-K91	Extension to 12 satellites	
R&S®SMBV-K96	Extension to 24 satellites	
To add for full test coverage		**Test cases according to GOST-R-55534/33471**
R&S®SMBV-K110	SBAS	Required for TC 5.5 (RAIM)
R&S®SMBV-K102	Antenna pattern	Required for TC 5.8 (location accuracy with obstructed signals)
Test automation		
R&S®SMBV-K360	ERA-Glonass test suite	+ R&S®CMWrun to be installed on a control PC

▷ For more information,
see www.rohde-schwarz.com/catalog/smbv100a

Other GNSS test solutions offered by Rohde &Schwarz

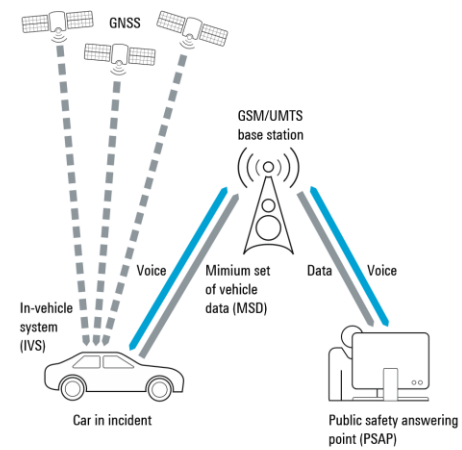
- GNSS waveforms with R&S®WinIQSIM2, 1 channel
- GNSS production tester R&S®SMBV-P101, 4 channels
- GNSS simulator R&S®SMBV100A, 24 channels
- GNSS simulator R&S®SMW200A, 72 channels

GNSS Performance Testing for eCall Modules

Automated tests with R&S®CMWrun and R&S®SMBV-K361

Test challenges

- As from April 1st 2018, newly registered cars and vans in the European Union must be equipped with the automatic emergency call system eCall
- Each eCall module has to undergo a certification process before being used in a car; this process comprises a series of conformance and performance tests
- The performance of the built-in GNSS receivers has to be tested against the EU regulation EU2017/76, Annex VI
- Tests cannot be performed in a real-world environment since this is difficult to implement, time-consuming, costly and almost impossible to reproduce



Basic architecture of an automatic emergency call system.

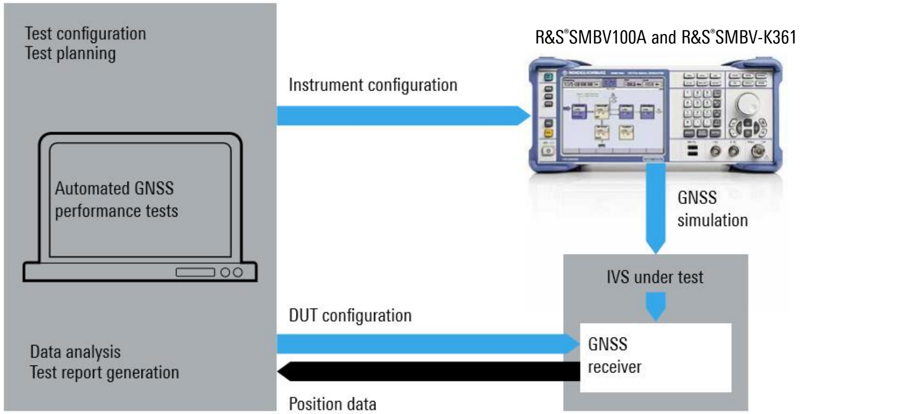
Test solution

- Perform tests in the lab under controlled and repeatable conditions using the GNSS simulator in the R&S®SMBV100A
- Install the R&S®SMBV-K361 and turn the R&S®SMBV100A into a fully automated eCall performance tester
- Schedule, configure and analyze your tests using the R&S®CMWrun sequencer software

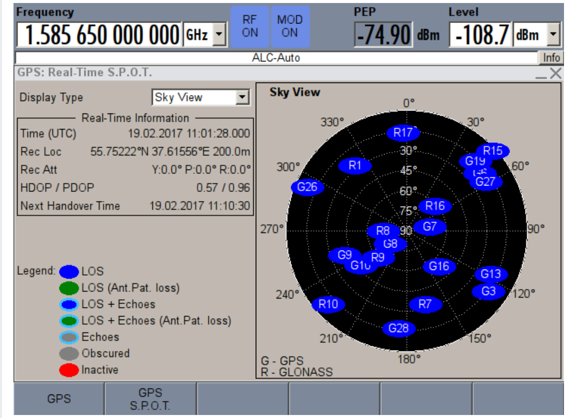
- Required GNSS performance tests include:
  - Tracking sensitivity
  - Acquisition sensitivity
  - Time to first fix (TTFF)
  - Location accuracy

Your benefits	Features
Tests are 100 % reproducible	The GNSS simulator in the **R&S®SMBV100A** makes sure that scenarios are fully reproducible, which makes the solution ideal for validation measurements prior to official certification tests.
Tests are fully automated	The **R&S®SMBV-K361** in combination with the R&S®CMWrun sequencer software automatically configures the signal generator; no manual instrument configuration is required.
Efficiently plan, execute and evaluate validation and certification tests	The test solution features **R&S®CMWrun** for automatic test configuration, scheduling, DUT configuration, data analysis and test report generation.

Test setup for automated GNSS performance tests



GNSS simulator in the R&S®SMBV100A



Combined GPS/Galileo/SBAS simulation performed by the R&S®SMBV100A.

Instrument configuration

Minimum HW configuration		
R&S®SMBV100A	Vector signal generator	
R&S®SMBV-B103	Frequency up to 3.2 GHz	
R&S®SMBV-B10	Baseband generator	
R&S®SMBV-B92	Hard disk	
Minimum SW configuration		**Test cases according to EU2017/79, Annex VI**
R&S®SMBV-K44	GPS	Required for TC 2.1, 2.2, 2.3, 2.5, 2.6, 2.7
R&S®SMBV-K66	Galileo	
R&S®SMBV-K92	GNSS enhanced	
R&S®SMBV-K91	Extension to 12 satellites	
R&S®SMBV-K96	Extension to 24 satellites	
R&S®SMBV-K110	SBAS	
To add for full test coverage [1)]		**Test cases according to EU2017/79, Annex VI**
R&S®SMBV-K102	Antenna pattern	Required for TC 2.4 (location accuracy with obstructed signals)
Test automation		
R&S®SMBV-K361	eCall test suite	+ R&S®CMWrun to be installed on a control PC

1) in case the eCall module needs to be tested against the UNECE2016/07 regulation, the SMBV-K94 option must be added to the instrument configuration

Other GNSS test solutions offered by Rohde & Schwarz

- GNSS waveforms with R&S®WinIQSIM2, 1 channel
- GNSS production tester, R&S®SMBV-P101, 4 channels
- GNSS simulator, R&S®SMBV100A, 24 channels
- GNSS simulator, R&S®SMW200A, 72 channels

▷ For more information,
see www.rohde-schwarz.com/catalog/smbv100a

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