AUTOMATED GNSS PERFORMANCE TESTING FOR AUTOMOTIVE MODULES

Automated testing against the Chinese national GNSS test standard (GB/T 45086.1-2024) with R&S®CMWrun sequencer software and the R&S®SMBV100B vector signal generator

The R&S®SMBV100B vector signal generator can be equipped with a multitude of GNSS options, turning the instrument into a reliable, full-featured GNSS signal source.

In the past few years, several automotive tests standards have become applicable that specify a range of GNSS performance tests. The goal of this is to ensure that in-vehicle GNSS based navigation systems meet minimum requirements in terms of their positioning, navigation and timing performance. One example of such a test standard is the EU directive 2017/19 that defines GNSS performance tests for in-vehicle eCall modules. These modules need to undergo a certification process before being used in a vehicle.

Your task

In mid-2025, a new test specification becomes applicable in China that contains procedures to test GNSS based in-vehicle navigation systems. The performance of the GNSS receivers used in the systems needs to be tested against the Chinese national GNSS test standard (GB/T 45086.1-2024). This includes testing the receiver's capability to provide data output rates of at least 1 Hz as well as to process signals from two frequency bands simultaneously. The standard defines a multitude of GNSS tests the receiver must pass to be fully compliant with the new standard. These tests cannot be performed in a real-world environment with live GNSS signals, since they are difficult to implement, time-consuming, costly and impossible to reproduce. A suitable GNSS simulator needs to be used instead.

Rohde&Schwarz solution

With the R&S®SMBV100B, these tests can be performed in the lab under controlled, well-defined and repeatable conditions. This general purpose vector signal generator can be turned into a full-featured GNSS simulator. It provides advanced simulation capabilities for configuring realistic and complex yet repeatable GNSS scenarios that can be run under controlled conditions.

Together with the R&S®CMWrun sequencer software and the R&S®SMBVB-K364 option, the R&S®SMBV100B becomes a fully automated GNSS performance tester. With the R&S®CMWrun software, users can schedule, configure and automatically perform the tests as well as analyze the performance of the receiver under test and generate test reports. The software provides predefined test scenarios for all test cases specified in the GB/T 45086.1-2024 standard.

Application Card | Version 02.00

Test coverage

The test cases specified in the GB/T 45086.1-2024 standard include the characterization of typical GNSS receiver parameters such as:

- Tracking sensitivity
- Acquisition sensitivity
- Time to first fix (TTFF)
- Location accuracy
- Velocity accuracy

The standard also defines tests against special events or under special conditions such as

- GPS week number rollover tests
- Leap second handling
- Testing against unexpected pseudorange errors (RAIM test)

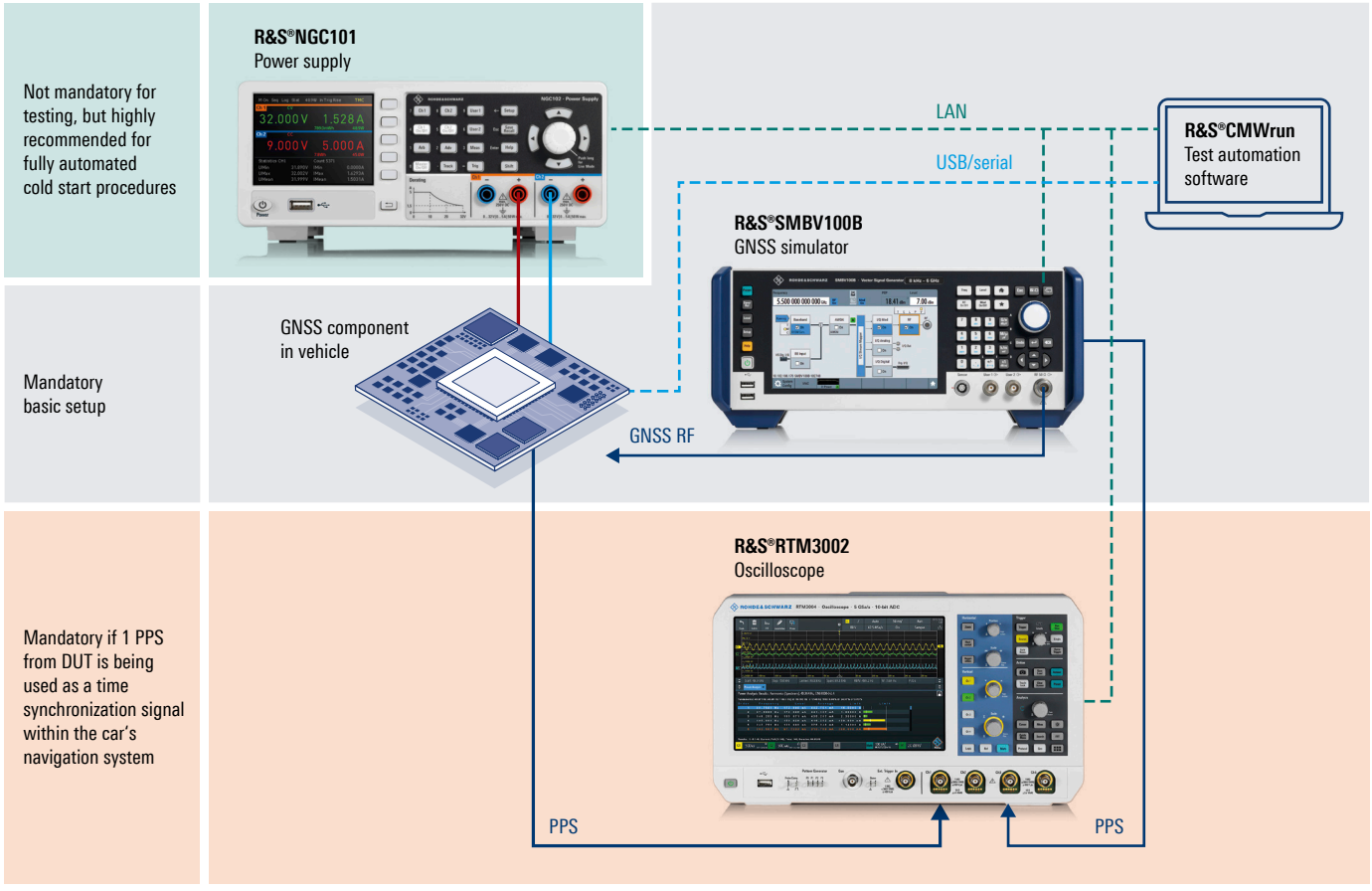
A complete list of all 46 test cases can be found in the "GNSS and Avionics Simulation for Rohde&Schwarz Signal Generators" specifications (PD 3607.6896.22).

Recommended test setup

Most of the test cases require a cold start of the DUT before performing the test. For this cold start, the test standard specifies that the DUT must be completely switched off and disconnected from its power supply. To allow automated testing without manual interaction, the R&S®SMBVB-K364 option includes support for a switchable R&S®NCG power supply. This power supply can be integrated into the test setup and performs a standard-compliant power off/on step for all relevant tests.

Some of the test cases include the verification of the receiver's timing performance. Whenever a 1 PPS signal is used as a timing source for other components in the car, this signal must be analyzed. This is why the R&S®SMBVB-K364 option supports the integration of R&S®RTM oscilloscopes; when used for the timing tests, the scopes are automatically configured, and the corresponding measurements are performed automatically.

Recommended test setup



Your benefits

Tests are fully compliant with the test standard
All 46 predefined test cases are in line with the Chinese national GNSS test standard (GB/T 45086.1-2024).

Tests are 100 % reproducible
The R&S®SMBV100B GNSS simulator ensures that all scenarios are fully reproducible, which makes the solution ideal for precompliance testing, verification and certification of onboard navigation modules.

Tests are fully automated
The R&S®SMBVB-K364 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/certification tests
Use the integrated test sequencing features of R&S®CMWrun for automatic test configuration, scheduling, DUT configuration, data analysis and test report generation.

See also

Product links:
www.rohde-schwarz.com/CMW
www.rohde-schwarz.com/product/SMBV100B

Automotive connectivity test solutions:
www.rohde-schwarz.com/automotive/connectivity
www.rohde-schwarz.com/automotive/satellite-navigation-testing

Ordering information

Designation	Type	Order No.	No. of required options
Minimum hardware configuration			
Vector signal generator, base unit	R&S®SMBV100B	1423.1003.02	1
Frequency option, 8 kHz to 3 GHz	R&S®SMBVB-B103	1423.6270.02	1
Real-time extension	R&S®SMBVB-K520	1423.7676.02	1
Minimum software configuration			
GPS	R&S®SMBVB-K44	1423.7753.02	1
Galileo	R&S®SMBVB-K66	1423.7882.02	1
GLONASS	R&S®SMBVB-K94	1423.7953.02	1
BeiDou	R&S®SMBVB-K107	1423.7999.02	1
Real-world scenarios	R&S®SMBVB-K108	1423.8008.02	1
Modernized BeiDou	R&S®SMBVB-K132	1423.8789.02	1
Upgrade to dual-frequency GNSS	R&S®SMBVB-K134	1423.8750.02	1
Upgrade to triple-frequency GNSS	R&S®SMBVB-K135	1423.8766.02	1
Add 12 GNSS channels	R&S®SMBVB-K137	1423.8795.02	3
Additive white Gaussian noise (AWGN)	R&S®SMBVB-K62	1423.7876.02	1
Test automation			
Chinese national GNSS test standard	R&S®SMBVB-K364	1423.9356.02	1
Sequencer software tool	R&S®CMWrun	can be downloaded from the Rohde&Schwarz website	–
Additional recommended hardware			
Single-channel power supply	R&S®NGC101	3657.2288.02	1
Oscilloscope, 100 MHz, 2 channels	R&S®RTM3002	1335.8794.02	1

Other automotive test automation solutions from Rohde&Schwarz

Application	Test type	Test standard	Test automation options
eCall	GNSS performance testing	EU 2017/19 Annex VI	R&S®CMWrun, R&S®SMBVB-K361
eCall	GNSS performance testing	ECE/TRANS/WP.29/GRSG/2017/12, Annex 10	R&S®CMWrun, R&S®SMBVB-K361
eCall	Conformance testing	CEN 16454:2023	R&S®CMWrun, R&S®CMW-KT110
NGeCall	Conformance testing	CEN 17240:2024	R&S®CMWrun, R&S®CMX-KF671B
ERA-GLONASS	GNSS performance testing	GOST 33471	R&S®CMWrun, R&S®SMBVB-K360
ERA-GLONASS	Conformance testing	GOST 33467, GOST 33470	R&S®CMWrun, R&S®CMW-KT110
GNSS RX characterization	GNSS performance testing	▶ No specific test standard ▶ Customizable test parameters ▶ Customizable pass/fail criteria	R&S®CMWrun, R&S®SMBVB-K362

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Rohde&Schwarz customer support
www.rohde-schwarz.com/support

PD 3673.0886.92 | Version 02.00 | March 2025 (ch)
Automated GNSS performance testing for automotive modules
Data without tolerance limits is not binding | Subject to change