

A-GPS and SUPL tests with the R&S®CRTU protocol test platform

The complex interaction between GPS functionality in mobile radio terminals and the related services in a network needs to function flawlessly. Rohde & Schwarz offers complete test solutions from a single source in this area.

GPS services will soon be a “must have” in wireless communications

The widespread use of GPS-based navigation systems is also having an impact on wireless communications, where position-dependent services are gaining significance. This trend has been reinforced by statutory provisions adopted by national regulatory authorities such as Regulation E911 issued by the US Federal Communications Commission (FCC), which requires the capability to signal the position of a caller who makes an emergency call in a wireless communications network. Complex systems of this kind work properly only if the GPS functionality in the mobile terminals interacts perfectly with the corresponding services provided by the infrastructure.

For A-GPS (assisted GPS) in WCDMA and GSM networks and for SUPL (secure user plane), Rohde & Schwarz now offers complete test solutions from a single source using the R&S®SMU200A signal generator as the satellite simulator and the R&S®CRTU protocol test platform as the system simulator. For SUPL tests, the R&S®CMU200 universal radio communication tester can also be used instead of the R&S®CRTU.

Seeking the exact position

There are different methods that can be used to determine the position of mobile terminals in wireless communications networks. They range from a coarse position estimate based on the radio cell (with the positioning accuracy determined by the cell size) to triangulation using three base stations and satellite-based position fixing by means of GPS.

GPS is a satellite-based system where the satellites transmit their orbital parameters and timing information. The data is divided into two groups which differ, for example, in terms of repetition rate. Complete transmission of all data takes 12.5 minutes. A complete data set is needed to determine the position.

In wireless communications networks, the coordinates of the base station in whose radio cell the mobile terminal is located can be used to make an initial approximation of the position. This information is transmitted to the mobile terminal as part of the assistance data to considerably shorten the time until exact GPS position data is available (FIG 1).

Tests for A-GPS and SUPL

Suitable data must be transmitted to and from the mobile terminal for determining its position in a wireless communications network by means of GPS. For A-GPS, the signaling protocol is extended to include the required messages. Since signaling is dependent on the standard, there is A-GPS for GSM and A-GPS for WCDMA. They essentially differ only in that they use different structures for the signaling protocol.

Another method of transmitting position data is to use an IP connection. This approach is used with SUPL. For applications involving an IP connection, it is irrelevant how data is transmitted, meaning they are *bearer agnostic*.

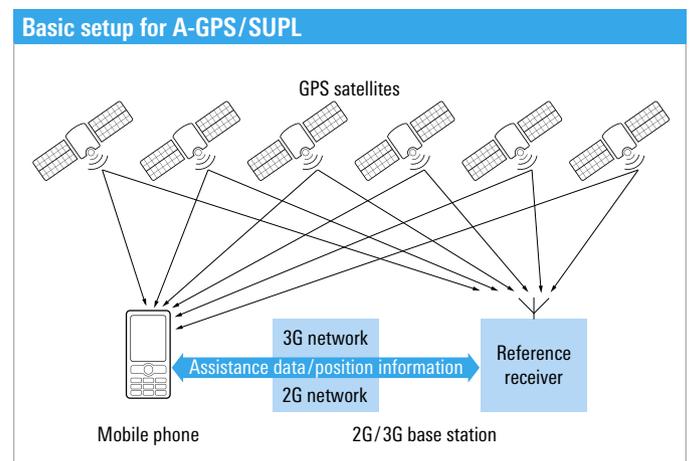


FIG 1 To reduce the time until exact GPS position data is available, the mobile phone is provided with the base station coordinates (via the assistance data) to enable a coarse position estimate.

Tests for A-GPS and SUPL include *signaling* and *minimum performance* tests.

Signaling tests check whether the messages that are exchanged comply with specifications in terms of type and format. Since these are highly dependent on the standard, separate (very different) test specifications exist for A-GPS for GSM, A-GPS for WCDMA and for SUPL. There are also separate work items (WI) for the different specifications for conformance tests in accordance with the Global Certification Forum (GCF) (FIG 2).

Minimum performance tests basically verify whether a mobile terminal is capable of determining its own position with a defined accuracy within a specified time interval. These tests were initially defined only for WCDMA. However, they also make sense for A-GPS for GSM and for SUPL, which is why the test specification for WCDMA has been applied to GSM. Analogous discussion has now begun for SUPL. It is still unclear to what extent multimode terminals that support, for example, A-GPS for GSM and for WCDMA will require the A-GPS minimum performance tests for all of the supported technologies.

Test solutions from Rohde & Schwarz

Rohde & Schwarz is the only manufacturer to offer a A-GPS and SUPL test solution from a single source. When equipped with the R&S®SMU-K65 software option, which is the A-GPS extension for the R&S®SMU-K44 standard GPS software option, the R&S®SMU200A signal generator meets all requirements that exist for the simulation of GPS satellite signals for A-GPS/SUPL test cases. The test cases that involve signaling to the wireless communications network are executed on the R&S®CRTU protocol test platform. This platform also controls the R&S®SMU200A, where it starts a satellite scenario for a specific location or path and a specific time and date (FIG 3). This can be one of the preconfigured scenarios

Signaling
Positioning information exchange
3G
Test specification: TS34.123
GCF work item 15
2G
Test specification: TS51.010
GCF work item 16
SUPL
Test specification: OMA-ETS-SUPL-V1
GCF work item 58

Minimum performance
3G
Test specification: TS34.171
GCF work item 30
2G
Test specification: TS51.010
SUPL
Test specification: none

FIG 2 Overview of test specifications and GCF work items.

for the conformance tests. It is also possible to run configurations with up to eight satellites for user-defined locations or paths. The R&S®SMU200A computes the associated assistance data and forwards it to the protocol tester. This ensures that the simulated satellite positions are consistent with the assistance data.

The R&S®CRTU protocol test platform is available in two variants: the R&S®CRTU-G for GSM signaling and the R&S®CRTU-W for WCDMA signaling. The R&S®CRTU-GW protocol tester combines both standards. Either one can be selected when the instrument is powered up. A configuration consisting of the R&S®CRTU-GW and R&S®SMU200A thus covers all A-GPS and SUPL test requirements for conformance tests.

A-GPS tests

With the R&S®CRTU-GC10 and R&S®CRTU-GC16 test packages for GSM A-GPS signaling and the R&S®CRTU-WE10 test package for WCDMA A-GPS signaling, a fully validated test solution has already been available for some time on the R&S®CRTU platform. The R&S®CRTU-WF02 packages now adds the minimum performance tests for WCDMA A-GPS, while the R&S®CRTU-GF02 provides GSM A-GPS test capability.

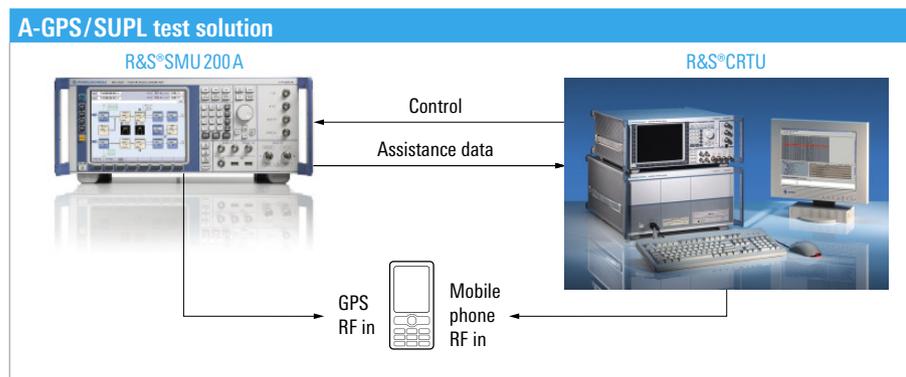


FIG 3 The R&S®SMU200A signal generator simulates the satellite signals, while the R&S®CRTU protocol test platform executes the test cases that involve signaling to the wireless communications network.

For all of the A-GPS tests, the familiar user interface of the R&S®CRTU-G/-W is available with its powerful analysis tools. Since minimum performance tests are based on the statistical evaluation of individual measurements, the distribution of measurement results is also presented graphically (FIG 4).

SUPL tests

With the R&S®CA-AC06 SUPL test package, Rohde&Schwarz is the first manufacturer to reach the 80% threshold for the corresponding GCF WI 58 and thus attain the test entry criterion from which these tests are mandatory.

For the test configuration in FIG 3, there is another variant for SUPL which is possible due to the special structure of these tests. SUPL is an application that uses a TCP/IP connection. This means that the requirements imposed on the system simulator are less demanding, so that the R&S®CMU200 universal radio communication tester can be used instead of the R&S®CRTU. In this case, the test application runs on an external PC. SUPL is one of several applications that fall into the category of *application testing*. All of these applications are

based on an IP connection and are thus *bearer agnostic*. The common framework for these applications is provided by the R&S®CRTU-AP01 ATE software, and the user interface and analysis tools are based on the corresponding elements of the R&S®CRTU environment (FIG 5).

Summary

The R&S®CRTU protocol test platform and the R&S®SMU200A signal generator provide users with a comprehensive A-GPS/SUPL test solution from a single source. This solution covers an extremely wide range of tests with a minimum of hardware. For customers who already use the R&S®CRTU, these tests are an additional application that runs in a familiar work environment, which reduces the time needed to learn the new test application. Since the entire range of A-GPS test capabilities is structured in a modular way, it is possible to find a cost-effective solution for any requirement that arises in the lab.

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FIG 4 Distribution of positioning results during a minimum performance test.

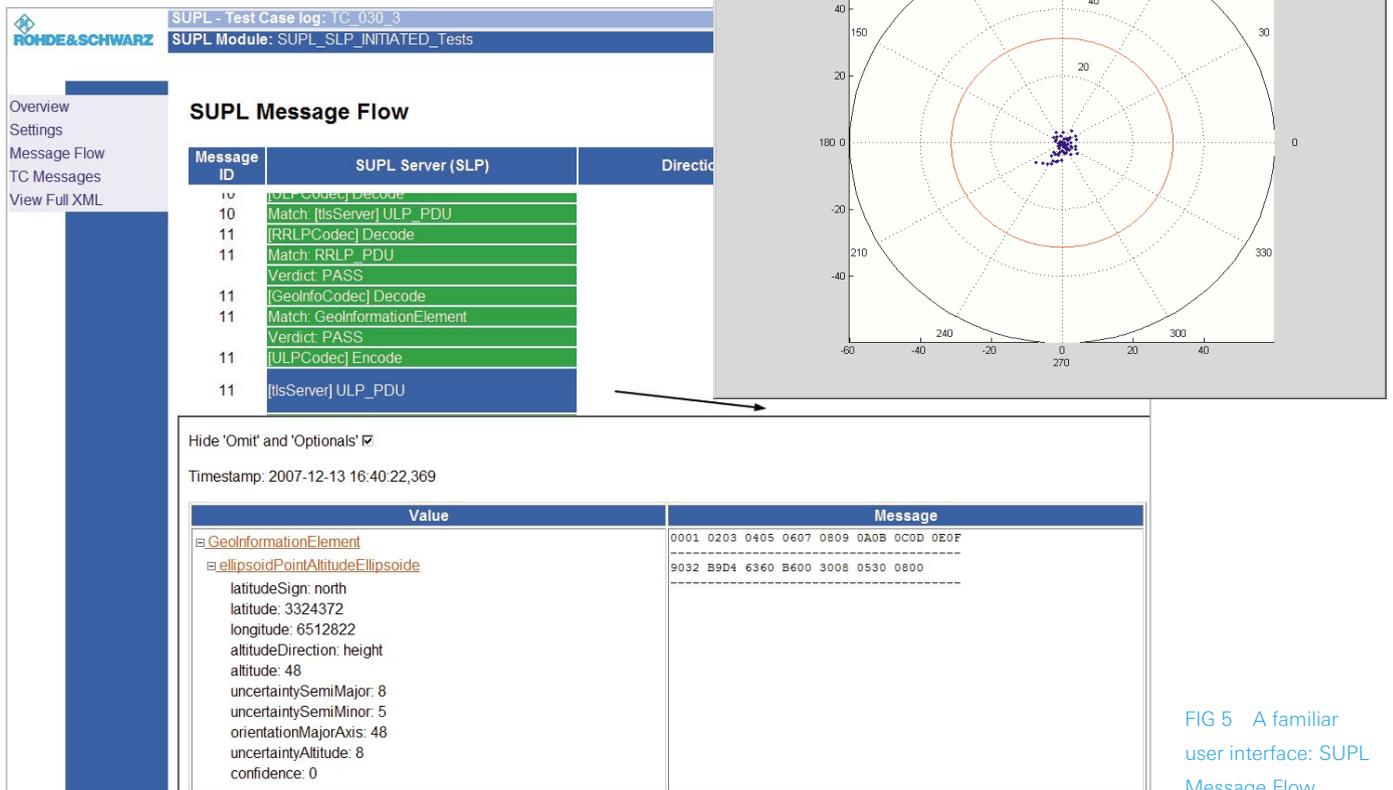


FIG 5 A familiar user interface: SUPL Message Flow.