APPLICATION NOTE

TestDrive-GNSS

An automation and reporting tool to unlock the power of Spirent GNSS Simulation Systems by speeding up and simplifying GNSS testing

A Spirent Application Note for Designers, Integrators and Manufacturers of GNSS Devices

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Scope

This Application Note explains how to use Spirent's TestDrive GNSS receiver characterisation tool.

It is written for designers, developers, integrators and manufacturers of GNSS receivers, who need to ensure that their products perform in the intended environment.

Spirent recommends you have a basic understanding of satellite navigation principles. Having an awareness of RF simulation as a test method is also desirable.

Introduction

There is a steady growth in the use of GNSS in new and existing markets. Consequently, there is an increasing reliance on GNSS technology. With this in mind, it is important for designers, manufacturers and consumers of these products to understand what to expect from such systems. This includes formulating an understanding of the limitations and problems of GNSS technologies.

Thorough testing of GNSS receivers is a time-consuming process which usually requires a number of repeat measurements to be taken (see DAN03 Fundamental GNSS receiver characteristics). Typically, the operator will be present during this process and the device will be re-configured for each measurement. Once the measurement has been collected it may also be necessary to record the result manually.

This application note outlines the need for RF simulation and introduces TestDrive GNSS, a means of managing the receiver performance characterisation process.

RF Simulation

An RF Constellation Simulator reproduces the environment that a GNSS receiver will experience by modelling vehicle and satellite motion, signal characteristics, atmospheric and other effects. When connected to the RF simulator the receiver will navigate according to the parameters of the test scenario.

Figure 1 shows the concept of GNSS simulation using a Spirent GSS6700 simulator. By its very nature, simulation is a representation of the real world. Simulation cannot reproduce the full richness of real world conditions.
A common misconception is that there is the need to exactly replicate real world conditions for a GNSS test to be valid.

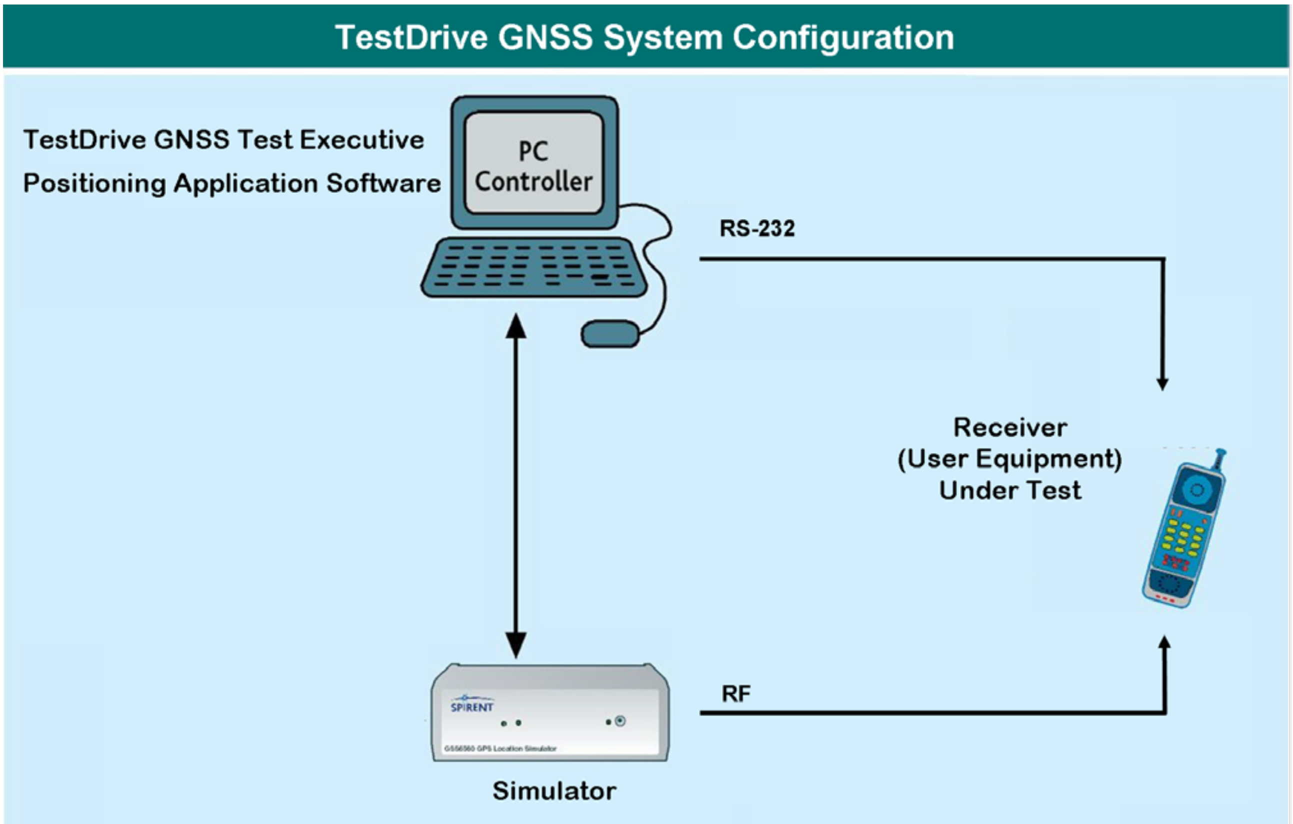


Figure 1 Example RF Simulation Flow

Application of representative effects via simulation is proven (over some 25 years of testing) to exercise receivers and adequately identify their limitations. More importantly, it gives complete repeatability, control and exact knowledge – down to bit level – of the signal which is stimulating the receiver.

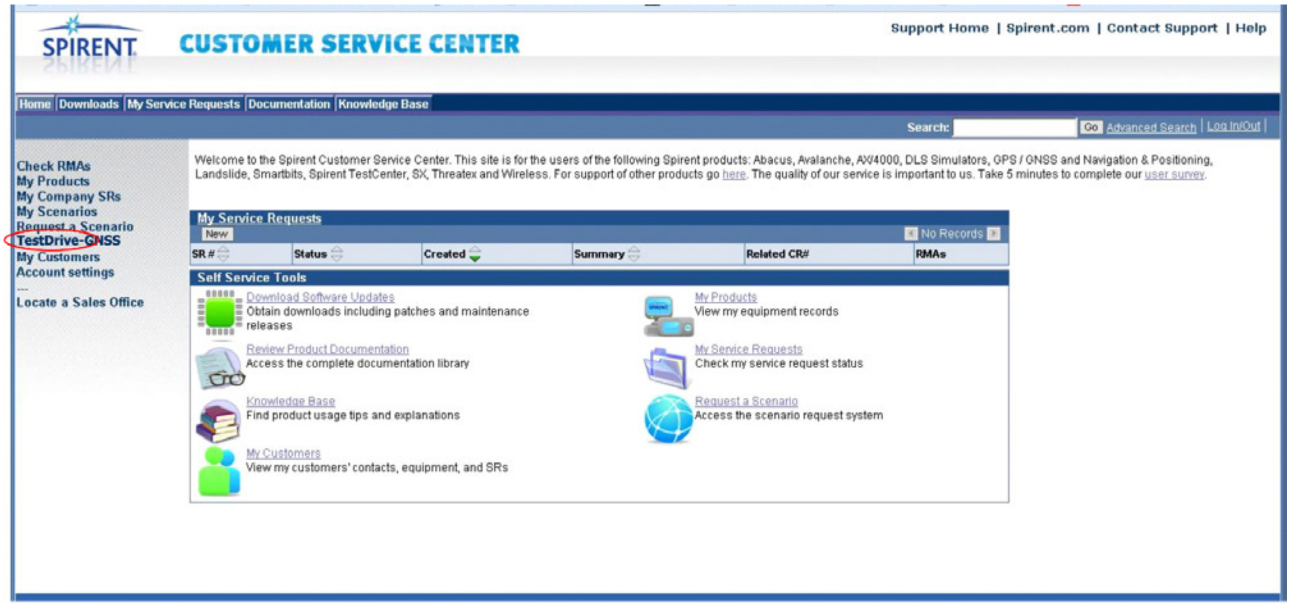
This is not possible when using real GNSS signals for test purposes. We should therefore look upon simulator testing as representing the real world, rather than replicating it.

TestDrive-GNSS

The Spirent TestDrive GNSS Test System provides SimGEN™, SimREPLAY*plus* and SimREPLAY customers with an integrated test solution that enables performance characterisation of GNSS User Equipment (UE). TestDrive GNSS automates the testing process by configuring the instruments in the system, stepping through the test sequences, and processing and storing the results. By removing much of the burden of manual test setup and configuration, TestDrive GNSS solves the following testing issues:

- Writing software to automate test sequences.
- Logging test results.
- Replication of test conditions.

The TestDrive GNSS System resides on the Spirent Customer Service Centre (CSC) website and it is accessed by logging into your account and following the "TestDrive GNSS" link on the left side of the page. See Figure 2



Features

With TestDrive-GNSS you can:

- Control both the GNSS RF Simulator and the UE simultaneously
- Manage suites of tests
- Archive sets of results
- Generate summary reports in a number of common formats

USING TestDrive-GNSS
Generating a test suite

The most simple test suite contains a single test case. Each line in a test suite can be one of several different test types.

Different tests are used to measure different performance criteria.

A unique set of parameters applies to each test type. Refer to the user manual for a detailed description of all supported test types.

Firstly, create a new suite from the **File › New › Suite** menu.

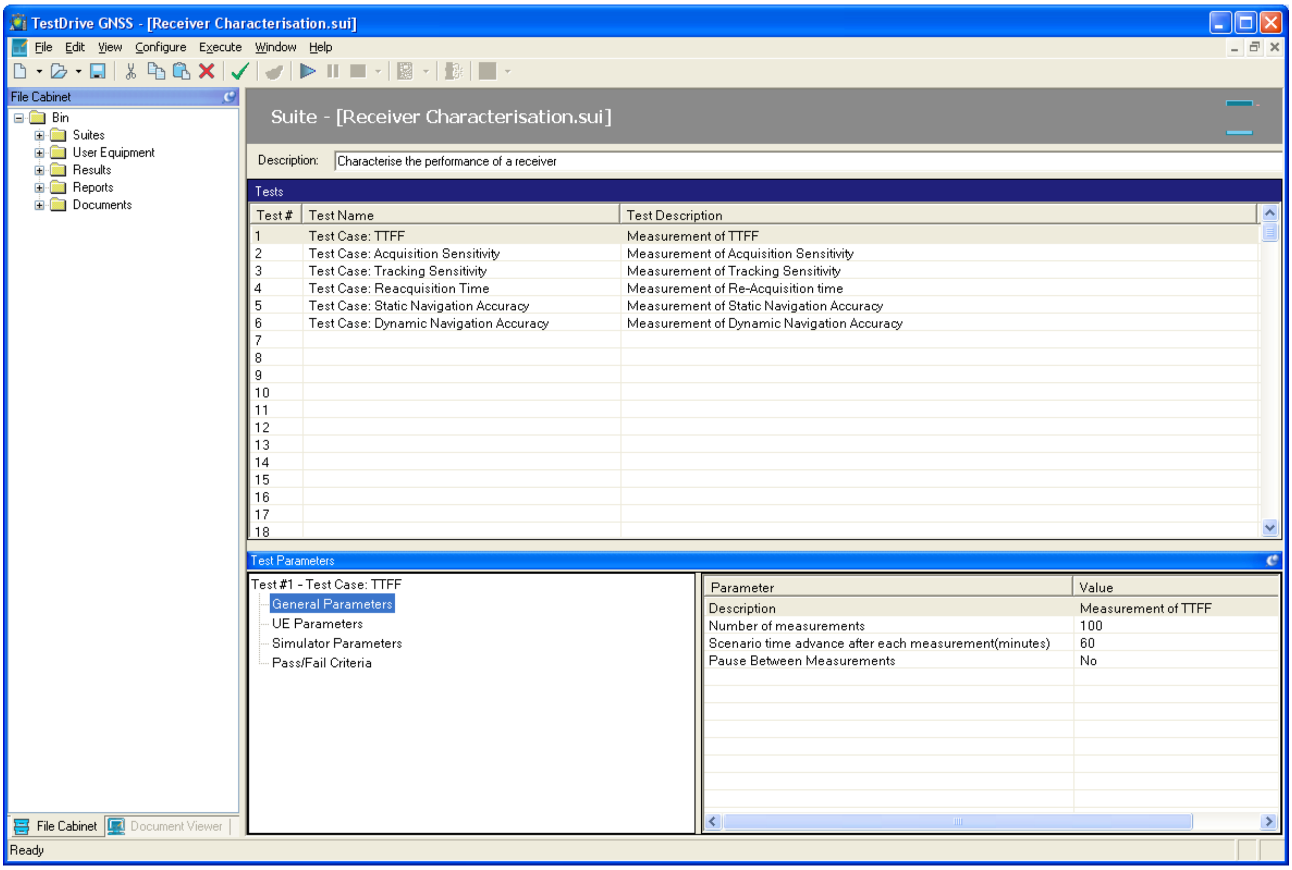
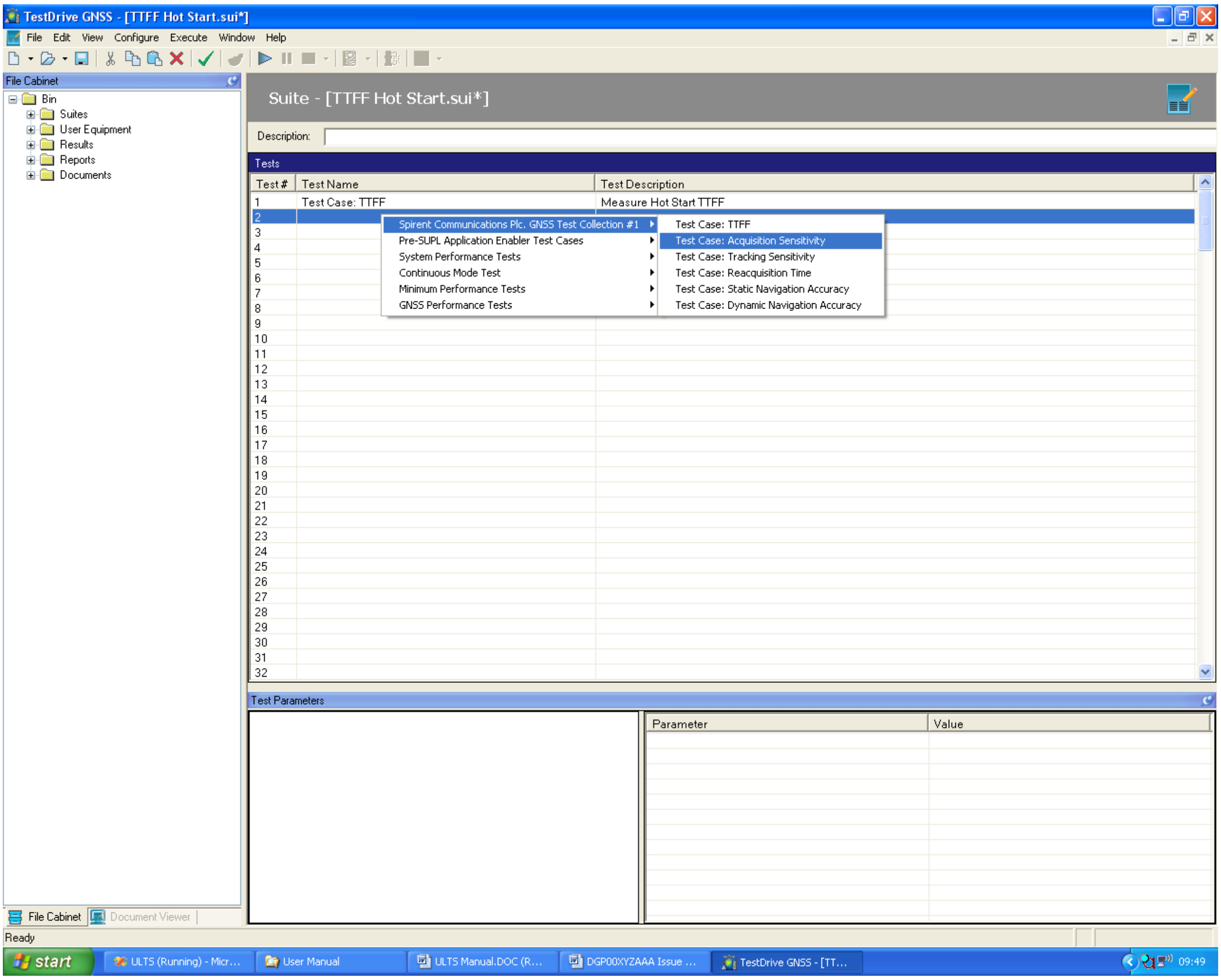


Figure 2 Creating a new suite

To select a test type when adding a new test:

- Click on a blank cell in the *Test Name* column of the suite window.
- Right-click on the cell to display the **Insert Test** menu.
- Select the desired test from the menus.

Figure 3 illustrates an example of adding a new UE Acquisition Sensitivity Test to a test suite.



This test suite can now be saved.

Figure 3: Adding a test to a test suite

Editing test parameters

Each test supported by TestDrive-GNSS includes a number of customisable test parameters that you can modify. Test parameters can be numerical values (e.g. *'Number of Measurements'*), text values (e.g. *'Test Description'*), or a list of selectable values (e.g. *'Pause Between Measurements'*).

To change the value of a particular test parameter:

- Click a specific line in the *Tests* pane to select the test.
- Select the parameter sub-group in the tree view on the left side of the *Test Parameters* pane.
- Click the parameter you want to edit and type or select a new value.

Figure 4 shows an example of selecting *'Pause Between Measurements'* from the *General Parameters* sub-group of a test case.

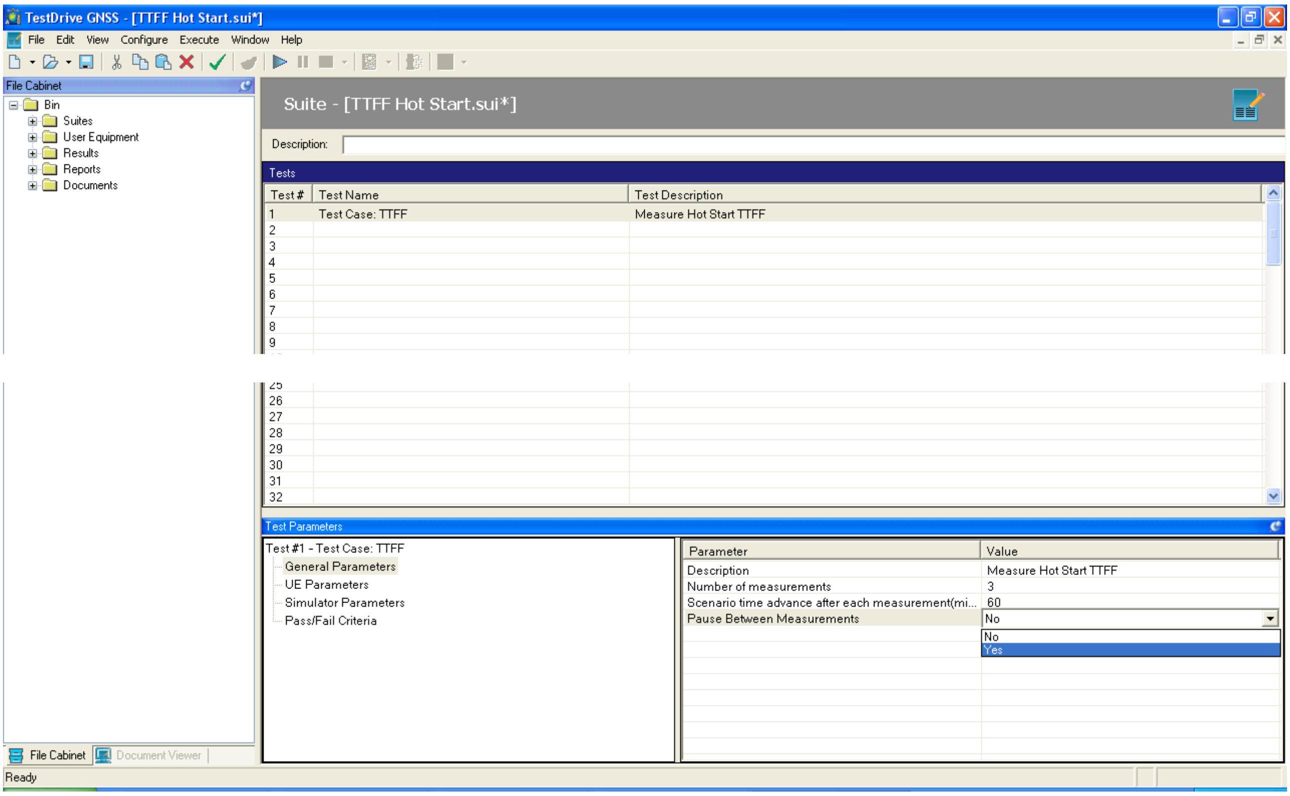


Figure 4: Selecting *'Pause between measurements'* from the *'General Parameters'*

Before running a Test Suite, it should be validated to help avoid test execution errors. TestDrive GNSS can analyse an entire suite for test setup and parameter value problems before execution. Validation checks test conditions against the current system configuration and alerts you if the system does not contain sufficient hardware to perform certain tests. Although this does not guarantee flawless execution, it significantly reduces the risk of problems during execution by detecting them beforehand.

To validate the Test Suite click the **Validate Suite** icon from the Toolbar or select **Execute › Validate.**

Configuring User Equipment

Before executing a test suite it is necessary to configure the user equipment. Open a new user equipment file by selecting the **File › New › User Equipment** option from the menus.

Choose settings which represent the receiver connection to your computer. An example of such a configuration is displayed in Figure 5.

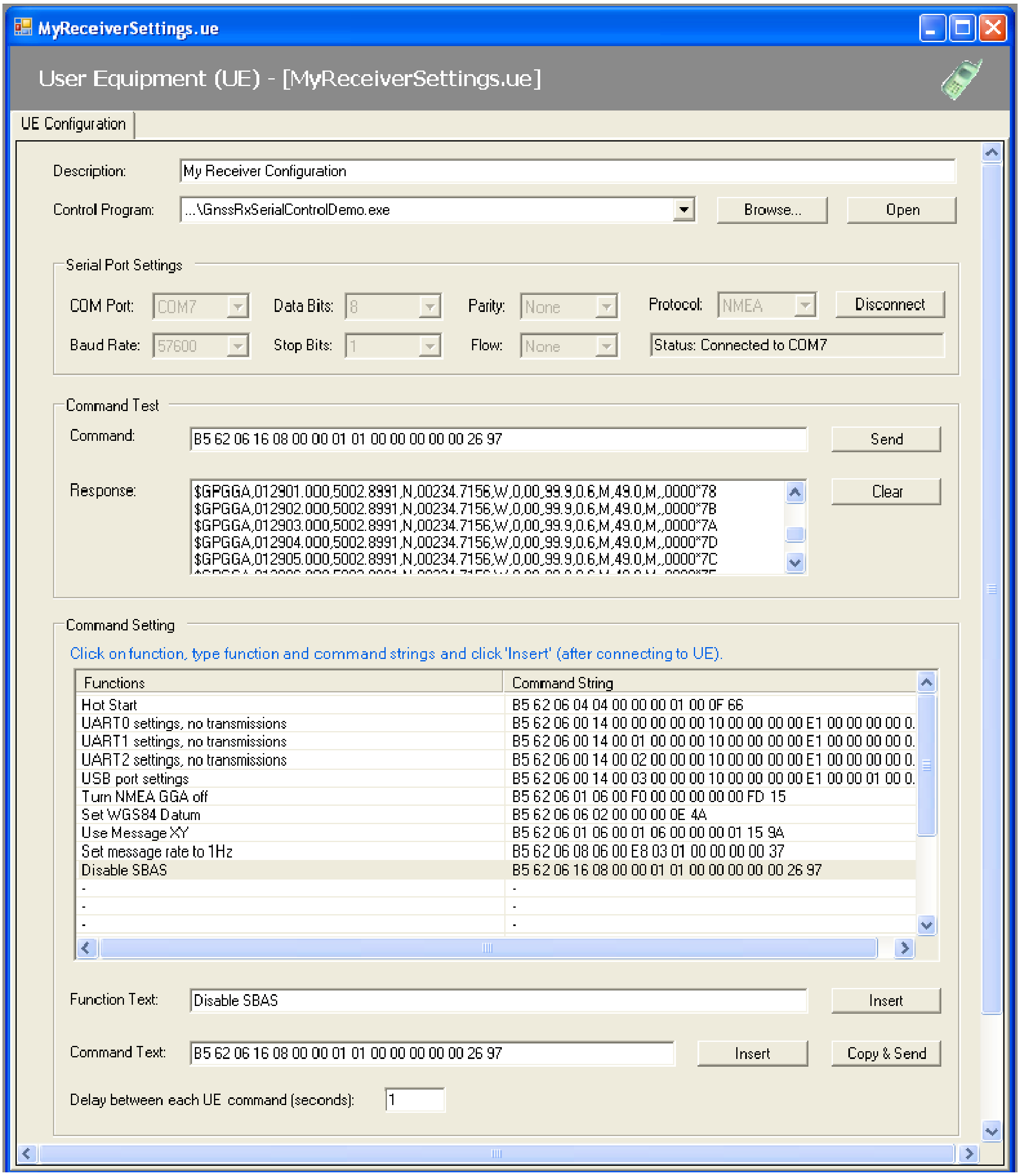


Figure 5: Configuring the user equipment

Once a connection has been made, the 'Response' window will be populated with the latest responses from the user equipment. The cursor can be positioned on the latest response by double-clicking in the response window. Note that it may be necessary to run the simulator at this point in order to generate responses from the user equipment.

TestDrive GNSS can control user equipment using the ubiquitous NMEA ASCII command set or alternatively using the SiRF binary protocol. Additionally, it is possible to specify your own protocol by creating a driver for use with TestDrive GNSS. More information on this can be found in the user manual supplied with the product.

The following list of commands is an example of how to populate the user equipment 'Command Settings' editor to control a SiRF GSD4e GPS receiver:

Switch to SiRF binary protocol	$PSRF100,0,57600,8,1,0*37
Navigation Initialisation	A0A20019800000000000000000000000000000000 000000000000009CB0B3
Set PDOP to 30	A0A200058901321E32010CB0B3
Switch off DGPS mode	A0A200038A0200008CB0B3
Set elevation mask to 5 degrees	A0A200058B0032003200EFB0B3
Static Navigation Flag Off	A0A200028F00008FB0B3
Set binary serial port (57600bps)	A0A20009860000E100080100000170B0B3

The following list of commands is an example of how to populate the user equipment 'Command Settings' editor to control a GSD4e SiRF capable GPS receiver:

Reset UE	set,/par/reset,yes
Enable the GPS constellation	set,/par/pos/gps/sat,on
Enable the GLONASS constellation	set,/par/pos/glo/sat,on
Disable all NMEA messages on serial port A	dm,/dev/ser/a
Enable NMEA GGA messages on serial port A at 1Hz rate	em,/dev/ser/a,/msg/nmea/GGA:1
PDOP Mask Value to 30	set,/par/pos/pdop,30.0

Populate the user equipment (.ue) file with commands which define your receiver configuration and connection settings.

Executing a Test

Once the UE settings have been configured and saved you may run the Test Suite by selecting **Execute › Run.** The *Execute Automatic Test* dialog box is displayed, allowing you to set several run specific options. Figure 6 gives an example of the *Execute Automatic Test* dialog box. When the test has completed the results will be stored in a file called TableView.csv which is located in the folder specified in Figure 6. This file can be used for further analysis.

Note: If the user is employing user equipment which responds with NMEA statements then the monitoring algorithm will determine that a measurement is successful by examining the NMEA GGA (Global Positioning System Fix Data) position fix flag in addition to the plan and spherical position error metrics specified in the test. If the user is employing user equipment which responds with the SiRF binary protocol then message 41 (Geodetic Navigation Data) will be examined to establish whether a fix has occurred in addition to the plan and spherical position error metrics specified in the test. If you are defining your own protocol then you should specify the protocol message you wish to monitor and the criteria for achieving a successful test outcome in your driver software.

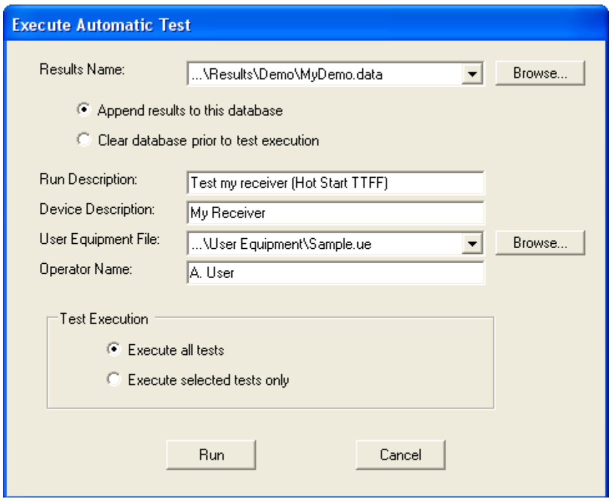


Figure 6: Execute Automatic test dialog box

Generate a Test Report

Test Reports can be generated from the current set of test results loaded in application memory by selecting **Execute › Generate Report** from the menu. You can print or save reports in a variety of standard file formats including Adobe Acrobat (**.PDF**), Microsoft Excel (**.CSV**) and Microsoft Word (**.DOC**). To review reports after saving them, load the report documents with the appropriate associated application.

Archive Test Results

To archive a set of test results select **File › Zip Active Results.**

For More Information

Please visit our website: http://www.spirent.com/positioning and do not hesitate to contact your nearest Spirent representative for more detailed information. To find the appropriate contact details please visit the 'Contact Us' page on the website and select your location and application.

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