Bring satellites into your lab: GNSS simulators from the T&M expert.

www.rohde-schwarz.com/GNSS-solutions
Our solutions …

A variety of software options can turn Rohde & Schwarz vector signal generators into powerful GNSS test solutions:

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

All these test solutions ensure that GNSS simulations are performed under well-defined, controlled conditions. They offer fully customizable and repeatable scenarios, i.e. one and the same test scenario can be replayed as often as needed and produce the same signals with the same characteristics.

Your challenge …

GNSS receiver tests can only be conclusive when they are performed under realistic conditions. A complete GNSS scenario must include proper simulation of the satellite orbits, the signal propagation characteristics, the characteristics of the receive antenna and the receiver environment. Realistic modeling of user movement taking into consideration vehicle attitude is also part of this simulation process. Generation of interfering signals may also be of interest to set up a simulation environment that is close to reality.

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

Signal obscuration

Especially in an urban environment, GNSS signals are often obstructed by buildings. In many cases, signal obstruction needs to be combined with multipath simulation since the line of sight signal might be completely obstructed and the receiver processes only the multipath components.

Vehicle movement

Many test tasks require the simulation of a moving receiver with consideration of vehicle attitude. In order to test moving receivers under high signal dynamics, the GNSS simulator has to be able to support scenarios where the simulated user is exposed to high velocities and accelerations.

Multipath simulation

In order to test the receiver performance in the presence of multipath, a GNSS simulator typically offers various ways to simulate such influences such as tapped-delay or ground multipath models, statistical channel models or deterministic multipath models.

Range simulation

The range between the satellite and the receive antenna is the basic measurement a GNSS receiver performs in order to compute its position. For realistic range simulation, the following aspects have to be considered:

- Ionospheric and tropospheric effects
- System inherent errors such as clock errors
- Unexpected ranging errors

Satellite orbit simulation

A realistic GNSS simulation has to support the simulation of different classes of satellite orbits (LEO/MEO/GEO/IGSO), including orbit errors and perturbations.

Jamming and interference

In order to emulate a real GNSS environment, external influences such as jamming and interference signals must be taken into account. The presence of additional signals such as LTE can then be simulated and how this influences the reception of the GNSS signals can be evaluated.

Systems and signals

In order to meet today’s testing needs, a GNSS simulator has to provide multi-constellation and multi-frequency scenarios, simulating all relevant systems and signals in all GNSS frequency bands at the same time.
Basic GNSS receiver development and production testing

Using R&S®CMW500 as a general-purpose GNSS receiver test solution

The R&S®CMW500 supports multiple constellations (GPS, Galileo, BeiDou, QZSS, Glonass and more) and their L1 and L2 frequencies. It can be used for multiple purposes such as test setup generation, test signal development and testing. It offers advanced GNSS performance in terms of frequency agility, flexibility and scalability.

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Single-frequency receiver characterization

In order to characterize the performance of GNSS receivers, there are basic functions needed to be tested. These include the assessment of the receiver's sensitivity, the determination of the receiver's time to first fix, the measurement of the receiver's tracking performance and the measurement of the receiver's GPS signal strength.

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High-end GNSS test solutions

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Advanced multi-frequency GNSS signal simulation

When it comes to more advanced, complex and demanding GNSS test tasks, it is often required to test the receiver's performance under different signal environments, such as interference or multipath environments or under the influence of atmospheric or orbital conditions. In such cases, the R&S®CMW500 supports multiple constellations (GPS, Galileo, BeiDou, QZSS, Glonass and more) and their L1 and L2 frequencies. It can be used for multiple purposes such as test setup generation, test signal development and testing. It offers advanced GNSS performance in terms of frequency agility, flexibility and scalability.

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Rohde & Schwarz
The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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

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