SimTEST v7.00
Software User Manual

Software for the Spirent range of satellite navigation simulator products

Document number: DGP01446AAA Document status: OFFICIAL

Document Issue: 2-01 Date of Issue: 27 March 2020

Published in England

Contents

1 General

Note: The term “simulator” refers to a configured arrangement of signal generators, computer controllers and ancillary items.

SimGEN® is a registered trademark of Spirent Communications plc.

Spirent reserves the right to supply simulator elements that may be superficially and visually different to those shown in an interconnection drawing, but which provide equivalent or better performance.

This document describes using the GSS7000 and GSS6300M-I, Spirent’s multiple-constellation, multiple-channel signal generators with Spirent’s SimTEST software.

SimTEST is a licenced feature of Spirent’s PosApp software.

PosApp is a major rework of Spirent’s long-standing SimGEN code base, separating the Graphical User Interface, the GUI, (*PosApp.exe*) from the simulation engine, the engine, (*PosApp_engine.exe*) responsible for the simulation calculations and communication with the signal generator.

Separating the GUI from the engine offers potential advantages:

→ Easily licenced features
→ Integration of the engine with other applications, either Spirent or third-party
→ Running the engine on different platforms, such as real-time platforms for higher performance
→ Using alternative GUIs tailored to specific applications, or on different platforms

SimTEST software supports Ethernet, and USB interfaces, and RS-232 using a USB to RS-232 adapter.

The Indian Regional Navigational Satellite System (IRNSS) constellation has an operational name of NAVIC (NAVigation Indian Constellation). This document and the SimTEST user interface refer to this constellation as IRNSS.

1.1 PosApp

Spirent distributes SimTEST software as a single executable, *PosApp.exe*. Spirent supplies PosApp together with a SimTEST licence file, *lservrc.txt*. Your licence determines which SimTEST features you can use, as shown in the following table.

Licence type	Description
No hardware trial	PosApp provides a time-limited, software only, trial of SimTEST on any PC.
Full trial	PosApp provides a time-limited, hardware and software, trial of SimTEST. After installing PosApp, you must install valid hardware keys for your signal generator.
No hardware	Use PosApp to install SimTEST to a specific, stand-alone PC. You can use the “no hardware” licence to generate scenarios. You cannot use the “no hardware” licence to control a Spirent signal generator. Your "No hardware" licence is part of Spirent support. If your Spirent support ends, your "No hardware" licence will cease running.
With a Spirent signal generator	Use to install PosApp on a GSS7000 embedded host or the GSS6300M-I integrated Controller and the install a SimTEST licence.

Features that are licensed separately are identified in this manual as follows:

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

Spirent pre-installs your licence on GSS7000 signal generators and new GSS6300M-I signal generators. If you delete the licence file, *lservrc.txt*, you will need to re-install your licence.

Note: Existing users of the GSS6300M-I signal generator upgrading from SimCHAN must remove SimCHAN and install PosApp and the licence file Spirent provides on the GSS6300M-I integral Controller.

SimTEST software is located in these folders:

→ On the GSS7000 embedded host, *D:\posapp\software\<version>*

→ On the GSS6300M-I integrated Controller, *C:\Program Files (x86)\Spirent Communications*

1.1.1 Upgrading a GSS6300M-I from SimCHAN to SimTEST

You upgrade from SimCHAN to SimTEST by following these steps:

1. Remove SimCHAN using the standard Windows program removal process.
2. Install SimTEST from the executable file Spirent supplies.
3. Install the licence file. See *Installing a licence file*, on page 1-5.

1.1.2 Spirent support expiry message

If you have Spirent support, SimTEST will display a message when you have 90-days and 30-days remaining on your software licence and support agreement, for example:

SimTEST displays a similar message if you only have a software licence.

Clicking LICENCE REQUEST… opens the **Licence Request Details** dialog with the required fields already populated. See *Requesting a licence file*, on page 1-6.

1.2 SimTEST description

SimTEST:

→ Supports GSS7000 and GSS6300M-I signal generators

→ Is capable of limited scenario editing

→ Runs scenarios Spirent supplies specifically for SimTEST

→ Runs SimREPLAY scenarios generated by SimTEST

1.3 GSS7000 description

All constellations support multipath by using additional channels. However, SimTEST does not support multipath for SBAS constellations.

The GSS7000 incorporates an embedded host running the following:

→ Linux, on which the PosApp engine runs

→ The Windows operating system, on which the PosApp user interface runs

The following figure shows a top-level configuration for the GSS7000 signal generator.

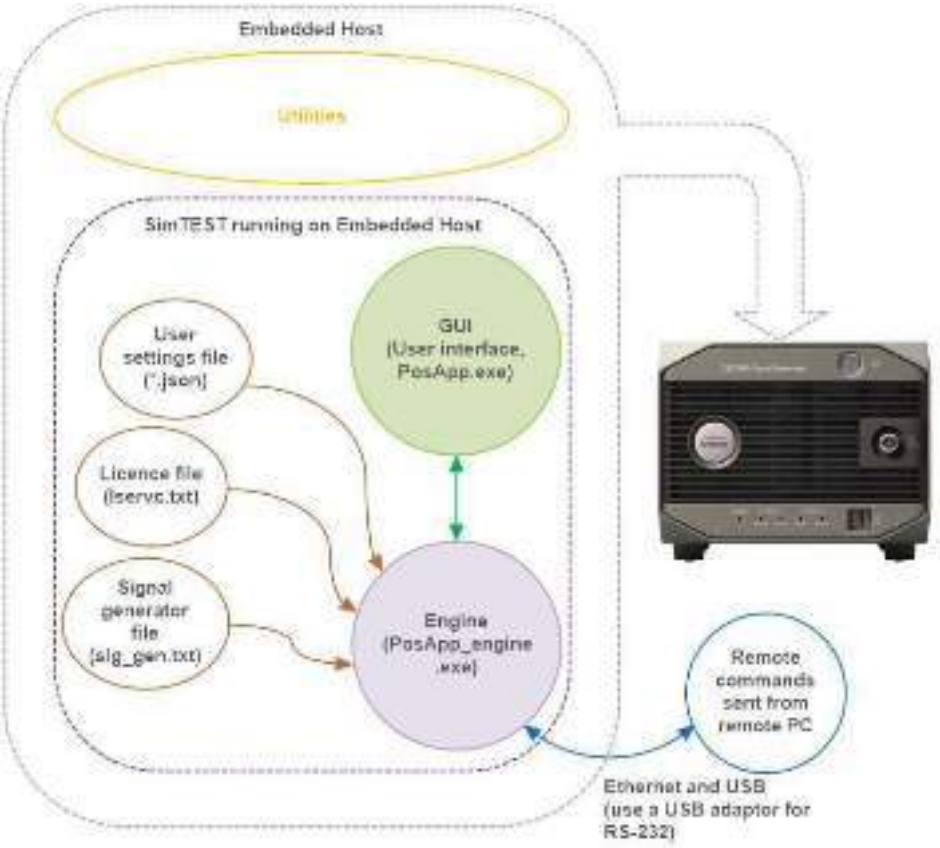


Figure 1-1: Basic configuration of the GSS7000 signal generator

1.3.1 Supported constellations

By default, the GSS7000 signal generator supports (with an appropriate constellation licence) the constellations, carriers and signal types shown in the following table.

Table 1-1: Constellations, carriers and signal types supported by the GSS7000

Constellation	Carrier	Default signal types
BeiDou	B1I	B1I
	B2I	B2I
	B3I	B3I
	B1C	B1C
	B2a	B2a
Galileo	E1	OS Data / Pilot
	E5ab	E5a Data / Pilot and E5b Data / Pilot
GLONASS	L1	C/A
	L2	C/A
GPS	L1	C/A and L1C
	L2	C/A or L2c (Pilot + Data)
	L5	I and Q
IRNSS	L5	SPS
SBAS	L1	C/A

Table 1-1: Constellations, carriers and signal types supported by the GSS7000 (continued)

Constellation	Carrier	Default signal types
	L5	I and Q
Note: SBAS is always available on GPS channels.		
Quasi-Zenith	L1	C, S and C/A
	L2	L2C
	L5	I and Q
	L6	D and E
Note: Quasi-Zenith is available on every GPS channel if you have a Quasi-Zenith licence.		

1.3.2 Supported navigation messages

The GSS7000 supports the navigation message types shown in the following table.

Table 1-2: Navigation message types supported by the GSS7000

Constellation	Message type	Applicable signal	Comment
BeiDou	D1 and D2	B1I, B2I and B3I	D2 does not include differential corrections or Iono grid. B1I and B2I broadcast Phase 2 D1 and D2 messages. B3I broadcasts Phase 3 D1 and D2 messages.
	B-CNAV1	B1C	Currently, PosApp does not implement the Phase 3 (BDGIM) Ionospheric Model.
	B-CNAV2	B2a	Currently, PosApp does not implement the Phase 3 (BDGIM) Ionospheric Model.
Galileo	I/NAV	E1-B and E5b-I	OS Galileo - excludes SoL support.
	F/NAV	E5a-I	Supports OS Galileo.
GLONASS	Public	L1-C/A	There is no data message on GLONASS P-code.
GPS	Legacy	C/A and P	
	CNAV	L2C and L5-I	
IRNSS	Nav	L5	
SBAS	Data	L1 and L5-I	
Quasi-Zenith	QZ-Legacy	L1-C/A	
	SLAS	L1S	
	QZ-CNAV	L2C and L5-I	
	QZ-CNAV-2	L1C	
	QZ-CLAS	L6D and E	

1.3.3 Channels and channel banks

The number of available channels depends on the number of channel banks installed in your signal generator and the number of channels your licence includes, each channel bank providing 64 channels. The maximum four channel banks give 256-channel capability.

Each channel bank supports all channels shown in the following table, but at any time supports only a single channel group. The constellation and frequency configuration remain fixed for the duration of the scenario.

Table 1-3: Channels supported by the GSS7000 channel banks

Signal type	Carrier frequency, MHz	Channel group	Signal type	Carrier frequency, MHz	Channel group
GPS L5	1 176.45	1	BeiDou B3I	1 268.52	3
IRNSS L5	1 176.45	1			
BeiDou B2a	1 176.45	1	BeiDou B1I	1 561.098	4
Galileo E5ab	1 191.795	1	GPS L1	1 575.42	4
			Galileo E1	1 575.42	4
BeiDou B2I	1 207.14	2	BeiDou B1C	1 575.42	4
GPS L2	1 227.6	2	GLONASS G1	1 601.719	4
GLONASS L2	1 245.781	2			

1.3.4 Licence management

Note: Spirent strongly recommends you copy each licence file you use and store this copy on a machine that is not used by any signal generator or used to run SimTEST.

Your licence sets up the channel bank(s) on your signal generator to generate signals from any constellation operating within a single frequency band.

Upgrading your signal generator to generate signals in a new frequency band is as simple as purchasing the relevant licence from Spirent. You may need to install additional channel banks if you want to generate new signals in addition to the signal your current licence permits.

Spirent might be able to license additional features that are not described here, for example, ULTS and PLTS. Contact Spirent to discuss your requirements.

1.3.5 Installing a licence file

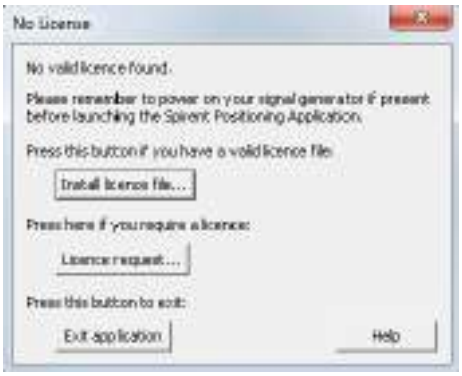
Spirent ships your signal generator with its licence installed. Each signal generator uses a separate licence. Spirent uses a SimTEST-specific licence file to enable the SimTEST software in its default state, together with any additional features that you may have, such as ULTS/PLTS.

If you need to re-install your licence, or install a new licence, use the following procedure. If you need to request a new licence file, see *Requesting a licence file*, on page 1-6.

To install a licence file:

Note: If you have an existing licence to replace, you must first delete the licence file `lservrc.txt`.

1. When you try to use SimTEST and there is no valid licence file, you see one of these dialogs:



If you see the one on the left, clicking OK displays the one on the right.

2. In the **No Licence** dialog, click INSTALL LICENCE FILE.
3. Navigate to the folder where you saved your licence file, select the file, and then click OPEN.

   PosApp saves this file to the Positioning Application folder as `lservrc.txt` and saves your PosApp licence file, using its original name, to the licence history folder within the PosApp installation.
4. After installing your licence, click OK in the **Licence installed** dialog to restart PosApp running as SimTEST.

1.3.5.1 Requesting a licence file

If you do not have a PosApp licence, you must request and install one before you can use SimTEST.

To request a licence:

1. When you try to use SimTEST and there is no valid licence file, you see one of these dialogs:

If you see the one on the left, clicking OK displays the one on the right.

2. In the **No Licence** dialog, click LICENCE REQUEST.

3. Do one of the following:
   - If you want a no hardware licence to run SimTEST without a signal generator, select NO HARDWARE and then click THIS PC.

     Note: The lock code is specific to the computer, so you must generate this code on the computer that will run SimTEST.
   - If you have an existing signal generator, select DRIVE SIGNAL GENERATOR, and then enter the associated serial number and model number.
     You can see your simulators, their serial numbers and your PosApp licences by logging in to the Customer Service Centre (CSC) website http://support.spirent.com.
4. Complete the remaining details.
5. Do one of the following to send your licence request to Spirent:
   - If you have an internet connection, click EMAIL DETAILS TO SPIRENT.
   - If you do not have an internet connection, click SAVE DETAILS TO FILE FOR MANUAL EMAIL. You can then e-mail the support licence request to Spirent Global Services at this e-mail address: licence_pt@spirent.com.

When you receive your licence, you can install it as described in *Installing a licence file*, on page 1-5.

1.3.6 SimTEST running on the embedded host

PosApp separates the Graphical User Interface, the GUI, (`PosApp.exe`) from the engine, (`PosApp_engine.exe`) to optimise GSS7000 signal generator performance; the engine runs on a real-time operating system (Linux), while the GUI remains operating on Windows, which runs on a Virtual Machine.

Separate embedded host processors (one each for engine and GUI) provide adequate performance for calculation of parameters, such as vehicle trajectories for up to 256 simulated satellite channels. The engine calculates the new parameters and sends them to the signal generator in time for the next epoch. The embedded host uses an internal PCIexpress interface to the GSS7000 signal generator to transfer the large amount of data generated.

1.3.7 Using the GSS7000 on a corporate LAN

For optimum performance of your GSS7000 simulator, Spirent recommends you do not connect your GSS7000 to a corporate LAN if that LAN uses the subsets 192.168.5.x, 192.168.25.x and/or 192.168.26.x

1.3.8 File locations

The following table shows the locations Spirent uses to install SimTEST and its components in the embedded host.

Table 1-4: SimTEST file and folder locations in the embedded host

Folder or file	Location on embedded host
Folders associated with the PosApp gui	
PosApp gui	*D:\posapp\software\<version>\gui*
BeiDou data sets	*D:\posapp\software\<version>\gui\Beidou_data_sets*
Datum files	*D:\posapp\software\<version>\gui\Datum Files*
Documents	*D:\posapp\software\<version>\gui\Docs*
Firmware upgrade utility	*D:\posapp\software\<version>\gui\Firmware Upgrade Utility*
Galileo data sets	*D:\posapp\software\<version>\gui\Galileo_data_sets*
Interface files	*D:\posapp\software\<version>\gui\interface files*
Log files	*D:\posapp\logs*
QZ files	*D:\posapp\software\<version>\gui\QZ files*
simtest_default.ant_pat	*D:\posapp\scenarios for SimTEST\simtest_default*
System data	*D:\posapp\conf*
Tools	*D:\posapp\software\<version>\gui\tools*
Utilities	*D:\posapp\software\<version>\gui*
SBAS datasets	*D:\posapp\software\<version>\gui\SBAS_data_sets\<constellation>*
Folders associated with the PosApp engine	
PosApp engine	*D:\posapp\software\<version>\engine*
Firmware	*D:\posapp\software\<version>\firmware*
Scenarios	*D:\posapp\scenarios for SimTEST*
Scripts	*D:\posapp\software\<version>\scripts*
Folders associated with Scenarios	
Scenarios	*D:\posapp\scenarios for SimTEST*
Shared folder	*D:\posapp\scenarios for SimTEST\shared*
Files associated with PosApp	
lservrc.txt	*D:\posapp\conf*
sig_gen.txt	*D:\posapp\conf*
spirent_ posapp_ user_ settings.json	*D:\posapp\conf*

1.3.9 Logging files

Note: SimTEST running on the embedded host allows you to move or delete log files while a scenario is running. Spirent strongly recommends you never move or delete any log file while a scenario is running. You will not be able to recover data from any log file you move or delete.

The following table details logging features in SimTEST running on the GSS7000 embedded host.

Table 1-5: SimTEST logging features on the GSS7000 embedded host

Feature	Description
LOGGING	SimTEST saves all log files to sub-folders of the folder *D:/posapp/logs* The type of log file determines the sub-folder name, as described below.
LOGGING - SIMTEST	**Note:** You cannot edit the log file location. SimTEST saves log files to sub-folders of a folder bearing the scenario name. The sub-folder name is the time stamp at the start of the run in the format YYYY_MM_DD_HH_MM_SS. For example: *D:/posapp/logs/<scenario_name>/2014_03_24_12_58_21* This name (12h 58 min 21 seconds on 24 March 2014) is only known after the scenario starts. The remote command LOG_DIR returns the sub-folder name while the scenario is running or before you rewind a scenario that has ended. For log file interfaces that give you an option to set the log file path, SimTEST displays the full path of the log file and disables BROWSE.
LOGGING - POSAPP	SimTEST saves the PosApp log files to the sub-folder *D:/posapp/logs/posapp* → PosApp log files include: → PosApp message logs - filename format: *PosApp _message_log_<date, time>.txt* → Remote command settings output file → Remote command settings log file → Utility log files (for example, hardware proxy filename format: *PosApp_Hardware_Proxy_message_log_2014_10_18_07_18_34.txt*) → Engine log files - filename format: *PosApp_en_message_log_<date, time>.txt*

1.3.10 Versions

The embedded host uses Windows installed on the C: drive, with SimTEST files installed on the D: drive. SimTEST installs certain *.dll files in the Windows folder on the C: drive.

This feature enables you to use any version of SimTEST installed since the original version.

Spirent supplies the embedded host installed with the latest version of SimTEST. Subsequent upgrades are installed in separate folders at *D:\posapp\software\<version>* where *<version>* is a folder whose name reflects the version number using the format *Vw_yy_zz*, where *w*, *y* and *z* are the figures 0 to 9, for example V6_00_01. You can see all versions installed by navigating to *D:\posapp\software* and looking at the folder names.

D:\posapp\software also contains the folder *default*, which contains files only for use under guidance by Spirent engineers. Do not delete this folder or any file within this folder.

To use a previous installation of SimTEST:

1. Open the file *D:\posapp\conf\active_version.txt*.

   This file contains a single line that describes the current version of SimTEST. This is the version of SimTEST that runs when you start SimTEST, for example V6_00_01. Installing an upgrade to SimTEST will automatically edit this file to refer to the upgraded version.

2. Edit the line so it contains the version you want to run.

   For example, you are currently running SimTEST V6_01_02 and want to run version V6_01_01. Edit the single line in the file *active_version.txt* to read 'V6_01_01' and save the file.

   Note: For the single line in the file *active_version.txt*, you must keep the exact format. Change only the version number. Do not press return at the end of the last character.

3. Power cycle your signal generator.

   When you start SimTEST the version in ***Help > About*** now refers to V6_01_01.

1.3.11 USB block devices present when starting your GSS7000

Note: USB block devices include flash memory devices, USB DVD drives, USB hard drives, and so on.

If a USB block device is present in any USB port on your GSS7000 signal generator, it will not boot correctly. You must remove any USB block device from the signal generator USB ports before starting your GSS7000.

1.3.12 Proxies

The GSS7000 embedded host requires the following proxies to allow communication between the engine and the GUI:

→ Secure proxy

→ File proxy

→ Hardware proxy

SimTEST uses Windows Scheduled Tasks that Spirent installs in GSS7000 embedded host to monitor and control each proxy. Disabling or removing the proxy Scheduled Tasks from the Windows Scheduled Task Manager will impair the performance of SimTEST, resulting in SimTEST ceasing to run.

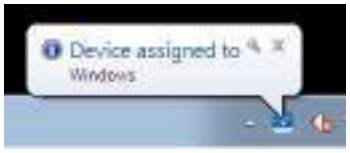
1.3.13 USB port assignment

The embedded host automatically recognises connection of a USB keyboard and mouse; you do not need to assign these USB devices. You must assign USB to RS232 adapters to Linux.

You must assign each available GSS7000 signal generator USB port to either Linux or Windows whenever you insert a USB device. The PosApp USB ASSIGN utility starts automatically when Windows boots and displays the NEW USB DEVICE CONNECTED dialog when you connect a USB device to any GSS7000 USB port:

Select ASSIGN FOR USE IN WINDOWS or ASSIGN FOR USE IN LINUX/POSAPP ENGINE and then click APPLY.

The Task Bar shows an appropriate message, for example:



The utility does not store details of any USB device and will always display the NEW USB DEVICE CONNECTED dialog when you insert a USB device.

1.3.13.1 Reset USB port assignment

Note: Following the steps in this section will reset the current USB port assignments for all USB ports on the GSS7000 embedded host.

In certain cases, you may need to change your initial USB port assignment. For example, you initially set the USB port to Windows and then later need to set that USB port to Linux, such as when using a USB to RS232 adapter for LAAS mes-

sages (which needs the USB port assigned to Linux) when using a GSS4150 LAAS VDB signal generator with the GSS7000 signal generator.

To reset all USB ports to Windows and set a USB port to Linux:

Right-click the USB assign icon in the Windows taskbar.

Click SETTINGS to open this dialog:

Click RESET

Click OK to confirm you want to reset the port assignment in this dialog:

The USB port assignment is now reset and can be reassigned as required, see *USB port assignment*, on page 1-10.

1.4 GSS6300M-I description

The GSS6300M-I signal generator incorporates an integral Controller running a Windows (64-bit) and Spirent's SimTEST software. Reference [4] describes the GSS6300M-I.

The following figure shows a top-level configuration for the GSS6300M-I signal generator, which incorporates an integral Controller running Windows and SimTEST. There is an internal USB connection from the integral controller to the signal generator that is not user-accessible.

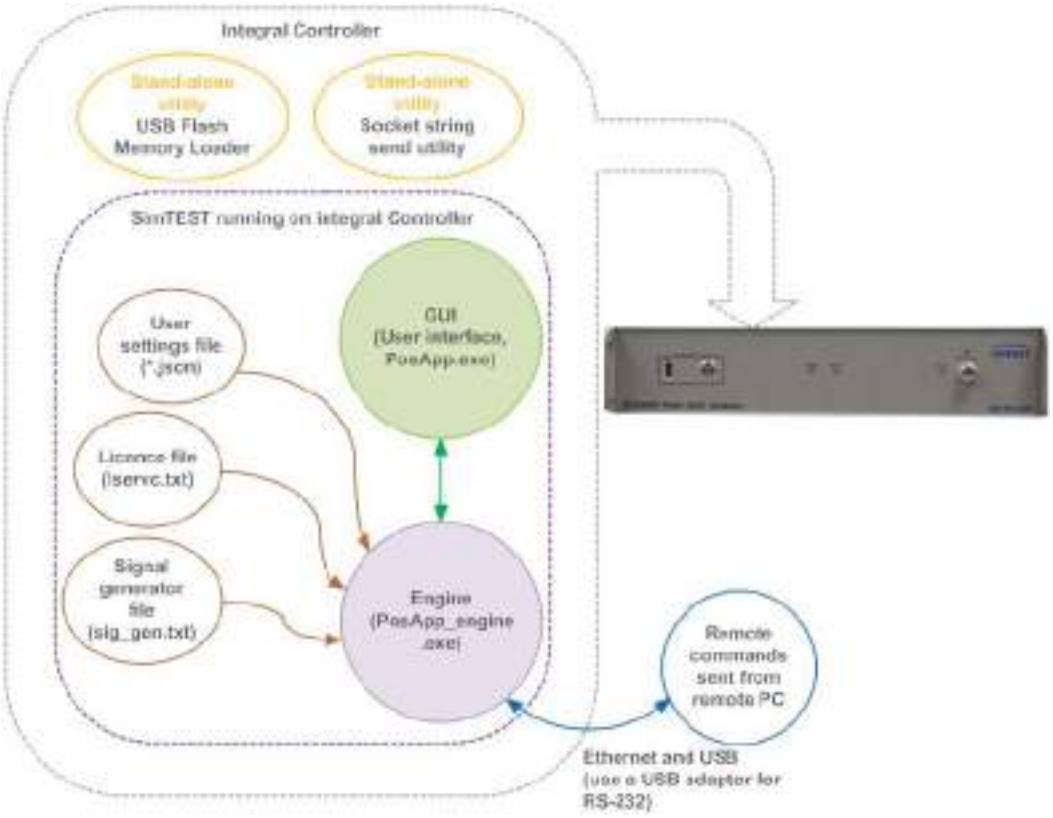


Figure 1-2: Basic configuration for the GSS6300M-I signal generator

The GSS6300M-I signal generator supports eight channels of the following constellations:

→ GPS/SBAS L1
→ GLONASS L1
→ Galileo E1
→ BeiDou B1
→ Quasi-Zenith

Spirent enables each group of eight channels separately by means of a licence. To support these constellations, you must first ensure your GSS6300M-I:

→ Has a serial number beginning with 6078, see reference [4]
→ Uses Firmware version 03-01-02 onwards
→ Uses FPGA image 7-04 onwards

Reference [22] details checking and updating the Firmware version and FPGA image of your GSS6300M-I signal generator.

A single GSS6300M-I running SimTEST supports one of these combinations of constellations (multiple channels on each constellation):

→ GPS/SBAS/Quasi-Zenith, Galileo, GLONASS
→ GPS/SBAS/Quasi-Zenith, BeiDou, GLONASS

To run GPS/SBAS/Quasi-Zenith, BeiDou, Galileo and GLONASS, you must use two GSS6300M-I signal generators as follows:

→ one running GPS/SBAS/Quasi-Zenith, Galileo, GLONASS; and one running BeiDou
→ one running GPS/SBAS/Quasi-Zenith, BeiDou, GLONASS; and one running Galileo

1.4.1 The GSS6300M-I integrated Controller

Spirent will install and configure the Windows Operating System on the GSS6300M-I integrated Controller and install the licence file for new signal generators. If you are upgrading an existing signal generator, follow *Installing a licence file*, on page 1-5,to install the SimTEST licence Spirent provides.

Spirent will provide details on installing PosApp to your GSS6300M-I integrated Controller.

The default folder for SimTEST software on the integrated Controller is:

C:\Program Files (x86)\Spirent Communications\Positioning Application

Depending on the signal generator you purchased, your GSS6300M-I will run up to four constellations with either four or eight channels per constellation, as follows:

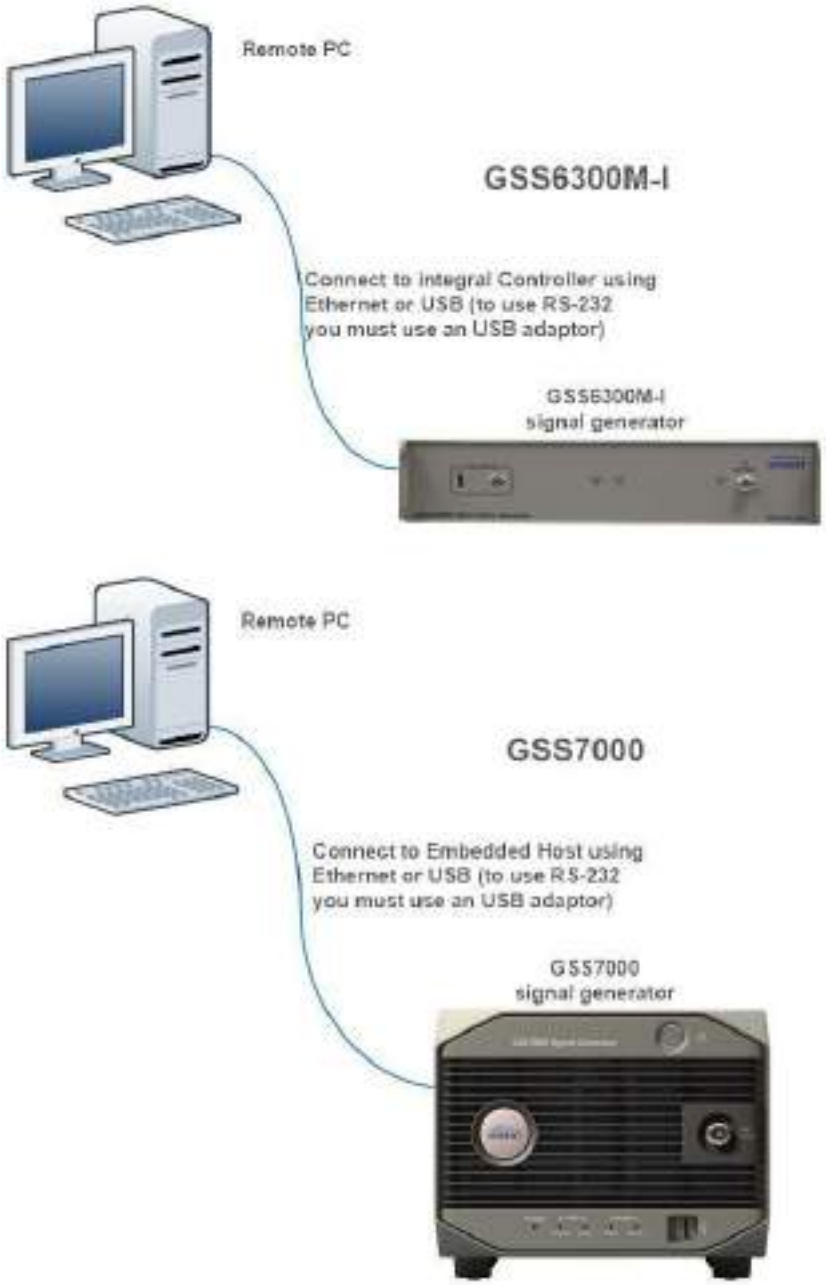
→ BeiDou OR Galileo
→ GLONASS
→ GPS / SBAS
→ Quasi-Zenith

If you have a signal generator supporting four channels per constellation and you have a Quasi-Zenith licence your signal generator provides four, dedicated, Quasi-Zenith channels and four GPS/SBAS channels.

If you have a signal generator supporting eight channels per constellation and you have a Quasi-Zenith licence, your signal generator provides four, dedicated, Quasi-Zenith channels and eight GPS/SBAS channels.

1.5 Remote commands

You can send remote commands to the GSS7000 embedded host (or the integrated Controller for the GSS6300M-I), and control the signal generator, from a remote PC. You can send the Remote commands over Ethernet, USB or the RS-232 serial bus. *Remote commands*, on page 8-1, describes the available remote commands.



1.6 Document conventions

This document uses the following formatting:

Table 1-6: Document conventions

Format	Description
Document conventions, on page 1-12	Hyperlinked cross-reference with page number. Click to go to this location.
CLEAR	User interface item.
Window name	Window and dialog names and area titles within them.
Menu > Item1 > Item2	Menu selection path or path to a dialog within the scenario tree.
`SimGEN.exe`	A file name or folder location.

Table 1-6: Document conventions (continued)

Format	Description
default_vx-yy	Default filename, where *yy is* the version number of major release *x*, followed by relevant extension.
Note: Insert the dongle	Important information.
Text	Text entered from keyboard.

1.7 Copyright, trademark and licencing notices

Microsoft and Windows are either trademarks or registered trademarks of Microsoft Corporation.

InstallShield is a registered trademark of InstallShield Software Corporation.

Alpha is a registered trademark of Hewlett Packard.

NovAtel is a registered trademark of NovAtel Inc.

MATLAB is a registered trademark of The Mathworks Inc.

SCRAMNet+ and SCRAMNet GT200 are registered trademarks of Curtiss-Wright Controls Inc.

All other company/product names in this manual are trademarks and/or service marks or registered trademarks and/or service marks of their respective holders.

1.7.1 WinPcap copyright notice:

Copyright (c) 1999 - 2005 NetGroup, Politecnico di Torino (Italy).

Copyright (c) 2005 - 2007 CACE Technologies, Davis (California).

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

3. Neither the name of the Politecnico di Torino, CACE Technologies nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

1.7.2 Boost Software License

See http://www.boost.org/users/license.html

Permission is hereby granted, free of charge, to any person or organization obtaining a copy of the software and accompanying documentation covered by this license (the "Software") to use, reproduce, display, distribute, execute, and transmit the Software, and to prepare derivative works of the Software, and to permit third-parties to whom the Software is furnished to do so, all subject to the following:

The copyright notices in the Software and this entire statement, including the above license grant, this restriction and the following disclaimer, must be included in all copies of the Software, in whole or in part, and all derivative works of the

Software, unless such copies or derivative works are solely in the form of machine-executable object code generated by a source language processor.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVEN SHALL THE COPYRIGHT HOLDERS OR ANYONE DISTRIBUTING THE SOFTWARE BE LIABLE FOR ANY DAMAGES OR OTHER LIABILITY, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

1.7.3 BSD 3-Clause License

See http://opensource.org/licenses/BSD-3-Clause

Applies to Spirent's use of Google's Protocol Buffers (http://code.google.com/p/protobuf/) and googletest (http://code.google.com/p/googletest/) only.

Copyright (c) 2014, Spirent Communications plc.

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

1.7.4 MIT License

See http://opensource.org/licenses/mit-license.php

Copyright (c) 2014 Spirent Communications plc

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

1.7.5 OpenSceneGraph Public License

See http://trac.openscenegraph.org/projects/osg/attachment/wiki/Legal/LICENSE.txt

See *GNU Lesser General Public License*, on page 1-17, for the LGPL referred to below.

OpenSceneGraph Public License, Version 0.0

==========

Copyright (C) 2002 Robert Osfield. Everyone is permitted to copy and distribute verbatim Copies of this licence document, but changing it is not allowed.

OPENSCENEGRAPH PUBLIC LICENCE TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

This library is free software; you can redistribute it and/or modify it under the terms of the OpenSceneGraph Public License (OSGPL) version 0.0 or later. Notes: the OSGPL is based on the LGPL, with the 4 exceptions laid out in the wxWindows section below.

---------- wxWindows Library Licence, Version 3

==========

Copyright (C) 1998 Julian Smart, Robert Roebling [, ...] Everyone is permitted to copy and distribute verbatim copies of this licence document, but changing it is not allowed.

WXWINDOWS LIBRARY LICENCE TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND

MODIFICATION This library is free software; you can redistribute it and/or modify it under the terms of the GNU Library General Public Licence as published by the Free Software Foundation; either version 2 of the Licence, or (at your option) any later version. This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Library General Public Licence for more details. You should have received a copy of the GNU Library General Public Licence along with this software, usually in a file named COPYING.LIB. If not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA.

EXCEPTION NOTICE 1. As a special exception, the copyright holders of this library give permission for additional uses of the text contained in this release of the library as licensed under the wxWindows Library Licence, applying either version 3 of the Licence, or (at your option) any later version of the Licence as published by the copyright holders of version 3 of the Licence document. 2. The exception is that you may use, copy, link, modify and distribute under the user's own terms, binary object code versions of works based on the Library. 3. If you copy code from files distributed under the terms of the GNU General Public Licence or the GNU Library General Public Licence into a copy of this library, as this licence permits, the exception does not apply to the code that you add in this way. To avoid misleading anyone as to the status of such modified files, you must delete this exception notice from such code and/or adjust the licensing conditions notice accordingly. 4. If you write modifications of your own for this library, it is your choice whether to permit this exception to apply to your modifications. If you do not wish that, you must delete the exception notice from such code and/or adjust the licensing conditions notice accordingly.

Source can be found at http://www.openscenegraph.org/projects/osg/wiki/Downloads

1.7.6 GNU Lesser General Public License

See https://www.gnu.org/licenses/lgpl.html

Version 3, 29 June 2007

Copyright © 2007 Free Software Foundation, Inc. < http://www.fsf.org/ >

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.

0. Additional Definitions.

As used herein, “this License” refers to version 3 of the GNU Lesser General Public License, and the “GNU GPL” refers to version 3 of the GNU General Public License.

“The Library” refers to a covered work governed by this License, other than an Application or a Combined Work as defined below.

An “Application” is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A “Combined Work” is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined Work was made is also called the “Linked Version”.

The “Minimal Corresponding Source” for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The “Corresponding Application Code” for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

1. Exception to Section 3 of the GNU GPL.

You may convey a covered work under sections 3 and 4 of this License without being bound by section 3 of the GNU GPL.

2. Conveying Modified Versions.

If you modify a copy of the Library, and, in your modifications, a facility refers to a function or data to be supplied by an Application that uses the facility (other than as an argument passed when the facility is invoked), then you may convey a copy of the modified version:

a) under this License, provided that you make a good faith effort to ensure that, in the event an Application does not supply the function or data, the facility still operates, and performs whatever part of its purpose remains meaningful, or

b) under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

3. Object Code Incorporating Material from Library Header Files.

The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

a) Give prominent notice with each copy of the object code that the Library is used in it and that the Library and its use are covered by this License.

b) Accompany the object code with a copy of the GNU GPL and this license document.

4. Combined Works.

You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

a) Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.

b) Accompany the Combined Work with a copy of the GNU GPL and this license document.

c) For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.

d) Do one of the following:

0) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.

1) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.

e) Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information is necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

5. Combined Libraries.

You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities, conveyed under the terms of this License.

b) Give prominent notice with the combined library that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

6. Revised Versions of the GNU Lesser General Public License.

The Free Software Foundation may publish revised and/or new versions of the GNU Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library as you received it specifies that a certain numbered version of the GNU Lesser General Public License “or any later version” applies to it, you have the option of following the terms and conditions either of that published version or of any later version published by the Free Software Foundation. If the Library as you received it does not specify a version number of the GNU Lesser General Public License, you may choose any version of the GNU Lesser General Public License ever published by the Free Software Foundation.

If the Library as you received it specifies that a proxy can decide whether future versions of the GNU Lesser General Public License shall apply, that proxy's public statement of acceptance of any version is permanent authorization for you to choose that version for the Library.

1.7.7 Zlib License

See http://www.zlib.net/zlib_license.html

/* zlib.h -- interface of the 'zlib' general purpose compression library version 1.2.8, April 28th, 2013

Copyright (C) 1995-2013 Jean-loup Gailly and Mark Adler

This software is provided 'as-is', without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions:

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.

2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.

3. This notice may not be removed or altered from any source distribution.

Jean-loup Gailly Mark Adler

jloup@gzip.org madler@alumni.caltech.edu

1.7.8 ZeroMQ Free Software Licenses

See http://zeromq.org/area:licensing

See *GNU Lesser General Public License*, on page 1-17, for the GNU Lesser General Public License V3 referred to below.

The libzmq library is licensed under the GNU Lesser General Public License V3 plus a static link exception.

You get the full source code. You can examine the code, modify it, and share your modified code under the terms of the LGPL.

Static linking exception. The copyright holders give you permission to link this library with independent modules to produce an executable, regardless of the license terms of these independent modules, and to copy and distribute the resulting executable under terms of your choice, provided that you also meet, for each linked independent module, the terms and conditions of the license of that module. An independent module is a module which is not derived from or based on this library. If you modify this library, you must extend this exception to your version of the library.

ZeroMQ for Commercial Applications

ZeroMQ is safe for use in close-source applications. The LGPL share-alike terms do not apply to applications built on top of ZeroMQ.

You do not need a commercial license. The LGPL applies to ZeroMQ's own source code, not your applications. Many commercial applications use ZeroMQ.

1.7.9 Python 2.7 license

A. HISTORY OF THE SOFTWARE

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see http://www.cwi.nl) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see http://www.cnri.reston.va.us) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see http://www.zope.com). In 2001, the Python Software Foundation (PSF, see http://www.python.org/psf/) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

All Python releases are Open Source (see http://www.opensource.org for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Release	Derived from	Year	OwnerGPL-compatible? (1)
0.9.0 thru 1.2	1991-1995		CWIyes
1.3 thru 1.5.2	1.2	1995-1999	CNRIyes
1.6	1.5.2	2000	CNRIno
2.0	1.6	2000	BeOpen.comno
1.6.1	1.6	2001	CNRIyes (2)
2.1	2.0+1.6.1	2001	PSFno
2.0.1	2.0+1.6.1	2001	PSFyes
2.1.1	2.1+2.0.1	2001	PSFyes
2.2	2.1.1	2001	PSFyes
2.1.2	2.1.1	2002	PSFyes
2.1.3	2.1.2	2002	PSFyes
2.2.1	2.2	2002	PSFyes
2.2.2	2.2.1	2002	PSFyes
2.2.3	2.2.2	2003	PSFyes
2.3	2.2.2	2002-2003`	PSFyes
2.3.1	2.3	2002-2003	PSFyes
2.3.2	2.3.1	2002-2003	PSFyes
2.3.3	2.3.2	2002-2003	PSFyes
2.3.4	2.3.3	2004	PSFyes
2.3.5	2.3.4	2005	PSFyes
2.4	2.3	2004	PSFyes
2.4.1	2.4	2005	PSFyes
2.4.2	2.4.1	2005	PSFyes

2.4.3	2.4.2	2006	PSFyes
2.5	2.4	2006	PSFyes
2.7	2.6	2010	PSFyes

Footnotes:

(1) GPL-compatible doesn't mean that we're distributing Python under the GPL. All Python licenses, unlike the GPL, let you distribute a modified version without making your changes open source. The GPL-compatible licenses make it possible to combine Python with other software that is released under the GPL; the others don't.

(2) According to Richard Stallman, 1.6.1 is not GPL-compatible, because its license has a choice of law clause. According to CNRI, however, Stallman's lawyer has told CNRI's lawyer that 1.6.1 is "not incompatible" with the GPL.

Thanks to the many outside volunteers who have worked under Guido's direction to make these releases possible.

B. TERMS AND CONDITIONS FOR ACCESSING OR OTHERWISE USING PYTHON

==========

PYTHON SOFTWARE FOUNDATION LICENSE VERSION 2

---

1. This LICENSE AGREEMENT is between the Python Software Foundation ("PSF"), and the Individual or organization ("Licensee") accessing and otherwise using this software ("Python") in source or binary form and its associated documentation.

2. Subject to the terms and conditions of this License Agreement, PSF hereby grants Licensee a nonexclusive, royalty-free, world-wide license to reproduce, analyze, test, perform and/or display publicly, prepare derivative works, distribute, and otherwise use Python alone or in any derivative version, provided, however, that PSF's License Agreement and PSF's notice of copyright, i.e., "Copyright (c) 2001, 2002, 2003, 2004, 2005, 2006 Python Software Foundation; All Rights Reserved" are retained in Python alone or in any derivative version prepared by Licensee.

3. In the event Licensee prepares a derivative work that is based on or incorporates Python or any part thereof, and wants to make the derivative work available to others as provided herein, then Licensee hereby agrees to include in any such work a brief summary of the changes made to Python.

4. PSF is making Python available to Licensee on an "AS IS" basis. PSF MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED. BY WAY OF EXAMPLE, BUT NOT LIMITATION, PSF MAKES NO AND DISCLAIMS ANY REPRESENTATION OR WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR THAT THE USE OF PYTHON WILL NOT INFRINGE ANY THIRD PARTY RIGHTS.

5. PSF SHALL NOT BE LIABLE TO LICENSEE OR ANY OTHER USERS OF PYTHON FOR ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES OR LOSS AS A RESULT OF MODIFYING, DISTRIBUTING, OR OTHERWISE USING PYTHON, OR ANY DERIVATIVE THEREOF, EVEN IF ADVISED OF THE POSSIBILITY THEREOF.

6. This License Agreement will automatically terminate upon a material breach of its terms and conditions.

7. Nothing in this License Agreement shall be deemed to create any relationship of agency, partnership, or joint venture between PSF and Licensee. This License Agreement does not grant permission to use PSF trademarks or trade name in a trademark sense to endorse or promote products or services of Licensee, or any third party.

8. By copying, installing or otherwise using Python, Licensee agrees to be bound by the terms and conditions of this License Agreement.

BEOPEN.COM LICENSE AGREEMENT FOR PYTHON 2.0

BEOPEN PYTHON OPEN SOURCE LICENSE AGREEMENT VERSION 1

1. This LICENSE AGREEMENT is between BeOpen.com ("BeOpen"), having an office at 160 Saratoga Avenue, Santa Clara, CA 95051, and the Individual or Organization ("Licensee") accessing and otherwise using this software in source or binary form and its associated documentation ("the Software").

2. Subject to the terms and conditions of this BeOpen Python License Agreement, BeOpen hereby grants Licensee a non-exclusive, royalty-free, world-wide license to reproduce, analyze, test, perform and/or display publicly, prepare derivative works, distribute, and otherwise use the Software alone or in any derivative version, provided, however, that the BeOpen Python License is retained in the Software, alone or in any derivative version prepared by Licensee.

3. BeOpen is making the Software available to Licensee on an "AS IS" basis. BEOPEN MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED. BY WAY OF EXAMPLE, BUT NOT LIMITATION, BEOPEN MAKES NO AND DISCLAIMS ANY REPRESENTATION OR WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR THAT THE USE OF THE SOFTWARE WILL NOT INFRINGE ANY THIRD PARTY RIGHTS.

4. BEOPEN SHALL NOT BE LIABLE TO LICENSEE OR ANY OTHER USERS OF THE SOFTWARE FOR ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES OR LOSS AS A RESULT OF USING, MODIFYING OR DISTRIBUTING THE SOFTWARE, OR ANY DERIVATIVE THEREOF, EVEN IF ADVISED OF THE POSSIBILITY THEREOF.

5. This License Agreement will automatically terminate upon a material breach of its terms and conditions.

6. This License Agreement shall be governed by and interpreted in all respects by the law of the State of California, excluding conflict of law provisions. Nothing in this License Agreement shall be deemed to create any relationship of agency, partnership, or joint venture between BeOpen and Licensee. This License Agreement does not grant permission to use BeOpen trademarks or trade names in a trademark sense to endorse or promote products or services of Licensee, or any third party. As an exception, the "BeOpen Python" logos available at http://www.pythonlabs.com/logos.html may be used according to the permissions granted on that web page.

7. By copying, installing or otherwise using the software, Licensee agrees to be bound by the terms and conditions of this License Agreement.

CNRI LICENSE AGREEMENT FOR PYTHON 1.6.1

---

1. This LICENSE AGREEMENT is between the Corporation for National Research Initiatives, having an office at 1895 Preston White Drive, Reston, VA 20191 ("CNRI"), and the Individual or Organization ("Licensee") accessing and otherwise using Python 1.6.1 software in source or binary form and its associated documentation.

2. Subject to the terms and conditions of this License Agreement, CNRI hereby grants Licensee a nonexclusive, royalty-free, world-wide license to reproduce, analyze, test, perform and/or display publicly, prepare derivative works, distribute, and otherwise use Python 1.6.1 alone or in any derivative version, provided, however, that CNRI's License Agreement and CNRI's notice of copyright, i.e., "Copyright (c) 1995-2001 Corporation for National Research Initiatives; All Rights Reserved" are retained in Python 1.6.1 alone or in any derivative version prepared by Licensee. Alternately, in lieu of CNRI's License Agreement, Licensee may substitute the following text (omitting the quotes): "Python 1.6.1 is made available subject to the terms and conditions in CNRI's License Agreement. This Agreement together with Python 1.6.1 may be located on the Internet using the following unique, persistent identifier (known as a handle): 1895.22/1013. This Agreement may also be obtained from a proxy server on the Internet using the following URL: http://hdl.handle.net/1895.22/1013".

3. In the event Licensee prepares a derivative work that is based on or incorporates Python 1.6.1 or any part thereof, and wants to make the derivative work available to others as provided herein, then Licensee hereby agrees to include in any such work a brief summary of the changes made to Python 1.6.1.

4. CNRI is making Python 1.6.1 available to Licensee on an "AS IS" basis. CNRI MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED. BY WAY OF EXAMPLE, BUT NOT LIMITATION, CNRI MAKES NO AND DISCLAIMS ANY REPRESENTATION OR WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR THAT THE USE OF PYTHON 1.6.1 WILL NOT INFRINGE ANY THIRD PARTY RIGHTS.

5. CNRI SHALL NOT BE LIABLE TO LICENSEE OR ANY OTHER USERS OF PYTHON 1.6.1 FOR ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES OR LOSS AS A RESULT OF MODIFYING, DISTRIBUTING, OR OTHERWISE USING PYTHON 1.6.1, OR ANY DERIVATIVE THEREOF, EVEN IF ADVISED OF THE POSSIBILITY THEREOF.

6. This License Agreement will automatically terminate upon a material breach of its terms and conditions.

7. This License Agreement shall be governed by the federal intellectual property law of the United States, including without limitation the federal copyright law, and, to the extent such U.S. federal law does not apply, by the law of the Commonwealth of Virginia, excluding Virginia's conflict of law provisions. Notwithstanding the foregoing, with regard to derivative works based on Python 1.6.1 that incorporate non-separable material that was previously distributed under the GNU General Public License (GPL), the law of the Commonwealth of Virginia shall govern this License Agreement only as to issues arising under or with respect to Paragraphs 4, 5, and 7 of this License Agreement. Nothing in this License Agreement shall be deemed to create any relationship of agency, partnership, or joint venture between CNRI and Licensee. This License Agreement does not grant permission to use CNRI trademarks or trade name in a trademark sense to endorse or promote products or services of Licensee, or any third party.

8. By clicking on the "ACCEPT" button where indicated, or by copying, installing or otherwise using Python 1.6.1, Licensee agrees to be bound by the terms and conditions of this License Agreement.

ACCEPT

CWI LICENSE AGREEMENT FOR PYTHON 0.9.0 THROUGH 1.2

Copyright (c) 1991 - 1995, Stichting Mathematisch Centrum Amsterdam,The Netherlands. All rights reserved.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose and without fee is hereby granted, provided that the above copyright notice appear in all copies and that both that copyright notice and this permission notice appear in supporting documentation, and that the name of Stichting Mathematisch Centrum or CWI not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission.

STICHTING MATHEMATISCH CENTRUM DISCLAIMS ALL WARRANTIES WITH REGARD TO THIS SOFTWARE, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, IN NO EVENT SHALL STICHTING MATHEMATISCH CENTRUM BE LIABLE FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

1.8 Intellectual property

Currently, one, or more, U.S. and foreign patents are pending.

1.9 Referenced documents

Spirent recommends you always refer to the latest issue of any referenced document.

[1] DGP00686AAA SimGEN User Manual

[2] DGP00792AAA SimREMOTE User Manual

[3] DGP01430AAA GSS7000 Signal Generator User Manual

[4] DGP01245AAA Production Test Signal Generator Hardware Manual

[5] MS3085 GSS6300M Datasheet

[6] MS7000 GSS7000 Datasheet

[7] IS-GPS-200F Navstar GPS Space Segment / Navigation User Interfaces Sept 2011

[8] IS-GPS-705A Navstar GPS Space Segment / User Segment L5 Interfaces

[9] ICD-GPS-204A Navstar GPS Instrumentation and Connectors Standard, Appendix 9: Standard Receiver Performance Tests, August 1982

[10] GLONASS ICD Version 5.1 2008

[11] Galileo Open Service SIS ICD, Issue 1, February 2010

[12] RTCA-DO229 and 229A - Minimum operational performance standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment

[13] BeiDou Navigation Satellite Sytem SIS ICD, Open Service Signal (Version 2.0). China Satellite Navigation Office, December 2013.

[14] BeiDou Navigation Satellite System Signal in Space Interface Control Document Open Service Signal B1C (Version 1.0, December 2017).

[15] BeiDou Navigation Satellite System Signal in Space Interface Control Document Open Service Signal B2a (Version 1.0, December 2017).

[16] BeiDou Navigation Satellite System Signal in Space Interface Control Document Open Service Signal B3I (Version 1.0, February 2018).

[17] NATO Standard Agreement STANAG 4294 Issue 1.

[18] ISRO-IRNSS-ICD-SPS-1.1 August 2017.

[19] ISRO-ISAC-IRNSS-PR July 2011 IRNSS Signal-in-Space ICD for SPS Version 1.2

[20] DAN017-TM SimROUTE Road-Matched Trajectory Generation Tool

[21] DCS0050B GSS6xxx High Level Output Configuration Procedure

[22] DCS0038A Updating GSS6300 GSS6700 Simulator Firmware or FPGA

[23] DCS0059B GSS7000 Customer calibration procedure

1.10 Hardware keys

Spirent uses hardware keys to assign SimTEST to a specific signal generator and so prevent unauthorised use. Spirent derives each 16-digit hexadecimal number key from the serial number of your signal generator. Spirent pre-installs the keys during factory configuration.

If Spirent provides your SimTEST host, Spirent installs the hardware keys during factory configuration and you need do nothing. If you install SimTEST to a PC you provide as the SimTEST host, the installation process loads a desktop short-cut to the Hardware keys utility. You must run the Hardware keys utility once before running SimTEST for the first time. You need only install your hardware keys once.

Note: If Spirent provides your SimTEST host, the Hardware keys utility might appear if you re-install or upgrade SimTEST. In this case, you must run the Harware keys utility before using SimTEST.

Where you use two signal generators, you must enter a hardware key for the signal generator Spirent designates the “Auxiliary”.

To install the hardware keys:

1. Double-click the desktop shortcut to the Hardware keys utility.

Existing keys appear in the KEY area.

Note: Currently, SimTEST does not use NEW AGILENT KEY.

2. Click NEW SIMULATOR KEY.

3. Enter the key of your signal generator, and optionally the details of the hardware unit.
4. Click INSERT.
5. On the **Hardware Keys Utility** dialog, click OK.

2 SimTEST

Note: Depending on your licence type, SimTEST shows disabled functions in grey text; or only shows enabled functions.

Each signal generator requires instructions to configure and commence simulation. You can generate these instructions by:

→ Using the SimTEST user interface

→ Remotely controlling the signal generator using remote commands sent to SimTEST from a remote PC, or from a separate program on the GSS7000 embedded host or the GSS6300M-I integrated Controller.

Remote commands, on page 8-1, details the remote commands SimTEST supports.

2.1 Starting SimTEST on the GSS7000

The GSS7000 signal generator incorporates an embedded host running Linux and the Windows operating system. Reference [3] describes operating this signal generator.

You must first connect a keyboard, mouse and monitor to your GSS7000 signal generator.

To start SimTEST:

1. Apply AC power to the GSS7000.
2. Check the rocker switch above the rear panel AC inlet is set ON (I).
3. Press the front panel POWER button.
4. Check the POWER indicator illuminates.
5. Monitor the HEALTH indicator on the front panel of the GSS7000 signal generator.
6. Wait until the HEALTH indicator stops flashing and remains green.
7. Start SimTEST, by double-clicking the desktop shortcut, which first checks the licencing of your GSS7000 signal generator.

   SimTEST and the GSS7000 signal generator are now ready for use.

When you start a scenario, the ACTIVE indicator illuminates and remains lit throughout the scenario.

2.2 Starting SimTEST on the GSS6300M-I

You must install your licence the first time you run SimTEST, see *Installing a licence file*, on page 1-5.

The GSS6300M-I signal generator incorporates an integrated Controller running the Windows operating system and SimTEST. Reference [4] describes operating this signal generator.

You must first connect a keyboard, mouse and DVI monitor to your GSS6300M-I signal generator.

To start SimTEST:

1. Apply AC power to the GSS6300M-I.
2. Check the rocker switch above the rear panel AC inlet is set ON (I).
3. Press the front panel CONTROLLER button.
4. Check the POWER indicator illuminates.
5. Monitor the HEALTH indicator on the front panel of the GSS6300M-I signal generator.
6. Wait until the HEALTH indicator stops flashing and remains green.

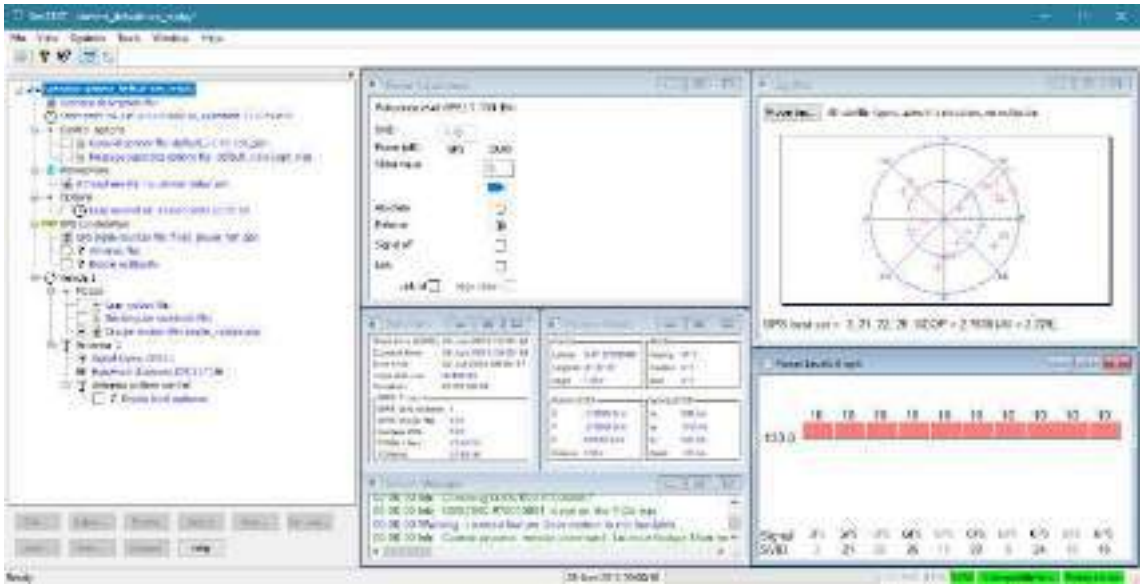
7. Start SimTEST, which first checks the licencing of your GSS6300M-I signal generator.

   SimTEST and the GSS6300M-I signal generator are now ready for use.

When you start a scenario, the ACTIVE indicator illuminates and remains lit throughout the scenario.

2.3 SimTEST user interface

The SimTEST user interface comprises a series of windows and dialogs, with a SCENARIO CONTENTS window on the left-hand side.



Blue text indicates a parameter you can edit, black text indicates a read-only parameter.

SimTEST asks you to load a scenario after it starts.

The scenario defines all parameters you need to run SimTEST, including:

→ The characteristics of the constellation(s) you want to simulate
→ Tropospheric and Ionospheric conditions
→ The vehicle type
→ The motion of vehicle
→ The level pattern (gain pattern) of receiving antenna

A scenario is the sum of these definitions. Only Spirent can create SimTEST scenarios.

You can recall saved scenarios and perform limited editing on these scenarios.

Spirent ships GSS7000 simulators with an example scenario in the common parent folder *D:\posapp\scenarios for SimTEST.*

2.4 Differences between channel and SVID

You can specify some remote commands to use either a channel or SVID, where:

→ channel refers to a channel in a Spirent signal generator. SimTEST automatically assigns (or you specifically assign) a channel to a satellite (SVID). The number of available channels depends on your signal generator.
→ SVID refers to a number (the PRN) identifying a particular satellite. SimTEST assigns an SVID to the next available channel. When an SVID sets, its channel becomes free and available for use by another SVID.

Choosing either channel or SVID in a command achieves the same result - SimTEST always applies the changes you specify to a signal generator channel, this table outlines the differences between channel and SVID:

Table 2-1: Differences between channel and SVID in remote commands

Parameter	Duration of Parameter settings	Outline of actions
Channel	Remainder of scenario (unless changed)	Automatically applies settings to that channel. You can change channel settings during the scenario. During the scenario, SimTEST can assign any SVID to that channel.
SVID	While SVID is visible	At the time of command, SimTEST scans all available channels for the SVID. If the SVID is present, SimTEST applies the settings. If the SVID is not present, SimTEST does not apply the settings.

channel settings apply for the remainder of the scenario. When SimTEST moves an SVID to a new channel, it always applies the settings of the new channel. SimTEST does not retain SVID settings when you move the SVID between channels.

SVID settings apply only while the SVID is visible. After the SVID sets, SimTEST does not retain non-default SVID settings.

2.5 Supported constellations

GSS7000 and GSS6300M-I signal generators need a licence to support each constellation. A GPS licence gives support for SBAS.

The following sections describe the constellations each signal generator supports:

→ *BeiDou*, on page 2-4
→ *Galileo*, on page 2-4
→ *GLONASS*, on page 2-5
→ *GPS*, on page 2-5
→ *IRNSS*, on page 2-5
→ *Quasi-Zenith*, on page 2-6
→ *SBAS*, on page 2-6

The following table outlines the constellation support. The GSS7000 supports all the frequencies in this table, up to a maximum of 256 channels if you have all four channel banks installed in your signal generator, and supports scenarios generated using the extended constellation.

The GSS6300M-I supports (with an appropriate licence) eight channels of each of the following constellations at the L1 frequency:

→ BeiDou
→ Galileo
→ GLONASS
→ GPS / SBAS / Quasi-Zenith (Notice the GPS constellation always takes precedence)

Table 2-2: Constellation support

Constellation	Frequency	Code	Comment
BeiDou	B1I (1 561.098 MHz)	B1I	PRN range 1 to 37
	B2I (1 207.14 MHz)	B2I	PRN range 1 to 37
	B3I (1 268.52 MHz)	B3I	PRN range 1 to 63
	B1C (1 575.42 MHz)	B1C	PRN range 1 to 63
	B2a (1 176.45 MHz)	B2a	PRN range 1 to 63

Table 2-2: Constellation support (continued)

Constellation	Frequency	Code	Comment
Galileo	E1 (1 575.42 MHz)	E1-B E1-C (and both the above with and without CBOC)	PRN range: 1 to 50
	E5 (1 191.795 MHz)	AltBOC	
GLONASS	L1 (channel 0: 1 602.0 MHz)	C/A	channels: -7 to +6
	L2 (channel 0: 1 246.0 MHz)	C/A	
GPS	L1 (1 575.42 MHz)	C/A L1C (Pilot+Data)	PRN range: 1 to 63
	L2 (1 227.6 MHz)	C/A	
	L5 (1 176.45 MHz)	On or Off	
IRNSS	L5	On or Off	PRN range: 1 to 16
Quasi-Zenith	L1 C/A (1575.42 MHz)	C/A L1S L1C	PRN range L1C and L1C/A: 193 to 202 PRN range L1S: 183 to 192
	L2 (1 227.6 MHz)	L2C	
	L5 (1 176.45 MHz)	L5C L5S	
	L6 (1 278.75 MHz)	L6D L6E	L61 (block 1) PRN 193 only L62 (block II) PRN 193 to 201 (198 undefined) L62 (block II) PRN 204 to 211 (208 undefined)
SBAS	L1 (1 575.42 MHz)	C/A	PRN range: 120 to 138
	L5 (1 176.45 MHz)		

2.5.1 BeiDou

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

BeiDou time lags GPS time by 14 seconds. For example, 23:58:00 (BeiDou time) is 23:58:14 (GPS time).

BeiDou signals provide a free, global, civilian service.

Reference [13] gives the BeiDou ICD version 2.0, which defines the B2 signal component and refers to the BeiDou B1 primary code as the B1I ranging code (CB1I).

References [14], [15] and [16] give the current version of the ICD for BeiDou with generation of navigation data for BeiDou signals B1C, B2a and B3I respectively.

The GSS6300M-I only supports BeiDou B1I, BeiDou Phase 2.

2.5.2 Galileo

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

Note: The GSS7000 signal generator only supports E1 and E5 and is currently limited to 16 channels for Galileo E5.

Galileo comprises a constellation of Earth-orbiting satellites capable of supporting precise positioning and navigation for both worldwide terrestrial and Earth-orbiting vehicles.

The Galileo system provides a number of navigation and positioning services.

2.5.3 GLONASS

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

Note: GLONASS uses an FDMA structure with channel numbers, K, ranging from -7 to +6.
GLONASS L1 frequency = 1602 +/- (K x 0.5625) MHz

The GLObal Navigation Satellite System (GLONASS) is a satellite-based radio positioning, navigation and time-transfer system similar to GPS, but differing in many respects. Two levels of service are available, Standard Accuracy System and the High Accuracy System. The system consists of three segments: Space, Control and User.

→ Space segment - consists of 24 satellites in three orbital planes, with eight satellites in each plane. C/A- and P-codes modulate the L1 signal. These codes are pseudo-random codes with independent navigation data superimposed. The pseudo-random number associated with spreading the signal is the same for all satellites.

Satellites transmit on a 'comb' of frequencies (FDMA), the distinction between the satellites being made by assigning different channel numbers to which the receiver may tune. The navigation data includes satellite clock, ephemeris (precise satellite position) and almanac (coarse satellite position) information.

→ Control segment - consists of a number of Earth-based monitor stations that track the GLONASS satellites and provide information to the Master Control Station. The Master Control Station determines the satellite orbits and uploads navigation data to each satellite at regular intervals.

→ User segment - utilises the signals transmitted from each satellite, together with precise measurement of the signal transmission delays and Doppler shifts, to determine the receiver's position and velocity. The receiver also synchronises its internal clock to GLONASS time.

2.5.4 GPS

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

The Global Positioning System (GPS) is a satellite-based radio positioning, navigation and time-transfer system. Two levels of service are available, the Standard Positioning Service (SPS) and the Precise Positioning Service (PPS). The system consists of three segments:

SPACE SEGMENT - consists of 24, or more, satellites in six orbital planes with at least four satellites in each plane. Each satellite uses a unique pseudo-random code to transmit, on three frequencies (L1, L2 and L5), a spread-spectrum signal modulated with navigation data that includes satellite clock, ephemeris (precise satellite position) and almanac (coarse satellite position) information.

CONTROL SEGMENT - consists of a number of Earth-based monitor stations that track the GPS satellites and provide information to a Master Control Station. The Master Control Station determines the satellite orbits and uploads navigation data to each satellite at regular intervals.

USER SEGMENT - utilises the signals transmitted from each satellite, together with precise measurement of the signal transmission delays and Doppler shifts, to determine the receiver's position and velocity. The receiver also synchronises its internal clock to GPS time. The receiver uses correlation techniques (CDMA) on the transmitted pseudo-random code to discriminate between GPS satellites.

2.5.5 IRNSS

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

With the launch of the last satellite in the constellation, the Indian Regional Navigational Satellite System (IRNSS) constellation has an operational name of NAVIC (NAVigation Indian Constellation). This document and the SimTEST user interface continues to refer to this constellation as IRNSS.

The Indian Regional Navigational Satellite System (IRNSS) constellation offers a service that will extend some 1 500 km around India. The IRNSS constellation consists of seven satellites, three in geostationary orbit and four in geosynchronous orbit. All satellites will be continuously visible from India for 24 hours a day.

The GSS7000 supports the IRNSS Standard Positioning Service at L5.

2.5.6 Quasi-Zenith

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

The Quasi-Zenith constellation offers an augmentation service over Japan and Australia. Quasi-Zenith satellites will provide signals from a high elevation angle giving improved navigation services for mountainous areas and urban canyons.

SimTEST uses the satellite's SVID to identify the control data it must apply to individual Quasi-Zenith satellites.

SVID and PRN are not synonymous for Quasi-Zenith satellites, as their PRN values are much larger and each Quasi-Zenith satellite broadcasts several signals using different PRNs.

2.5.7 SBAS

Licensed feature: *You will need a SMAS and GPS licence to use this constellation. Contact Spirent for licencing details.*

Satellite Based Augmentation Systems (SBAS) augment primary navigation systems such as GPS and GLONASS and provide increased accuracy, integrity and availability. The transport mechanism relies on a radio signal transmitted by one or more geostationary satellites that has a similar form to the GPS signal. WAAS, EGNOS, and MSAS are examples of such systems.

A network of ground-monitoring stations evaluates the performance of the relevant navigation constellations, obtaining accuracy improvement by calculating pseudorange correction information for the SBAS satellites to broadcast in a navigation message. The SBAS system rapidly achieves improved integrity by including 'Don't use' type information whenever it detects a problem with a navigation satellite.

Additional ranging capability for the Geostationary SBAS satellites improves SBAS availability.

2.6 Simulation iteration rate

SimTEST running on the GSS7000 signal generator uses a 100 millisecond simulation iteration rate.

2.7 GSS7000 synchronisation

Notes:

1) The 1PPS input impedance is 50 Ω. The pulse width of incoming signals should be ≥120 ns.

2) Do not use TRIG IN (Immediate Trigger Mode) at the same time as 1PPS IN, as both inputs would be attempting to control the timer. However, you can use TRIG IN (Delayed Trigger Mode) with 1PPS IN.

The GSS7000 signal generator incorporates input and output signal ports that you can use to synchronise time between the signal generator and the remainder of the system. This section describes using the 1PPS IN and/or TRIG IN inputs to achieve synchronisation. Reference [3] gives more details on these ports.

The GSS7000 signal generator maintains time internally by means of a time counter, clocked by an internal 10 MHz clock. Simulations always start on a one-second rollover of this timer. Before starting a simulation, you can synchronise your GSS7000 to an external system by applying a rising edge to the 1PPS IN rear panel input. Then, start the simulation by appropriate timing of the software RUN command (TRIGGER MODE: DISABLED); or by selecting DELAYED TRIGGER MODE and applying a rising edge to the TRIG IN rear panel connector. The simulation starts on the next one-second rollover of the timer.

Alternatively, you can select IMMEDIATE TRIGGER MODE, to force the timer to a point just before the one-second rollover. It freezes until a rising edge is detected on the TRIG IN rear panel connector, and the simulation starts running after a short delay.

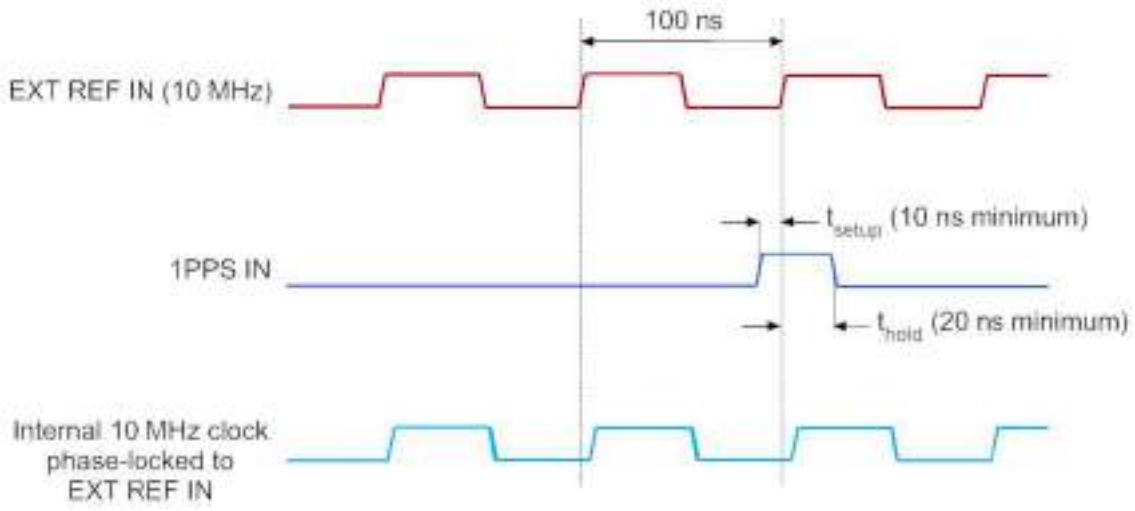
If coarse synchronisation to your system is sufficient, this is all you need do. However, certain fixed delays, and uncertainties of the order of 100 ns will exist.

To achieve precise synchronisation, you must supply your GSS7000 signal generator with an external 10 MHz frequency reference and observe certain timing requirements between the EXT REF IN signal and the following:

→ *1PPS IN* (see page 2-7)
→ *TRIG IN – Immediate Mode* (see page 2-8)
→ *TRIG IN – Delayed Mode* (see page 2-8)

2.7.1 1PPS IN

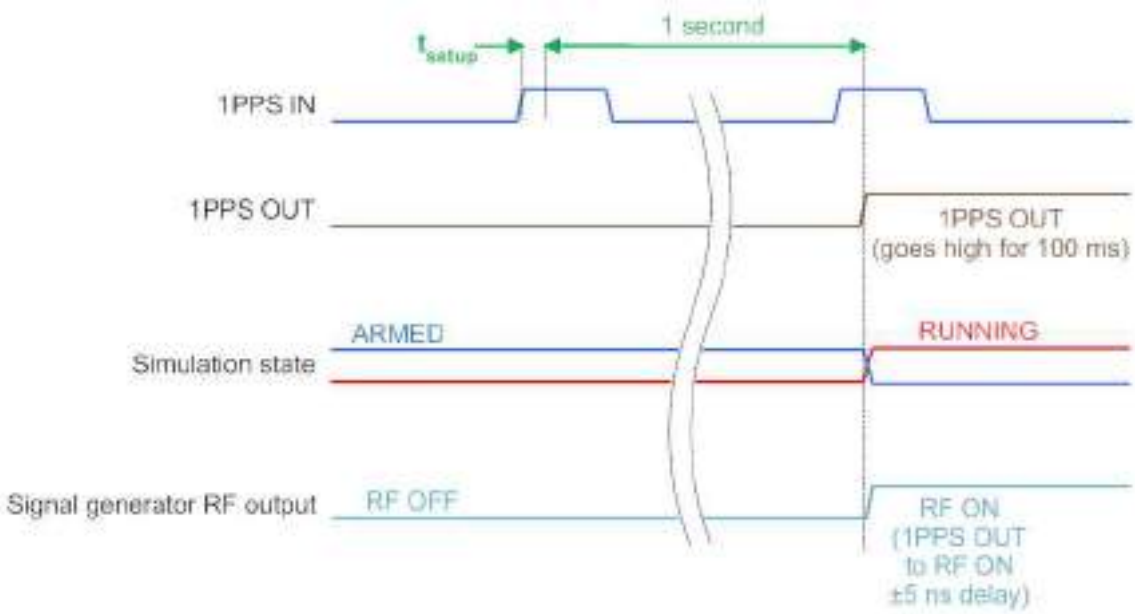
The following figures shows the timing requirements you need for the RF output from the signal generator to be within 100 ns from run to run. Provided you meet these timing requirements, the RF signal timing will be fixed and repeatable with respect to REF IN.



The EXT REF IN signal may be a square wave as shown (for example, a TTL/CMOS signal) or a sinusoid. Irrespective of the input waveform, the timing reference point is the ac zero-crossing of the signal.

The 1PPS IN pulse must start (t_{setup}) at least 10 ns before the ac zero-crossing point of the EXT REF IN waveform (but not within 20 ns of the previous leading edge) and remain high (t_{hold}) for at least 20 ns after the ac zero-crossing point. The 1PPS IN pulse must have a pulse width no less than 30 ns (minimum values for t_{setup} + t_{hold}), and can remain high after 30 ns.

As long as you meet these timing requirements, the RF signal timing, see below, will be fixed and repeatable, with respect to EXT REF IN, every time you run a simulation.

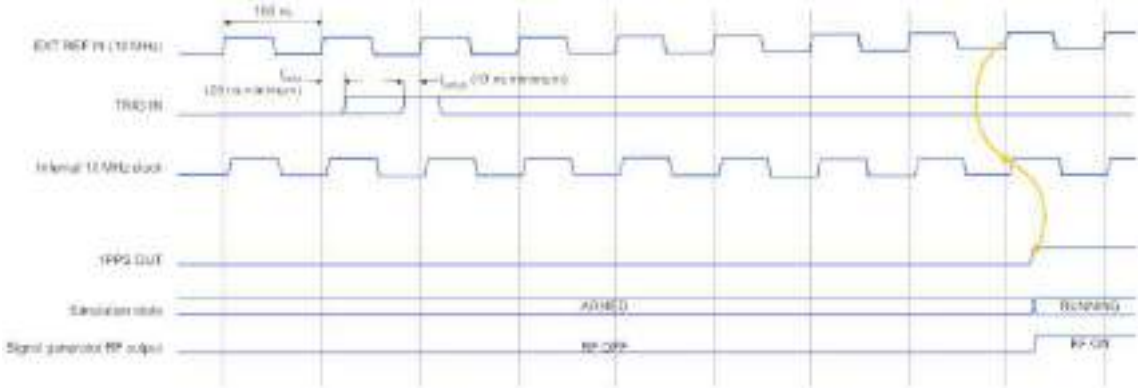


Note alignment of 1PPS OUT, as shown in the figure, does not occur immediately, but one second after detection of the 1PPS IN. SimCHAN disables the 1PPS IN input during a simulation, so that synchronisation can only take place when the signal generator is in the HALT state.

The delay between the 1PPS OUT rising edge and its resulting phase transition at RF, seen at the RF Output Port is nominally zero, reference [1] gives details on the tolerance.

2.7.2 TRIG IN – Immediate Mode

When using the Immediate Trigger mode, the timing requirements for the rising edge of TRIG IN with respect to EXT REF IN are the same as for the 1PPS IN input (this is 10 ns setup, 20 ns hold). However, before the simulation starts there is a delay of six, 10 MHz clock cycles after recognising the trigger, see this figure:



2.7.3 TRIG IN – Delayed Mode

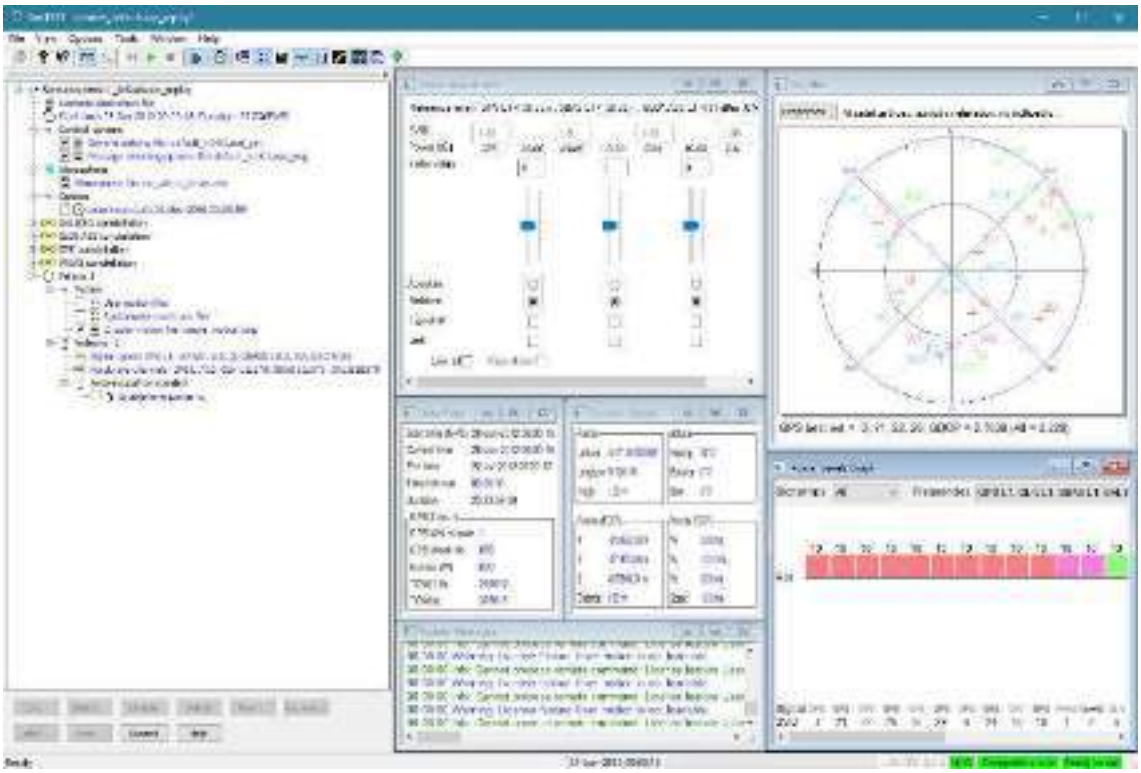
If you want to start on a defined 1PPS event in Delayed Mode, the rising edge of TRIG IN must occur at least 1.1 milli-seconds before the 1PPS OUT rising edge.

3 SimTEST menu

Note: The SimTEST main display windows are independent of the constellation or combination of constellations, your scenario uses. This Chapter show screenshots of different constellations to highlight certain features.

Use the menus to select the windows SimTEST displays, and to select the default window layout and save and restore window layouts you choose.

This figure shows a typical SimTEST window layout:



This document does not describe standard Windows menu commands.

Use the menu items to set up SimTEST and run a scenario.

The screenshots show available keyboard short-cuts.

3.1 File

OPEN, CLOSE and SAVE, apply to the whole scenario (a hierarchical set of files).

Printing prints highlighted source files as ASCII text.

This menu shows the four most recently used scenarios.

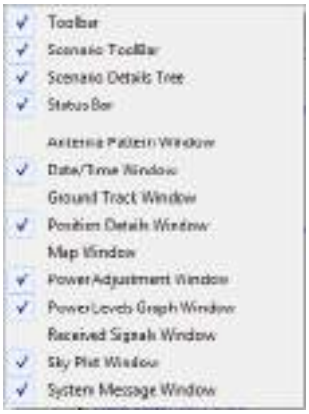
Spirent recommends using the Toolbar buttons instead of FILE-RUN, FAST FORWARD and so on.

Table 3-1: File menu items

Item	Description
OPEN	Open a SimTEST scenario settings file (*.scn_replay)
CLOSE	Close scenario, leaving SimTEST open
SAVE AS REPLAY SCENARIO (.SCN_REPLAY)	Save a scenario under a new name and to a new folder letting you export scenarios. This will copy all shared files to a new, shared, folder, in the default location: → *C:\Program Files (x86)\Spirent Communications\Positioning Application\Scenarios for SimTEST* (GSS6300M) → *D:\PosApp\Scenarios for SimTEST* (GSS7000)
EXIT	Exits SimTEST

3.2 View

Use this menu to display or hide SimTEST Toolbars and windows - a tick shows the Window will be shown in the SimTEST user interface:



You can also use the SimTEST toolbar buttons to display certain windows.

3.3 Options

The following table shows the items in the OPTIONS menu:

3.3.1 Control Options

Note: In all cases, the H/W field on the status display changes from green to amber in No hardware mode.

This figure shows the **Control Options** menu:

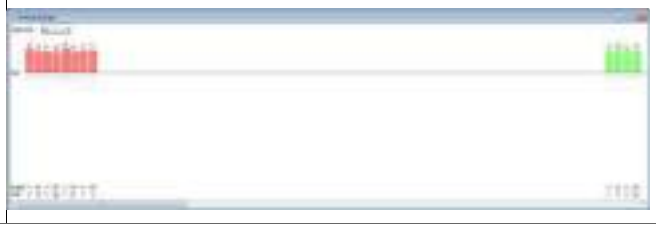
Options you set using this menu apply to all scenarios you run with SimTEST.

Options you set using this menu are overwritten, for a specific scenario, by options you set using ***<scenario name>-Control options***.

Table 3-2: Control Options dialog items

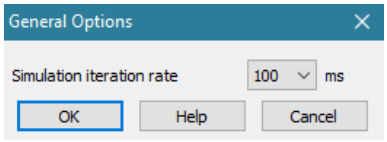
NO HARDWARE ("DUMMY RUN")	Select: run a scenario without connecting a signal generator.
Note: From SimGEN version 2-83 onward, you must connect a valid Spirent signal generator to the SimGEN Controller, or install a "no hardware" licence, to enable data logging to a file when you run any scenario in No hardware ("dummy run") mode.	
DISPLAY A WARNING BEFORE RUNNING WITHOUT HARDWARE	Select: display a warning before running without a signal generator
DISPLAY A WARNING BEFORE VIEWING READ-ONLY FILES	Select: show the read-only warning message used in SimREPLAY and SimREPLAYplus.
SAVE SCENARIO BEFORE RUN	Select: automatically saves scenario (if you have made changes) after you click RUN
AUTO START APPLICATION WITH OPERATING SYSTEM	Select: automatically starts SimGEN after Windows loads
AUTO RUN ON LOADING SCENARIO	Select: automatically starts running scenario 1 in the FILE menu 'Most Recently Used' list. If this list is empty, SimGEN runs the default scenario *Example1.scn*.
AUTO REPEAT RUN	Select: continuously re-winds and repeats the scenario
Note: Selecting Autostart application with operating system and Autorun on loading scenario loads SimTEST and automatically runs a scenario after you switch on the GSS7000 embedded host or the GSS6300M-I integral Controller.	

Table 3-2: Control Options dialog items (continued)

DUMP SIGNAL GENERATOR MESSAGES	Only for use by Spirent Global Support Engineers.
CHANNEL CENTRIC VIEW	Clear (default): relevant windows show satellite groupings, the SVID centric view. Does not show empty channels, resulting in a compact window when using a large number of channels. For example, POWER LEVEL GRAPH:  Select: relevant windows show channel groupings (legacy setting). Shows empty SVIDs resulting in an extended window when using large numbers of channels; for example, the same POWER LEVEL GRAPH as above: 

3.3.2 General options

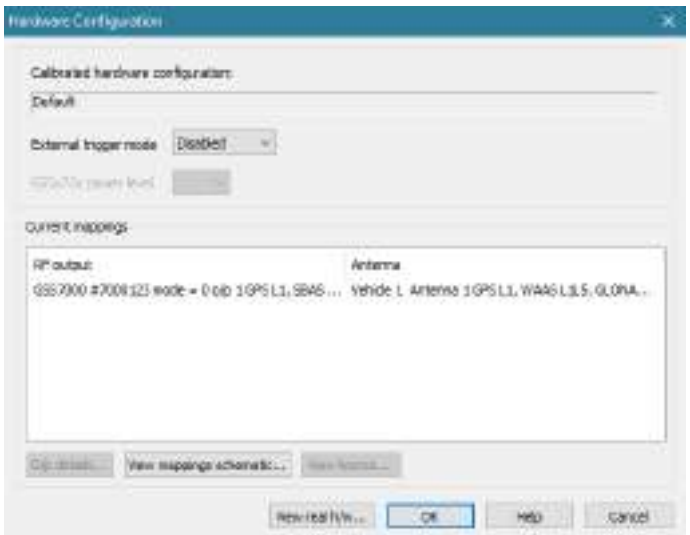
This figure shows the **General options** dialog:



The simulation iteration rate is the interval at which SimTEST iterates its motion models and pseudorange calculations. Spirent specifies this rate as a time in milliseconds with “every” being implied. Select from 10 ms or 100 ms.

3.3.3 Hardware configuration

To check your signal generator configuration, open the menu item ***Options > Hardware Configuration*** to display the **Hardware Configuration** window:



Select a signal generator and click VIEW REAL H/W... to see the signal generators connected to your GSS7000 embedded host.

Selecting a signal generator in the CURRENT MAPPINGS area enables O/P DETAILS…, which shows the signal generator **Options and Settings** dialog (the signal generator serial number appears in the title bar), for example:

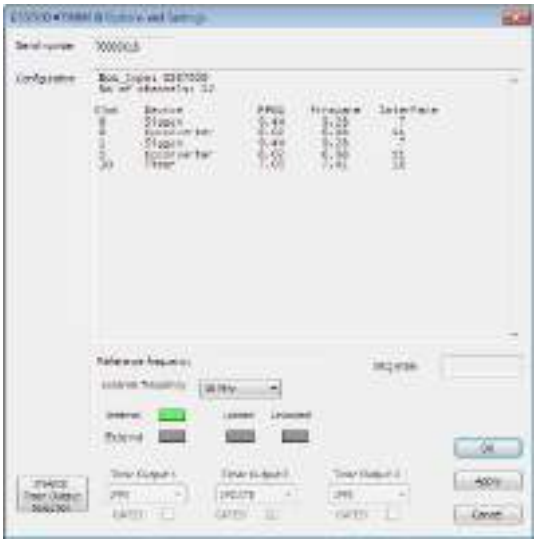
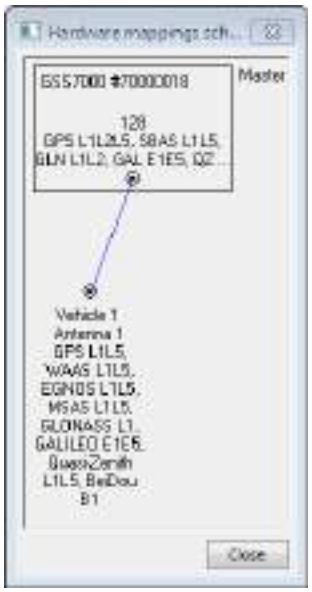


Table 3-3: Options and Settings dialog items

Item	Description
SERIAL NUMBER	The serial number of your GSS7000 signal generator.
CONFIGURATION	Shows the number of channels your GSS7000 signal generator supports, FPGA and Firmware details of each signal generator module and RF Upconverter module in each channel bank, and FPGA and Firmware details of the Timer module.
REFERENCE FREQUENCY	Select an External frequency your GSS7000 signal generator supports. The Reference frequency area shows the status of the frequency reference. The green indicator shows the internal reference is in use. Indicators will show the phase locked status of any external reference you use.
ENABLE TIMER OUTPUT SELECTION	Normally the Timer Outputs are disabled to prevent accidental changes. Click to enable each Timer Output setting and choose the timer output you want to use for each of Timer Output 1, Timer Output 2 and Timer Output 3. Reference [3] details the Timer Outputs. You can also select each timer output to be GATED (timer output is present only when a scenario is running). SimTEST applies the new settings when you click OK or Apply.

Click VIEW MAPPINGS SCHEMATIC to see a schematic of the mapping between your GSS7000 signal generator and the vehicle and antenna characteristics of the current scenario:



In the above image, the line from the upper box to Vehicle / Antenna shows the signal generator supporting the constellations and frequencies the scenario defines (the Hardware is “mapped” to that Vehicle and Antenna).

If your signal generator does not support the constellations your scenario uses, the linking line is missing.

Click VIEW LICENCE to show the **Licence** window (each licence sets up the channel bank(s) to generate a single frequency for a specific constellation), for example:

The LICENCE window displays the constellations and frequencies you can use.

Validated refers to whether SimTEST has read details from an installed licence or from the *sig_gen.txt* file. For SimTEST to read details from an installed licence, you must have installed a licence file.

If the LICENCE window does not show validated, SimTEST has read the details of your signal generator from the *sig_gen.txt* file. This will give you the ability to run only in “no hardware” mode.

3.3.4 Message Reporting

Notes:

1) If you do not select Disable message pop-ups, SimTEST remains stalled until you acknowledge the message.

2) The selections in this dialog do not output binary data.

3) When using GSS7000 signal generators, enabling Log to file-H/W comms will result in over 95% of the log file containing H/W comms logs, with the log file size exceeding 10 GB. Unless you specifically require a log of H/W comms, Spirent recommends you deselect Log to file-H/W comms.

This dialog controls the types of messages appearing in the **System Messages**window and the messages SimTEST records in the log files.

Select the messages you want to display and the messages you want to log to file.

Table 3-4: Message Reporting dialog items

DISABLE MESSAGE POP-UPS	Select to disable messages requiring your acknowledgement before SimTEST will continue. Useful when you operate SimTEST using the remote control interface.		
DISABLE HALT ON FATAL HARDWARE BITE ERRORS	Contact Spirent before use.		
PURGE LOG FILES AFTER DAYS	SimTEST retains all log files for the number of days you enter in the DAYS area. On start up, the PosApp engine deletes any file in the ...\logs folder that was last modified over the number of DAYS you enter.		
	Units: integer days	Range: 1 to 1000 days	Default: 10
Note: SimTEST deletes any file in the ..\logs folder that was last modified over the number of days you enter, it does not check if the file is a log file.			

3.3.5 RS-232 port setting

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

See *RS232 port settings*, on page 8-2.

3.4 Tools

This section details the Tools available in SimTEST.

Table 3-5: Tools menu items

Item	Description
7XXX/9XXX UTILITIES	*IEEE/IP String Send Utility* (see page 3-8) *FPGA Image Loader* (see page 3-10) *Host Controller* (see page 3-13) BIOS Battery Status, see *BIOS Battery Status*, on page 3-18
GENERAL UTILITIES	*SimROUTE* (see page 6-15) *Socket string send utility* (see page 7-1)
CHANGE HARDWARE CONFIGURATION	*Change Hardware Configuration* (see page 3-18) Use this dialog to select an alternative signal generator, if available.
INSTALL LICENCE FILE	Use this dialog to overwrite your existing licence file with a new licence file. Notice the licence file must use the extension `*.txt`, but can have any name. Using this dialog will rename your licence file with the correct licence filename for SimTEST, `lservc*.txt`. Navigate to the licence file (`lsevrc*.txt`) you want to use and click OPEN. You must restart SimTEST after installing a new licence file.

3.4.1 IEEE/IP String Send Utility

Notes:

1) SimTEST does not support IEEE-488

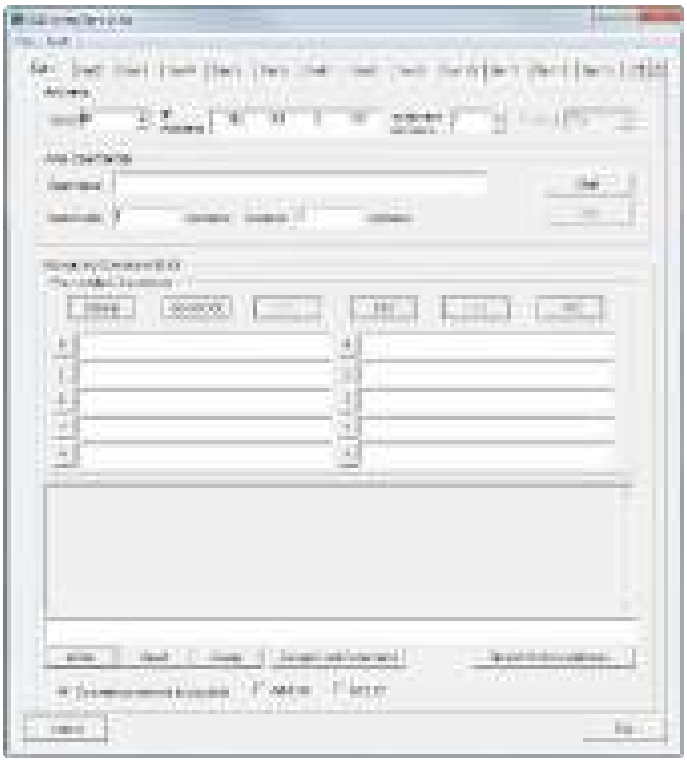
2) You can use the ***IP*** String Send utility to control SimTEST using IP and the .

3) Pre-Loaded Commands GTL and GET are not available under the IP protocol.

4) The IP string send utility detects whether a GSS7000 embedded host; or a GSS6300M-I integrated Controller, is in use and applies the correct IP address:

- 192.168.25.1 for GSS7000 signal generators
- 127.0.0.1 for GSS6300M-I signal generators

The IEEE/IP STRING SEND utility allows interactive control of signal generators using IP.



The utility is a useful diagnostic tool to check signal generator operation. It can control the signal generator as an interactive, single channel signal generator.

If your signal generator uses IP, you must first map the IP address, see *Mapping the base IP Address*, on page 3-9.

3.4.1.1 Mapping the base IP Address

Notes:

1) Spirent set the base IP address before shipping you signal generator. Contact Spirent Global Services before changing base address.

2) Only applicable to signal generators with an IP address.

3) You must use IP address 192.168.25.1 for GSS7000 using the embedded host and IP address 127.0.0.1 for the GSS6300M-I using the integrated Controller.

This maps the base IP address of your signal generator to Instrument Address 0. Select ***Tools > Set IP mapping*** to open the **Set IP mapping** dialog:

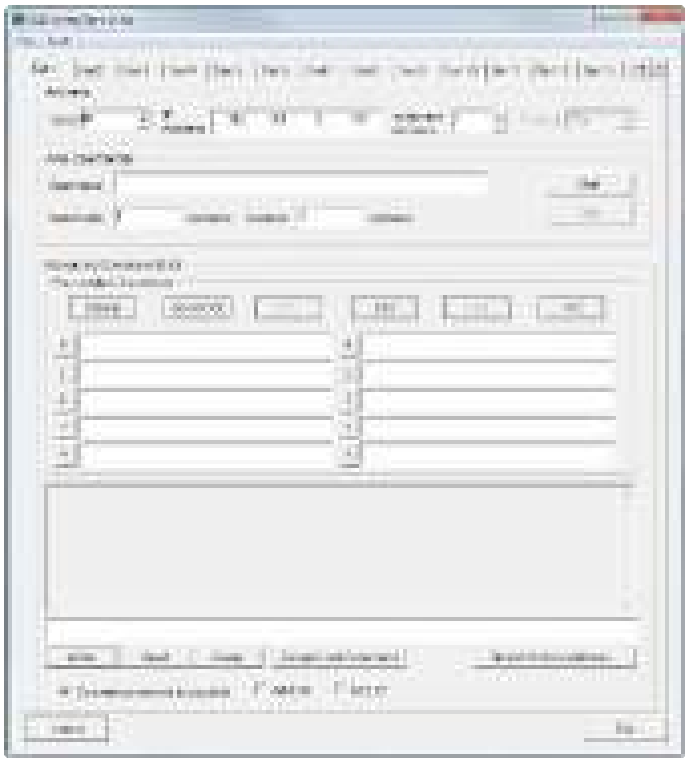
Type the IP base address that you want to map to Instrument Address 0 in the text box. The maximum Instrument address is 30.

Click OK.

Click on the up / down arrows to the right of the INSTRUMENT ADDRESS text box until the IP address of your signal generator appears in the IP ADDRESS text box.

3.4.1.2 Using the utility

The utility dialog has fifteen tabs at the top of the dialog. Each tab gives an identical screen that you can use to send commands to your signal generator:



This table describes the main areas of the dialog.

Table 3-6: IEEE String Send Utility

Item	Description
Area	Description
GPIB	Not applicable for SimTEST.
AUTO COMMANDER	Define the command, its send rate and duration.
INTERACTIVE COMMAND SHELL	You can send the following preloaded commands by clicking the appropriate button: → SDC - Sends Selective Device Clear to the device at the current Address → GET - Not applicable for SimTEST → IFC - Momentarily sets the Interface Clear bus control line → GTL - Not applicable for SimTEST **Note:** The IP protocol does not support all preloaded commands. Beneath the preloaded buttons is the history of the last 10 commands. You can resend a command by pressing the corresponding key on the keyboard number pad. The area under the history shows the response from the signal generator.
Command text box	Beneath the response area for the signal generator, you can type a command string. Click on one of the buttons below the text box to execute the command string

3.4.2 FPGA Image Loader

Notes:

1) You can only open one instance of the FPGA Image Loader.

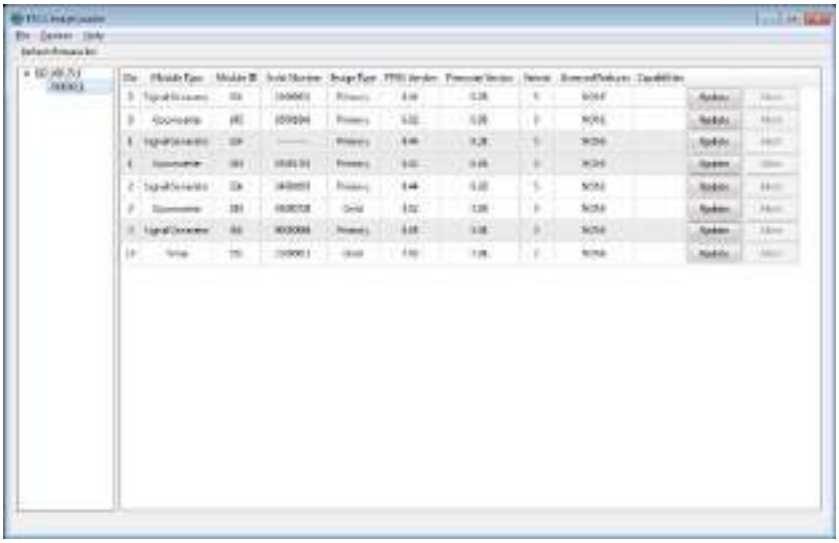
2) If the FPGA Image Loader dialog does not display the IP address or serial number of your GSS7000 signal generator, Spirent recommends you restart your GSS7000 signal generator then navigate to and open the Image loader executable, *FPGA_Image_Loader.exe*. If the problem persists, contact Spirent Global Services.

Use the FPGA IMAGE LOADER to update the GSS7000 Signal Generator, RF Upconverter and Timer FPGAs.

To update the FPGA Image Loader:

1. Ensure your embedded host has the latest version of PosApp installed.
2. Turn on AC power to your GSS7000 signal generator.
3. Start your GSS7000 signal generator by pressing the front panel on / off switch.
4. Wait for Windows to load.
5. Navigate to the Spirent software folder on your GSS7000 embedded host, default location *D:\posapp\software\<version>\gui*.
6. Double-click *FPGA_Image_Loader.exe*.

The FPGA IMAGE LOADER dialog opens and automatically selects your signal generator in the left-hand area.



7. Take a screenshot of this dialog, or record the information for each module whose FPGA you want to update.

   Use the procedure at the end of this section to determine if the update was successful.

Table 3-7: FPGA Image Loader dialog items

Item	Description
SLOT	The signal generator card frame slot where the module is installed
MODULE TYPE	Lists each module type in the currently selected signal generator
MODULE ID	Lists the Spirent Module ID
SERIAL NUMBER	Lists each Module serial number
IMAGE TYPE	Type of image currently running, either GOLD or PRIMARY
FPGA VERSION	Version of FPGA currently installed in each module. **Note:** FPGA Version displays the currently running version
FIRMWARE VERSION	Version of firmware currently running in each module. **Note:** Firmware Version displays the currently running version.
VARIANT	Displays FPGA variants
LICENCED FEATURES	Licenced features in any of the installed modules
CAPABILITIES	A combination of the loaded image and whether a feature in the loaded image is licenced

Table 3-7: FPGA Image Loader dialog items (continued)

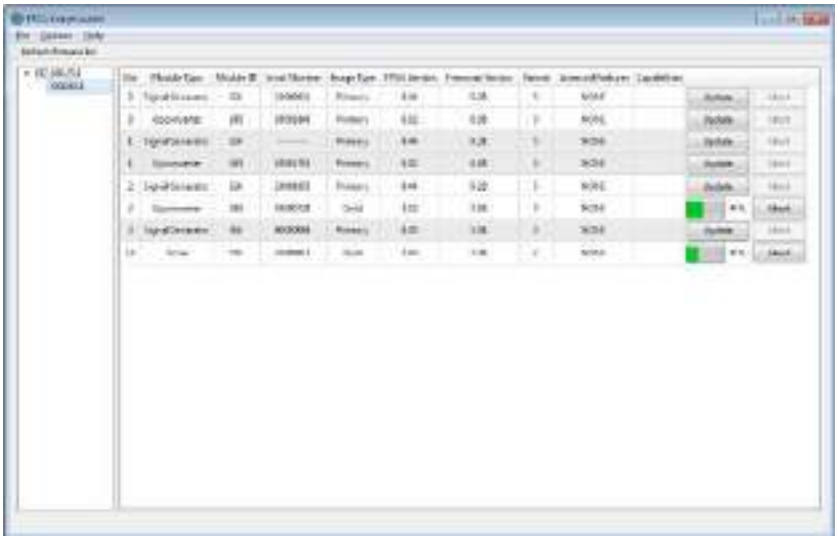
Item	Description
UPDATE	Click UPDATE, then navigate to the image you want to install. Images use the extension *.mcs, for example: *BBFR_S04_OR_SP0_02-33_02-14_KZZZ_I1.mcs*
ABORT	ABORT appears after selecting an image. Click to cancel updating the FPGA image for that module. Loading first deletes the original FPGA image then loads the new FPGA image. **Note:** Clicking ABORT does not restore the original FPGA image for that module, it will remain deleted. You must then reload this image to restore your module to its previous state

To apply a new FPGA image to a module:

1. Click UPDATE corresponding to the module you want to update.
2. Navigate to the FPGA image for that module.

   The FPGA IMAGE LOADER displays a message if the FPGA image you selected is incompatible with that module and will request you select a new image.
3. Click OK.

   The UPDATE button changes to a progress bar and the loader begins loading the new image. Once complete, the progress bar returns to an UPDATE button. You can click ABORT to abort the update process.



4. Repeat this process to update the FPGA in each module, as required.

After updating the last module, Spirent recommends you confirm the update(s) were successful.

To confirm the updates are succesful:

1. Shutdown Windows on your GSS7000 signal generator.
2. Turn off AC power to your GSS7000 signal generator at the rear panel AC switch.
3. Wait for 30 seconds.
4. Turn on AC power to your GSS7000 signal generator at the rear panel AC switch.
5. Press the front panel on / off switch.
6. Wait for Windows to load.
7. Re-run the FPGA IMAGE LOADER.

8. Compare the details in this dialog with the details you recorded earlier and ensure each module displays the updated details.

3.4.3 Host Controller

Notes:

1) Spirent recommends you only use this utility under the guidance of a Spirent Global Support engineer.

2) Each time you start SimTEST, it automatically synchronises the time of the Linux operating system with that of the Windows operating system.

3) The Linux operating system operates in UTC time only; whereas the Windows operating system lets you change time zones and adjust for daylight saving.

4) SimTEST runs in the Windows operating system that, in turn, runs in a Virtual Machine on a Linux operating system in the embedded host. This means changing an IP address is more complicated than in a computer running Windows or Linux alone. Spirent recommends you follow EXACTLY the details describing changing an IP address. To change the IP address for a port visible in the Linux operating system, you must use this utility. To change the IP address for a port visible in the Windows operating system, you must use the Windows Local Area Connection dialogs.

5) After changing the Windows, or Linux, (or both) IP address of any rear-panel Ethernet port, you must shut down your GSS7000 signal generator using Windows-Shut down. Then wait 30 seconds and restart your GSS7000 signal generator. This will ensure the embedded host assigns the correct IP address. Using Windows-Restart will not correctly configure IP address changes.

6) You must use unique IP addresses. Duplicate IP addresses may cause issues with connections to the embedded host D:\ drive or to the Windows operating system. You can check the IP addresses currently in use by clicking Read Network Port Info.

7) The Spirent factory default is for the embedded host Windows network adapter for the SIMREMOTE rear-panel Ethernet port to use DHCP to assign IP addresses. If you want to assign a static IP address to the SIMREMOTE port, you must use a unique Windows IP address, which must be on the same subnet as the Linux IP address for the SIMREMOTE port.

8) IP Addresses 192.168.5.x, 192.168.10.x, 192.168.25.x and/or 192.168.26.x are reserved for Spirent use.

This utility is part of SimTEST and lets you perform the following operations on the GSS7000 embedded host, when SimTEST is running:

→ Separately start, stop and reload the firmware and engine

→ Manually synchronise the time between the Linux and Windows operating systems

→ Log network traffic

This utility installs to folder *D:\posapp\software\<version>\gui\Host_control.*

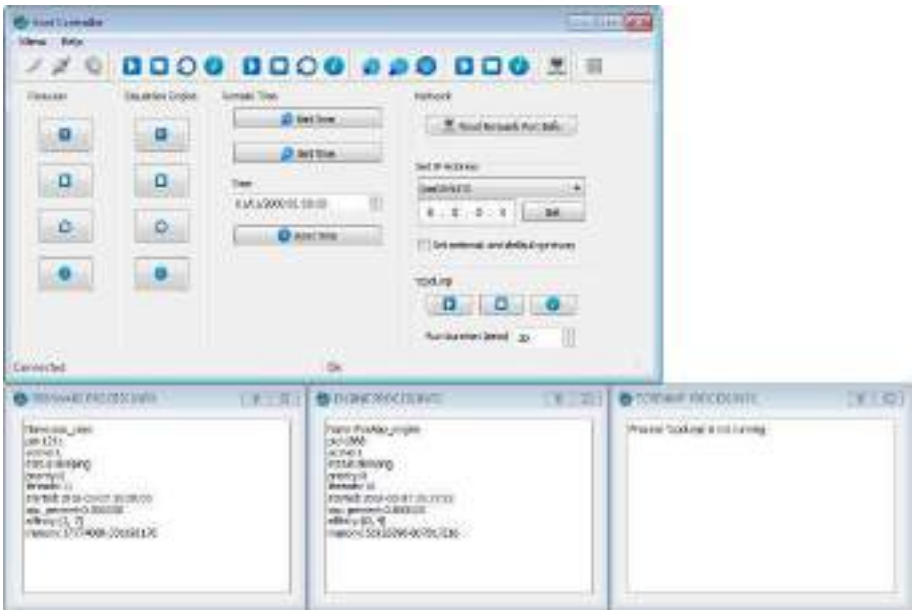


Table 3-8: Host Controller dialog items

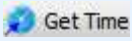
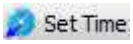
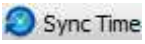
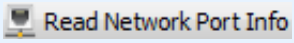
Item	Description		
FIRMWARE and SIMULATION ENGINE provide separate control of these two items.			
	Click to start	FIRMWARE shortcut: Shift+F5	SIMULATION ENGINE shortcut: Ctrl+F5
	Click to stop	FIRMWARE shortcut: Shift+F6	SIMULATION ENGINE shortcut: Ctrl+F6
	Click to restart	FIRMWARE shortcut: Shift+F7	SIMULATION ENGINE shortcut: Ctrl+F7
	Click to show PROCESS INFO window, as shown in the figure above.	FIRMWARE shortcut: Shift+F8	SIMULATION ENGINE shortcut: Ctrl+F8
Note: Using any shortcut will update all PROCESS INFO windows.			
Remote time display and change the Linux operating system time			
	Click to get the Linux operating system time and display it in the TIME (IN UTC) area		
	Click to set the Linux operating system time to the time shown in the TIME (IN UTC) area		
Time (in UTC)	Displays the Linux operating system time using the format: DD/MM/YYYY HH:MM:SS Select the parameter you want to change and type the new value, or select the new value with the up / down arrows		
	Click to synchronise the Linux operating system time to that of the Windows operating system		
	Click to display the NETWORK PORT INFORMATION window, see below.		
	Click to Shutdown all Worker Units. Enabled with Distributed Engines, contact Spirent for details		

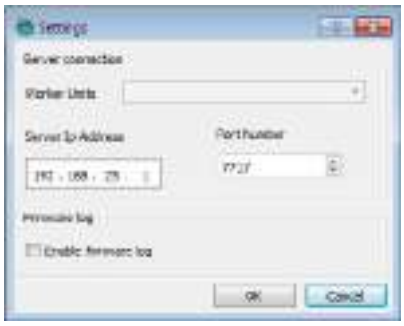
Table 3-8: Host Controller dialog items (continued)

Item	Description
Set IP Address	Before you configure the IP address of this port, Spirent recommends you: **Note:** Read the "Ports" section in reference [3], the GSS7000 user manual **Note:** Read the Notes below Use to set the Linux IP Address of the GSS7000 embedded host rear-panel Ethernet ports using this dropdown menu. Choose the port from: → SimREMOTE (default) Default setting is DHCP → SIMPORT Default setting is the following static IP address: • IP ADDRESS: 192.168.10.1 • NETMASK: 255.255.255.0 • GATEWAY: 192.168.10.1 To change the default setting of the port you select: TO USE A STATIC IP ADDRESS → Type the unique IP Address you want to use. (This IP address must be on the same subnet as the corresponding Windows IP address for the port you select in the dropdown) → Click SET → See SET NETMASK AND DEFAULT GATEWAY TO USE DHCP → Type 0.0.0.0 → Click SET Notice set netmask and default gateway automatically deselect and a message appears confirming "Manual settings of Netmask and Default gateway are not applied for DHCP". → Read Note 1) and shutdown your GSS7000 signal generator. → After your GSS7000 signal generator restarts, start SimTEST and open this utility, then click READ NETWORK PORT INFO to check your IP Address has been correctly set. See the Example settings after these Notes.
Notes: **1)** **2)**	
Example settings for: One router One GSS7000 embedded host One remote PC	
ROUTER	Provides an Internet connection IP address:192.168.1.250 netmask:255.255.255.0

Table 3-8: Host Controller dialog items (continued)

Item	Description
GSS7000 EMBEDDED HOST	Using the SIMREMOTE port with a static IP address connecting to a LAN LINUX IP address set using the Host Controller utility: IP address:192.168.1.1 netmask:255.255.255.0 gateway:192.168.1.250 (router) WINDOWS IP address of the Local Area Connection set in the Windows network adapter: IP address:192.168.1.2 netmask:255.255.255.0 gateway:192.168.1.250 (router)
REMOTE PC	Sends remote commands using the Socket String Send utility to the engine in the GSS7000 embedded host, which has the IP address: 192.168.1.1, port 15650 WINDOWS IP address of the Local Area Connection set in the Windows network adapter: IP address:192.168.1.101 netmask:255.255.255.0 gateway:192.168.1.250 (router)
Note: For each of the above examples, only configure a gateway if you need to use an internet connection. A direct ethernet connection between the GSS7000 signal generator and a remote PC sending remote commands does not need a gateway.	
SET NETMASK AND DEFAULT GATEWAY	Deselect: Automatically set NETMASK and DEFAULT GATEWAY. Select: Enter appropriate NETMASK and DEFAULT GATEWAY addresses to use a static IP address, for example: 
tcpdump logs all network traffic to the file *filename.tcpd* in the Windows log folder, location: *D:/posapp/logs/posapp*. Spirent recommends using Wireshark (www.wireshark.org) to view this file.	
	Click to start the TCPDUMP process
	Click to stop
	Click to show the TCPDUMP PROCESS INFO window, as shown in the figure above
Run duration (secs)	Select, or type, the time over which you want to log network traffic
	Units: seconds | Range: 1 to 600 s | Default: 30
Note: Only use ***tcpdump*** under the guidance of a Spirent Global Services engineer.	
Status Bar displays whether the utility is CONNECTED OR DISCONNECTED TO A GSS7000 EMBEDDED HOST	

Table 3-8: Host Controller dialog items (continued)

Item	Description
Toolbar (duplicates the FIRMWARE, SIMULATION ENGINE, REMOTE TIME, TCPDUMP AND NETWORK BUTTONS), IN ADDITION TO:	
	Connect to the GSS7000 embedded host
	Disconnect from the GSS7000 embedded host
	Click (or use MENU-SETTINGS) to open the SETTINGS dialog:  WORKER UNITS - a dropdown only enabled with Distributed Engines, contact Spirent for details ENABLE FIRMWARE LOG Deselect: (default) no firmware logging Select: Saves a firmware log to the Windows log folder: `D:/posapp/logs/posapp/fw_log.txt`
Note: Server Ip Address and Port number set the address of the PosApp engine. Only change these settings under the guidance of a engineer	

You can also access all these functions from MENU.

Clicking READ NETWORK PORT INFO displays the NETWORK PORT INFORMATION dialog:

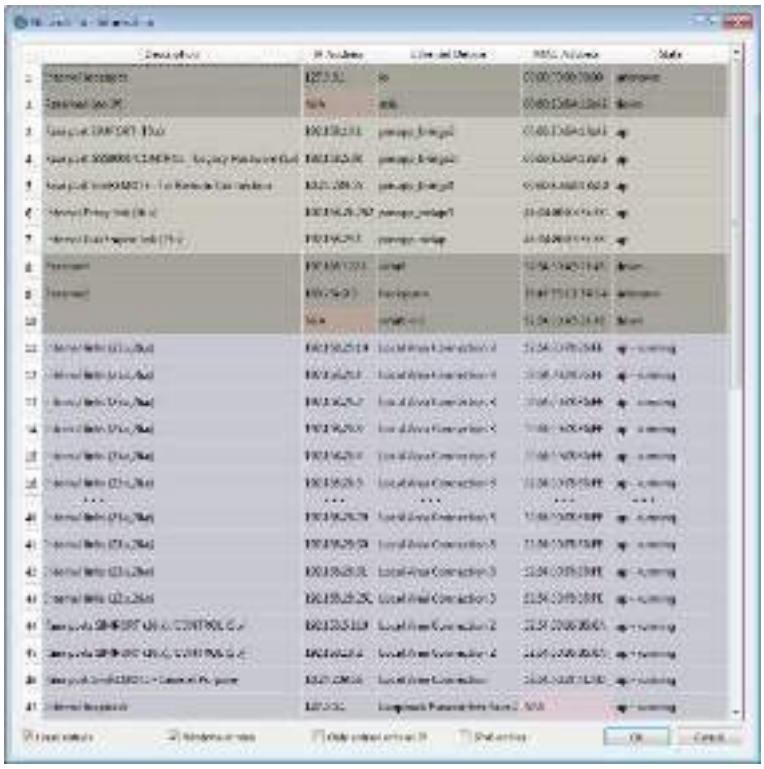


Table 3-9: Network Port Information dialog items

Item	Description
Linux entries	Deselect: Do not show Linux entries Select: Show Linux entries (shown in grey)
Windows entries	Deselect: Do not show Windows entries Select: Show Windows entries (shown in blue)
Only entries with an IP	Deselect: Show all entries. Entries without an IP address are identified with N/A (and colour-coded as shown in the figure above) Select: Show only entries with an IP address
IPv6 entries	Deselect: Show only IPv4 entries Select: Show IPv4 and IPv6 entries (IPv6 entries are colour-coded)

3.4.4 BIOS Battery Status

See *BIOS Battery Status*, on page 3-18.

3.4.5 Change Hardware Configuration

Note: If you use a single signal generator, or a single possible configuration, you do not need to use Change Hardware Configuration.

If you use several signal generators, you can employ different configurations with SimTEST. All possible configurations, together with any associated calibration offsets, are stored in the file `sig_gen.txt` located in the SimTEST installation folder. Spirent normally configures this file before system delivery and supplies the file `sig_gen.txt`, together with your hardware licence keys.

When you select CHANGE HARDWARE CONFIGURATION, SimTEST first warns you about changing hardware and then displays the dialog.

CALIBRATED HARDWARE CONFIGURATION shows the configurations given in *sig_gen.txt*. After selecting a configuration SimTEST displays it graphically in the area below. Click OK to select this configuration.

3.5 Window

You can save the layout of the windows you see. Select the windows you want to see (the layout) using Windows standard **View** menu. Save this layout using **Save Layout**:.

Table 3-10: Window menu items

Item	Description
DEFAULT LAYOUT	Select to change to the SimTEST default window layout
SAVE LAYOUT	Saves the current layout of the SimTEST windows
RESTORE LAYOUT	Go to the previously saved window layout

3.6 Help

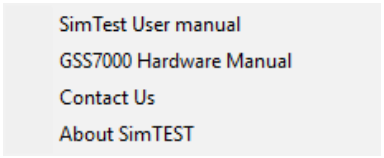


Table 3-11: Help menu items

Item	Description
SimTEST User manual	Opens the help file version of this document.
GSS7000 Hardware Manual	Opens the pdf version of reference [3].
Contact Us	Opens a PDF file giving up-to-date Spirent contact information. The details in this file takes precedence over the contact details in the current user manual
About SimTEST	Click to display ICD Compliance, version numbers and licence information, including hardware licence and firmware details. Each licence details area shows additions (or exclusions) from a standard licence. This figure shows a licence for a GSS7000 signal generator, with IRNSS L5 as a non-standard, licenced feature:  describes the details in HARDWARE LICENCE. Clicking COPY TO CLIPBOARD copies all the licence details to the clipboard. Clicking CREDITS… displays open source library acknowledgements:  Clicking ICD COMPLIANCE… displays ICD compliance information (NOTES details partial compliance, not supported and so on): 

4 SimTEST toolbar

Hide or display toolbars using the VIEW menu. This table details the toolbar buttons:

	Print the underlying XML data of the file you select in the **Scenario Contents** window. This button is only enabled after you select a printable file
	Shows the current software version number from -About
	Click and move the "?" cursor to the item on which you require help
	Displays the **System Messages** window
	Manually switch the remote input

Scenario toolbar - left-hand side

	REWIND - When a simulation ends, SimTEST displays the **End of simulation** dialog
	RUN - Runs the current scenario. (Or arms it to wait for an external hardware trigger in external trigger modes)
	STOP - Stops a running scenario

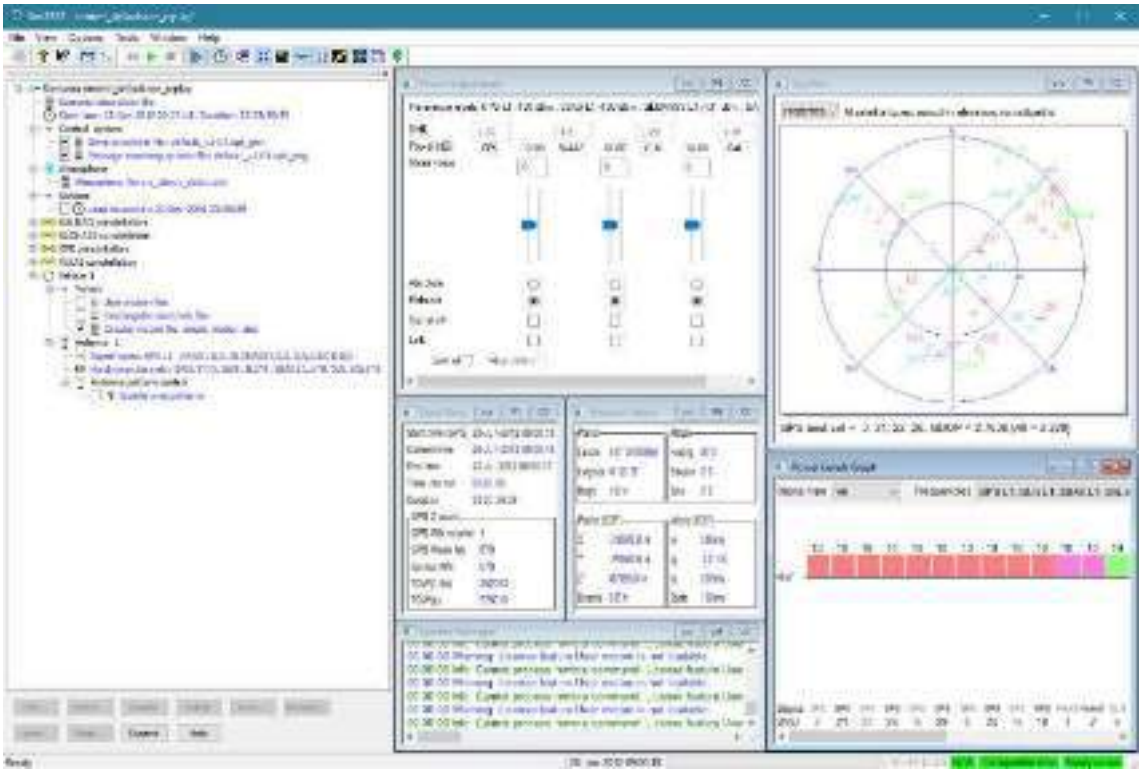
Scenario toolbar - right-hand side

	Display the **Scenario contents** window
	Display the scenario **Date/Time** window
	Bring the current Antenna window to the front. Only visible if the scenario uses more than one antenna.
	Display the **Position Details** window
	Display the **Ground Track** window
	Display the **Power Levels Graph** window
	Display the **Power Adjustment** window
	Display the **Received Signals** window
	Display the **Sky Plot** window
	Display the **Antenna Pattern** window

Display the **Vehicle Map** window

5 SimTEST main area

This figure shows the SimTEST user interface:



5.1 Scenario contents window

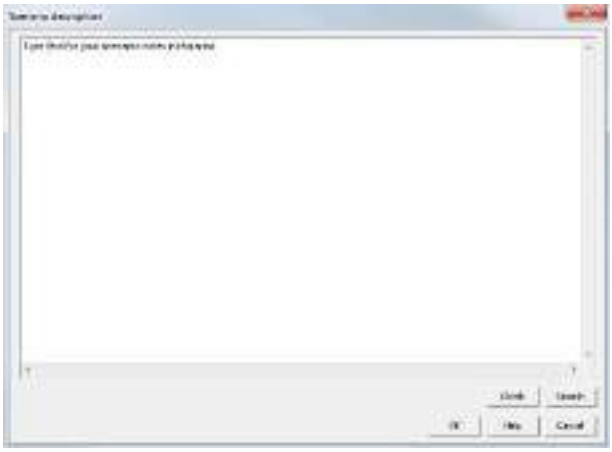
Note: Parameters in blue text are editable; parameters in black text are read-only.

The **Scenario Contents** window, at the left side of the main SimTEST window, displays the scenario and its constituents.

For a new scenario, SimTEST defines default data files and gives them unique filenames. You can view the default data by expanding the scenario and double-clicking the data filename. This figure shows an example of a fully expanded **Scenario contents** window:

5.1.1 Scenario description file

This is an optional, text-only, file using extension *.dsc. You can use this file, for example, to create notes on the scenario. The SCENARIO DESCRIPTION FILE is stored in the current scenario folder. The following image shows an example file *my notes.dsc*:

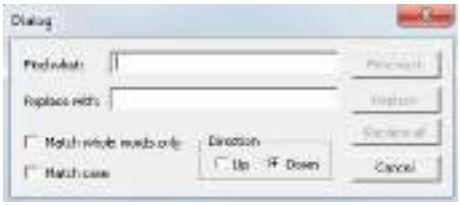


Enter details into a Scenario description file by highlighting SCENARIO DESCRIPTION FILE in the **Scenario contents** window and then double-click to open the file editor.

Type your text in the editor.

Click OK to save the file in the current scenario's folder using a name of your choice.

Click SEARCH to open the **Find and Replace** dialog:



Type a word or phrase in the FIND WHAT text box and click FIND NEXT. The search starts from the current position of the cursor in the DIRECTION you select (default is DOWN) and highlights the first instance of the word or phrase. You can replace this word or phrase with the text you type in the REPLACE WITH text box by clicking REPLACE, which replaces the highlighted text; or click REPLACE ALL to replace every occurrence of the word or phrase in the FIND WHAT text box without additional confirmation.

You can select whether to MATCH WHOLE WORDS in the FIND WHAT text box and whether to MATCH THE CASE of the text in the FIND WHAT text box.

CHECK is currently disabled.

Click OK to save the changes. Click CANCEL to discard all changes.

5.1.2 Start time and Duration

To change the scenario start time or duration, open the **Start time and duration** dialog by double-clicking START TIME in the **Scenario Contents** window:

Table 5-1: Start time and duration dialog items

START TIME	Enter the start time of the scenario. The start time of a new scenario is 00:00:00 on the day of creating the scenario. The SimGEN Controller's internal clock determines the day. BeiDou time is 14 seconds behind GPS time.		
	Units: date hh:mm:ss.ss	Range: 06 January 1980 00:00:00.00 to 06 January 2048 23:59:59.00	
USE HOST (PC) TIME	Select this option to use the time on the host PC as the start time. **Note:** On a VM system, you need to sync the Linux time to Windows before this will display the correct time in PosApp, using the Sync Time option of the Host Controller utility.		
DURATION	Enter the duration of the scenario. If you exceed the maximum value, SimGEN shows the range limits.		
	Units: d hh:mm:ss.ss	Maximum: 23d 23:59:59	Default: 9 d

5.1.3 Control options

SimTEST uses the ***Options >*** menu item to set global options that apply for all scenarios; whereas ***<scenario tree> > Control options*** applies options for the currently open scenario.

Select each option that you want to use.

5.1.3.1 General options file

General options, on page 3-4, details these options. Double click to open the dialog.

Spirent recommends you save all new options files to a name of your choice and you do not overwrite the default file (`*.opt_gen`).

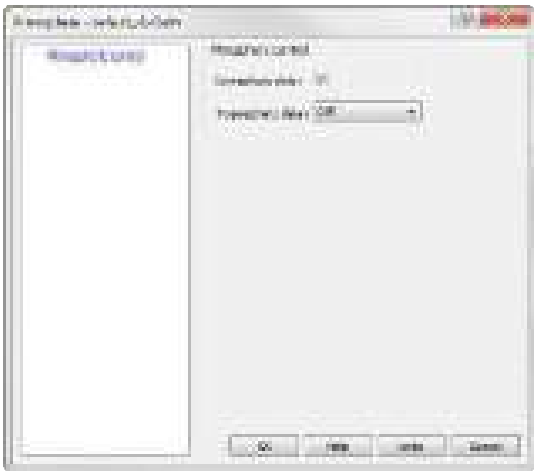
5.1.3.2 Message reporting options file

Message Reporting, on page 3-6, details these options. Double click to open the dialog.

Spirent recommends you save all new options files to a name of your choice and you do not overwrite the default file (`*.opt_msg`).

5.1.4 Atmosphere

The atmosphere file (`*.atm`) defines the characteristics of SimTEST's simulated Ionosphere and Troposphere, and defines the Ionospheric data included in the Navigation Data message. Edit the atmosphere file in a similar way to editing the constellation file.



SimTEST uses a default atmosphere file, *default_vx-yy.atm*. If you change any file parameter, Spirent recommends you save the file using a filename of your choice.

IONOSPHERIC DELAY	Select (default): apply ionospheric delay from all satellite signals Deselect: remove ionospheric delay from all satellite signals
TROPOSPHERIC DELAY	Select from: Off (default): does not apply tropospheric delay Typical (Default): Minimum (Dry): Maximum (Wet):

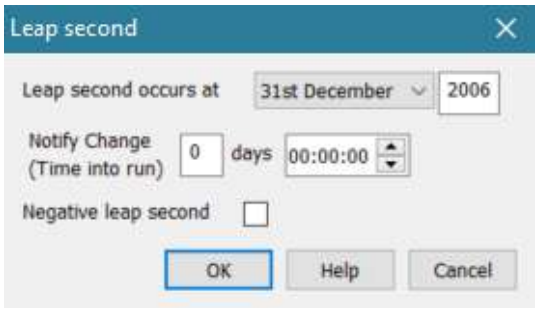
5.1.5 Options - Leap second

Notes:

1) You must set the scenario start time so the leap second occurs during the scenario.

2) A GLONASS leap second event affects the GLONASS signal. Other constellations support leap second events with no change to their signals.

Use to specify a date when a leap second is to occur. If this date is relevant to the current scenario time, the GNSS constellation will give advance warning of the timing of this event. GLONASS uses the "KP" flag for this purpose. Notice this only affects timing of GLONASS signals if the scenario transmits the time at which the leap second occurs.



LEAP SECOND OCCURS AT	Select one of the preferred dates 30TH JUNE or 31ST DECEMBER
NOTIFY CHANGE TIME INTO RUN)	Enter the day and time into the scenario when you want to declare a leap second event. The leap second event data changes after the day and time you enter. SimTEST transmits leap second information as part of the relevant navigation data message, which can be several minutes after the time you enter.
	Units: days hh:mm:ss Maximum: 23 days 23:59:59 Default: 0 days 00:00:00

NEGATIVE LEAP SECOND	Deselect (default): use a positive leap second Select: use a negative leap second, see

5.1.5.1 Leap second events

Leap second events relate to adjustments of UTC (which defines the standard time of day) to ensure it remains appropriately aligned with the solar day (as determined by the Earth's rotation). The SI definition of a second is in terms of a caesium atomic clock and UTC time is aligned with this atomic time (TAI), apart from the introduction of leap seconds (typically every year or two). For example, since 31st December 2016, when the last leap second was added, TAI has been exactly 37 seconds ahead of UTC.

GNSS time (like TAI) is continuous without leap seconds; so, in this context, there are no leap second events. However, most GNSS, except GLONASS, navigation data messages broadcast information including forthcoming (or recent) leap second occurrences to allow correct determination of UTC time from GNSS time.

However, GLONASS implements leap seconds and consequently GLONASS signal timing shifts by one second, introducing some discontinuity into GLONASS navigation data messages.

PosApp version 6-02SR01 onwards lets you use a positive or negative leap second.

SimTEST inserts a positive leap second between second 23:59:59 and second 00:00:00, for example:

```
23:59:58
23:59:59
23:59:60
00:00:00
```

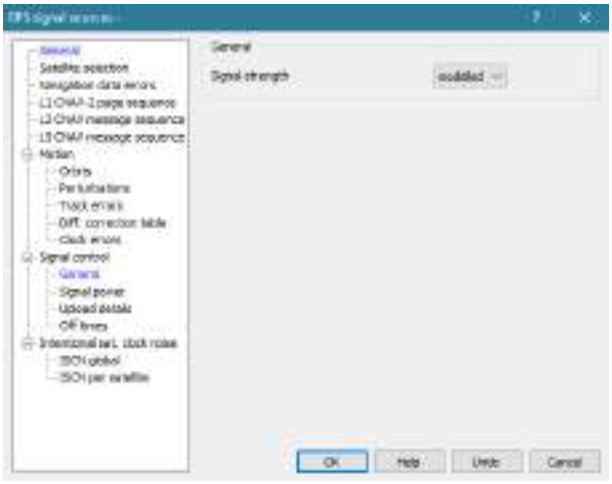
SimTEST inserts a negative leap second by suppressing second 23:59:59; second 23:59:58 is followed immediately by second 00:00:00, for example:

```
23:59:57
23:59:58
00:00:00
```

5.1.6 Signal sources file - General

SimTEST calculates the RF power level at the front panel output port of the signal generator; the calculation depends on your selection of *Modelled signal strength* or *Fixed signal strength*.

Note: The General dialog shown is for the GPS constellation, but all constellations use the same dialog.



5.1.6.1 Modelled signal strength

The modelled signal strength provides your receiver with realistic signal levels by using these details:

→ The GNSS base level from the ICD

→ Signal and code level offsets

→ The inverse-square loss over the satellite to vehicle range

→ Losses from the transmit antenna pattern of the satellite

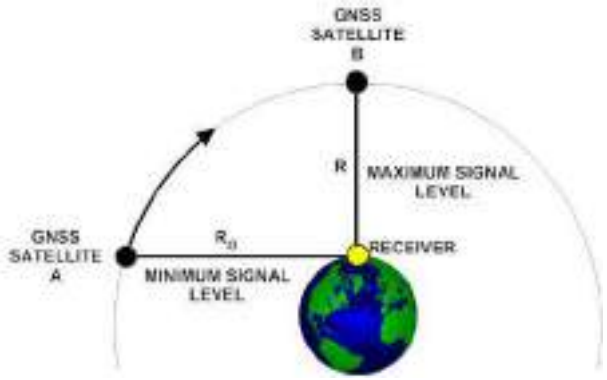
→ Losses from the antenna pattern of the receiver

SimTEST uses this equation:

$$P_O = P_{ICD} + O_G + O_F + O_S + 20*\log_{10}(R_0 / R) - L_{TX} - L_{RX}(dBm)$$

where:

P_O	is the signal generator output power for a given satellite
P_{ICD}	is the guaranteed minimum signal level for the GNSS satellite. For example, reference [7] specifies the level for GPS
O_G	is the GLOBAL OFFSET. You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-GLOBAL OFFSET
O_F	is the frequency specific offset, if in use. You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-GLOBAL L1 OFFSET
O_S	is the signal specific offset, if in use. You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-C/A CODE OFFSET
R_0	is the reference range used for inverse-square variation calculation and equal to the range from a receiver on the ground to the GNSS satellite at zero elevation. $R_0 = [(satellite\_orbital\_radius)^2 – (earth\_radius)^2]^{1/2}$, see the figure below
R	is the range from GNSS satellite to the receiver, see the figure below. R = (satellite_orbital_radius) – (earth_radius)
L_{TX}	is the loss from the GNSS satellite transmit antenna in the direction of the receiver.
L_{RX}	is the loss from the receiver antenna in the direction of the GNSS satellite. Your receiver antenna pattern defines this loss.



For example, the following table gives typical parameter values (and their sources) to show calculation of the simulated RF power from an overhead GPS satellite for a ground-based receiver using L1 C/A code:

Parameter	Description	Value
P_{ICD}	Guaranteed ICD minimum signal level for a GPS satellite, from reference [7]	-130 dBm
O_G	Global Offset You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-GLOBAL OFFSET	+15 dB
O_F	Frequency specific offset You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-GLOBAL L1 OFFSET	0 dB

Parameter	Description	Value
O_S	Signal specific offset You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-C/A CODE OFFSET	+1 dB
R_0	$[(\text{satellite\_orbital\_radius})^2 - (\text{earth\_radius})^2]^{1/2}$ $= [(26\ 560\ 632)^2 - (6\ 378\ 137)^2]^{1/2}$ obtain satellite_orbital_radius from the constellation editor read-only parameter GPS-MOTION ORBITS-ROOT SEMI MAJOR AXIS	25 783 455 m
R	(satellite_orbital_radius) – (earth_radius) = (26 560 632) – (6 378 137)	20 182 495 m
L_{TX}	Satellite transmit antenna loss in the direction of the receiver (typical)	+2 dB
L_{RX}	Receiver antenna loss in the direction of the GPS satellite (typical) ***Note***: A positive number in the receive and transmit antenna patterns reduces the power level	+3 dB

Substituting the parameter values into the equation above gives the modelled GPS L1 C/A signal power for the satellite with the orbit radius shown:

$$P_O = -130 + 15 + 0 + 1 + 20*\log(25\ 783\ 455 / 20\ 182\ 495) - 2 - 3$$

$$= -130 + 13.1 = -116.9 \text{ dBm}$$

You can make similar calculations for satellites in other constellations.

5.1.6.2 Fixed signal strength

The fixed signal strength maintains the power you specify at a constant level (regardless of satellite to vehicle range and satellite antenna pattern); however, the receiver antenna pattern does modify the power level. In this case, SimTEST calculates output power using this equation:

$$P_O = P_{ICD} + O_G + O_F + O_S - L_{RX}$$

where:

P_O	is the signal generator output power for a given satellite
P_{ICD}	is the guaranteed minimum signal level for the GNSS satellite. For example, reference [7] specifies the level for GPS
O_G	is the GLOBAL OFFSET. You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-GLOBAL OFFSET
O_F	is the frequency specific offset, if in use. You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-GLOBAL L1 OFFSET
O_S	is the signal specific offset, if in use. You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-C/A CODE OFFSET
L_{RX}	is the loss from the receiver antenna in the direction of the GNSS satellite. Your receiver antenna pattern defines this loss.

For example, the following table gives typical parameter values (and their sources) to show calculation of the fixed RF power from an overhead GPS satellite for a ground-based receiver using L1 C/A code:

Parameter	Description	Value
P_{ICD}	Guaranteed ICD minimum signal level for a GPS satellite, from reference [7]	-130 dBm
O_G	Global Offset You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-GLOBAL OFFSET	+15 dB

Parameter	Description	Value
O_F	Frequency specific offset You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-GLOBAL L1 OFFSET	0 dB
O_S	Signal specific offset You can see this in the constellation editor read-only parameter SIGNAL CONTROL-SIGNAL POWER-L1 POWER-C/A CODE OFFSET	+1 dB
L_{RX}	Receiver antenna loss in the direction of the GPS satellite (typical) ***Note***: A positive number in the receive and transmit antenna patterns reduces the power level	+3 dB

Substituting the parameter values into the equation above gives the fixed GPS L1 C/A signal power for the satellite with the orbit radius shown:

$$P_O = -130 + 15 + 1 - 3$$

$$= -130 + 13.0$$

$$= -117.0 \text{ dBm}$$

5.1.7 Signal sources file - Signal control - General

Each constellation uses this dialog as follows:

→ Turn on or off the code(s) for

→ Set Earth obscuration in SBAS constellations (including Quasi-Zenith)

→ All other settings are disabled.

For each constellation, after clicking OK, type a name of your choice for the new signal sources file.

5.1.7.1 BeiDou

Dialog for the BeiDou signal sources file, SATELLITE 1 TO 5:

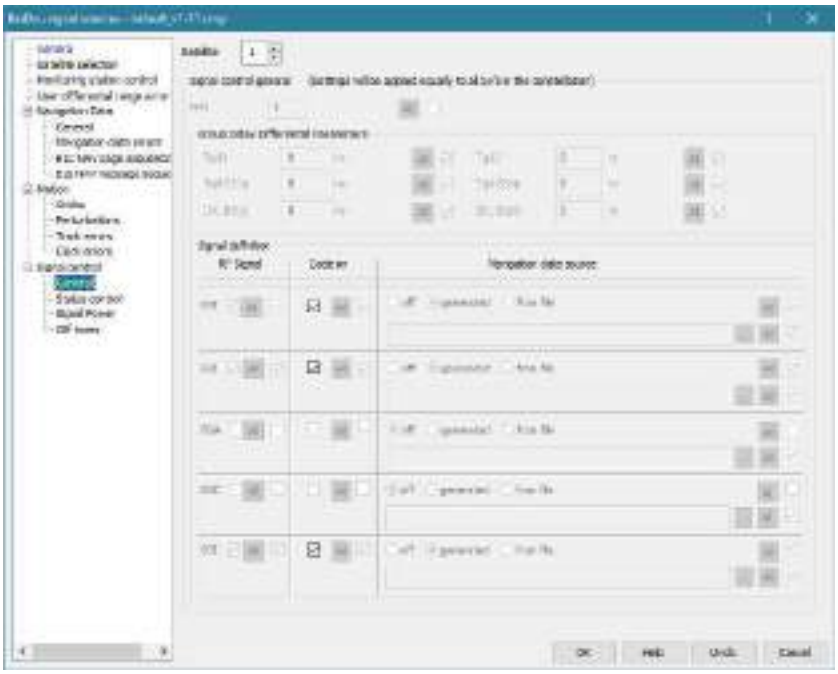


Table 5-2: Beidou Signal control - General dialog items

Item	Description
Satellite	Select the SATELLITE SVID whose settings you want to change.
Code on	For each signal type: Select: (default) Code on Deselect: Code off
Note: For Satellites 1 to 5, RF Signal-B2A and -B1C are disabled and set off.	

5.1.7.2 Galileo

Note: SimTEST selects the read-only parameter Code-All; changes you make to any Code settings will apply to all satellites in the constellation.

Dialog for the Galileo signal sources file:

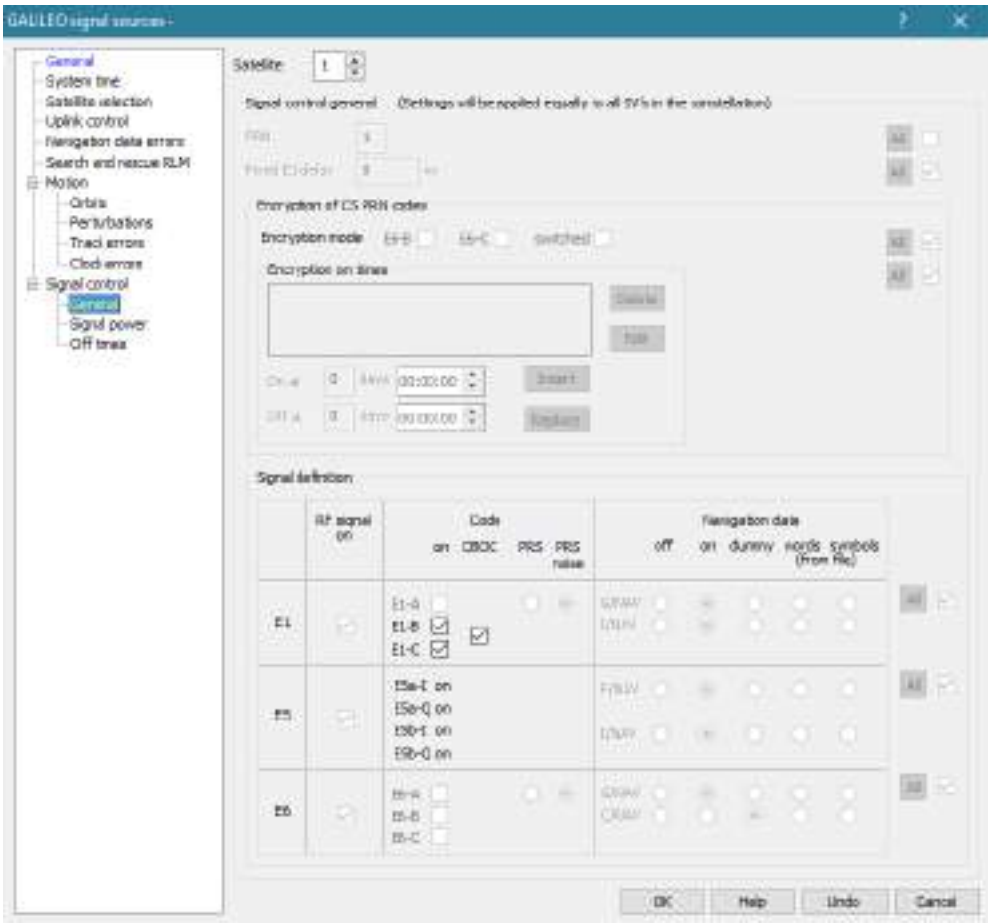


Table 5-3: Galileo Signal control - General dialog items

Item	Description
Satellite	Select the SATELLITE SVID whose settings you want to change.
Code on	For E-B and E1-C: Selected (default): on Deselect: off For CBOC: Selected (default): on for both E1-B and E1-C Deselect: off for both E1-B and E1-C

5.1.7.3 GLONASS

Note: SimTEST selects the read-only parameter C/A code-All; changes you make to any Code settings will apply to all satellites in the constellation.

Dialog for the GLONASS signal sources file:

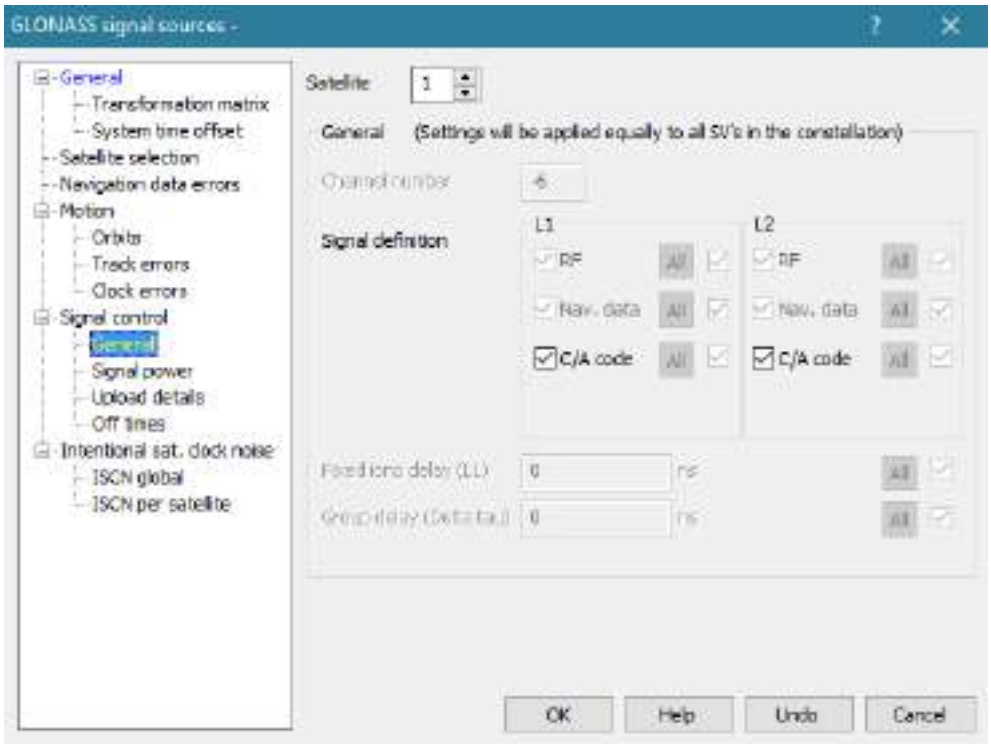


Table 5-4: GLONASS Signal control - General dialog items

Item	Description
Satellite	Select the SATELLITE SVID whose settings you want to change.
L1, L2	For C/A code: Select: (default) Code on Deselect: Code off

5.1.7.4 GPS

Notes:

1) SimTEST selects the read-only parameter Code-All; changes you make to any Code settings will apply to all satellites in the constellation.

2) The navigation data sources for L1 C/A-code and L1 P-code are constrained to be the same (as these are generated from the same data stream in the satellite). This means that disabling P-code (if licensed) also disables the navigation data on C/A-code. If you want to test L1 C/A-code (with NAV data) without P-code, first disable both codes, then enable C/A-code.

Dialog for the GPS signal sources file:

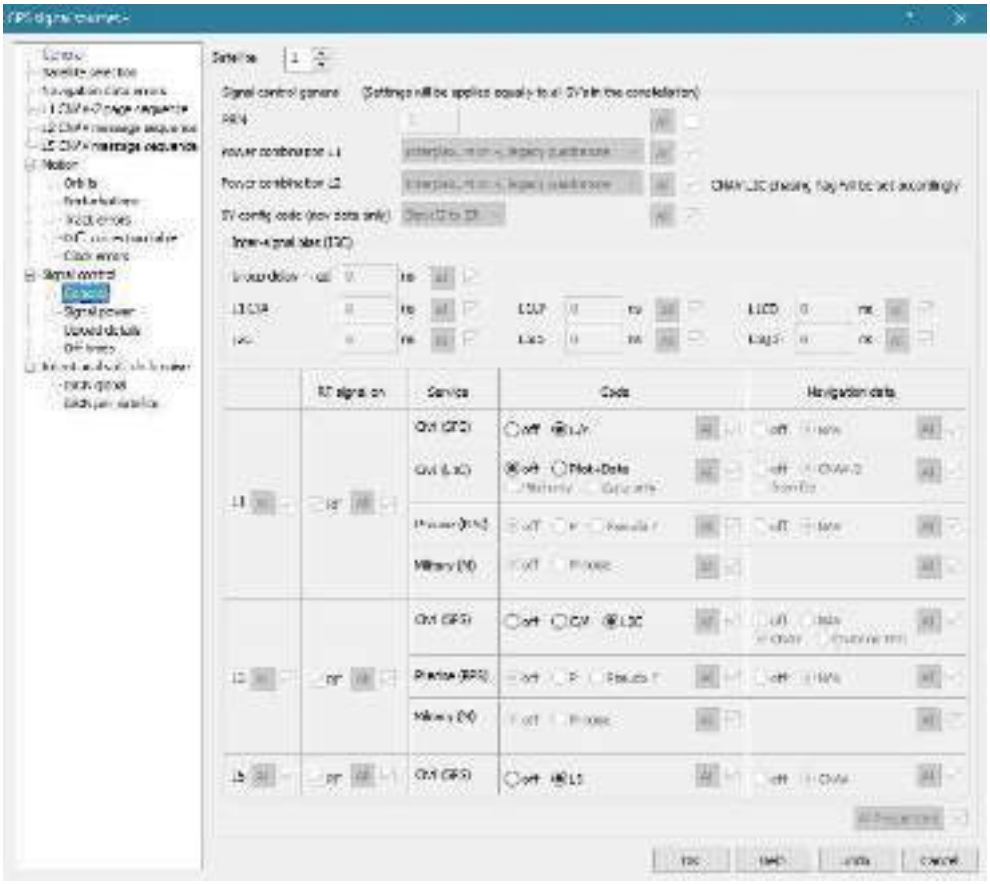


Table 5-5: GPS Signal control - General dialog items

Item	Description	
SATELLITE	Select the SATELLITE whose settings you want to change.	
	SERVICE	CODE
L1	CIVIL (SPS)	Selected (default): C/A or select: OFF
	CIVIL (L1C)	Selected (default): OFF or select: PILOT+DATA
L2	CIVIL (SPS)	Selected (default): OFF or select from: C/A OR L2C
L5	CIVIL (SPS)	Selected (default): L5 or select: OFF

5.1.7.5 IRNSS

Note: SimTEST selects the read-only parameter Code on-All; changes you make to any Code settings will apply to all satellites in the constellation.

Dialog for the IRNSS signal sources file:

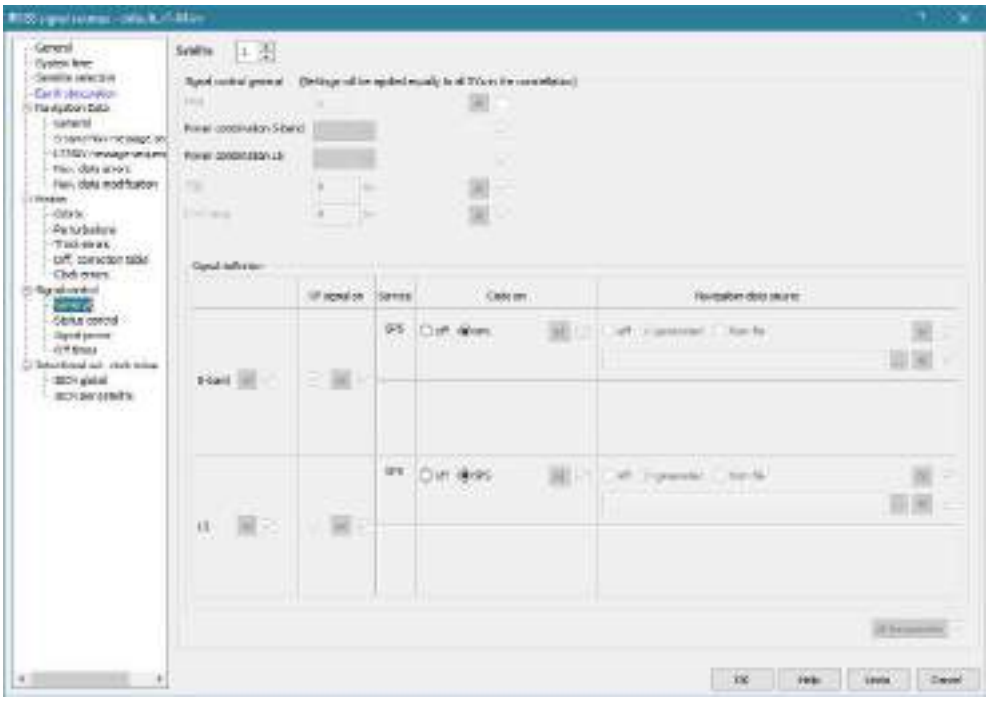


Table 5-6: IRNSS Signal control - General dialog items

Item	Description	
SATELLITE	Select the SATELLITE whose settings you want to change.	
	SERVICE	CODE
L5	CIVIL (SPS)	Selected (default): L5 or select: OFF

5.1.7.6 Quasi-Zenith

Note: SimTEST selects the read-only parameter Code on-All; changes you make to any Code settings will apply to all satellites in the constellation.

Dialog for the Quasi-Zenith signal sources file:

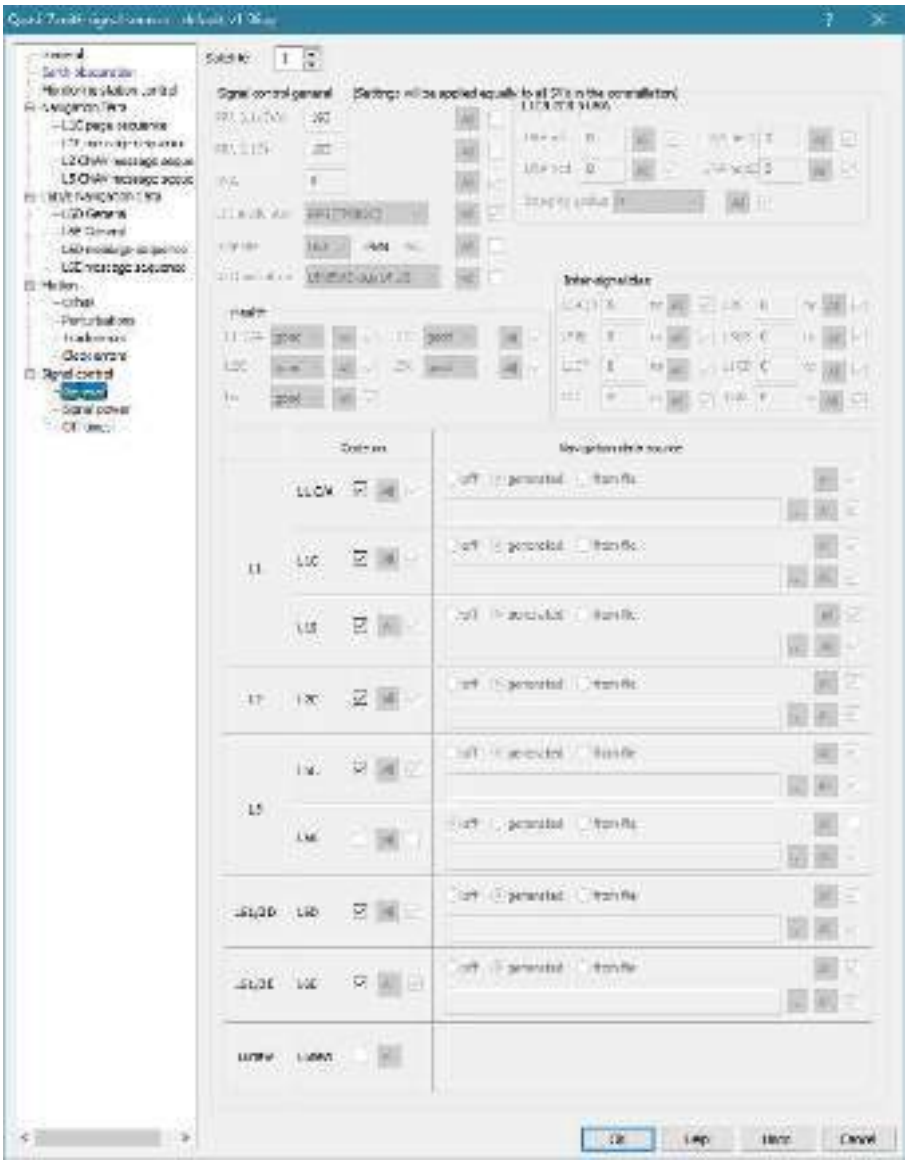


Table 5-7: Quasi-Zenith Signal control - General dialog items

Item	Description
SATELLITE	Select the SATELLITE whose settings you want to change.
Code on	For each signal type: Select: (default) Code on Deselect: Code off

5.1.8 SBAS constellation - Earth obscuration

Use this dialog to determine how SimTEST calculates SBAS satellite obscuration by the Earth's surface. For example, the WAAS constellation:

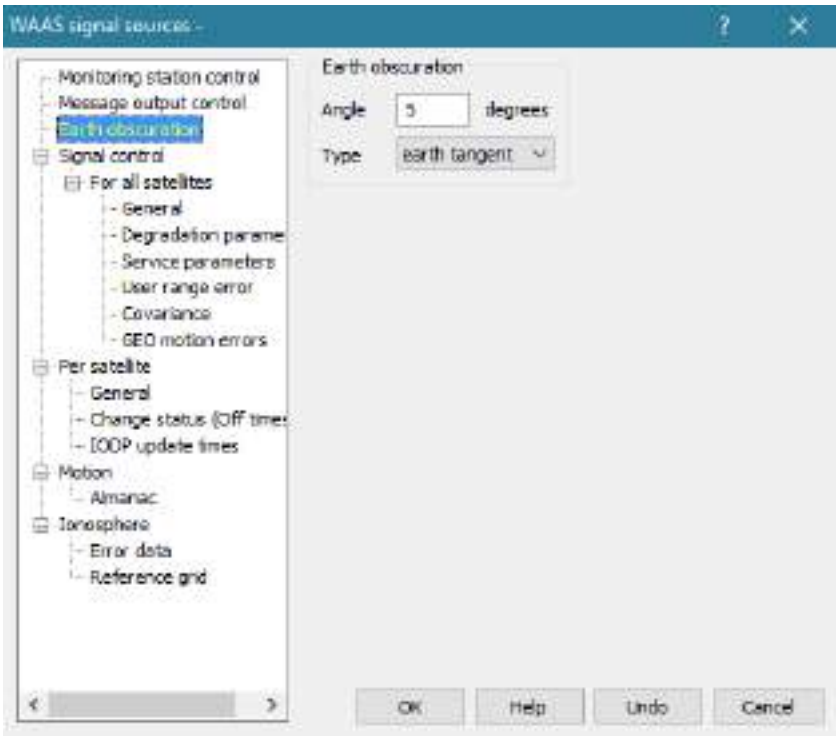
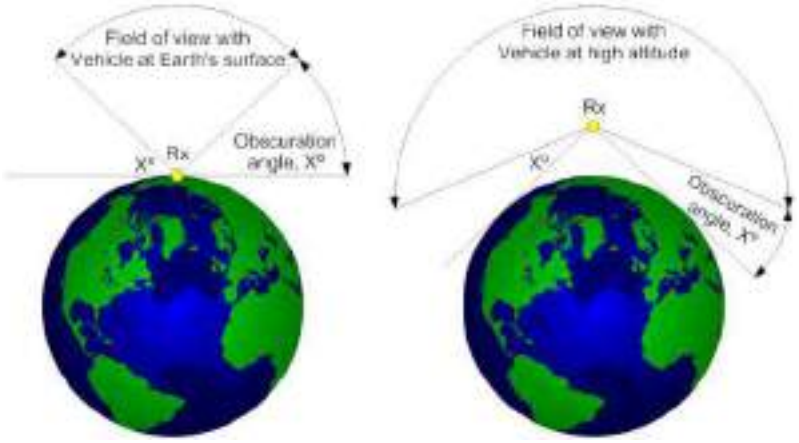
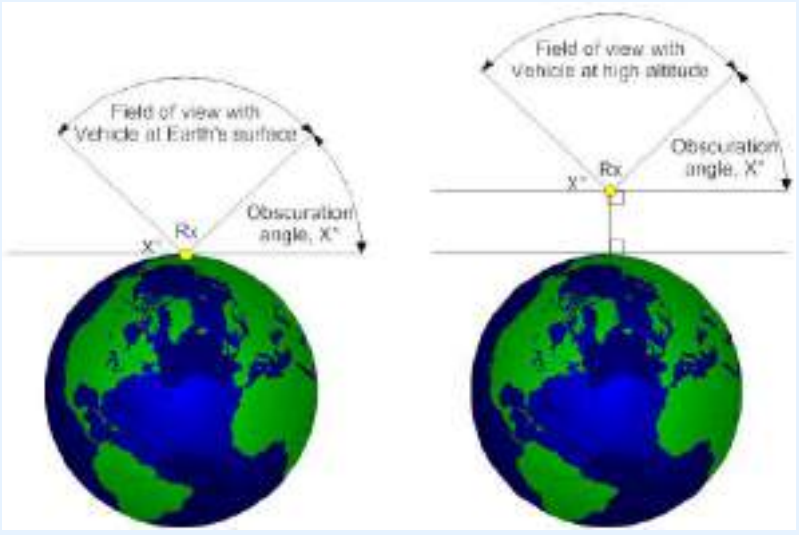


Table 5-8: Earth obscuration dialog items

ANGLE	The obscuration, or mask, angle above the horizon The Earth masks satellites below this angle. SimGEN does not simulate satellites below this angle. Many receivers let you specify an angle below which they will not attempt to track satellites. The default 5° is a common value.		
	Units: degrees	Range: -5.00 to 90°	Default: 5
Note: When working with navigation from the Moon, you must use a negative obscuration angle to ensure simulation of satellites directly below the Moon. Spirent recommends using -2°			
TYPE	Choose from two types of horizon:		

Table 5-8: Earth obscuration dialog items (continued)

EARTH TANGENT	The horizon is a line from the vehicle position tangential to the Earth's surface. 
LOCAL HORIZONTAL	The horizon is a plane perpendicular to the Earth's surface that passes through the vehicle. 

5.1.9 Constellation - Almanac file

Click to place a check mark in the box to identify an ALMANAC FILE is in use.

Double-click ALMANAC FILE to navigate to a Yuma file to use as an Almanac file. When you click OK the file name you select appears in the **Scenario Contents** window.

5.1.10 Constellation - Enable multipath

All constellations support multipath by using additional channels (SimTEST does not support multipath for SBAS constellations).

Click to enable a fixed offset multipath. Use the dialog you see after double-clicking ENABLE MULTIPATH to enter the multipath ATTENUATION and RANGE OFFSET:

ATTENUATION	Units: dB	Range: -20 to 40 dB	Default: 0
RANGE OFFSET	Units: metre	Range: 0 to 1 000 m	Default: 0

5.1.11 Vehicle > Motion > User motion file

The *Vehicle Map* (see page 6-4) lets you generate a user motion file from a start point, end point and mode of travel you define. User motion files use the extension *.umt.

To select a User Motion file, first expand ***Scenario tree > Vehicle > Motion***.

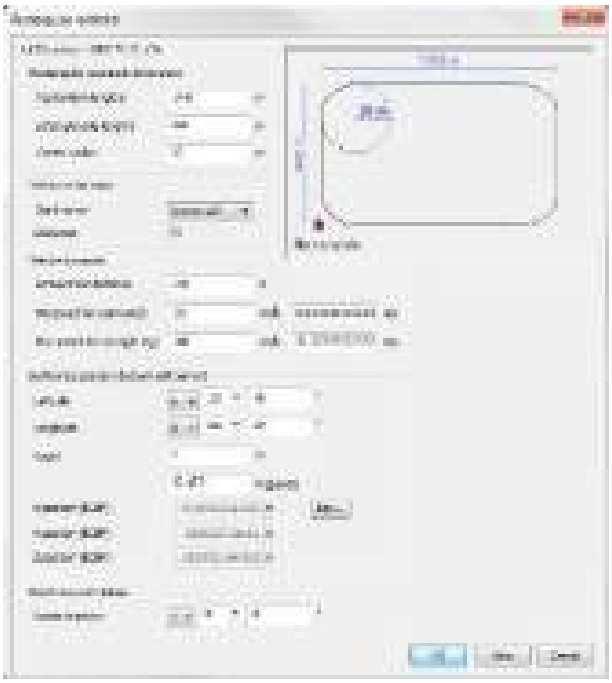
Select USER MOTION FILE (ensure there is a tick in the box, as shown in the figure below)

Right-click USER MOTION FILE, click SELECT and choose the User Motion file you want to use in your scenario.

5.1.12 Vehicle > Motion > Rectangular racetrack

This model aids scenario generation for mobile phone testing. Although directly aimed at the 3GPP specification TS 25.171, a wider audience may use this model.

The following image shows the parameters that configure the size and location of the racetrack and the corner radius. You can also set the vehicle dynamics.



At the start of the scenario, the vehicle is travelling at the cornering velocity to ensure first lap dynamics are identical to all subsequent laps.

Once the scenario starts, the vehicle will traverse the track indefinitely.

Table 5-9: Simple motion - Rectangular racetrack file dialog items

Item	Description		
RECTANGULAR RACETRACK DIMENSION			
TOP/BOTTOM LENGTHS	Units: metre	Range: 4 to 100 000 m	Default: 1440
LEFT / RIGHT SIDE LENGTHS	Units: metre	Range: 4 to 100 000 m	Default: 940
CORNER RADIUS	Units: metre	Range: 1 to 25 000 m	Default: 20
VEHICLE INITIAL STATE			
START CORNER	Select the start corner Default: bottom left		
CLOCKWISE	Select for clock wise motion (default) Clear for anti-clockwise motion		
VEHICLE DYNAMICS			
ACCELERATION DISTANCE	Units: metre	Range: 1 to 25 000 m	Default: 250
MIN SPEED (ON CORNERING)	Units: kilometres per hour	Range: 1 to 10 000 $km.h^{-1}$	Default: 25
MIN SPEED (ON STRAIGHT LEG)	Units: kilometres per hour	Range: 1 to 10 000 $km.h^{-1}$	Default: 100
REFERENCE POSITION (BOTTOM LEFT-HAND CORNER)	Defines the bottom left-hand corner of the racetrack		
LATITUDE	Units: degrees, minutes	Range: N 90° 0’ to S 90° 0´	
LONGITUDE	Units: degrees, minutes	Range: E 180° 0.0´ to W 180° 0.0´	

Table 5-9: Simple motion - Rectangular racetrack file dialog items (continued)

Item	Description		
HEIGHT	Type the vehicle height relative to either: the WGS ellipsoid or to the local geoid. Reference [1] derives the relationship between local geoid and ellipsoid heights. These heights will vary with position.		
	Units: metre	Range: -1 000 to +1 E7 m	Default: 0 (30.772 geoid)
CLICKING SET… OPENS THIS DIALOG IN WHICH YOU CAN ENTER THE REFERENCE LOCATION IN ECEF COORDINATES:  NOTICE LATITUDE, LONGITUDE AND HEIGHT UPDATE AUTOMATICALLY AS YOU MOVE BETWEEN THE X, Y AND Z POSITIONS.			
X POSITION (ECEF), Y POSITION (ECEF), Z POSITION (ECEF)	Units: metres	Range: -1E10 to 1E10 m	
RACETRACK ORIENTATION			
ROTATE TRACK BY	Type the rotation angle in degrees and minutes		

5.1.13 Vehicle - Motion - Circular motion file

Notes:

1) This model describes a perfect circle about a fixed point. The intention is that a mobile phone could perform this motion centred on a base station. This motion simulates phone dynamics for GPS navigation while maintaining a constant range to the base station.

2) SimTEST treats Circle Radius as the distance from the Centre to the vehicle position along an arc modelling the curvature of the Earth.

This model sets a mobile phone in circular motion about a base station. It maintains constant range (no Doppler) to the base station.

Table 5-10: Simple motion - Circular motion file dialog items

Item	Description		
TYPE	Choose from: circular (default) or static		
CENTRE (of circular motion)	Type the location of the base station at the centre of the circle, you can use LATITUDE, LONGITUDE and HEIGHT; or ECEF coordinates.		
LATITUDE	Units: degrees, minutes	Range: N 90° 0' to S 90° 0´	
LONGITUDE	Units: degrees, minutes	Range: E 180° 0.0´ to W 180° 0.0´	
HEIGHT	Type the height of the centre of motion relative to either: the WGS ellipsoid or to the local geoid. Reference [1] derives the relationship between local geoid and ellipsoid heights. These heights will vary with position.		
	Units: metre	Range: -1 000 to 1 E7 m	Default: 0 (-18 geoid)
Clicking SET opens this dialog in which you can enter the reference location in ECEF coordinates:  Latitude, longitude and height update automatically as you move between the X, Y and Z positions.			
X POSITION (ECEF), Y POSITION (ECEF), Z POSITION (ECEF)	Units: metres	Range: -1E10 to 1E10 m	
CIRCLE RADIUS	Units: metre	Range: 1 to 1 500 000 m	Default: 100
CLOCKWISE	Select for clock wise motion (default) Clear for anti-clockwise motion		
INITIAL BEARING FROM CENTRE	Type the bearing of the vehicle from the centre of the circle at the start of the scenario. 90° places the vehicle due East of the centre of the circle.		
SPEED (+VE = CLOCKWISE)	Units: metres per second	Range: ± 100 000 $m.s^{-1}$	Default: 1
STATIC DURATION	Units: seconds	Range: 1 to 32 400 s	Default: 0
SPEED CHANGE DURATION	Type the time over which you want to change the speed. Typing a value in this text box enables STATIC DURATION.		
	Units: seconds	Range: 1 to 32 400 s	Default: 0

5.1.14 Vehicle - Antenna - Signal types

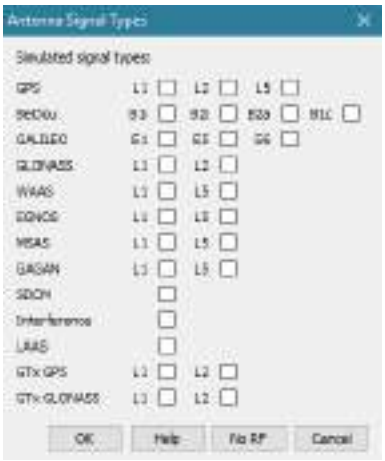
You must associate at least one GNSS signal type with each antenna. Working in the **Scenario Contents** window, expand VEHICLE, then ANTENNA to show SIGNAL TYPES. This image shows VEHICLE1-ANTENNA1.

The following steps show associating GPS L1 with VEHICLE 1-ANTENNA 1.

→ Select ANTENNA 1-SIGNAL TYPES.

→ Right-click and select EDIT.

→ Select GPS L1 from the ANTENNA SIGNAL TYPES dialog



→ Click OK.

You must ensure your signal generator configuration supports all the constellations and antennas you select.

5.1.14.1 Adding or changing the antenna signal types

Depending on the capability of your signal generator, you can associate other signal types with the antenna.

To associate a new signal type with Antenna 1:

→ Select ANTENNA 1-SIGNAL TYPES.

→ Right-click and select EDIT.

→ Select the signal type you want to use from the list of signal types.

→ Click OK.

As before, you must ensure your signal generator supports all the constellations and antennas you select.

5.1.15 Hardware channels

Note: The **Channel usage** dialog is only visible when using GSS9000-series and GSS7000 signal generators.

When you double-click ANTENNA 1-HARDWARE CHANNELS the **Channel usage** dialog opens. The dialog lets you control how SimGEN assigns channels between each constellation in your scenario, and has these buttons:

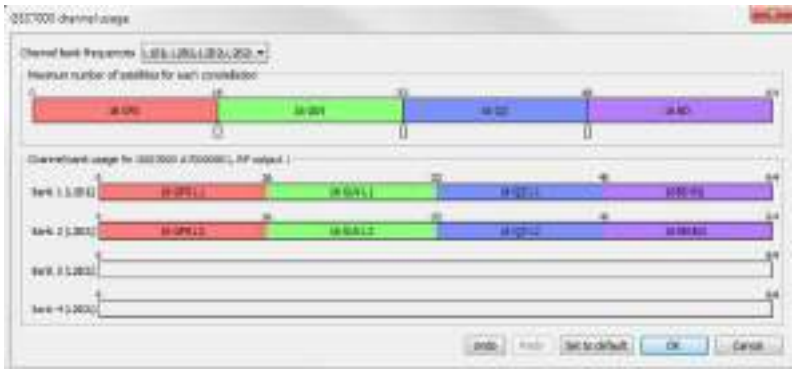
Button	Description
Undo	(Keyboard shortcut CRTL+Z) Undoes any changes you have made using the sliders.
Redo	(Keyboard shortcut CRTL+Y) Re-applies the changes you made using the sliders.
Set to default	Set to the default of equal channels per constellation. **Note:** SBAS constellations use a small number of channels.
OK	Save slider settings and close dialog.
Help	Opens the help topic for the dialog.
Cancel	Do not save slider settings and close dialog.

The following table shows examples of use. The examples represent both GSS9000 and GSS7000 hardware; the functionality is identical for both hardware types.

Table 5-11: Hardware channel usage dialog examples

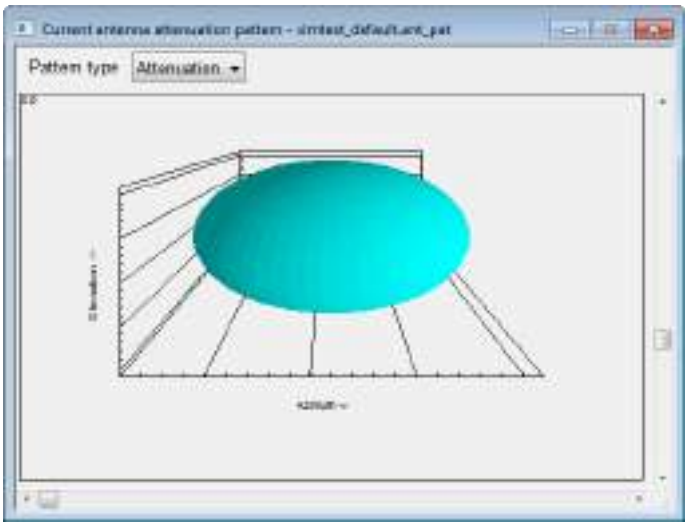
Description	Channel usage dialog
GSS9000 with four channel banks, supporting up to 16 channels per channel bank, one frequency band per channel bank. This figure uses a licence for 64 channels and the GPS L1 constellation. All four channel banks are in use.	
GSS9000 with one channel bank, supporting up to 16 channels. This example uses a licence for 16 channels and the constellations BeiDou B1I, Galileo E1, GLONASS L1, GPS L1 and EGNOS L1. SimGEN initially divides the available channels equally between constellations, giving fewer channels to SBAS constellations (where present). Sliders in the area MAXIMUM NUMBER OF SATELLITES FOR EACH CONSTELLATION let you adjust the channels assigned to each constellation, as shown in the lower image, where the number of Galileo channels is increased to 5.	 

Table 5-11: Hardware channel usage dialog examples (continued)

Description	Channel usage dialog
GSS7000 installed with the maximum four channel banks (supporting up to 64 channels per channel bank, one frequency band per channel bank). This figure uses a licence for up to 256 channels and the BeiDou B1I and B2I, GLONASS L1 and L2, GPS L1 and L2, and Quasi-Zenith L1 and L2 constellations. Notice the number of satellites in a constellation remains the same across the frequency bands.	
Using the same details as above, the CHANNEL BANK FREQUENCIES drop-down lets you move the L2 and L5 frequencies between different channel banks. The number of channels assigned to a constellation remains the same across the frequency bands	 

5.1.16 Vehicle - Antenna - Antenna pattern control - Enable level patterns

This window shows a 3-D view of the antenna pattern. The default antenna pattern is hemi-spherical, with 0 dB gain. See a larger view by clicking in the Title bar:

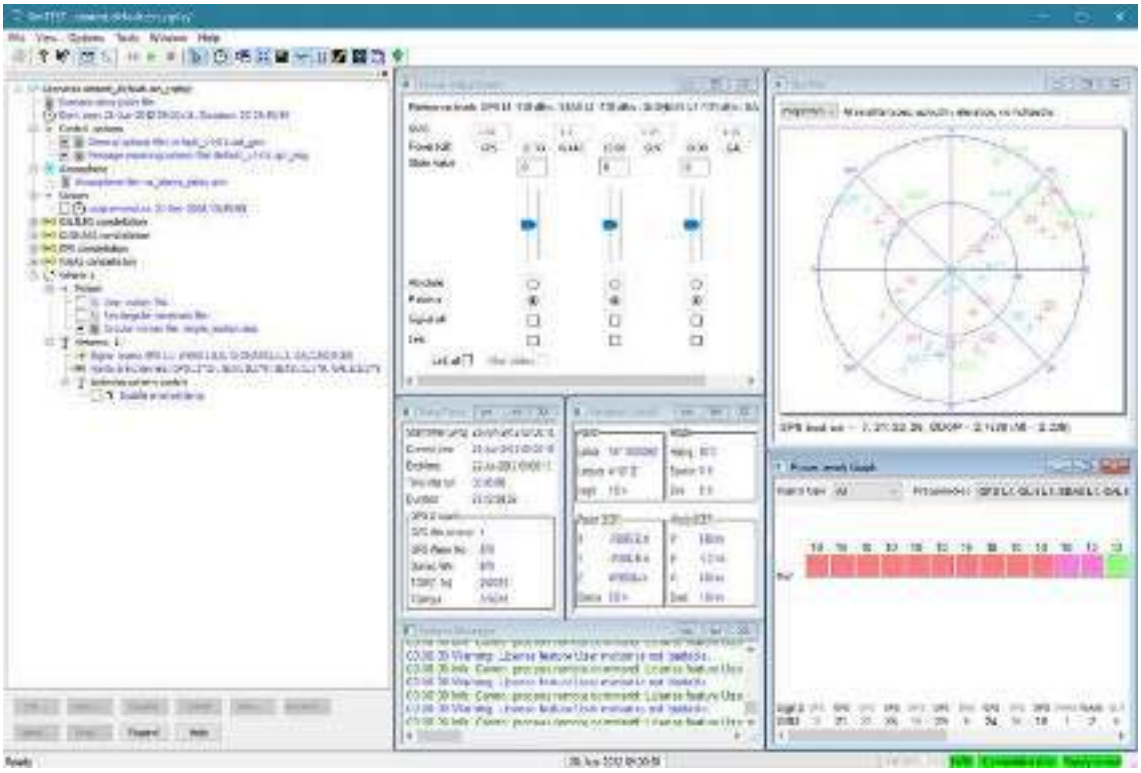


If the window is not visible, click on VIEW-ANTENNA PATTERN WINDOW, or click on the  toolbar button. The scroll bars move the 3-D view in azimuth and elevation.

Double-clicking the 3-D display animates the image, double-click again to stop the animation.

6 SimTEST windows

This chapter refers to each window in the SimTEST user interface:



Use the VIEW menu to see the available windows and select the windows you want to display in the SimTEST user interface.

6.1 Antenna Pattern

See *Vehicle - Antenna - Antenna pattern control - Enable level patterns*, on page 5-22.

6.2 Date/Time

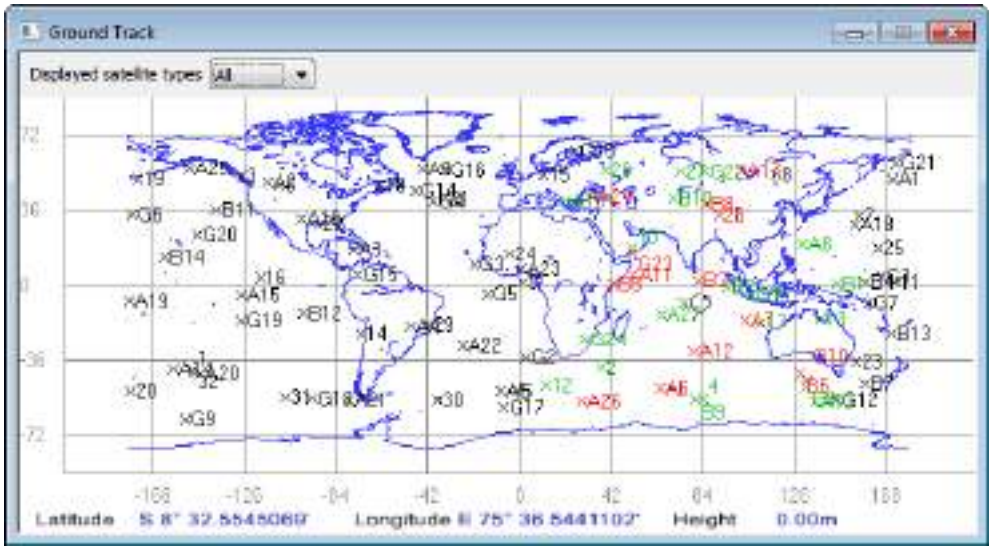
Note: The start-time of a new scenario is 00:00:00 on the day of creating the scenario. See *Start time and Duration*, on page 5-2, to see how to specify the start day.

Click the DATE/TIME button  on the toolbar to display the current simulation time, scenario start and end times and duration. You cannot edit the details in this window:

START TIME	The GPS date and time for the scenario start
CURRENT TIME	The date and time into the scenario
END TIME	The date and time the scenario will finish
TIME INTO RUN	The elapsed time since starting the scenario
GPS Z COUNT	The current simulated time in GPS format
GPS WN ROLLOVER	The GPS Week rollover number
GPS WEEK NO	The GPS week number
GALILEO WN	The Galileo week number
TOW (1.5S)	Time of Week in 1.5 second units
TOW (S)	Time of Week in one second units

6.3 Ground Track

Click the GROUND TRACK button  on the toolbar to open the GROUND TRACK window. This window displays the ground track of the current vehicle on a high-resolution map of the Earth's surface and shows its current LATITUDE, LONGITUDE and HEIGHT.



The 'x' with an adjacent vehicle symbol shows the current vehicle position on a line representing the recent path of the vehicle.

DISPLAYED SATELLITE TYPES-ALL shows satellites from: all constellations. Alternatively, select a constellation from the drop-down DISPLAYED SATELLITE TYPES (SimTEST does not display the drop-down list if your scenario uses only one constellation).

GROUND TRACK identifies GPS satellites by SVID only. Other constellations identify the satellite using these identifiers:

Constellation	Prefix	Example	Constellation	Prefix	Example
BeiDou	B	B1	SBAS - GAGAN	GN	GN1
Galileo	A	A1	SBAS - MSAS	M	M2
GLONASS	G	G10	SBAS-SDCM	S	S3
GPS	(none)	12	SBAS - WAAS	W	W2
IRNSS	N	N2	Quasi-Zenith	Q	Q3
SBAS - EGNOS	E	E2			

GROUND TRACK satellite symbol colours:

Colour	Description
Green	Satellite is visible by vehicle. SimTEST is simulating the satellite.
Red	Satellite is visible by vehicle. SimTEST cannot simulate the satellite, typically due to insufficient channels.
Cyan	Satellite is not visible by vehicle. SimTEST does not simulate this satellite.

In the GROUND TRACK window:

→ Use the mouse wheel to zoom in or out of the GROUND TRACK window

→ Drag the mouse and zoom in to the area (you cannot zoom out using dragging)

→ Pan the map (move the map within the window) by holding down the SHIFT keyboard button and dragging the mouse. In the pan mode, the cursor changes to a  symbol. You cannot pan the map at MAXIMUM ZOOM OUT

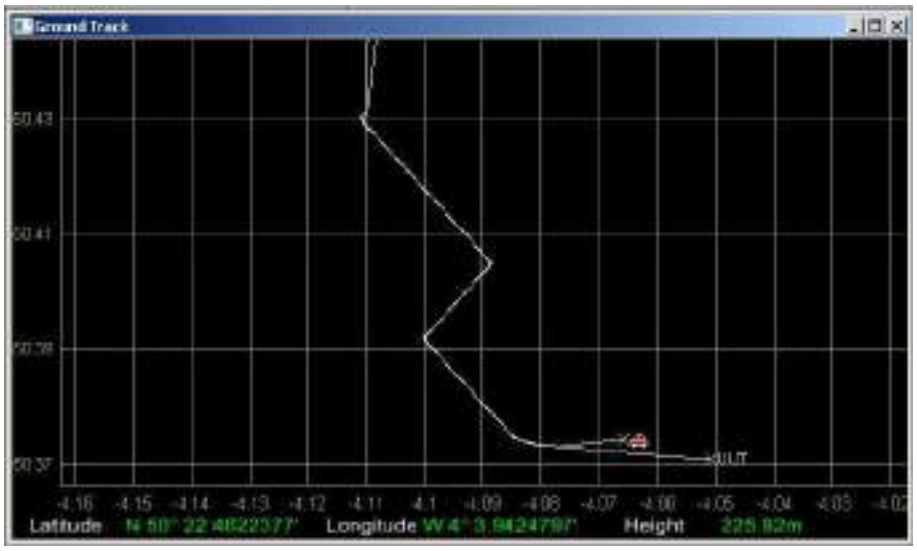
→ With the cursor in the GROUND TRACK window, right-click to display a context menu with these items:

ZOOM IN	Select to zoom in.
ZOOM OUT	Select to zoom out.
STANDARD ZOOM	The view depends on the extent of the vehicle motion: → It shows the “whole world” view if the vehicle is static, moving at high velocity or has travelled a large distance. → It zooms to the area of motion if the vehicle has just started moving, or is moving over a small area.
MAX ZOOM OUT	Select to view the whole world map.
FIXED / VARIABLE ASPECT RATIO	Fixed (default): Map has constant aspect ratio on zoom or resize. Variable: Map aspect ratio changes on zoom or resize.

6.3.1 NMEA receiver position

Note: You may need to zoom in before you are able to distinguish the receiver and the vehicle.

If you connect a receiver with NMEA output to the GSS7000 embedded host or the GSS6300M-I integrated Controller, GROUND TRACK will display the position of the receiver (using a different colour and the label UUT), as well as that of the vehicle:



6.4 Position Details

Note: You can mount antennas at different locations on the simulated vehicle, so their positions and velocities will differ.

Click the POSITION DETAILS button on the toolbar to display the current position in latitude and longitude and ECEF co-ordinates. This window shows velocity and attitude for the vehicle and antenna in the drop-down list. Distance is the same as a vehicle odometer and refers to the total distance travelled (in three dimensions) during the scenario. The window title bar shows the vehicle and antenna details:

6.5 Vehicle Map

Notes:

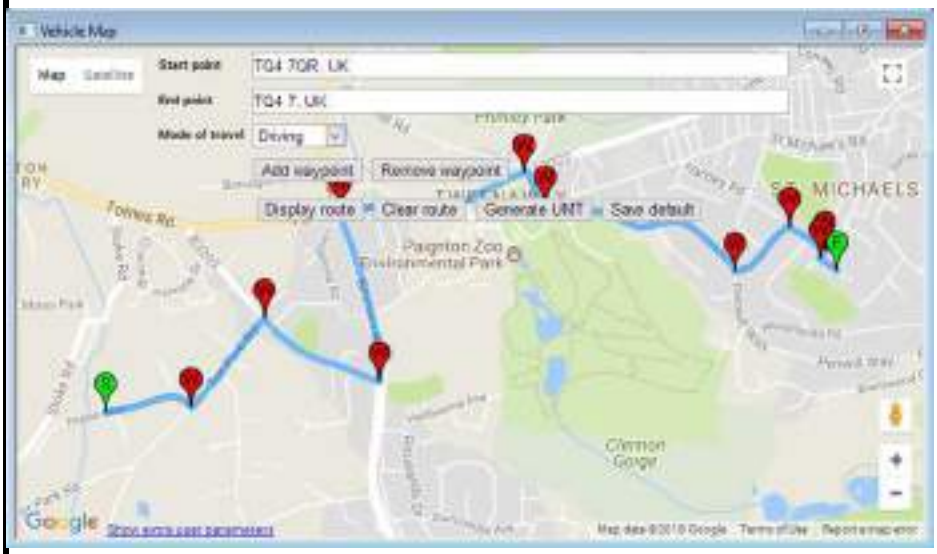
1) SimTEST uses Python for route generation, which PosApp version 6.03 onwards automatically installs.

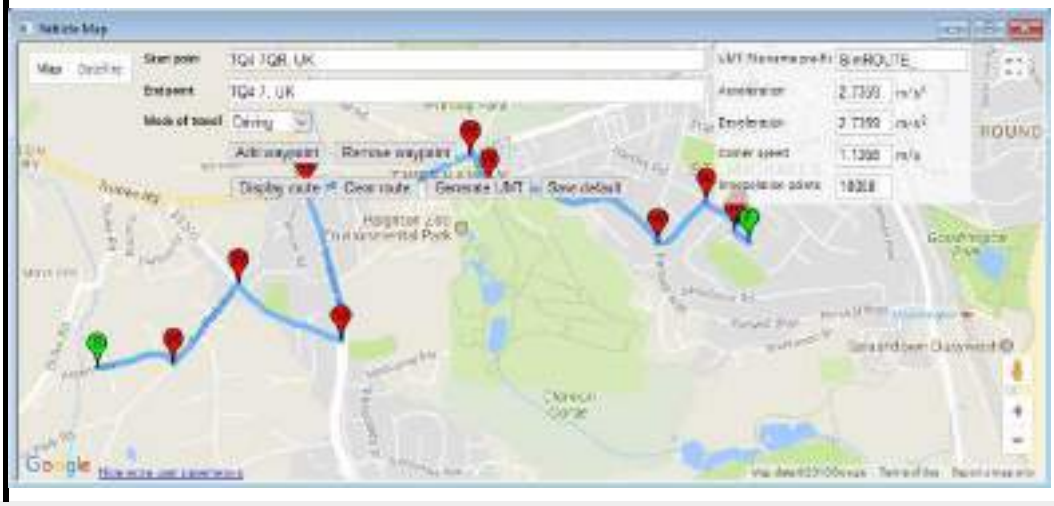
2) Your embedded host must have internet access to display Google Maps.

3) This section does not describe how to use Google Maps.

Click VEHICLE MAP WINDOW to generate a vehicle route (as a user motion, `*.umt`, file) from within SimTEST using Google Maps.

The default route generation process places 10 000 points between the start point and the end point. You can use this user motion file during the scenario by using a remote command.

Start point	Type the start point of your journey
End point	Type the end point of your journey
Mode of travel	Select the mode of travel from the list
Add waypoint	Adds a single waypoint. Click to add further waypoints. Waypoints are shown as a W inside a red marker.
Remove waypoint	Removes a single waypoint.
Display route	Displays the route zoomed in as far as possible to show start point to end point, with each waypoint shown if the scale allows. For example, using the start point and end point in the figure above:  Google Map elevation data may take some time to process. A notification appears when elevation processing is complete, which closes after two seconds; or click CLOSE.
Clear route	Clears the route shown in the **Vehicle Map** window.

Generate UMT	Generates a *.umt file from the route currently shown. SimTEST saves the file SimROUTE_.umt to the current scenario folder. If a file with the same name exists in this folder, SimTEST adds the current date and time to the file name using the format SimROUTE_yyyy-mm-dd_hh-mm-ss.umt For a description of using user motion files in a scenario, see *Vehicle > Motion > User motion file*, on page 5-16. *LOAD_UMT* (see page 8-9) describes the remote command to use a user motion file in a scenario.
Save default	Save the current START POINT and END POINT as the default
Show extra user parameters	Click the hyperlink to display the parameters. UMT FILE NAME PRE-FIX: the default file name is SimROUTE_.umt. You can change the text “SimROUTE_”; you cannot change the extension. See Note 2), below, before typing new values for these parameters: → ACCELERATION: Shows default acceleration for all modes of travel → DECELERATION: Shows default deceleration for all modes of travel → CORNER SPEED: Shows default cornering speed for all modes of travel → INTERPOLATION POINTS: Number of points between start point and end point for route generation for all modes of travel Click HIDE EXTRA USER PARAMETERS to hide these parameters. 

Notes:

1) You cannot change the units from the SI units in the dialog.

2) SimGEN does not perform error, or range, checking for any user parameter.

While running, the scenario plots the vehicle route in the VEHICLE MAP window:

You can use the NMEA output from your GNSS receiver to display received data on the route. You must use a RS232 to USB adapter connected to a Linux USB port, see *RS232 port settings*, on page 8-2.

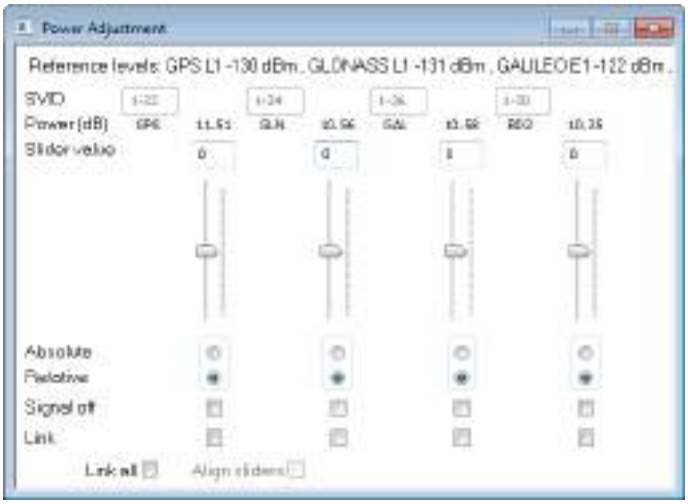
6.6 Power Adjustment

Notes:

1) Where this document quotes signal level in dB, it is normally with respect to the appropriate reference level. See the relevant GNSS ICD for details on the appropriate reference levels.

2) SimTEST shows power levels for satellites with RF turned off because you cannot select frequencies in this display. However, Power Levels Graph is frequency dependent.

Click the POWER ADJUSTMENT button  on the toolbar to open the POWER ADJUSTMENT dialog.



Use this dialog to set the signal level for each simulated satellite (identified using its SVID). Each slider adjusts all carrier frequencies currently simulated by that satellite.

You can use the mouse to drag the sliders, or click above or below a slider to increase or decrease its value by 1 dB. Alternatively, position the mouse on the slider and use the keyboard Page Up Page Down keys to increment/decrement the slider value in 1 dB steps; or use the Up / Down keys for 0.1 dB steps.

Table 6-1: Power Adjustment dialog items

Item	Description
Absolute	Directly applies the level set on the sliders to the output signal. Ignores effects due to any receiver antenna level patterns. Ignores signal-levels from simulation files.
Relative	Uses the slider values as OFFSETS from the signal-levels you specify in the scenario (adds slider values to the normal simulated signal-levels). The signal truncates to the maximum shown if the base signal plus offset exceeds the maximum available from the signal generator.
Signal Off	Deselect (default): Signal on that channel is On. Select: Signal on that channel is Off. The signal level displays as 'Off' in the Power Levels window and the slider is disabled.
Link	Deselect (default): Select:
Link all	Deselect (default): you can set each slider independently Select: all sliders move when you set any slider, retaining their offsets
Align sliders	Deselect (default): all sliders maintain independent alignment Select: sets all sliders to same horizontal alignment

6.7 Power Levels Graph

Click the POWER LEVELS button  on the toolbar to open the POWER LEVELS GRAPH window. In the window:

→ The number above, or below, each vertical bar is the rounded signal level, in dB, with respect to the reference level, in dBm, displayed at the left of the horizontal reference line.

→ The number at the bottom of the window, below each column, is the SVID of the satellite on that channel.

→ Clicking on a column displays the PRN code powers.

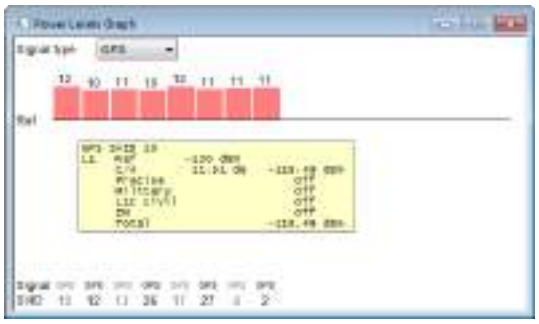
→ Satellites that you have switched OFF show the text 'Off'.

→ Satellites obscured from view appear off but show the text "Obs".

→ The label for the horizontal reference line shows the published reference level for the constellation, in dBm.

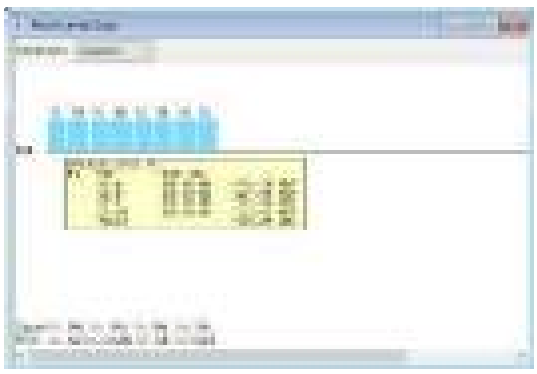
The following figures show example POWER LEVELS GRAPH windows for GPS, GLONASS, Galileo, BeiDou and Quasi-Zenith satellites.

GPS satellites

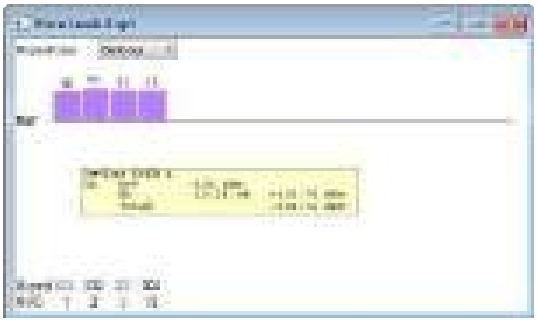


GLONASS satellites

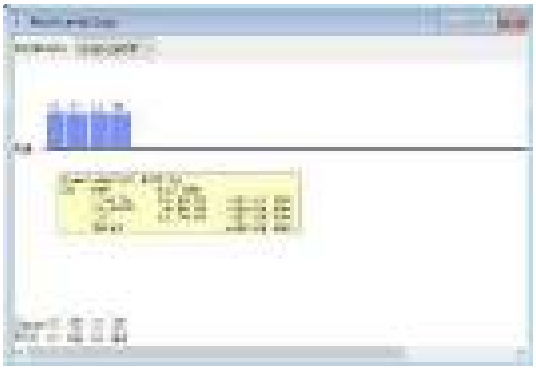
Galileo satellites



BeiDou satellites



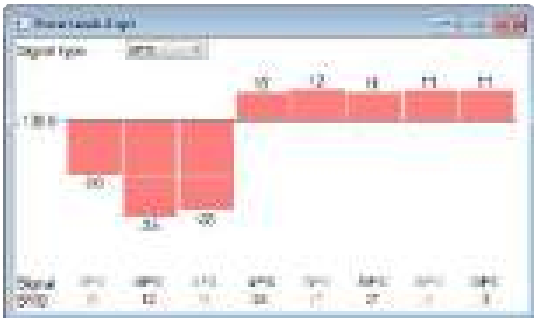
Quasi-Zenith satellites



Additional display features

If your scenario uses constellations with different reference levels, **Power Levels Graph** shows the text “Ref” instead of a power level in dBm. The following figure shows the **Power Levels Graph** for GPS L1 (reference level -130 dBm) and Galileo E1 (reference level -122 dBm).

The **Power Levels Graph** shows a thin white line at 20 dB below the reference level. This line represents the minimum power accuracy of Spirent signal generators.



Double-click the POWER LEVELS window to display the *Power Adjustment* (see page 6-7) dialog. You can also select the POWER ADJUSTMENT window from the VIEW menu item, or by using the Toolbar button.

6.8 Received Signals

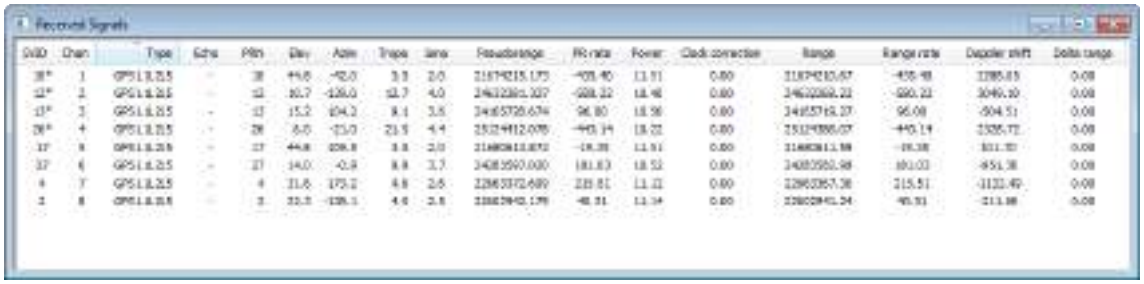
Notes:

1) Channel numbering in this window is from one to ‘n’. SimTEST defines channel numbers internally as zero to ‘n-1’ with the System Messages window using channel numbering.

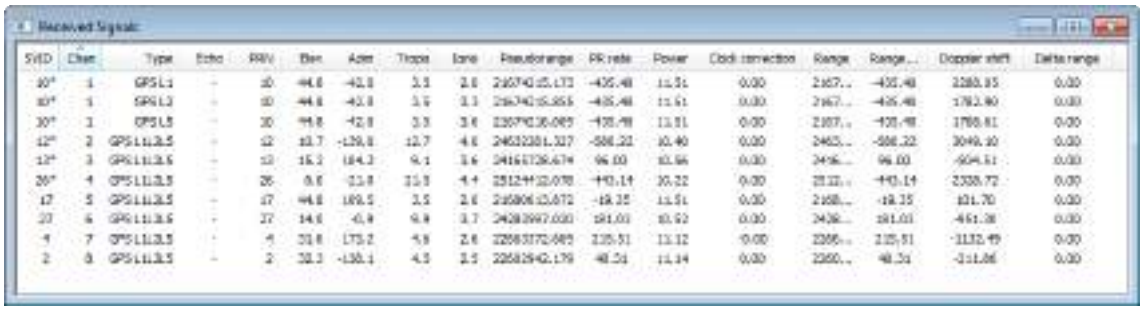
2) SimTEST shows power levels for satellites with RF turned off because you cannot select frequencies in this display. However, Power Levels Graph is frequency dependent.

3) All constellations support multipath by using additional channels (SimTEST does not support multipath for SBAS constellations).

Click the RECEIVED SIGNALS button  on the toolbar to open the SIGNALS RECEIVED window, which displays satellite signal data for each channel in tabular form:



Right-clicking any entry in the table and selecting SHOW DATA FOR ALL FREQUENCIES expands the “composite” data in that row into the individual frequency data. For example, right-clicking in the first row of the figure above (TYPE-GPS L1L2L5) and selecting SHOW DATA FOR ALL FREQUENCIES displays the data for each of L1, L2 and L5:



If your scenario uses multipath signals, right-clicking on the SVID with multipaths and selecting SHOW MULTIPATH SIGNALS FOR THIS SVID displays the data for each multipath signal associated with this SVID.

Right-clicking in the table header lets you select columns to display and you can sort (low to high, or high to low) after selecting a column.

Table 6-2: Received signals column descriptions

Item	Description
SVID	Satellite ID. The asterisk, see SV ID 20* in the above figure, shows this satellite is one of the four in the “best set” SimTEST uses to calculate the DOP value.
Chan	Signal generator channel number
Type	Satellite type and the carrier
Echo	Multipath signals of an ID. Uses “-“ for the incident signal, “1” for the first reflected (multipath) signal, “2” for the second and so on
PRN	Pseudo-Random Noise sequence associated with the satellite, normally the same as its SVID, except for GPS satellites.
Elev and Azim	Satellite elevation and azimuth angle from the vehicle in degrees.

Table 6-2: Received signals column descriptions (continued)

Item	Description
Tropo and Iono	Additional signal delay (in metres) as satellite signals pass through the Troposphere and Ionosphere, see *Atmosphere*, on page 5-3. For GPS satellites, the data in this window corresponds to L1. Correspondingly, L2 takes precedence over L5.
Pseudorange	Simulated signal delay, metres. It includes delay due to the free-space distance between the GPS satellite *at time of transmission* and the receiver *at time of reception,* plus Tropospheric and Ionospheric delays; together with other errors and effects, you specify in the scenario. Displays L1 delay if an L1 signal is present in the simulation.
PR Rate	Rate of change of pseudorange, metres per second
Power	Simulated signal power, relative to the nominal GPS minimum, in dB. Displays the L1 power level (if the scenario uses an L1 signal)
Clock correction	Displays the value of the CLOCK CORRECTION parameter
Range	Displays the value of the RANGE parameter
Range rate	Displays the value of the RANGE RATE parameter
Doppler shift	Displays the value of the DOPPLER SHIFT parameter
Delta range	Displays the value of the DELTA RANGE parameter

6.9 Sky Plot

Click the SKY PLOT button  on the toolbar. SKY PLOT gives a view “looking down” from a point beyond the satellite orbits and directly above the vehicle position. A satellite that is directly overhead (90° elevation) will be shown at the centre of the SKY PLOT display. A satellite with zero degrees elevation will be on the circumference of the SKY PLOT display.

The SKY PLOT display does not change with changes in vehicle attitude.

SKY PLOT uses the symbol ‘+’ to show the positions in the sky of the currently simulated satellites, relative to the current vehicle position.

Vehicles at high altitudes may be above certain satellites. SKY PLOT uses an ‘x’ symbol to identify these satellites. When a vehicle is above a satellite, SKY PLOT shows that vehicle altitude as the negative of the elevation displayed in the **Received Signals** window. SKY PLOT shows SVID adjacent the ‘+’ (or ‘x’) symbol, as in the following figure, which shows only GPS satellites.

Double-click anywhere in the Sky Plot window to display the **Received Signals** window, which shows satellite and signal data in tabular form.

Sky Plot identifies satellites as follows:

Constellation	Prefix	Example	Constellation	Prefix	Example
BeiDou	B	B1	SBAS - GAGAN	GN	GN1
Galileo	A	A1	SBAS - MSAS	M	M2
GLONASS	G	G10	SBAS-SDCM	S	S3
GPS	(none)	12	SBAS - WAAS	W	W2
IRNSS	N	N2	Quasi-Zenith	Q	Q3
SBAS - EGNOS	E	E2			

This table details the colours that help distinguish constellations in the SKY PLOT display:

Constellation	Colour in Sky Plot	Constellation	Colour in Sky Plot
BeiDou	Purple	IRNSS	Purple
Galileo	Light blue	Quasi-Zenith	Blue
GLONASS	Green	SBAS	Mauve
GPS	Red		

By default, the **Sky Plot** window indicates the SVIDs (for example, 19*) of the four satellites in the “best GDOP set”. You can select other DOP types by clicking PROPERTIES to show the **Sky plot properties** dialog.

Table 6-3: Sky plot properties dialog items

Item	Description
Plot type	Choose from AZIMUTH V ELEVATION (default) or AZIMUTH V RANGE.
Show multipaths	Deselect (default): does not show multipaths Select: show multipaths. The multipath azimuth and elevation values correspond with the Echo values in the **Received Signals** window.
Note: All constellations support multipath by using additional channels (SimTEST does not support multipath for SBAS constellations).	
Displayed satellite types	If your scenario uses more than one satellite type (for example GPS and GLONASS), you can choose the satellite type you want to display or use the default ALL
DOP display	Dilution Of Precision (DOP) indicates the navigational accuracy the receiver can obtain from the currently simulated satellite geometry. DOP of 1 to 2.5 is good, whereas a DOP of 9 is poor.

Table 6-3: Sky plot properties dialog items (continued)

Item	Description
DOP type	The DOP type you select here only applies to Sky Plot; it does not affect the algorithm used by SimTEST. Similarly, Sky Plot does not use the DOP type SimTEST uses in modelling. Sky Plot shows the calculated DOP values and, where more than three satellites are visible, the associated best set of satellites. Choose from: → GDOP - Best geometric arrangement of satellites - best general solution (default) → PDOP - Best positional accuracy → HDOP - Best horizontal accuracy → VDOP - Best vertical accuracy → TDOP - Best time accuracy
Notes: **1)** With exactly three satellites visible, SimTEST does not calculate the best set and only calculates HDOP and VDOP. **2)** SimTEST cannot perform DOP calculations with fewer than three satellites visible.	
SATELLITE	Enabled only if your scenario uses more than one constellation. Choose the constellation you want to use for the DOP calculation, or choose ALL to use all visible satellites from all constellations in your scenario. The text under the display will show “All constellations:” followed by the DOP type and the calculated DOP.

6.10 System Messages

Note: The SimTEST_message_log.txt file records every system message.

Click the MESSAGES button on the toolbar to open the SYSTEM MESSAGES window.

System messages use this colour-coding:

Text colour	Message severity	Text colour	Message severity
Dark Red	Hardware	Grey	Debug
Red	Error and Fatal	Blue	Warning
Green	Information		

When a scenario is running, system messages are time-stamped with time-into-run. When a scenario is not running, the message timestamps will be zero.

You can select the categories of system message using the menu item ***Options > Message Reporting***. You can also choose to log messages to the log file *[executable filename]_message_log.txt*, which is located in the current scenario folder.

To clear all messages from the **System Message** window left-click on the icon at the top left of the title bar and select CLEAR MESSAGES.

6.11 Status bar

This is always visible at the bottom of the SimTEST main window.

Table 6-4: Status bar items

Item	Description
11-Sep-2008 00:00:00	Start date and time of the current scenario.
LOCKED	Local_Lockout status: → Enabled - flashing white text “LOCKED” on red background → Disabled - grey text Transfers command of a scenario from the SimTEST interface to using remote commands from a remote control interface. As soon as you enable Local_Lockout, you cannot use SimTEST to start a scenario or use SimTEST to access anything that affects a running scenario. You can continue to use the SimTEST interface to read scenario data; however, Local_Lockout disables certain buttons and menu items. SimTEST displays a warning if you try to edit files that will affect a running scenario: 
LOG	Grey text - logging disabled.
H/W	Shows state of signal generator: → Amber background - SimTEST running in “no hardware” mode, with the signal generator disabled or disconnected. → Green background - running in normal mode with a signal generator connected.
Compatible h/w	Signal generator and scenario compatibility. Shows flashing red “Incompatible h/w” if signal generator is unable support the scenario.
Ready to run	Shows the status of the simulation as one of “Loading”, “Ready to run”, “Arming”, “Armed”, “Running”, “Paused” or “Ended”. These states are the same as the simulation status returned to remote control programs.

6.12 End of simulation

When you stop a scenario, the **End of simulation** dialog appears:

For GSS7000 signal generators using SimTEST, the features in this dialog are disabled.

With GSS6300M-I signal generators using SimTEST on the integrated Controller, you can save the User Actions file and the Logged Data file to locations you specify by clicking BROWSE and navigating to the location you want to use.

You use the REWIND SCENARIO option as follows:

→ Select (default): rewinds the scenario automatically when you click OK.

→ Deselect: you must use the REWIND button on the toolbar to rewind the scenario.

Note: After stopping a scenario, you must rewind it before you can run it again, or make changes to its parameters.

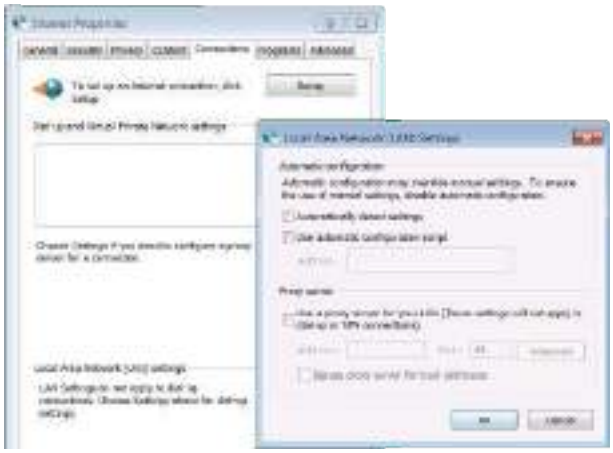
6.13 SimROUTE

Note: You must connect your signal generator to the internet to use SimROUTE. The status bar indicates 'Online' if SimTEST connects to the internet at the time it starts.

Currently, for Google Maps to update properly, you must disable auto detection of proxies.

To disable auto detection:

1. Click ***Start > Control Panel > Internet Options > Internet Properties > Connections > LAN Settings***.
2. Deselect AUTOMATICALLY DETECT SETTINGS as shown in the following image:



3. Click OK.

To use SimROUTE:

1. Click ***Tools > General Utilities > SimROUTE Utility***.

   The SimROUTE Utility opens on the Spirent CSC log-in page.
2. Enter your details and navigate to the SimROUTE page.
3. Follow the details in reference [20] to generate your route.

The **Vehicle Map** window shows a map of the route you generated using SimROUTE, together with your vehicle's progress during the scenario.

7 Sending remote commands

This chapter describes various utilities Spirent supplies to send remote commands.

7.1 Socket string send utility

Use the Spirent socket string send utility to send remote commands to the embedded host or the integrated Controller from a remote PC.

You can access this utility in the following ways:

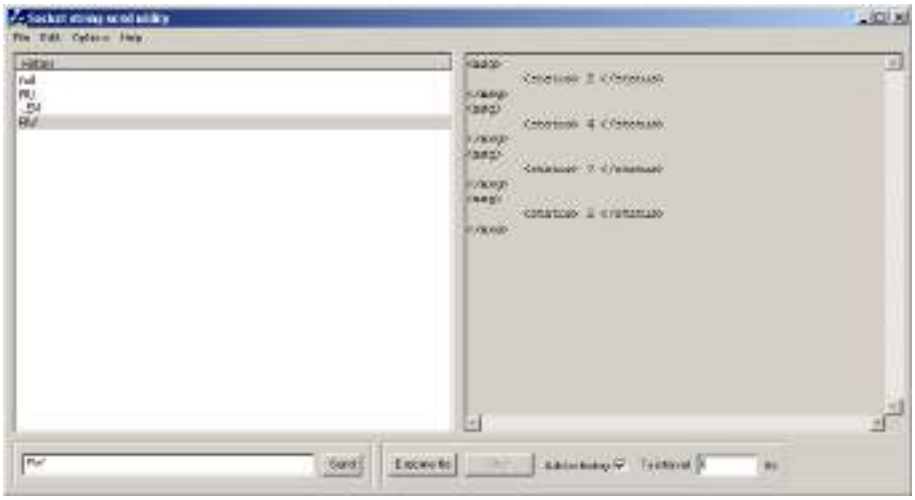
→ From the PosApp UI, choose ***Tools > General Utilities > Socket String Send***

→ If you are using SimTEST, *socket string send.exe* is installed into the default folder:

- *C:\Program Files\Spirent Communications\Positioning Application* (integrated controller)
- *D:\posapp\software\<version>\gui* (embedded host)

To run this utility navigate to this folder and double-click *socket string send.exe*.

→ To use this utility on a remote PC running Windows, first copy *socket string send.exe* to a convenient folder on the remote PC and then double-click *socket string send.exe*.



Tip: The SimTEST **System Messages** window displays messages relating to the socket connection.

Table 7-1: Socket string send utility window items

Item	Description
History	The left-hand area shows commands you have sent.
Responses	The right-hand area shows responses from SimTEST if you send remote commands. *Table 7-2* on page 7-2 describes the status numbers.
Send text box	Type the required command in the Send text box at the lower left-hand side of the interface. You can enter a previously sent command by clicking on the command in the History area. You can remove text by clicking in an empty part of the History area.

Table 7-1: Socket string send utility window items (continued)

Item	Description
Send	Click SEND to send the command in the text box. **Tip:** You can check the status of the scenario at any time by typing **`null`** into the Send text box and clicking SEND.
Execute file	Click EXECUTE FILE to run a history file. The commands in the history file are sent at the interval you enter in the TX INTERVAL text box. Load a history file by selecting ***File > Load History***.
Stop	Click STOP to end execution of the history file.
Add to history	Select ADD TO HISTORY to add the commands you enter to a text (*`*.txt`*) file. that is saved by default to the current scenario folder. You can choose the file location by selecting ***File > Save History***. If you have selected ADD TO HISTORY, each time you close the utility you are asked if you want to save the history.
Tx interval	Enter the interval, in ms, at which history file commands are executed.

Table 7-2: Scenario status descriptions

Status number	Description
0	No scenario specified
1	Loading
2	Ready
3	Arming
4	Armed
5	Running
7	Stopped and not reset; waiting for further commands.

To configure the socket string send utility:

1. Open *`socket_string_send.exe`* from one of the following locations:
   - ***Tools > General Utilities > Socket String Send***
   - On an embedded host or C50r SimGEN host:
     `D:\posapp\software\<PosApp version>\gui`
   - On a 64-bit SimGEN controller:
     `C:\Program Files (x86)\Spirent Communications\Positioning Application`
2. Within the utility select ***Options->TCP/IP*** address and then click DEFAULT ENGINE ADDRESS.

The hostname should default to:

- For an embedded host or C50r SimGEN host, 192.168.25.1
- For a SimGEN controller, 127.0.0.1

3. Enter the port number by clicking the appropriate button for the system you are using.

   The buttons apply the default port number.

4. Click OK.

5. If you want to record read-write timings in the log file, select ***Options > Output timings in log file***.

   This is a toggle command. When selected, you see a check mark by the side of the menu item.

7.2 Remote command example - running a scenario

You can use the **Socket string send** utility to send any of the remote commands to your signal generator.

Example of running a scenario using remote commands:

1. Run the socket send string utility.

2. Type **SC** and specify a scenario file:
   SC, <full file path>MySavedScenario.scn_replay

   Remember to include the full pathname.

3. Click SEND to load the scenario file.

   The lower right-hand corner of the SimTEST status bar shows *Ready to run*.
   A message appears in the Responses area:

```
<msg>
       <status> 2 <\status>
<\msg>
```

   Table 7-2 on page 7-2 shows that message status 2 means *Ready*.

4. Click any empty space in the History area.

5. Type **RU_NOWAIT** and click SEND.

   The scenario starts.

   The lower right-hand corner of the SimTEST status bar shows *Running*.

   Tip: You can check the status of the scenario at any time by typing **NULL** and clicking SEND.

   A new message appears in the Responses area:

```
<msg>
```

```
        <status> 5 <\status>
<\msg>
```

Table 7-2 on page 7-2 shows that message status 5 means *Running*.

6. To end the scenario immediately, type **"-,EN,1"** (see) in the SEND TEXT area and click SEND.

   The lower right-hand corner of the SimTEST status bar briefly shows “Ended” and then “Ready to Run”. A new message appears in the Responses area:

```
<msg>
        <status> 7 <\status>
<\msg>
```

Table 7-2 on page 7-2 shows that message status 7 means *Ended*.

7.3 USB string send utility

The USB STRING SEND utility allows interactive control over USB of the superseded GSS6560 and GSS5060 signal generators. It can be a useful diagnostic tool to check signal generator operation as well as driving the signal generator as an interactive single channel signal generator.

Note: This utility cannot send synchronous commands and is not suitable for controlling more than one signal generator.

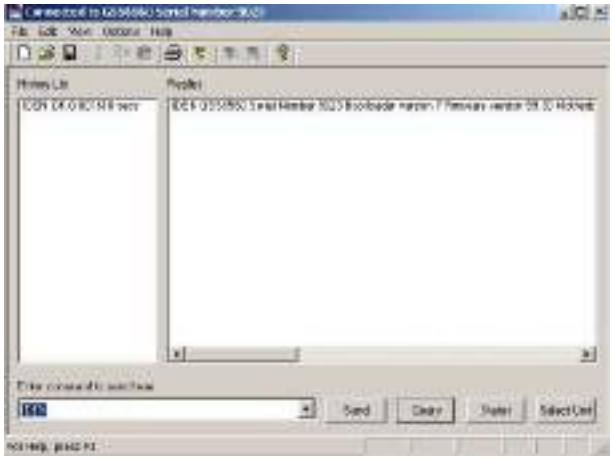


Table 7-3: USB string send utility window items

Item	Description
History list	The left-hand area shows commands you have sent.
Replies	The right-hand area shows responses from SimTEST if you send remote commands.
Enter command to send here	Type or choose the required command for execution.
Send	Click SEND to send the command.
Query	Click QUERY to send the command.
Status	Click STATUS to get the status of the signal generator.
Select unit	Click SELECT UNIT to select a different signal generator on the USB bus.

To run the USB string send utility:

1. Navigate to the *Positioning Application* folder and double-click *USB_String_Send.exe*.

2. Choose the signal generator, by both device type and serial number, and then click OK.

   The USB STRING SEND dialog is available for use.

3. Do one of the following in the ENTER COMMAND TO SEND HERE text box:
   - Choose the command to use
   - Type a valid command

4. Click SEND or QUERY to execute the command.

7.4 IP string send utility

Notes:

1) Pre-Loaded Commands GTL and GET are only available under the IEEE-488 protocol and are not available under the IP protocol.

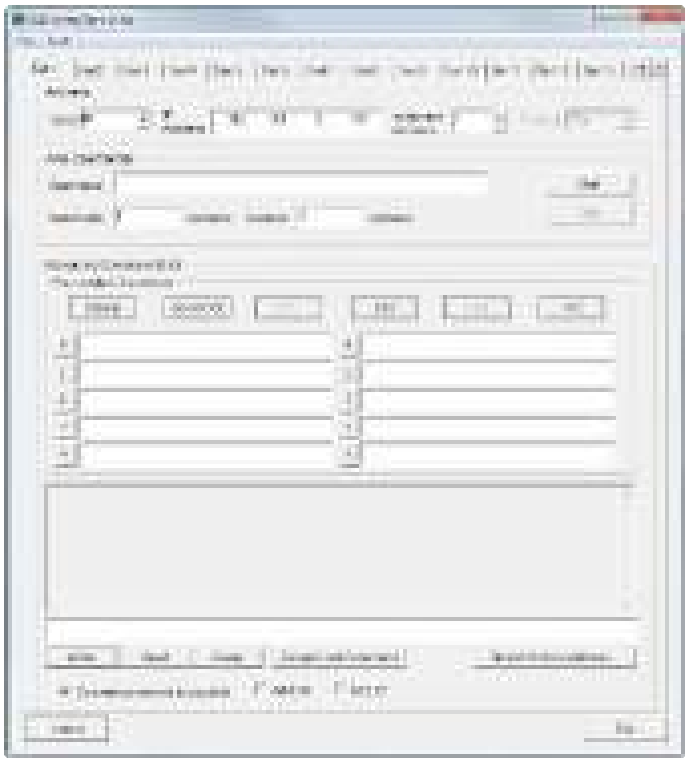
2) The IP string send utility detects whether a SimGEN controller (GSS8000-series, and earlier, signal generator), a C50r SimGEN Host (GSS9000-series signal generator) or an Embedded Host (GSS7000 signal generator) is in use and applies the correct IP address:
   - 127.0.0.1 for GSS8000-series, and earlier, signal generators
   - 192.168.25.1 for GSS9000-series and GSS7000 signal generators

3) After changing the signal generator configuration in a simulator consisting of multiple GSS8000-series (or earlier) signal generators, Spirent recommends you use the ***IEEE string send*** utility to send to each signal generator a series of ***SDC*** messages.
   You must wait for each signal generator to report its status before sending the next ***SDC*** message.
   Before you stop sending ***SDC*** messages to a signal generator, you must wait for it to report its status as good.
   Each signal generator in your simulator must report its status as good before you start a new run.

The String Send utility allows interactive control of GSS9000-series, GSS7000 and GSS8000-series signal generators using IP; or GSS77xx/78xx, STR4760/80 or STR4790 signal generators over an IEEE-488 bus. You can find it in this folder:

→ *D:\posapp\software\<version>\gui* (C50r or embedded host)

→ *C:\Program Files (x86)\Spirent Communications\Positioning Application* (integrated controller)



The String Send utility is a useful diagnostic tool to check signal generator operation. It can control the signal generator as an interactive, single channel signal generator.

7.4.1 Map the base IP Address

Notes:

1) Spirent set the base IP address before shipping you signal generator. Contact Spirent Global Services before changing base address.

2) Only applicable to signal generators with an IP address.

3) You must use IP address 192.168.25.1 for GSS9000-series signal generators using the C50r SimGEN Host, or GSS7000 signal generators using an Embedded Host.

If your signal generator uses IP, you must map the base IP address to INSTRUMENT ADDRESS 0.

→ Click on TOOLS-SET IP MAPPING... to open the SET IP MAPPING dialog:

→ Type the IP base address that you want to map to INSTRUMENT ADDRESS 0 in the text box. The maximum INSTRUMENT ADDRESS is 30.

→ Click OK.

→ Click on the up / down arrows to the right of the INSTRUMENT ADDRESS text box until the IP address of your signal generator appears in the IP ADDRESS text box.

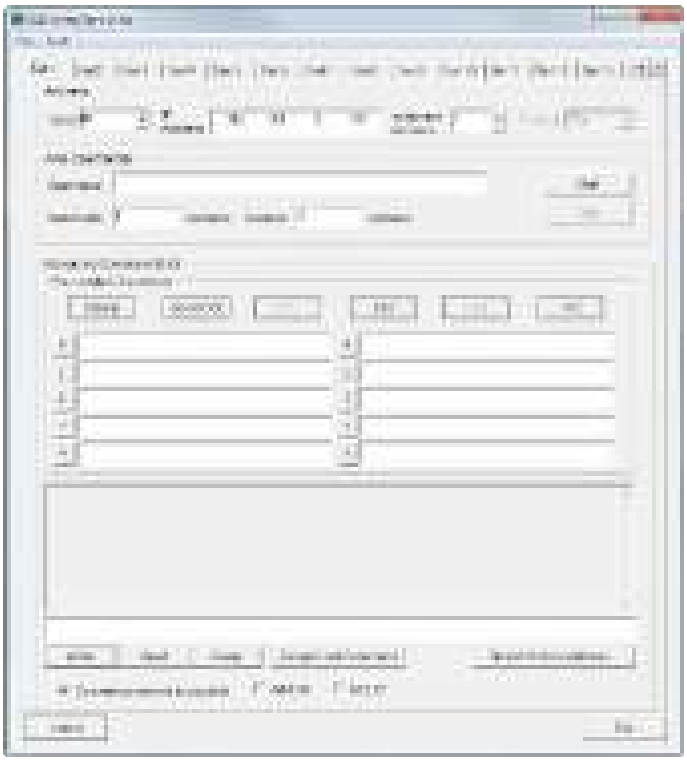
7.4.1.1 Selecting the IEEE-488 address

Note: Only applicable to signal generators using the IEEE-488 bus.

Click on the up / down arrows to the right of the INSTRUMENT ADDRESS text box to select the IEEE-488 bus address of your signal generator. The maximum INSTRUMENT ADDRESS is 30.

7.4.1.2 Using the IP string send utility

The utility dialog has fifteen tabs at the top of the dialog. Each tab gives an identical screen that you can use to send commands to your signal generator:



The following table details the main areas of the dialog.

Table 7-4: IEEE or IP String Send Utility dialog items

Item	Description
GPIB IP address	For signal generators using the IEEE-488 bus enter the GPIB card number and Timeout of your signal generator, then select its instrument address. For signal generators using IP select the IP address.
Auto commander	Define the command, its send rate and duration.
Interactive Command Shell	There are some pre-loaded commands that you can apply: → SDC - Sends Selective Device Clear to the device at the current Address → GET - Sends Group Execute Trigger to the device at the current Address. GET is only available using the IEEE-488 bus → IFC - Momentarily sets the Interface Clear bus control line → GTL - Sends Go To Local command. GTL is only available using the IEEE-488 bus **Note:** The IP protocol does not support all pre-loaded commands. Beneath these buttons is the history of the last 10 commands. You can resend a command by pressing the corresponding key on the keyboard number pad.
Under history buttons	This area shows the response from the signal generator. Click in the text box beneath the response area for the signal generator and type the command string. Click on the buttons below this area to execute the command string.

7.5 GSS6300M-I remote access

For remote access to your GSS6300M-I, Spirent recommends you use either:

→ Windows Remote Desktop

→ VNC (SimTEST has a VNC client pre-installed)

Spirent recommends you use VNC when using a tablet device to remotely access your GSS6300M-I.

Your GSS6300M-I includes an integrated controller running the Windows operating system. You must consult your local network administrator before you connect your GSS6300M-I to your network.

Before using remote access to control your GSS6300M-I, your local network administrator must set up remote access on your Windows network for the remote access protocol you want to use.

7.6 Single channel mode

SIngle channel mode simulates one channel for each enabled frequency in a constellation and controls Spirent's signal generators. Any licensed SimTEST unit can be switched to the single channel mode.

In single channel mode, you can specify signal parameters such as pseudo-range and level, and can switch on and off the various signals and codes.

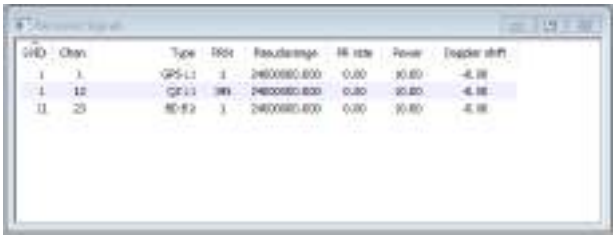
To set up single channel mode:

1. Open your required scenario.
2. Open *socket_string_send.exe* from one of the following locations:
   - On an embedded host or C50r SimGEN host:
     D:\posapp\software\<PosApp version>\gui
   - On a 64-bit SimGEN controller:
     C:\Program Files (x86)\Spirent Communications\Positioning Application
3. Send a null command by typing **null** in the lower left box and then clicking SEND.

   If configured correctly, status 2 appears in the response window.
4. To switch from SimGEN mode to single channel mode, send the following command:

   SET_DIR_PR,1

   The GUI's received signals should now show only one satellite per constellation as shown in the screenshot below:



5. Use the interface, remote commands or the socket string send utility to control what you want to do.
6. To disable the SCU mode, type in the following command:

   SET_DIR_PR,0

8 Remote commands

You can remotely control the signal generator using the remote commands listed here. For readability, categories are used to group together commands of a similar type, as summarised in the following table.

Table 8-1: Index of remote commands

Category	See
Scenario commands	*Table 8-4* on page 8-4
Time commands	*Table 8-5* on page 8-11
Signal power commands	*Table 8-6* on page 8-14
Signal control commands	*Table 8-9* on page 8-18
Hardware and calibration commands	*Table 8-11* on page 8-29
Vehicle data request commands	*Table 8-12* on page 8-31
Signal data request commands	*Table 8-13* on page 8-32
Transmitter data request commands	*Table 8-14* on page 8-34
Navigation commands	*Table 8-15* on page 8-35
Engine commands	*Table 8-16* on page 8-57

Before you continue, Spirent recommends you review *Table 8-2* on page 8-1, which covers the remote command syntax.

Table 8-2: Remote command syntax

Symbol	Description	Example
< >	Category name	<number>
,	Delimiter between categories	VEH_X_POS,v1
Δ	A compulsory space within the command text	`-,MOT,TN_GTXΔGPS:3` **Note:** When you type the command, you use a space, not the Δ.
[ ]	Optional parameter	[<d>]<hh>:<mm>:<ss>
|	OR	<timeFormat> | <actionImmediately>
::=	Defined	ss::= 0-59
""	Literal	"1" type 1
{ }	Zero or more times	<number>|<string>{,<number>|<string>}
-	Range	0-23
( )	Descriptive text	(defaults to 0 if not used)

8.1 Interface types

8.1.1 Ethernet

To use remote commands over Ethernet, you must use TCP/IP and the client program must connect to port 15650.

8.1.2 RS232 port settings

Licensed feature: *You will need a licence to use this feature. Contact Spirent for licensing details.*

The following image shows the RS232 PORT SETTINGS dialog.

Note: Serial ports are not available directly on an embedded host; you must use a USB-to-serial port adapter to provide an RS232 serial port. If you are using an embedded host, this dialog lists USB ports only.

Table 8-3: RS232 port settings dialog items

Item	Description
Port	Lists all available serial ports as Serial n (physical name), where: → n is the port number starting at 1 → (physical name) is one of: • /dev/ttyUSBx (Linux, with x starting at 0) • COMx (Windows, with x starting at 1)
Settings	Change the RS232 settings using these drop-down menus: 
Note: Spirent are aware the embedded host does not detect certain adaptors when using the following Baud rates: 14 400, 128 000 and 256 000. Spirent recommends you do not use these Baud rates when using any USB to RS-232 adapter.	
Used by	Define the function of the port from the drop-down list

8.2 Timestamp

Notes:

1) SimTEST will not accept or process further commands until the current command is actioned. Specifying a command with a time of application in the future will block recognition of further commands until that time.

2) Spirent recommends you always send time-stamped remote commands at intervals corresponding to the iteration rate you select in your scenario.

3) You can buffer any timed command by placing the '@' character at the start of the timestamp. This enables SimREMOTE to process further commands that are sent after the buffered command but before the timestamp of the buffered command. If you buffer a command, it is stored and actioned at the specified time. You can buffer multiple

commands and you can send them in any time order; the buffer ensures they are actioned at the specified time. When you send a buffered command with a time less than or equal to the current scenario time, it is buffered then executed immediately.

Description	The timestamp field prefixes all timed commands and specifies the time into run to action the command. Use '-' instead of a time format to action the command as soon as it is received. Prepend the time format with the '@' character to buffer the command and action it at the correct time. The default buffer capacity is 10000; this can be modified in the user settings. You receive an error message if: → You send a command to the buffer and the buffer is full → You send a non-timed command to the buffer		
Format	timestamp	::=	[<buffer>]<timeFormat1> | <timeFormat2> | <timeFormat3> | <timeFormat4> | <actionImmediately>
Where	buffer	::=	@
	timeFormat1	::=	[<d>]<hh>:<mm>:<ss>[.<ms>]
	d	::=	0-23 (defaults to 0 if not used)
	hh	::=	0-23
	mm	::=	0-59
	ss	::=	0-59
	ms	::=	0-999 (in 1 millisecond steps, defaults to 0 if not used)
	timeFormat2 to timeFormat4 use a range equivalent to 0 to 2073599 seconds (that is, 0 s to 23 d 23 h 59 m 59.999 s)		
	timeFormat2	::=	<s.ssss…exxx> (full floating point format)
	ssss…	::=	0-9.99999…
	xxx	::=	-003-+006
	timeFormat3	::=	<s.ssss…exxx> (simplified floating point format)
	ssss	::=	0-9.99999…
	xxx	::=	-3-+6
	timeFormat4	::=	<sssssss.xxx>
	ssss	::=	0-2073599
	xxx	::=	000-999
	action Immediately	::=	"-"
Examples			
timeFormat1:	@01:02:03.4,SIG_LEVEL,V1_A1,BeiDou B1I,1,0 (buffered) 1 12:05:10.100,SIG_LEVEL,V1_A1,BeiDou B1I,1,0		
timeFormat2:	3.7234000000e+003,SIG_LEVEL,V1_A1,BeiDou B1I,1,0 (equivalent to 01:02:03.4,SIG_LEVEL,V1_A1,BeiDou B1I,1,0)		
timeFormat3:	3.7234e+3,SIG_LEVEL,V1_A1,BeiDou B1I,1,0 (equivalent to 01:02:03.4,SIG_LEVEL,V1_A1,BeiDou B1I,1,0)		

timeFormat4:	3723.4,SIG_LEVEL,V1_A1,BeiDou B1I,1,0 (equivalent to 01:02:03.4,SIG_LEVEL,V1_A1,BeiDou B1I,1,0)
Action immediately:	-,SIG_LEVEL,V1_A1,BeiDou B1I,1,0
End scenario	Now, end the scenario: -,EN,1 End the scenario in 1 day, 12 hours, 10 minutes, 10.1 seconds: 1 12:10:10.100,EN,1

8.3 Returned response format

Remote commands will return a status number, as shown in *Table 7-2* on page 7-2.

Remote commands will return an error description if the command or its syntax is incorrect.

8.4 Scenario commands

Table 8-4: Scenario commands

Command	Description
**IDN?* (see page 8-9)	Return the version of SimGEN
AR (see page 8-8)	Arms the scenario
EN (see page 8-7)	End a running scenario
INIT_POS (see page 8-5)	Set a vehicles initial position
LOAD_ALMANAC (see page 8-8)	Loads a YUMA format almanac file
LOAD_UMT (see page 8-9)	Loads a user motion file
LOG_DIR (see page 8-10)	Queries log file name for scenario running only on C50r SimGEN Host
NULL (see page 8-8)	Returns the status of the scenario
RU (see page 8-6)	Run a scenario
RU_NOWAIT (see page 8-7)	Runs scenario without waiting for ARMED state.
RW (see page 8-8)	Rewind an ended scenario
SAVE_SCENARIO (see page 8-10)	Save a scenario
SC (see page 8-4)	Select a scenario
SC_NAME (see page 8-5)	Returns currently selected scenario name
TR (see page 8-6)	Set trigger mode

8.4.1 SC

Note: If you want to load a filename that includes commas, you must enclose the full path in inverted commas (" "). For example:

- "C:\Program Files\Spirent Communications\Positioning Application\Scenarios\Test\user,actions,2.scn"
- "…\Shared\user,actions,2.scn"

Description	Loads a scenario file (*.scn) from the given path. If a filename is not given, the command looks in the current directory for a scenario file. To correctly specify a scenario, you must give the absolute path to the scenario file. Must be sent before a scenario has been run.
Format	SC[,<file_name_and_path>]
Where	File_name_and_path ::= absolute path and file name
Returns	Status.

8.4.2 SC_NAME

Description	Returns the name of the currently loaded scenario.
Format	SC_NAME[,includepath]
Where	includepath ::= parameter to return the full path to the currently loaded scenario
Returns	Status and scenario filename.
Example 1	Using the scenario file: *C:\Program Files\Spirent Communications\Positioning Application \Scenarios\6700_SPACE\6700_SPACE.scn* SC_NAME Returns the name of the scenario file: <msg> <status> 2 </status> <data> 6700_SPACE.scn </data> </msg>
Example 2	Using the scenario file: *C:\Program Files\Spirent Communications\Positioning Application \Scenarios\6700_SPACE\6700_SPACE.scn* SC_NAME, includepath Returns the name and full path to the scenario file: <msg> <status> 2 </status> <data> C:\Program Files\Spirent Communications\Positioning Application\Scenarios\6700_SPACE\6700_SPACE.scn </data> </msg>

8.4.3 INIT_POS

Description	Overrides the current simulation initial position (static scenarios only). Only valid for static and remote vehicles (but note that remote vehicles can be moving). Not a valid command for vehicle models with motion. Must be sent before running a scenario, but after an SC command. You must always set the timestamp of this command to "-" or 0D00:00:00.
Format	<timestamp>,INIT_POS,<veh_mot>,<latitude>,<longitude>, <height>
Where	timestamp ::= See *Timestamp*, on page 8-2. veh_mot ::= <vehicle_id>"_"<motion_id>

	vehicle_id	::=	"v"<v_number>
	v_number	::=	vehicle number starting from 1
	motion_id	::=	"m"<m_number>
	m_number	::=	"1" (motion model number always 1)
	latitude	::=	latitude, degrees, +ve = North
	longitude	::=	longitude, degrees, +ve = East
	height	::=	height, metres

Returns	Status.

Example	Set the initial position of vehicle 1, motion model number 1, to be 10.0° N, 20.0° E and 30.0 m high:
	`-,INIT_POS,v1_m1,10.0,20.0,30.0`
	At the start of the scenario, set the initial position of vehicle 2, motion model number 1, to be 30.0° S, 20.0° E and 10.0 m high:
	`0 00:00:00,INIT_POS,v2_m1,-30.0,20.0,10.0`

8.4.4 TR

Description	Sets the trigger mode. You must send this command before an RU command. Trigger mode operation depends on your signal generator, as follows: → GSS9000-series signal generator see reference [13]. → GSS8000 signal generator see reference [23]. → GSS7000 signal generator see reference [22] → GSS4150 signal generator see reference [24]
Format	`TR,<mode>`
Where	`mode ::= "0" (software trigger) | "1" (Immediate triger mode - trigger as soon as trigger pulse is detected) | "2" (Delayed trigger mode - trigger on edge of next 1PPS after trigger pulse is detected)`
Returns	Status.

Example	Set software trigger mode:
	`TR,0`
	Exit trigger mode on edge of next 1PPS after trigger pulse is detected:
	`TR,2`

8.4.5 RU

Description	Run the currently selected scenario (requires an external pulse to start in Immediate or Delayed trigger modes). In the ARMED state and with TR,0 (software trigger), the scenario runs on the next 1PPS. If an AR (arm) command has not been received, the RU command performs an AR (arm) command first. In this case the time to start is delayed by an indeterminate number of seconds.
Format	`RU`
Returns	Status.
Example	`RU`

8.4.6 RU_NOWAIT

Description	Arms and runs the currently selected scenario (requires an external pulse to start in Immediate or Delayed trigger modes). The RU command waits until the ARMED state is achieved before returning with a response. The RU_NOWAIT command returns immediately and does not wait for the ARMED state. Use RU_NOWAIT when an external armed source is used.
Format	`RU_NOWAIT`
Returns	Status.
Example	`RU_NOWAIT`

8.4.7 EN

Description	End the currently running scenario.		
Format	`<timestamp>,EN[,<ending_type>[,<log_option>][,reset][,time]]`		
Where	`timestamp`	`::=`	See *Timestamp*, on page 8-2.
	`ending_type`	`::=`	`"0" (Stop scenario and leave at ENDED state. Default) | "1" (Stop scenario and rewind to INITIALISED state. Ready to run again) | "2" (Stop scenario and rewind to INITIALISED state. Rewind remote command file and repeat command sequence in it. Only applies to remote commands from file)`
	`log_option`	`::=`	`"0" (If logging is enabled do not produce log files) | "1" (If logging is enabled produce log files. Default)`
	`reset`	`::=`	`"0" (Do not reset remote input. Default) | "1" (Reset remote input)`
	`time`	`::=`	`0-10 (Time after which engine discards remote messages. Integer seconds, after executing EN command. Default is zero - immediately)`
Returns	Status.		

Examples	End current scenario now using all default states:
	`-,EN`
	End current scenario at 24 hours into run and leave at Intialised state, rewind remote command file and repeat remote command file sequence. Produce log files. Do not reset remote input. Discard remote messages immediately:
	`1 00:00:00,EN,2,1,0,0`
	End current scenario now. Rewind scenario, ready to run. Do not produce log file. Reset remote input. Discard remote messages 3 seconds after executing command:
	`-,EN,1,0,1,3`
	End current scenario now. Leave at Ended state. Produce log file. Do not reset remote input. Discard remote message 5 seconds after executing command:
	`-,EN,0,1,0,5`		

8.4.8 RW

Description	Rewinds a scenario, ready to run again, after using the EN command with `ending_type` set to 0.
Format	`RW`
Returns	Status. See *Returned response format*, on page 8-4.
Example	`RW`

8.4.9 AR

Description	Arms the current scenario. Send this command before an RU command. Your system must be in the armed state before you can send the RU command. The AR command blocks other commands and will not return a result until the arming phase is complete. It also blocks remote communication with SimGEN during the arming phase. This means external arming sources that need to get data from SimGEN at the arming time; or communicate to SimGEN they are armed, cannot do so because the AR command blocks communication with SimGEN.
Format	`AR`
Returns	Status.
Example	`AR`

8.4.10 NULL

Description	Returns status information (no other function)
Format	`NULL`
Returns	Status.
Example	`NULL`

8.4.11 LOAD_ALMANAC

Note: If you want to load a filename that includes commas, you must enclose the full path in inverted commas (" "). For example:

- "C:\Program Files\Spirent Communications\Positioning Application\Scenarios\Test\user,actions,2.scn"
- "…\Shared\user,actions,2.scn"

Description	Loads an almanac file according to its extension: → *.txtYUMA - all constellations → *.yumaYUMA - all constellations → *.glo_almGLONASS Almanac file - Spirent defined format → *.glo_rsa GLONASS Almanac file - Russian space agency format → *.aglGLONASS Almanac file → *.??NRinex file for GPS or Galileo only → *.al3SEM file for GPS or Galileo only → *.tleTLE file - all constellations See reference [1] for details on TLE files. The file must be present in either the current scenario folder (no path required) or the Shared folder using the full path or the abbreviation `...\Shared\filename.txt`.
Format	`LOAD_ALMANAC,<file_name>,<rollover_week_number>, <constellation>`

Where	file_name	::=	filename (see Description, above)
	rollover_week_number	::=	[0 - 5]
	constellation	::=	"BEIDOU" | "CAPS" | "GALILEO" | "GLONASS" | "GPS" | "IRNSS" | "QZ" (If omitted, default constellation is GPS)
Returns	Status.		

Example	Load the Almanac file *yuma1.txt* in the current scenario folder, using rollover week number 1 , for constellation GPS:
	`LOAD_ALMANAC,yuma1.txt,1,GPS`
	Load the Almanac file *yuma2.txt* in the 'Shared' folder, using rollover week number 1 , for constellation GPS:
	`LOAD_ALMANAC,…\Shared\yuma2.txt,1,GPS`
	Load the Almanac file *TLE1.tle* in the current scenario folder, using rollover week number 1 , for constellation Galileo:
	`LOAD_ALMANAC,TLE1.tle,1,GALILEO`		

8.4.12 *IDN?

Description	Use this command on its own to get the SimGEN version number. If you have a GSS7000 signal generator, you can also use it with the command *FW_CMD* (see page 8-31) to get ASCII equipment identification.
Format	`*IDN?`
Returns	Status and SimGEN version number.

Example	`*IDN?`
	Returns:
	`<msg>`
	`<status> 2 </status>`
	`<data>Spirent,SimGEN,0,V6.00.01_RC01_LIBS547074_ENG547060`
	`</data>`
	`</msg>`

8.4.13 LOAD_UMT

Note: If you want to load a filename that includes commas, you must enclose the full path in inverted commas (" "). For example:

- "C:\Program Files\Spirent Communications\Positioning Application\Scenarios\Test\user,actions,2.scn"
- "…\Shared\user,actions,2.scn"

Description	Loads a user motion (**.umt*) file. The file must be present in either the current scenario folder (no path required) or the 'Shared' folder using the full path or the abbreviation *...\Shared\filename* **Note:** Ignored if scenario is running.		
Format	`LOAD_UMT,<vehicle_id>,<file_name>`		
Where	vehicle_id	:=	"v"<v_number>
	v_number	:=	vehicle number starting from 1
	file_name	:=	filename (see Description, above)

Returns	Status.

Example	For vehicle 1, load the *Aircraft_Example_1.umt* file from the current scenario folder:
	`LOAD_UMT,v1,Aircraft_Example_1.umt`
	For vehicle 1, load the *Aircraft_Example_2.umt* file from the 'Shared' folder:
	`LOAD_UMT,v1,…\Shared\Aircraft_Example_2.umt`

8.4.14 LOG_DIR

Description	Returns the full path of the sub-folder that SimGEN running on the C50r SimGEN Host uses to store log files. The command only returns the sub-folder name while the scenario is running or before you rewind a scenario that has ended. The sub-folder name is the time stamp at the start of the run in the format YYYY_MM_DD_HH_MM_SS, for example: *D:/posapp/logs/<scenario_name>/2019_03_24_12_58_21*. This name (12h 58 min 21 seconds on 24 March 2019) is only known after the scenario starts.
Format	`LOG_DIR`
Returns	Status and full path of the log files sub-folder.

Examples	The currently running scenario name is "Test_all", the scenario start time was 12h 58 min 21 seconds on 24 March 2014.
	While the scenario is running, or before you stop and rewind this scenario, you query the full path and name of the sub-folder in which SimGEN stores the log files for this scenario:
	`LOG_DIR`
	Response:
	`<msg>`
	`<status> 2 </status>`
	`<data> D:/posapp/logs/Test_all/2014_03_24_12_58_21 </data>`
	`</msg>`

8.4.15 SAVE_SCENARIO

Note: This command will be rejected if the <path> you specify is unchanged and you have changed either <commit_type> or <save_type>.

Description	Save a scenario		
Format	`SAVE_SCENARIO[,<commit_type>,[<save_type>,<path>]]`		

Where	`commit_type`	::=	`| "with_changes"`
			`| without_changes`
			`(If you do not specify commit_type, the default is "with_changes")`

	`save_type`	::=	`"as_simgen"`
			`| "as_simreplay"`
			`(If you do not specify save_type, the default is the current type. If you specify save_type, you must also specify path)`

	`path`	::=	`(the path to scenario folder must include the last slash. If you do not specify path, the default is the current path)`

Returns	Status.

Examples	Save the recent changes to a SimGEN scenario to the folder *C:\Program Files\Spirent Communications\Positioning Application\Scenarios\Test*
	`SAVE_SCENARIO,with_changes,as_simgen,C:\Program Files\Spirent Communications\Positioning Application\Scenarios\Test\`
	Save the recent changes to a replay scenario to the folder *C:\Program Files\Spirent Communications\Positioning Application\Scenarios for SimTEST\Test*
	`SAVE_SCENARIO,with_changes,as_simgen,C:\Program Files\Spirent Communications\Positioning Application\Scenarios for SimTEST\Test\`

8.5 Time commands

Table 8-5: Time commands

Command	Description
GPS_TIME (see page 8-12)	Retrieves the number of seconds from GPS time zero
GPS_UTC_OFFSET (see page 8-13)	Retrieves GPS to UTC offset, at a given time
START_TIME (see page 8-12)	Sets the start time and duration of the current scenario
STTIME (see page 8-12)	Retrieves the start time of the current scenario
TIME (see page 8-11)	Retrieves the current time into run when the command is received
TIME_STEP (see page 8-11)	Retrieves the time into run of the current time step
UTC_TIME (see page 8-12)	Retrieves the scenario time as an ASCII string
ZCNT_TOW (see page 8-13)	Retrieves the z-count TOW in seconds

8.5.1 TIME

Description	Retrieves the current time into run when the command is received.
Format	`<timestamp>,TIME`
Where	`timestamp ::= See Timestamp, on page 8-2.`
Returns	Status and time into run in seconds, to nearest ms. Returns zero when in ARMED state.

Example	`-,TIME`
	Returns current time into run now:
	`<msg>`
	`<status> 2 </status>`
	`<data> 15081.961 </data>`
	`</msg>`

8.5.2 TIME_STEP

Description	Retrieves the time into run of the current time step, in 4, 5, 10 or 100 ms steps (depending on simulation iteration rate)
Format	`<timestamp>,TIME_STEP`
Where	`timestamp ::= See Timestamp, on page 8-2.`

Returns	Status and the time step in seconds (floating point number) for example 31.120. Returns zero when in ARMED state
Example	Now, return time into run of current time step: `-,TIME_STEP`

8.5.3 GPS_TIME

Description	Returns the number of seconds from GPS time zero, (6th January 1980)
Format	`<timestamp>,GPS_TIME`
Where	`timestamp ::= See Timestamp, on page 8-2.`
Returns	Status and data (time in integer seconds).
Example	Now, return number of seconds from GPS time zero: `-,GPS_TIME`

8.5.4 UTC_TIME

Description	Returns the current scenario time as an ASCII string.
Format	`<timestamp>,UTC_TIME`
Where	`timestamp ::= See Timestamp, on page 8-2.`
Returns	Status and data (date and time as an ASCII string, format dd-mmm-yyyy hh:mm:ss).

Example	`-,UTC_TIME`
	Now, returns current scenario time:
	`<msg>`
	`<status> 2 </status>`
	`<data> 28-Jan-2018 09:00:03 </data>`
	`</msg>`

8.5.5 STTIME

Description	Retrieves the start time of the current scenario.
Format	`STTIME`
Returns	Status and data (format is <date>Δ<time> see section *START_TIME*, on page 8-12)
Example	`STTIME`

8.5.6 START_TIME

Description	Over-rides current simulation start time, date and duration. You should send this command after an SC command and before running a scenario. The scenario start time must begin on a 6-second boundary. For example, 12:00:06 or 12:00:18 but not 12:00:15.
Format	`START_TIME,<date>Δ<time>[,<duration>][,sat_loc]`
Where	`date ::= <dd>"-"<mmm>"-"<yyyy>`
	`dd ::= (day of the month)`

	mmm	::=	"JAN" | "FEB" | "MAR" | "APR" | "MAY" | "JUN" | "JUL" | "AUG" | "SEP" | "OCT" | "NOV" | "DEC" (month)
	yyyy	::=	year
	time	::=	<hh>":"<mm>":"<ss>
	duration	::=	[<d>Δ]<hh>:<mm>:<ss>(default is 9 days) When you want to change the start time but keep the existing duration, enter 0 for the duration.
	d	::=	0-23 (number of days)
	hh	::=	0-23 (hour)
	mm	::=	0-59 (min)
	ss	::=	0-59 (seconds)
	sat_loc	::=	"0" don't maintain satellite location| "1" maintain satellite location Reference [1] describes sat_loc as maintain satellite locations. Using the sat_loc parameter overwrites the signal sources file for every constellation your scenario uses with the new satellite orbital data.
Returns	Status.		
Example 1	Set the scenario to start on 1st January 2020 at 10:00am, scenario to run for 5 days and 2 hours: START_TIME,01-JAN-2020 10:00:00,5 02:00:00		
Example 2	Set the scenario to start on 12th December 2020 at 1:00pm, scenario to run for 1 hour: START_TIME,12-DEC-2020 13:00:00,01:00:00		
Example 3	Change the scenario start time to start on 12th December 2020 at 1:00pm, keep the existing scenario duration and maintain satellite location: START_TIME,12-DEC-2020 13:00:00,0,1		

8.5.7 GPS_UTC_OFFSET

Description	Retrieves GPS to UTC offset, at a given time into the run, in decimal seconds		
Format	<timestamp>,GPS_UTC_OFFSET		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
Returns	Status and data (offset in decimal, double precision, seconds).		
Example	Now, get GPS to UTC offset: -,GPS_UTC_OFFSET		

8.5.8 ZCNT_TOW

Description	Retrieves the GPS Time Of Week in seconds		
Format	<timestamp>,ZCNT_TOW		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
Returns	Status and data (current GPS TOW in integer seconds).		
Example	Now, get GPS Time Of Week: -,ZCNT_TOW		

8.6 Signal Power commands

Note: From SimGEN version 5.05 onwards, you can specify 'user-friendly' SVID numbers for the GPS constellation in the non-contiguous ranges 1 to 32 and 65 to 95, which allows direct use of extended SVID numbers. To maintain backwards compatibility, you can still specify extended SVID numbers mapped onto SVID 33 onwards, where SVID 33 corresponds to SVID 65.

Table 8-6: Signal power commands

Command	Description
POW_LEV (see page 8-16)	Set the power level by Channel or SVID
POW_ON (see page 8-16)	Set the power on or off by Channel or SVID
REF_DBM (see page 8-17)	Sets the reference label
SAT_POW_OFFSET (see page 8-18)	Offsets the RF Power level of a given SVID

Choosing either Channel or SVID in a remote command achieves the same result - the changes you specify are always applied to a simulator channel. *Table 8-7* on page 8-14 outlines the differences between Channel and SVID.

Table 8-7: Choosing between Channel and SVID

Parameter	Duration of Parameter settings	Outline of SimGEN actions for remote Signal Power commands
Channel	Remainder of scenario (unless changed)	SimGEN automatically applies settings to that Channel. During the scenario, SimGEN can assign any SVID to that Channel.
SVID	While SVID is visible	At the time of command, SimGEN scans all available channels for the SVID. If the SVID is present, SimGEN applies the Channel settings.

8.6.1 Channel settings - rules and example

Channel settings apply for the remainder of the scenario. When SimGEN moves an SVID to a new channel, it always applies the settings of the new channel. SimGEN does not retain SVID settings when you move the SVID between channels.

For example: You set SVID 1 to use the RF Power Level -125 dBm on Channel 5. Later in the scenario, you force SVID 1 onto Channel 9.

SimGEN does not retain the -125 dBm RF Power Level when it moves SVID 1 from Channel 5 to Channel 9. SimGEN will apply the default RF Power Level for Channel 9 (for example, -130 dBm) to SVID 1.
A new SVID appearing on Channel 5 uses the -125 dBm RF Power Level you had set previously.

If you want to assign a specific RF Power Level to a specific SVID, Spirent recommend you use **Constellation-Signal sources file-Signal control-Signal power**, see reference [1].

8.6.2 SVID settings - rules and examples

SimGEN applies SVID settings only while the SVID is visible. SimGEN does not retain non-default SVID settings after the SVID sets.

For example: In a scenario, SimGEN automatically assigns SVID 1 to Channel 10. During the scenario, you set a +20 dB relative RF Power Level on SVID 1. Later in the scenario, SVID 1 sets. Later still, SVID 1 rises again and SimGEN automatically assigns SVID 1 to Channel 3 (as Channel 10 is assigned to another SVID). SVID 1 uses the settings for Channel 3.

Channel 10 retains the Power Level settings from your earlier setting for SVID 1 for the duration of the scenario.

Note: This only applies for POW_LEV. With other commands, when an SVID starts on a new channel, it uses the default Channel settings.

If you want to set the RF Power Level of a specific SVID permanently Off, Spirent recommends you remove that SVID from the constellation by using SimGEN to deselect **Constellation-Signal sources file-Motion-Orbits-Present**, see reference [1].

8.6.3 Run once and move on - rules and examples

SimGEN does not check for the presence of an SVID in a constellation before running a remote command. SimGEN runs each remote command once and moves to the next command. SimGEN produces an **Information** error message in the **System Messages** window when it runs a remote command for an SVID that is not present in a constellation (see reference [1] for details on setting the message types shown in the **System Messages** window).

For example: The default setting for SVID 1 is RF On. During your scenario, a remote command sets SVID 1 to RF Off. However, at the time of this remote command, SVID 1 has yet to appear in the constellation. SimGEN runs the remote command, which cannot be applied to SVID 1. SVID 1 subsequently appears in the constellation with RF On (its default setting).

If you want to ensure an SVID appears in a constellation with particular (non-default) settings, Spirent recommend you determine the time the SVID appears in the constellation and apply remote commands at, or just after, this time.

8.6.4 Shared signal power parameters

Note: From SimGEN version 5.05 onwards, you can specify 'user-friendly' SVID numbers for the GPS constellation in the non-contiguous ranges 1 to 32 and 65 to 95, which allows direct use of extended SVID numbers. To maintain backwards compatibility, you can still specify extended SVID numbers mapped onto SVID 33 onwards, where SVID 33 corresponds to SVID 65.

Each command gives details of its specific parameters and an example of the command. The following parameters are common across all signal power commands:

Shared Signal Power Parameters	`timestamp`	`::=`	See *Timestamp*, on page 8-2.
	`veh_ant`	`::=`	`<vehicle_id>"_"<antenna_id>`
	`vehicle_id`	`::=`	`"v"<v_number>`
	`v_number`	`::=`	`vehicle number starting from 1`
	`antenna_id`	`::=`	`"a"<a_number>`
	`a_number`	`::=`	`antenna number starting from 1`
	`constellation`	`::=`	`"BEIDOU" | "CAPS" | "EGNOS" | "GAGAN" | "GALILEO" | "GLONASS" | "GPS" | "GTXΔGLONASS" | "GTXΔGPS" | "GTXΔBEIDOU" | "GTXΔGALILEO" | | "Interference" | "IRNSS" | "LAAS" | "MSAS" | "Quasi-Zenith" | "SDCM" | "WAAS"` **Notes:** **1)** If you do not specify `signal_type`, it is assumed to be GPS. **2)** The character 'Δ' represents a space in the command that you type.

	id	::=	0-n (Channel number | 1-n (Satellite SVID) | (a list of the ids you want to use. Use a range, or list, inside plain double quotes, ASCII character 0x22(hex) or 34 (decimal), for example: "1-10,12,15" - do not use "smart" quotes) **Notes:** **1)** Spirent recommends you use the list format with channel ids only; although use with SVID ids is allowed. **2)** If you use the list format with SVID ids, the same multi-path ID will apply to all SVID ids in the list.
	multi_index	::=	"0" (incident signal | (number of the multipath starting at 1 - only applies in SVID mode)
	mode	::=	"0" (svid mode, use ID = 1-n) | "1" (channel mode, use ID = 0-n)
	all_flag	::=	"0" (apply to specified channel / SVID) | "1" (apply to all channels / SVIDs)

8.6.5 POW_ON

Description	Turn RF power On or Off at a specified time.
Format	<timestamp>,POW_ON,<veh_ant>,<state>,<signal_type>,<id>,<multi_index>,<mode>,<all_flag>
Where	state ::= "0" (off) | "1" (on)
	See *Shared signal power parameters*, on page 8-15.
Returns	Status.
Example	Now, turn Off channel 0 (shown as 1 in the windows interface), for vehicle 1 antenna 1 -,POW_ON,v1_a1,0,GPS,0,0,1,0 5 s into run, turn On (assumed GPS satellite) SVID 1 for vehicle 2 antenna 1 0 00:00:05,POW_ON,v2_a1,1,1,0,0,0

8.6.6 POW_LEV

Notes:

1) If you send an absolute POW_LEV command you have set the mode to absolute and subsequent MOD commands will have no effect.

2) If you send a relative POW_LEV command you have set the mode to relative. Relative POW_LEV and MOD commands will offset the power level from the originally calculated value.

3) Up to SimGEN 2-80, SimREMOTE would not action this command if specified with an SVID that was not being simulated at <timestamp>, even if <all_flag> was set. From SimGEN 2-81 onwards, if the <all_flag> is set SimREMOTE will action the command whatever the SVID.

Description	Sets the power level by Channel or satellite. <align> is only relevant when you set <all_flag> to 1. *Table 8-8* on page 8-17 details the combinations of <absolute> and <align> when <all_flag>=1
Format	<timestamp>,POW_LEV,<veh_ant>,<level>,<signal_type>,<id>,<multi_index>,<mode>,<all_flag>,<absolute>,<align>,<all_tx_type>

Where	level	::=	power level (dB with respect to the Stanag minimum; or offset in dB, see <absolute>)
	absolute	::=	"0" (relative power) | "1" (absolute power)
	align	::=	"0" (off) | "1" (on)
	all_tx_type	::=	"0" (only for specified Channels/SVID of signal_type) | "1" (for all Channels/SVID of signal_type)
	See *Shared signal power parameters*, on page 8-15.		
Returns	Status: See *Returned response format*, on page 8-4.		
Example	Now, set power level for vehicle 1 antenna 1 on GPS satellite SVID 23 to an absolute level of 10.5 dB `-,POW_LEV,v1_a1,10.5,GPS,23,0,0,0,1,0,0`		

Table 8-8: Combining <absolute> and <align> when <all_flag>=1

<absolute>	<align>	Description
1	1	Sets all Channels to the value specified
1	0	Sets specified Channel/SVID to this absolute value. Offsets levels of all other Channels from their current values by the change in the specified Channel.
0	1	Offsets all the Channels by the specified amount from their levels, as calculated in the unmodified scenario.
0	0	Offsets specified Channel/SVID by the specified amount from its level as calculated in the unmodified scenario. Offsets all other Channels from their current values by the change in the specified Channel.

8.6.7 REF_DBM

Description	By default, power bar graphs and sliders display signal levels with respect to a reference level of -130 dBm. This command changes the label of the reference level to the value specified. **Note:** This does not affect the generated signal level.		
Format	`REF_DBM,<level>`		
Where	level	::=	Value of dBm to 1 decimal place
Returns	Status.		
Example	Set reference level to -150.3 dBm: `REF_DBM,-150.3`		

8.6.8 SAT_POW_OFFSET

Description	Offsets the RF Power level of a specified SVID. The new RF Power level remains with the specified SVID if it moves channels. **Note:** This remote command is only valid for 'genuine' satellite constellations, it is not valid for LAAS or ground transmitters
Format	`<timestamp>,SAT_POW_OFFSET,<signal_type>,<svid>,<offset>`
Where	`offset ::= Power level offset, dB (added to "Global offset" in SimGENs constellation file using the signal power page) offset range: +40.0 to -60.0 dB`
	See *Shared signal power parameters*, on page 8-15.
Returns	Status.
Example	Now, Offset the RF Power level of GPS SVID 22, level -5.5 dB: `-,SAT_POW_OFFSET,GPS,22,-5.5` **Note:** This offset of -5.5 dB remains with SVID 22 on any channel until the end of this scenario, or a new SAT_POW_OFFSET command.

8.7 Signal Control commands

Note: From SimGEN version 5.05 onwards, you can specify 'user-friendly' SVID numbers for the GPS constellation in the non-contiguous ranges 1 to 32 and 65 to 95, which allows direct use of extended SVID numbers. To maintain backwards compatibility, you can still specify extended SVID numbers mapped onto SVID 33 onwards, where SVID 33 corresponds to SVID 65.

Table 8-9: Signal control commands

Command	Description
MOD (see page 8-25)	Use a series of MOD commands, at regular intervals in conjunction with SWITCH_SAT, to define changes in level, code and carrier offset data for an SVID
SWITCH_SAT (see page 8-18)	Defines the state of signals for visible satellites.

Choosing either Channel or SVID in a remote signal control command achieves the same result: SimGEN applies the changes you specify to an SVID. *Table 8-10* on page 8-18 outlines the differences between Channel and SVID.

Table 8-10: Choosing between channel and SVID

Parameter	Duration of Parameter settings	Outline of SimGEN actions for remote Signal Control commands
Channel	While SVID is visible	SimGEN applies the command to the specified Channel only if it is simulating an SVID at that time. Once that original SVID leaves the Channel, SimGEN restores the default Channel conditions.
SVID	While SVID is visible	SimGEN applies the command to the specified SVID only if it is assigned to a signal generator Channel at that time. Once the SVID leaves the Channel, SimGEN restores the default Channel conditions.

8.7.1 SWITCH_SAT

All SWITCH_SAT commands apply whether the satellite is visible at the time of applicability or has yet to rise. For example, you can set a SWITCH_SAT command at the start of the scenario for a satellite yet to rise; when the satellite rises during the scenario, the SWITCH_SAT command takes effect.

Note: Remote command channel numbering starts from 0 (channel numbering in the SimGEN Channel Assignment dialog starts from 1).

SimREMOTE performs SWITCH_SAT commands in advance, on sampling interval boundaries, as part of the periodic satellite selection routine. Set the sampling interval using **[Constellation]-Satellite selection-Sampling interval**, see reference [1]. As the Sampling interval range is 1 to 600 seconds (default = 6 s) you must ensure you send SWITCH_-SAT commands well in advance to ensure SimREMOTE actions the command at the time you want. You must also take into account the significant fraction of a second it takes to start a channel. For example, if you set Sampling interval = 1 second, Spirent recommends you do not send SWITCH_SAT commands to turn ON/OFF a particular satellite at a rate of 1 second.

Certain SWITCH_SAT remote commands are complex. Spirent recommends you first copy the examples given for each command and run them to see their effect. You can then adjust the command parameters as required.

Each command gives details of its specific parameters and an example of the command. The following parameters are common across all SWITCH_SAT commands:

Shared SWITCH_SAT parameters:			
	veh_ant_tn	::=	<vehicle_id>"_"<antenna_id>"_"<tx_net>
	vehicle_id	::=	"v"<v_number>
	v_number	::=	vehicle number starting from 1
	antenna_id	::=	"a"<a_number>
	a_number	::=	antenna number starting from 1
	tx_net	::=	"VT"<tx_num>
	tx_num	::=	"1"(GPS)| "2"(WAAS)| "3"(EGNOS) | "4" (MSAS) | "5"(GLONASS) | "10"(GALILEO) | "11"(GPSΔGTX) | "12" (QZ) | "24" (IRNSS) | "25" (BeiDou) | "26" (CAPS) | "27" (GLONASSΔGTX) | "28" (GAGAN) | "29" (SDCM)
	svid	::=	Satellite svid | a list of the satellite svids you want to use. Use a range, or list, inside plain double quotes, ASCII character 0x22(hex) or 34 (decimal), for example: "1-10,12,15" - do not use "smart" quotes) | "ALL" [| "All" | "all"] (to select all Channels or SVIDs using any combination of upper and/or lower case)

8.7.1.1 SWITCH_SAT: Normal

Description	Returns the SVID to its "normal" state (counteracts other SWITCH_SAT commands). **Note:** The Normal command has no effect at the start of a scenario.
Format	<timestamp>,SWITCH_SAT,<veh_ant_tn>,<svid>,<switch_type>
Where	<switch_type> ::= "0" (Normal)
Return	Status.
Example	At 1.600 seconds into the run, set vehicle 1, antenna 1 GPS SVID18 to Normal 00:00:01.600,SWITCH_SAT,V1_A1_VT1,18,0

8.7.1.2 SWITCH_SAT: Forced

Description	Forces an SVID to use a Channel you specify.		
Format	<timestamp>,SWITCH_SAT,<veh_ant_tn>,<svid>,<switch_type>, <forced_channel>		
Where	switch_type	::=	"1" (Forced)
	forced_channel	::=	channel on which to place <svid>, numbering from 0
Return	Status.		
Example	At start of scenario, Force vehicle 1, antenna 1, GPS SVID 3 onto Channel 3 00:00:00,SWITCH_SAT,V1_A1_VT1,3,1,3		

8.7.1.3 SWITCH_SAT: Banned

Description	Removes an SVID from the scenario.		
Format	<timestamp>,SWITCH_SAT,<veh_ant_tn>,<svid>,<switch_type>		
Where	<switch_type>	::=	"2"
Return	Status.		
Example	At start of scenario, for vehicle 1, antenna 1, Ban GPS SVID 6 00:00:00,SWITCH_SAT,V1_A1_VT1,6,2		

8.7.1.4 SWITCH_SAT: Multipath

Description	Defines multipath signals on a selected SVID and Channel. Use for ground reflection, fixed offset, Doppler offset, vertical plane, reflection pattern, Legendre, polynomial and sinusoidal multipath types.		
Format	<timestamp>,SWITCH_SAT,<veh_ant_tn>,<svid>,<switch_type>, <mpth_type>,<remove_los>,<num_mpths>,<num_data_sets>, <data_sets>		
Where	switch_type	::=	"3"
	mpth_type	::=	"0"(Ground reflection / Line of sight, LOS) |"1"(Fixed offset) |"2"(Doppler offset) |"3"(Vertical plane) |"4"(Reflection pattern) |"5"(Legendre |"6"(Polynomial) |"7"(Sinusoidal)
	remove_los	::=	remove LOS? "0"(no) | "1"(yes)
	num_mpths	::=	number of multipaths or echoes
	num_data_sets	::=	number of <data_sets> = num_mpths+1 LOS always has a <data_set>, even if you remove it.
	data_sets	::=	<data_set>{,,<data_set>,, … ,,<data_set>}

	data_set	::=	"<41>"<echo_no>,<channel>, <attenuation>,<range_offset>, <initial_delay_in_chips>, <doppler_offset>,<initial_phase>, <carrier_phase>,<carrier_doppler>, <reflection_loss>,<leg_A0>,<leg_A1> , <leg_A2>,<leg_A3>,<leg_A4>,<leg_A5> , <leg_D0>,<leg_D1>,<leg_D2>,<leg_D3>, <leg_D4>,<leg_D5>,<duration>,<poly_ A1>,<poly_A2>,<poly_A3>,<poly_A4>, <poly_A5>,<poly_D1>,<poly_D2>,<poly_ D3>,<poly_D4>,<poly_D5>,<sin_attn_p eak>, <sin_attn_freq>,<sin_attn_phase>, <attenuation_bias>,<sin_delay_peak> , <sin_delay_freq>,<sin_delay_phase>, <delay_bias>
	For ease of use, every 10th <data_set> parameter shown above is inverted. **Notes:** **1)** There is no comma after the first parameter in a <data_set>; all other parameters are separated by a single comma. **2)** <data_sets> comprises one or more <data_set> fields. **3)** Two commas separate each <data_set> field. **4)** Terminate <data_sets> with two commas after the last <data_set>.		
Where (continued)	**<data_set> parameters** Each <data_set> consists of 41 parameters common to all types of multipath. You must set non-relevant parameters to zero. Common parameters (used in each mpath_type)		
	<41>	::=	number of parameters in data set.
	echo_no	::=	"0"(incident) |"1"(first mpath) |"2"(second mpathand so on, for all mpaths
	channel	::=	"-1"(not forced) |forced channel number
	Parameters for specific Multipath types. Set non-relevant parameters to zero. **Ground reflection (mpath_type 0)**		
	attenuation	::=	attenuation in dB
	initial_phase	::=	"-1" (not applicable)
	Fixed offset (mpath_type 1)		
	attenuation	::=	attenuation in dB
	range_offset	::=	range offset in metres
	initial_phase	::=	"-1" (not applicable)
	Doppler offset (mpath_type 2)		
	attenuation	::=	attenuation in dB
	initial_delay_in_	::=	initial delay in C/A chips

	doppler_offset	::=	Doppler offset in Hz
	initial_phase	::=	"0"(not random) |"1"(random)
	carrier_phase	::=	carrier phase in radians(only used if initial_phase = 0, otherwise carrier_phase = 1 (random))
	Note: The Doppler offset (in Hz) is applied to L1. The L2 Doppler offset is derived from the L2 pseudorange rate offset, which in SimGEN has been set to be equal to the L1 pseudorange rate offset (in m.s-1).		
	Vertical plane (mpath_type 3)		
	initial_phase	::=	"0"(not random) |"1"(random) |"-1"(not applicable)
	carrier_phase	::=	carrier phase in radians (used if initial_phase = 0)
	carrier_doppler	::=	carrier Doppler in Hz
	reflection_loss	::=	reflection loss in dB
	Note: You must select Scenario-Vehicle-Options-Vertical plane file.		
	Reflection patterns (mpath_type 4)		
	initial_phase	::=	"-1"(not applicable)
	Note: You must select Scenario-Vehicle-Antenna-Options-Enable reflection pattern multipath.		
	Legendre (mpath_type 5)		
	initial_phase	::=	"-1"(not applicable)
	leg_A0-leg_A5	::=	relative amplitude coefficients
	leg_D0-leg_D5	::=	delay coefficients, seconds
	duration	::=	duration of a single period, seconds
	Polynomial (mpath_type 6)		
	initial_phase	::=	"-1"(not applicable)
	duration	::=	duration of a single period, seconds
	poly_A1-poly_A5	::=	amplitude coefficients, dB
	poly_D1-poly_D5	::=	delay coefficients, seconds
	attenuation_bias	::=	coefficient A0, dB
	delay_bias	::=	coefficient D0, seconds
	Sinusoidal (mpath_type 7)		
	initial_phase	::=	"-1"(not applicable)
	sin_attn_peak	::=	attenuation peak, dB
	sin_attn_freq	::=	attenuation frequency, Hz
	sin_attn_phase	::=	attenuation phase, radians
	attenuation_bias	::=	attenuation bias, dB
	sin_delay_peak	::=	delay peak, nano-seconds
	sin_delay_freq	::=	delay frequency, Hz
	sin_delay_phase	::=	delay phase, radians

	`delay_bias ::= delay bias, nano-seconds`
Returns	Status.
Examples	**Note:** Use double commas to separate each <data_set>. For ease of use, every 10th <data_set> parameter in these examples is `inverted`.

Example 1:
Ground reflection
	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is ground reflection (LOS), LOS not removed, 2 multipaths, 3 data sets (LOS + 2 multipaths),
	Details of applicable <data_set> parameters, all other parameters set to 0:
	LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable.
	First multipath: 41 parameters, echo 1, not forced, 5dB attenuation, random phase not applicable.
	Second multipath: 41 parameters, echo 2, forced to channel 3, 6dB attenuation, random phase not applicable.
	`00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,0,0,2,3,`
	`<41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>1,-1,5,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>2,2,6,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`

Example 2:
Fixed offset
	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is fixed offset, LOS not removed, 1 multipath, 2 data sets (LOS + 1 multipath)
	Details of applicable <data_set> parameters, all other parameters set to 0:
	LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable.
	First multipath: 41 parameters, echo 1, not forced, 2.2 dB attenuation, 2.3 m range offset, random phase not applicable.
	`00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,1,0,1,2,`
	`<41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>1,-1,2.2,2.3,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`

Example 3:
Doppler offset
	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is Doppler offset, LOS not removed, 2 multipaths, 3 data sets (LOS + 2 multipaths)
	Details of applicable <data_set> parameters, all other parameters set to 0:
	LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable.
	First multipath: 41 parameters, echo 1, not forced, 3.3dB attenuation, 3.1 C/A chips initial delay, 3.2 Hz Doppler offset, random phase.
	Second multipath: 41 parameters, echo 2, not forced, 3.6dB attenuation, 3.4 C/A chips initial delay, 3.5 Hz Doppler offset, 0.0645772 radians carrier phase.
	`00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,2,0,2,3,`
	`<41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>1,-1,3.3,0,3.1,3.2,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>2,-1,3.6,0,3.4,3.5,0,0.0645772,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`

Example 4: Vertical plane	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is Vertical plane, LOS is removed, 2 multipaths, 3 data sets (LOS + 2 multipaths), Details of applicable <data_set> parameters, all other parameters set to 0: **Note:** Although LOS is removed you must enter data for the 41 LOS parameters (this data can be non-zero). LOS: 41 parameters, echo 0, (not forced), (0 dB attenuation), (random phase not applicable). First multipath: 41 parameters, echo 1, not forced, random phase, 4.2 Hz carrier Doppler, and 4.1dB reflection loss. Second multipath: 41 parameters, echo 2, not forced, 0.0785398 radians carrier phase, 4.4 Hz carrier Doppler, 4.3dB reflection loss 00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,3,1,2,3, <41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,, <41>1,-1,0,0,0,0,1,0,4.2,4.1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,, <41>2,-1,0,0,0,0,0,0.0785398,4.4,4.3,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,
Example 5: Reflection pattern	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is Reflection pattern, LOS not removed, 1 multipaths, 2 data sets (LOS + 1 multipath) Details of applicable <data_set> parameters, all other parameters set to 0: LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable. First multipath: 41 parameters, echo 1, not forced, random phase not applicable 00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,4,0,1,2, <41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,, <41>1,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,
Example 6 Legendre	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is Legendre, LOS not removed, 1 multipaths, 2 data sets (LOS + 1 multipath) Details of applicable <data_set> parameters, all other parameters set to 0: LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable. First multipath: 41 parameters, echo 1, not forced, random phase not applicable, relative amplitude coefficient A0 (6.1) to A5 (6.15), delay coefficient D0 (6.2 s) to D5 (6.25 s), duration 60 s 00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,5,0,1,2, <41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,, <41>1,-1,0,0,0,0,-1,0,0,0,6.1,6.11,6.12,6.13,6.14,6.15,6.2, 6.21,6.22,6.23,6.24,6.25,60,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,,

Example 7:
Polynomial
	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is Polynomial, LOS not removed, 1 multipath, 2 data sets (LOS + 1 multipath)
	Details of applicable <data_set> parameters, all other parameters set to 0:
	LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable.
	First multipath: 41 parameters, echo 1, not forced, random phase not applicable, duration 7.3 s, amplitude coefficient A1 (7.11 dB) to A5 (7.15 dB), delay coefficient D1 (7.21 s) to D5 (7.25 s), attenuation bias 7.1 dB, delay bias 7.2 ns.
	`00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,6,0,1,2,`
	`<41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>1,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,7.3,7.11,`
	`7.12,7.13,7.14,7.15,7.21,7.22,7.23,7.24,7.25,0,0,0,7.1,0,0,0,7`
	`.2,,`

Example 8:
Sinusoidal
	At start of scenario, set Multipath for vehicle 1 antenna 1 on GPS SVID4, multipath type is Sinusoidal, LOS not removed, 1 multipath, 2 data sets (LOS + 1 multipath)
	Details of applicable <data_set> parameters, all other parameters set to 0:
	LOS: 41 parameters, echo 0, not forced, 0 dB attenuation, random phase not applicable.
	First multipath: 41 parameters, echo 1, not forced, random phase not applicable, attenuation peak 8 dB, attenuation frequency 8.1 Hz, attenuation phase 0.143117 radians, attenuation bias 8.3 dB, delay peak 8.4 ns, delay frequency 8.5 Hz, delay phase 0.150098 radians, delay bias 8.7 ns
	`00:00:00,SWITCH_SAT,V1_A1_VT1,4,3,7,0,1,2,`
	`<41>0,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,`
	`<41>1,-1,0,0,0,0,-1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,`
	`0,0,0,0,0,0,0,8,8.1,0.143117,8.3,8.4,8.5,0.150098,8.7,,`

8.7.1.5 SWITCH_SAT: Include

Description	Includes a specific SVID in the scenario.
Format	`<timestamp>,SWITCH_SAT,<veh_ant_tn>,<svid>,<switch_type>`
Where	`<switch_type>     ::=    “4”`
Return	Status.
Example	At start of scenario, set vehicle 1, antenna 1, to Include GPS SVID 17 `00:00:00,SWITCH_SAT,V1_A1_VT1,17,4`

8.7.2 MOD

Notes:

1) If you use a SWITCH_SAT command at t = 0, Spirent recommends you set the timestamp of the first associated MOD command to be later than t = 0.

2) For correct time synchronisation of pseudorange offset data, the MOD commands should be supplied 30 ms in advance. (This must be 400 ms for STR4760 systems when using a simulation iteration rate of 100 ms).
SimGEN accepts remote commands for processing when the current run-time is within 400 ms of the command reference time (timestamp).
MOD commands are buffered. MOD commands read from file will always be available at the time they need to be applied. Commands sent from a remote system (or separate process on the same PC) can be sent with the correct timestamps, but they must be sent early by the required amount if it is necessary to get exact correspondence of the simulated and input profiles with time.
For rapidly varying data, the MOD commands should be supplied at a rate of between 10 and 100 Hz. Where data is available in advance, SimGEN will interpolate as required, and will apply changes in code and carrier pseudorange offset linearly over the simulation iteration rate period.
SimGEN holds changes in code and carrier offsets at the levels defined by the last command it receives until it implements a new MOD command. Where the introduction of a MOD command will exceed the dynamic capability of the signal generator, the signal generator interpolates the offsets linearly over iteration periods as required. In these cir-

cumstances, the bulk logging data reflects the pseudo range to be applied not the actual interpolated values.
If the definition of MOD commands is infrequent or irregular so that there is no future data, the offset values are held at the levels defined by the last command received.
Notice scenarios will run differently (giving effects such as changes in C/No ratio) when you use various combinations of SIR and MOD timestamp intervals

3) When using MOD data from the start of a scenario the first truth values generated for level and pseudorange are not influenced by the MOD data.

4) If you send an absolute POW_LEV command, you have set the mode to absolute and subsequent MOD commands will have no effect.

5) If you send a relative POW_LEV command, you have set the mode to relative. Relative POW_LEV and MOD commands will offset the power level from the originally calculated value

6) *Command file*, on page 4-2, gives an example of correctly assigning remote commands at the beginning of a scenario.

7) The MOD command cannot be used when SE-NAV is running with PosApp.

Spirent designed the MOD command to be used as a series of commands at regular intervals. The MP_SWITCH command must precede the first MOD command.

Description	Use in conjunction with MP_SWITCH to define signal offsets applied to direct or multipath signals. The power range you can apply is (based on the ICD reference level): → Upper limit for all signal generators, except the GSS7000: +20 dB → Upper limit for the GSS7000 signal generator: +15 dB → Lower limit for GSS9000-series (and the superseded GSS8000-series, GSS7xxx and GSS6560) signal generators: -49.8 dB → Lower limit for the GSS7000 signal generator: -40 dB → Lower limit for superseded STR4760 generator: -39.9 dB **Note:** If you set power levels lower than these values, the signal generator LCD shows “Off”. Contact Spirent for information on power accuracy below -20 dBm.

Format	`<timestamp>,MOD,<veh_ant>,<constellation>,<id>,`
	`<multi_index>,<mode>,<all_flag>,<frequency>,<all_freq>,`
	`<sig_level>,<carr_offset>,`
	`<code_offset>[,<azimuth_override>,<elev_override>]`

Where	
	`timestamp ::= See Timestamp, on page 8-2.`
	`veh_ant ::= <vehicle_id>”_”<antenna_id>`
	`vehicle_id ::= “v”<v_number>`
	`v_number ::= vehicle number starting from 1`
	`antenna_id ::= “a”<a_number>`
	`a_number ::= antenna number starting from 1`

	`constellation ::= “BEIDOU” | “CAPS” | “EGNOS” | “GAGAN”`
	`| “GALILEO” | “GLONASS” | “GPS”`
	`| “GTXΔGLONASS” | “GTXΔGPS”`
	`| “GTXΔBEIDOU” | “GTXΔGALILEO” |`
	`| “Interference” | “IRNSS” | “LAAS”`
	`| “MSAS” | “Quasi-Zenith” | “SDCM”`
	`| “WAAS”`

	Note: The character ‘Δ’ represents a space in the command that you type.
	`id ::= 0-n (Channel number)` `| 1-n (Satellite SVID)`

	multi_index	::=	"0" (incident signal) | (number of the multipath starting at 1 - this only applies in SVID mode) | -1 (offsets should be applied to all NLOS for a specific LOS)
	mode	::=	"0" (svid mode, use ID = 1-n) | "1" (channel mode, use ID = 0-n)
	all_flag	::=	"0" (apply to specified channel / SVID) | "1" (apply to all channels / SVIDs)
	frequency	::=	BEIDOU "0" (B1I) | "1" (B2I) | "2" (B1C) | "3" (B2a) | "4" (B3I) CAPS "0" (C1) | "1" (C2) | "2" (C3) EGNOS "0" (L1) | "2" (L5) GAGAN "0" (L1) | "2" (L5) GALILEO "0" (E1) | "1" (E6) | "2" (E5) GLONASS "0" (L1) | "1" (L2) GPS "0" (L1) | "1" (L2) | "2" (L5) GTXΔGLONASS "0" (L1) | "1" (L2) GTXΔGPS "0" (L1) | "1" (L2) | "2" (L5) GTXΔGALILEO "0" (E1) | "1" (E6) | "2" (E5) GTXΔBEIDOU "0" (B1i) | "1" (B2i) IRNSS "0" (S-band) | "2" (L5) MSAS "0" (L1) | "2" (L5) Quasi-Zenith "0" (L1) | "1" (L2) | "2" (L5) | "3" (L6) SDCM "0" (L1) WAAS "0" (L1) | "2" (L5)
	Note: The character 'Δ' represents a space in the command that you type.		
	all_freq	::=	"0" (single frequency) | "1" (all frequencies)
	sig_level	::=	signal level offset, dB, decimal value positive value gives increase in level

	carr_offset	::=	carrier offset, m, (decimal number) Typical ranges: GSS9000: ±3 000 m GSS8000: ±3 000 m GSS6700: ±1 000 m (positive value increases prange)
	code_offset	::=	code offset, m, (decimal number) Typical ranges as on carr_offset
	Note: The combination of your signal generator and the vehicle motion determines the ranges of the parameters carr_offset and code_offset. Contact Spirent Global Services if you need to use ranges outside the typical ranges shown.		
	azimuth_override	::=	multipath azimuth override, radians, decimal number Spirent recommend using values in the range ±2π
	elev_override	::=	multipath elevation override, radians, decimal number Spirent recommend using values in the range ±0.5π
	Note: The optional parameters azimuth_override and elev_override let you specify the default azimuth and elevation angle of arrival for any multipath signal, except for ground reflection and land mobile multipaths, which are calculated automatically. They set the signal arrival angles at the vehicle before other calculations are applied. If you do not use these optional parameters, SimGEN calculates default angles. These optional parameters are never applied to LOS signals. The azimuth and elevation overrides cannot be used when you set multi_index = -1.		
Returns	Status.		
Example 1	Apply 3.2 dB increase in level, 10.7 m increase in carrier prange and a 10.65 m increase in code prange for SVID 14, on all frequencies: `0 00:00:00.00,MOD,v1_a1,gps,14,0,0,0,0,1,3.2,10.7,10.65`		

Example 2	MOD and MP_SWITCH command
	Analysis of the logged data from the pre-run shows SVID 3 present on Channel 1 and you want to add a multipath copy of that signal at 6 seconds into the run, on Channel 10, for 6 seconds.
	Simulated satellite set calculation rate is set to 6 s.
	Simulation iteration rate is set to 10 ms.
	Only L1 commands are shown. The command file would look like this:
	`00:00:03,MP_SWITCH,v1_a1,GPS,3,1,1,9`
	Note: MP on, must be sent early.
	`00:00:06.00,MOD,v1_a1,GPS,3,9,1,1,0,0,3.0,10.6,10.7`
	`00:00:06.01,MOD,……..`
	`00:00:06.02,MOD,……..`
	…
	`00:00:08.99,MOD,…..`
	`00:00:09.00,MP_SWITCH,v1_a1,GPS,3,0,1`
	Note: MP off, must be sent early.
	`00:00:09:00,MOD,……..`
	`00:00:09:01,MOD,……`
	…
	`00:00:11.99,MOD,……`
	Insert additional multipath commands for this or other satellites in the same time-ordered sequence.

Example 3	At zero seconds into scenario, for vehicle 1 antenna 1 using Galileo SVID 27 on all frequencies, apply 3.2 dB increase in level, 0.7 m increase in carrier prange, 0.6 m increase in code prange, for multipath signals use 0.1 radians absolute azimuth override and -0.2 radians absolute elevation override 0 00:00:00.00,MOD,v1_a1,galileo,27,1,0,0,0,1,3.2,0.7, 0.6,0.1,-0.2
Example 4	At zero seconds into scenario, for vehicle 1 antenna 1 using Quasi-Zenith SVID 1 on all frequencies, apply 3.2 dB increase in level, 10.7 m carrier offset, 10.65 m code offset. `00:00:00,MOD,v1_a1,Quasi-Zenith,1,0,0,0,3,0,3.2,10.7,10.65`

8.8 Hardware and calibration commands

Note: Some of these commands are for Spirent use only.

Table 8-11: Hardware and calibration commands

Command	Description
CAL (see page 8-30)	Turns on calibration mode.
CAL_LEVL (see page 8-30)	Adjusts the output level at the front panel.
FW_CMD (see page 8-31)	Use to pass commands to firmware.
RFOF (see page 8-29)	Returns the serial number and rear connector offset setting.

8.8.1 RFOF

Notes:

1) Not for use with GSS7000 or GSS9000-series signal generators, as the Automatic Calibration Utility reads and records the offsets.

2) You must use USB String Send, see reference [1], to send this command as a query to a GSS6300 / GSS6700 signal generator.

Description	This command returns the difference in signal level at the front panel and rear panel RF connectors, with the query response time in seconds. This command is only for use with GSS8000-series, GSS77xx, GSS6700 and GSS6300 signal generators. With GSS8000-series and GSS7xxx signal generators, this command gives a return of up to four values, one for each signal type in use. With GSS6700 and GSS6300 signal generators, you must provide the constellation type and frequency.
Format	`RFOFΔ[<constellation><frequency>]Δ?`
Where	`<constellation> ::= "BD2" | "GPS" | "GLO" | "GAL"`
	Note: If you omit <constellation> the command returns data for the GPS constellation.
	`<frequency> (use with GSS6300 and GSS6700 only) ::= "L1" | "E1" | "B1"`
Returns	Status. Data (the signal level difference in dB and the query response time in seconds)

Example 1	`RFOF ?`
	Returns signal level difference for the GPS Constellation:
	`<msg>`
	`<status> 2 <\status>`
	`<data>58.12 0.00162<\data>`
	<\msg>

Example 2	`RFOF GALE1 ?`
	Returns signal level difference for the Galileo constellation, frequency E1:
	`<msg>`
	`<status> 2 <\status>`
	`<data>58.25 0.00162<\data>`
	`<\msg>`

8.8.2 CAL

Note: Not for use with GSS9000-series signal generators.

Description	Sets GSS8000-series and GSS77xx signal generators into power-level calibration mode. **Note:** Only use in "Ready-to-run" mode.
Format	`CAL,<state>`
Where	`state ::= "ON"|"OFF"`
Returns	Status.
Examples	`CAL,ON` `CAL,OFF`

8.8.3 CAL_LEVL

Note: Not for use with GSS9000-series signal generators.

Description	Set the level at the front panel connector to the value you specify - for GSS8000-series and GSS77xx signal generators only. **Note**: Only valid after CAL,ON
Format	`CAL_LEVL,<level>`
Where	`Level ::= level in dB x 10 with respect to the nominal GPS power level. For example, 11.5 dB is a level of 115.`
Returns	Status.
Example	Set the output level to -15 dB with respect to the nominal GPS level: `CAL_LEVL,-150`

8.8.4 FW_CMD

Notes:

1) Do not use this command while a scenario is running.

2) This command only applies to GSS9000-series, GSS8000-series and GSS7000-series and GSS7xxx signal generators.

Description	Use to forward a command to the embedded software on a signal generator.
Format	`FW_CMD<address>,<response>,<command>`
Where	`address ::= IEEE hardware address | IP address | "0" (for all units defined in the hardware configuration)`
	`response ::= "0" (no response from command expected) | "1" (response from command expected)`
	`command ::= the command to send`
Returns	`Either Status alone, or Status and data (when a response is expected).`
Example	To send the *IDN? command to a signal generator with IP address 192.168.5.100, with expected response from the signal generator: `FW_CMD,192.168.5.100,1,*IDN?`

8.9 Data request commands

These commands return the requested simulation data item or items for the time requested. All data items that are available to quick-look and post-processing are available with these commands. The command syntax is identical to that logged in the **.qll* file created when a set of logged data items are specified. See the SimGEN Software User Manual, reference [1]. As with logging data from within SimGEN, data requests are on a Vehicle, Antenna, Signal or transmitter basis.

8.9.1 Vehicle data request commands

Table 8-12: Vehicle data request commands

Command	Returns
VEH_HEIGHT	The height of the vehicle (GPS Ellipsoid)
VEH_LAT	The latitude of the vehicle
VEH_LONG	The longitude of the vehicle
VEH_SPEED	The speed of the vehicle

All the Vehicle data request commands share the same command format.

Description	Generic Vehicle data request command
Format	<timestamp>,<command>,<vehicle_id>
Where	timestamp ::= See *Timestamp*, on page 8-2.
	command ::= See *Table 8-12* on page 8-31.
	vehicle_id ::= "v"<v_number>
	v_number ::= vehicle number starting from 1
Returns	Status and data.
Example 1	Now, return the Vehicle latitude for vehicle 1: -,VEH_LAT,v1

8.9.2 Signal Data Requests

Notes:

1) You can specify 'user-friendly' SVID numbers for the GPS constellation in the non-contiguous ranges 1 to 32 and 65 to 95, which allows direct use of extended SVID numbers. To maintain backwards compatibility, you can still specify extended SVID numbers mapped onto SVID 33 onwards, where SVID 33 corresponds to SVID 65.

2) You can enter the freq parameter using upper, lower or mixed case. For example, you may use 'BEIDOU_B1I', 'BeiDou_B1I' or 'beidou_b1i'.

Table 8-13: Signal data request commands

Command	Description
SIG_ALL	Returns all
SIG_AZIM	Returns the azimuth of the signal
SIG_ELEV	Returns the elevation of the signal
SIG_IONO_DELAY	Returns the ionosphere delay of the signal
SIG_LEVEL	Returns the signal level
SIG_PR_RATE	Returns the pseudorange rate of the signal
SIG_PRANGE	Returns the pseudo range of the signal (at time T the distance between the antenna and the satellite at time T-1)
SIG_TROPO_DELAY	Returns the troposphere delay of the signal
SIG_TXID	Returns the SVID of the signal's transmitter

All the signal data request commands share the same command format:

Description	Generic signal data request command.
Format	<timestamp>,<command>,<veh_ant>,<frequency>,<id>, <mode>,<multi_index>,
Where	timestamp ::= See *Timestamp*, on page 8-2.
	command ::= See *Table 8-13* on page 8-32.
	veh_ant ::= <vehicle_id>"_"<antenna_id>
	vehicle_id ::= "v"<v_number>
	v_number ::= vehicle number starting from 1
	antenna_id ::= "a"<a_number>
	a_number ::= antenna number starting from 1

	frequency	::=	"BeiDou_B1I" | BeiDou_B2I" | "BeiDou_B3I" | "BeiDou_B2a" | "BeiDou_B1C" | "CAPS_C1" | "CAPS_C2" | "CAPS_C3" | "EGNOS_L1" | "EGNOS_L5" | "GAGAN_L1" | "GAGAN_L5" | "GALILEO_L1" | "GALILEO_E5" | "GALILEO_E6" | "GLONASS_L1" | "GLONASS_L2" | "GPS_L1" | "GPS_L2" | "GPS_L5" | "GTx_L1" | "GTx_L2" | "GTx_L5" | "GTx_GLN_L1" | "GTx_GLN_L2" | "GTx_BEIDOU_B1i" | "GTx_BEIDOU_B2i" | "GTx_BEIDOU_B2a" | "GTx_BEIDOU_B1c" | "GTx_BEIDOU_B3i" | "GTx_GALILEO_E1" | "GTx_GALILEO_E5" | "GTx_GALILEO_E6" | "Interference_F1" | "IRNSS_S" | "IRNSS_L5" | "LAAS_VDB" | "MSAS_L1" | "MSAS_L5"" | "QZ_L1" | "QZ_L2" | "QZ_L5" | "QZ_L6" | "SBAS_L1" | "SBAS_L5" | "WAAS_L1" | "WAAS_L5" | "SDCM_L1
	id	::=	0-n (Channel number) | 1-n (Satellite SVID)
	mode	::=	"0" (svid mode, use ID = 1-n) | "1" (channel mode, use ID = 0-n)
	multi_index	::=	"0" (incident signal) | (number of the multipath starting at 1 - only applies in SVID mode)
Returns	Status: See *Returned response format*, on page 8-4. Status and data. For SIG_ALL the data returned is: → channel id, → transmitter constellation type, → multipath index, → elevation, azimuth, → x,y,z, → tropo delay, iono delay, → pseudorange, pseudorange rate, range, → signal level → pseudorange error → range rate → pseudorange error rate → doppler shift → delta range For SIG_TXID the data returned is set to –1 if the channel or SVID is unallocated.		

Example 1	Now, return the signal level (for example, -3 dB with respect to the reference level) for BeiDou B1I from SVID 2:
	`-,SIG_LEVEL,V1_A1,BeiDou B1I,2,0`
	`<msg>`
	`  <status> -3 </status>`
	`</msg>`

Example 2	Now, return all signal data for vehicle 1, antenna 1, on GPS, channel 0, channel mode, for the incident signal on frequency L1:
	`-,SIG_ALL,v1_a1,GPS_L1,1,0,0`
	`<msg>`
	`<status> 2 </status>`
	`<data>`
	`2,`
	`GPS,`
	`0,`
	`1.2815473555,2.2459775814,`
	`26002688.603,4558799.473,-3650332.704,`
	`2.576,2.585,`
	`20508577.069,231.660,20475121.663,`
	`12.00,`
	`1291.667,`
	`148.327,`
	`83.333,`
	`-1217.353,`
	`231.604`
	`</data>`
	`</msg>`

8.9.3 Transmitter data requests

Notes:

1) From SimGEN version 5.05 onwards, you can specify 'user-friendly' SVID numbers for the GPS constellation in the non-contiguous ranges 1 to 32 and 65 to 95, which allows direct use of extended SVID numbers. To maintain backwards compatibility, you can still specify extended SVID numbers mapped onto SVID 33 onwards, where SVID 33 corresponds to SVID 65.

2) You can enter the constellation parameter using upper, lower or mixed case. For example, you may use 'tn_BEIDOU', 'tn_beidou' or 'tn_BeiDou'.

Table 8-14: Transmitter data request commands

Command	Description
TX_SVID	Returns the SVID of the transmitter

All the transmitter data request commands share the same command format:

Description	Generic transmitter data request command
Format	`<timestamp>,<command>,<constellation>,<svid>`
Where	`timestamp ::= See Timestamp, on page 8-2.`
	`Command ::= See Table 8-14 on page 8-34.`

	constellation ::= 'tn_' must precede the constellation name: "tn_BEIDOU" | "tn_CAPS" | "tn_EGNOS" | "tn_GAGAN" | "tn_GALILEO" | "tn_GLONASS" | "tn_GPS" | | "tn_GTXΔGLONASS" | "tn_GTXΔGPS" | "tn_Interference" | "tn_IRNSS" | "tn_LAAS" | "tn_MSAS" | "tn_Quasi-Zenith" | "tn_SDCM" | "tn_WAAS"
	Note: The character 'Δ' represents a space in the command that you type, see *Table 8-2* on page 8-1.
	svid ::= satellite svid
Returns	Status and data.
Example 1	Now, return the transmitter SVID: -,TX_SVID,tn_GPS,34 <msg> <status> 2 </status> <data> 66 </data> </msg>

8.10 Navigation commands

Note: From SimGEN version 5.05 onwards, you can specify 'user-friendly' SVID numbers for the GPS constellation in the non-contiguous ranges 1 to 32 and 65 to 95, which allows direct use of extended SVID numbers. To maintain backwards compatibility, you can still specify extended SVID numbers mapped onto SVID 33 onwards, where SVID 33 corresponds to SVID 65.

Table 8-15: Navigation commands

Command	Description
BEIDOU_B1CNAV_DATA_ERR and BEIDOU_B2ANAV_DATA_ERR (see page 8-51)	Apply BeiDou B1C and B2a navigation data errors
BEIDOU_B1CNAV_DATA_MOD (see page 8-48)	Apply BeiDou B1C navigation data modifications
BEIDOU_B2ANAV_DATA_MOD (see page 8-49)	Apply BeiDou B2a navigation data modifications
BEIDOU_D1_NAV_DATA_ERR and BEIDOU_NAV_DATA_ERR (see page 8-53)	Apply BeiDou D1 and D2 navigation data errors
BEIDOU_ D1_NAV_DATA_MOD and BEIDOU_D2_NAV_DATA_MOD (see page 8-50)	Apply BeiDou D1 and D2 navigation data modifications
GAL_DATA_ERR (see page 8-41)	Apply Galileo navigation data errors
GLONASS_NAV_DATA_ERR (see page 8-42)	Apply GLONASS navigation data errors
GPS_NAV_DATA_ERR (see page 8-37)	Apply GPS 'L1 Legacy' navigation data errors
IRNSS_NAV_DATA_ERR (see page 8-45)	Apply IRNSS navigation data errors
IRNSS_NAV_DATA_MOD (see page 8-43)	Apply IRNSS navigation data modification
QZ_L1S_NAV_DATA_ERR (see page 8-56)	Apply Quasi-Zenith L1S navigation data errors

Table 8-15: Navigation commands (continued)

Command	Description
QZ_L1S_NAV_DATA_MOD (see page 8-56)	Apply Quasi-Zenith L1S navigation data modifications
QZ_L1CA_NAV_DATA_ERR (see page 8-54)	Apply Quasi-Zenith L1C/A navigation data errors
QZ_L1CA_NAV_DATA_MOD (see page 8-55)	Apply Quasi-Zenith L1CA navigation data modifications
QZ_L6D_NAV_DATA_ERR and QZ_L6E_NAV_DATA_ERR (see page 8-55)	Apply Quasi-Zenith L1C/A navigation data modifications
QZ_L6D_NAV_DATA_MOD and QZ_L6E_NAV_DATA_MOD (see page 8-57)	Apply Quasi-Zenith L6D (or L6E) navigation data modifications
SBAS_DATA_ERR (see page 8-38)	Apply SBAS navigation data errors

If you want to use a command start time of zero, first arm the scenario and then send the command with a timestamp of "-" (perform now) and set the start time to zero. Then send the RUN command to run the scenario.

8.10.1 SVID rule

SimTEST applies SVID settings only while the SVID is visible. SimTEST does not retain non-default SVID settings after the SVID sets.

8.10.2 SET_NAV

Enable navigation data messages.

Comment	You must send this command before running the scenario		
Description	Sets the navigation data for each constellation		
Format	`<timestamp>,SET_NAV,<time>,<frequency>,<channel>, <all_channels>,<state>`		
Where	`timestamp`	::=	`You must always set the time of application of this command to "-" or 0Δ00:00:00. See Timestamp, on page 8-2.`
	`frequency`	::=	`"BEIDOU_B1" | "GALILEO_L1" | "GLONASS_L1" | "GPS_L1" | "IRNSS_L5" | "SBAS_L1" | "QZ_L1"`
	`channel`	::=	`(channel number)`
	`all_channels`	::=	`"0" (apply to specified channel) | "1" (apply to all channels)`
	`state`	::=	`"0" (navigation data off) | "1" (navigation data on)`
Returns	Status		
Example	Now, disable the Galileo navigation data message on all channels: `-,SET_NAV,GALILEO_L1,0,1,0`		

8.10.3 GPS_NAV_DATA_ERR

Description	Remote input and insertion into action queue of GPS 'L1 Legacy' navigation data errors (see reference [1]) already scheduled in current scenario
Format	`<timestamp>,GPS_NAV_DATA_ERR,<constellation>,<svid>, <start_time>,<end_time>,<word-1>,<subframe-1>, <all_svs>,<all_words>,<word3_10>,<all_subframes>,<error_type>`
Where	`timestamp ::= See Timestamp, on page 8-2.`
	`constellation ::= "tn_GPS"`
	`svid ::= "1-63"`
	`start_time ::= time at which error is applied, milliseconds into scenario`
	`end_time ::= time at which error is completed, milliseconds into scenario`
	`word-1 ::= required word minus 1`
	`subframe-1 ::= required subframe minus 1`
	`all_svs ::= "0" (apply to specified svid) | "1" (apply to all svids)`
	`all_words ::= "0" (apply to specified word) | "1" (apply to all words)`
	`word3_10 ::=` "3-10"(word 3 to 10, as required)
	`all_subframes ::= "0" (apply to specified sub-frame) | "1" (apply to all sub-frames)`
	`error_type ::= "No corruption" | "set one bit" | "set two bits" | "set three bits" | "set all zero" | "set word alternate 0 and 1" | "diverge IODC and IODE"`
Returns	Status.
Example	At the start of the scenario, set GPS Legacy navigation data errors on SVID 1. Errors start at 2,400 ms and end at 3,000 ms; word-1 is 3 (word 4 required), subframe-1 is 2 (subframe 3 required), all_svs is false, all_words is false, word3_10 is set to word 4, all_subframes is false, the error type is "set all zero": `00:00:00,GPS_NAV_DATA_ERR,tn_GPS,1,2400,3000,3,2,0,0,4,0,set all zero`

8.10.4 GPS_L2CNAV_DATA_ERR and GPS_L5NAV_DATA_ERR

Description	Remote input and insertion into action queue of GPS L2C or L5 navigation data errors already scheduled in current scenario. These errors are added after parity correction, so parity will be corrupted.
Format	`<timestamp>,GPS_LxyNAV_DATA_ERR,TN_GPS,<svid>, <start_time>,<end_time>,<msg_num>,<all_svs>,<all_msgs>,<fec>, <first_bit_to_flip>,<num_bits_to_flip>`
Where	`timestamp ::= See Timestamp, on page 8-2. Must be before start_time.` `Can be sent before starting the scenario.`

	GPS_LxyNAV_DATA_ERR	::=	"GPS_L2CNAV_DATA_ERR" | "GPS_L5NAV_DATA_ERR"
	svid	::=	"1-32" and "65-95" (satellite svid)
	start_time	::=	time at which error is applied, milliseconds into scenario
	end_time	::=	time at which error is completed, milliseconds into scenario
	msg_num	::=	*Figure 8-1* on page 8-38, shows message_numbers.
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	all_msgs	:;=	"0" (apply specified msg_num) | "1" (apply all messages)
	fec	::=	"0" (apply error after FEC) | "1" (apply error before FEC)
	first_bit_to_flip	::=	The first bit to flip (invert)
	num_bits_to_flip	::=	The number of bits to flip (invert)
Returns	Status.		
Example	At start of scenario, set GPS L2C Navigation data error on SVID 2. Begin at start of scenario, finish 60 minutes into scenario. Use message number 1 (UTC and IONO), apply specified message to specified SVID. First bit to flip = 12, number of bits to flip = 133 00:00:00,GPS_L2CNAV_DATA_ERR,tn_GPS,2,0,3600000,1,0,0,0,12, 133		

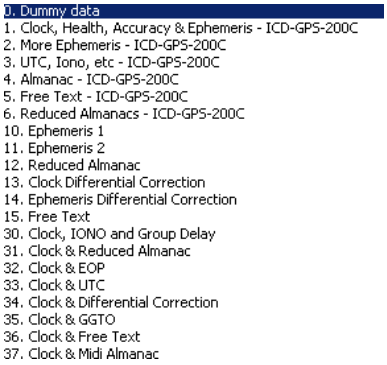


Figure 8-1: GPS L2C and L5 navigation data error message types

8.10.5 SBAS_DATA_ERR

Notes:

1) As SimGEN applies the same navigation data to both SBAS L1 and L5, it will apply the same navigation data error to both SBAS L1 and L5.

2) Quazi Zenith L1 SAIF navigation data errors are similar to SBAS navigation data errors (as opposed to Quasi-Zenith L1 "legacy", L1 CNAV, L2 CNAV and L5NAV).

Description	Remote input and insertion into action queue of SBAS navigation data errors already scheduled in current scenario		
Format	<timestamp>,SBAS_DATA_ERR,<signal_type>,<svid>,<all_svs>,<message_type>,<seq_num>,<start_time>,<end_time>,<before_FEC>,<first_bit_to_flip>,<num_bits_to_flip>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	signal_type	::=	"TN_EGNOS" | "TN_GAGAN" | "TN_WAAS" | "TN_MSAS" | "TN_SDCM"
	svid	::=	"1-5" (satellite svid)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	message_type	::=	*Figure 8-2* on page 8-40, shows the SBAS message_types. *Figure 8-3* on page 8-40, shows the Quasi-Zenith message_types.
	seq_num	::=	n (Use to modify message 'n' in a sequence of >n identical message_types sent by SimGEN) | "1" (Use where seq_num is not applicable for message_type)
	start_time	::=	time at which error is applied, milliseconds into scenario
	end_time	::=	time at which error is completed, milliseconds into scenario
	before_FEC	::=	"0" (apply error after FEC) | "1" (apply error before FEC)
	first_bit_to_flip	::=	If before_FEC = "0": This is the first symbol of the 500 broadcast symbols to flip If before_FEC = "1": This is the first bit of the 250-bit message to flip
	num_bits_to_flip	::=	If before_FEC = "0": This is the number of symbols to flip If before_FEC = "1": This is the number of bits to flip
Returns	Status.		
Example	At start of scenario, set EGNOS navigation data errors on SVID 1. Message type 1 (PRN mask assignments) with sequence number 3. Errors end 61 minutes into scenario. Errors applied after FEC (to symbols), with first symbol to flip = 1 and number of symbols to flip = 10 00:00:00,SBAS_DATA_ERR,TN_EGNOS,1,0,1,3,0,3660000,1,1,10		

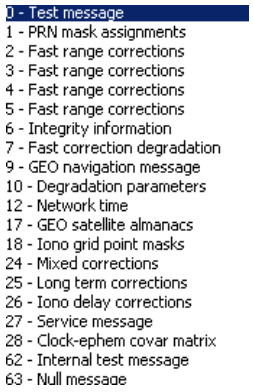


Figure 8-2: SBAS navigation data error - message types

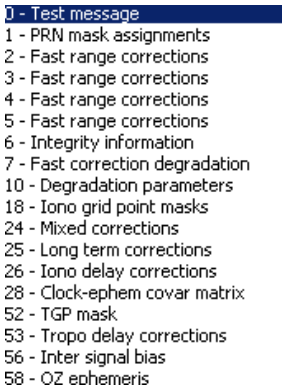


Figure 8-3: Quasi-Zenith navigation data error - message types

8.10.6 GPS_L2CNAV_DATA_MOD

Description	Remote input and insertion into action queue of GPS navigation data modifications already scheduled in current scenario		
Format	<timestamp>,GPS_L2CNAV_DATA_MOD,TN_GPS,<svid>,<start_time>, <end_time>,<message_type>,<all_svids>,<all_msgs>,<data_mods>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-32" amd "65-95" (satellite svid)
	start_time	::=	time at which modification is applied, milliseconds into scenario
	end_time	::=	time at which modification is completed, milliseconds into scenario
	message_type	::=	*Figure 8-4* on page 8-41, shows the message types.
	all_svids	::=	"0" (specified svid) | "1" (all svids)
	all_msgs	::=	"0" (use specified message type) | "1" (use all message types)
	data_mods	::=	modify each bit using: "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)

Returns	Status.

Example	At start of scenario, set GPS L2CNAV data modification on SVID 2 to begin at the start of the scenario and end 60 minutes into the scenario. Modify message type 6, leave bit 1 as is, bit 2 set to 0, bit 3 set to 1, bit 4 invert:
	`00:00:00,GPS_L2CNAV_DATA_MOD,TN_GPS,2,0,3600000,6,0,0,`
	`-01X---- -------- -------- -------- -------- -------- --------`
	`-------- -------- -------- -------- --------`
	`-------- -------- -------- -------- -------- -------- --------`
	`-------- -------- -------- -------- --------`
	`-------- -------- -------- -------- -------- -------- --------`
	`-------- -------- -------- ----`

Figure 8-4: GPS L2C navigation data modification - message types

8.10.7 GAL_DATA_ERR

Description	Apply Galileo navigation data errors		

Format	`<timestamp>,GAL_DATA_ERR,TN_GALILEO,<nav_dat_stream>,`
	`<svid>,<all_svs>,<frame>,<all_frames>,<subframe>,`
	`<all_subframes>,<page_time>,<all_pages>,<start_time>,`
	`<end_time>,<before_FEC>,<first_bit_to_flip>,`
	`<num_bits_to_flip>`		

Where	`timestamp`	`::=`	See *Timestamp*, on page 8-2. You must always set the time of application of this command to "-" or 0Δ00:00:00
	`nav_data_stream`	`::=`	"I/NAV E1-B"
	`svid`	`::=`	"1-36" (satellite svid)
	`all_svs`	`::=`	"0" (apply to specified svid) | "1" (apply to all svids)
	`frame`	`::=`	Always "1"
	`all_frames`	`::=`	Always "1"
	`subframe`	`::=`	"1-24" (subframe to be modified)
	`all_subframes`	`::=`	"0" (apply to specified subframe) | "1" (apply to all subframes)
	`page_times`	`::=`	"0-29" (Time into subframe of the start time of this page, seconds)
	`all_pages`	`::=`	"0" (apply to specified page) | "1" (apply to all pages)

	start_time	::=	Time to apply the modifications to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the modifications (milliseconds into run)
	before_FEC	::=	"0" (apply error after FEC)
	first_bit_to_flip	::=	"1-250" (The first symbol in the sequence to flip)
	num_bits_to_flip	::=	"0-200" (The number of symbols to flip)
Returns	Status.		
Example	At start of scenario, modify I/NAV data on E1-B for all satellites, all frames and all subframes. Time into page is zero seconds, apply to all pages. Errors begin at start of scenario and end at 29 days into scenario. Apply errors after FEC. First symbol to flip is 111, flip 25 symbols `00:00:00,GAL_DATA_ERR,TN_GALILEO,I/NAV E1-B,5,1,1,0,1,1,0,1,0,2505600000,0,111,25`		

8.10.8 GLONASS_NAV_DATA_ERR

Description	Remote input and insertion into action queue of Galileo navigation data errors already scheduled in current scenario.		
Format	`<timestamp>,GLONASS_NAV_DATA_ERR,TN_GLONASS,<svid>,<start_time>,<end_time>,<frame>,<string>,<all_svs>,<all_frames>,<all_strings>,<first_bit_to_flip>,<num_bits_to_flip>`		
Where	timestamp	::=	See *Timestamp*, on page 8-2. You must always set the time of application of this command to "-" or 0Δ00:00:00
	svid	::=	"1-24" (Satellite svid)
	start_time	::=	Time at which error is applied, milliseconds into scenario
	end_time	::=	Time at which error is completed, milliseconds into scenario
	frame	::=	"1-5" (The data frame in which you want the bit errors to take effect)
	string	::=	"1-15" (The number of the data string in which you want the bit errors to take effect)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	all_frames	::=	"0" (apply to specified word) | "1" (apply to all words)
	all_strings	::=	"0" (apply to specified string) | "1" (apply to all strings)
	first_bit_to_flip	::=	"1-200" (The first bit in the sequence to flip)

	num_bits_to_flip	::=	"0-200" (The number of bits to flip)
Returns	Status.		
Example	At start of scenario, set GLONASS navigation data errors. Errors begin at start of scenario and end at 29 days into scenario. Apply errors to all SVIDs, all words, all frames and all strings. First bit to flip is 25, flip 55 bits: `00:00:00,GLONASS_NAV_DATA_ERR,TN_GLONASS,2,0,2505600000,3,4,1,1,1,25,55`		

8.10.9 IRNSS_NAV_DATA_MOD

These commands let you modify both the S-band and L5-band broadcast navigation data streams modulated onto the RF signal, while maintaining parity.

Although the timestamp specifies the time SimGEN actions this command, SimGEN calculates and downloads navigation data to the signal generator in advance. This means the timestamp (and the time SimGEN sends the message) must be at least six seconds before the modification start time you specify in the command. Also, notice SimGEN applies the modifications to the next specified frame/subframe/page occurring after the start_time.

You must ensure your start_time and end_time are compatible with the timing of the frame/subframe/page you want to modify. Be aware these times are times-into-run (so t = 0 is the start of run) and the simulation start time-of-week determines the navigation data sequence start. To simplify matters, the example scenario start time has been set to the start of a week, that is, the start TOW (time-of-week) is set to zero.

You must correctly identify the frame/subframe/sequence/bits if you attempt to modify a specific data value in the message and correctly scale and format the data according to the IRNSS ICD detailed in reference [12]. In accordance with this ICD, Spirent numbers bits in the message starting at bit 1, not bit 0.

8.10.9.1 S-band and L5 Navigation Data Modification (subframes 1 and 2)

Description	Modify both S-band and L5 broadcast navigation data stream (subframes 1 and 2)		
Format	<timestamp>,IRNSS_SL5NAV_DATA_SF12_MOD,TN_IRNSS,<svid>, <all_svs>,<subframe>,<all_subframes>,<start_time>, <end_time>, <bit_modifiers>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-16" (satellite svid)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	subframe	::=	"1" | "2" (subframe to be modified)
	all_subframes		"0" (apply to specified subframe) | "1" (apply to all subframes)
	start_time	::=	Time to apply the modifications to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the modifications (milliseconds from start of run)
	bit_modifiers	::=	Characters to specify each of the 214 bits of a message body. Spirent uses 8-bit sections separated by spaces. "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)

Returns	Status.

Example	Modify S-L5 navigation data for svid 4. Set Subframe 2, from 0 seconds into run to 3600 seconds into run to set bit 1 to 0, bit 3 to 0, and bit 6 to 0, all other bits unchanged:
	`00:00:00,IRNSS_SL5NAV_DATA_SF12_MOD,TN_IRNSS,4,0,2,0,0,`
	`3600000,0-0--0--`
	`-------- -------- -------- -------- -------- --------`
	`-------- -------- -------- -------- -------- --------`
	`-------- -------- -------- -------- -------- --------`
	`-------- -------- -------- -------- -------- --------`
	`-------- -------- -------- -------- -------- --------`
	`-------- ------`

8.10.9.2 S-Band or L5 Navigation Data Modification (subframes 3 and 4)

Description	Modify either S-band or L5 broadcast navigation data stream (subframes 3 and 4)		
Format	S-band: <timestamp>,IRNSS_SNAV_DATA_SF34_MOD,TN_IRNSS, <svid>,<all_svs>,<message_type>,<all_messages>, <sequence_number>,<all_sequences>,<start_time>, <end_time>,<bit_modifiers> L5: <timestamp>,IRNSS_L5NAV_DATA_SF34_MOD,TN_IRNSS, <svid>,<all_svs>,<message_type>,<all_messages>, <sequence_number>,<all_sequences>,<start_time>, <end_time>,<bit_modifiers>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-16" (satellite svid)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	message_type	::=	"5" (Ionospheric grid parameters) | "7" (Almanac parameters) | "9" (UTC and Time Sync Parameters wrt GNSS) | "11" (EOP and Ionospheric coefficients) | "14" (Differential Corrections for one satellite) | "16" (Encryption key subset) | "18" (Text message)
	all_messages	::=	"0" (apply to specified message_type) | "1" (apply to all message_types)
	sequence_number	::=	Range is a function of message_type: "5" ("1-6") | "7" ("1-16") | "14" ("1-16") | "18" ("1-256") | All other message types - "1"
	all_sequences	::=	"0" (apply to specified page) | "1" (apply to all pages)

	start_time	::=	Time to apply the modifications to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the modifications (milliseconds from start of run)
	bit_modifiers	::=	Characters to specify each of the 214 bits of a message body. Spirent uses 8-bit sections separated by spaces. "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)
Returns	Status.		
Example 1	Modify S-band navigation data for SVID 5. Set Message Type 7, Sequence 8 from 0 second into run to 3600 seconds into run to set bit 1 to 0, bit 3 to 0, bit 6 to 0 and bit 8 to 0, all other bits unchanged: `00:00:00,IRNSS_SNAV_DATA_SF34_MOD,TN_IRNSS,5,0,7,0,8,0,0,36000 00,0-0--0-0 -------- -------- -------- -------- -------- ----- --- -------- -------- -------- -------- -------- -------- ---- ---- -------- -------- -------- -------- -------- -------- --- ----- -------- -------- -------- -------- -------- -------- -- ------ -------- -------- -------- -------- ------`	
Example 2	Modify L5 navigation data for SVID 6. Set Message Type 11, Sequence 1 from 0 second into run to 3600 seconds into run to set bit 6 to 0, bit 9 to 0, and bit 10 to 0, all other bits unchanged: `00:00:00,IRNSS_L5NAV_DATA_SF34_MOD,TN_IRNSS,6,0,11,0,1,0,0,360 0000,-----0-- 00------ -------- -------- -------- -------- --- ----- -------- -------- -------- -------- -------- -------- -- ------ -------- -------- -------- -------- -------- -------- - ------- -------- -------- -------- -------- -------- -------- - ------- -------- -------- -------- -------- ------`	

8.10.10 IRNSS_NAV_DATA_ERR

These commands let you apply errors to S-band and L5-band broadcast navigation data streams modulated onto the RF signal, while maintaining parity.

Although the timestamp specifies the time SimGEN actions this command, SimGEN calculates and downloads navigation data to the signal generator in advance. This means the timestamp (and the time SimGEN sends the message) must be at least six seconds before the modification start time you specify in the command. Also, notice SimGEN applies the modifications to the next specified frame/subframe/page occurring after the start_time.

You must ensure your start_time and end_time are compatible with the timing of the frame/subframe/page you want to modify. Be aware these times are times-into-run (so t = 0 is the start of run) and the simulation start time-of-week determines the navigation data sequence start. To simplify matters, the example scenario start time has been set to the start of a week, that is, the start TOW (time-of-week) is set to zero.

You must correctly identify the frame/subframe/sequence/bits if you attempt to modify a specific data value in the message and correctly scale and format the data according to the IRNSS ICD detailed in reference [12]. In accordance with this ICD, Spirent numbers bits in the message starting at bit 1, not bit 0.

8.10.10.1 S-band and L5 Navigation Data Errors

Note: SimGEN will add trailing zeroes (or truncate to the required number of hexadecimal charcters) data you enter in the `hex_subframe` parameter. SimGEN does not check your data for non-hexadecimal characters.

Description	Apply errors to both the S-band and L5 broadcast navigation data stream (subframes 1 and 2)		
Format	<timestamp>,IRNSS_SL5_NAV_DATA_ERR,TN_IRNSS, <svid>,<all_svs>,<subframe>,<all_subframes>,<start_time>, <end_time>,<post_FEC>,<first_bit>,<number_of_bits>,<hex>, <hex_subframe>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-16" (satellite svid)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	subframe	::=	(Subframe to be modified) "1" | "2"
	all_subframes	::=	"0" (apply to specified subframe) | "1" (apply to all subframes)
	start_time	::=	Time to apply the errors to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the errors (milliseconds from start of run)
	post_FEC	::=	"0" Apply after FEC | "1" Apply before FEC
	first_bit	::=	"1-600" (post_FEC = "0") "1-292" (post_FEC = "1")
	number_of_bits	::=	"1-600" (post_FEC = "0") "1-292" (post_FEC = "1")
	hex	::=	"0" Disable hexadecimal subframe message (requires first_bit and number_of_bits) | "1" Enable hexadecimal subframe message (overrides data in first_bit and number_of_bits)
	hex_subframe	::=	Up to 150 hexadecimal characters (post_FEC = 0) Up to 73 hexadecimal characters (post_FEC = 1)
Returns	Status.		
Example	Modify S-L5 NAV data for SVID 4. Set Subframe 2, from 0 second into run to 3600 seconds into run (flip from bit 10 for 11 bits data present but hexadecimal subframe message overrides), post-FEC, use hexadecimal subframe message ABCDEF0123456789012: 00:00:00,IRNSS_SL5_NAV_DATA_ERR,TN_IRNSS,4,0,2,0,0,3600000,0,10,11,1,ABCDEF0123456789012		

8.10.10.2 S-band or L5 Navigation Data Errors

SimGEN will add trailing zeroes to, or truncate to the required number of hexadecimal characters, data you enter in the hex_subframe parameter. SimGEN does not check your data for non-hexadecimal characters.

Description	Apply errors to either the S-band or L5 broadcast navigation data stream (subframe 3 and 4)		
Format	S-band: <timestamp>,IRNSS_SNAV_DATA_ERR,TN_IRNSS, <svid>,<all_svs>,<message_type>,<all_messages>, <sequence_number>,<all_sequences>,<start_time>,<end_time>, <post_FEC>,<first_bit>,<number_of_bits>,<number_of_bits>, <hex>,<hex_subframe> L5: <timestamp>,IRNSS_L5_NAV_DATA_ERR,TN_IRNSS, <svid>,<all_svs>,<message_type>,<all_messages>, <sequence_number>,<all_sequences>,<start_time>,<end_time>, <post_FEC>,<first_bit>,<number_of_bits>,<number_of_bits>, <hex>,<hex_subframe>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-16" (satellite svid)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	message_type	::=	"5" (Ionospheric grid parameters) | "7" (Almanac parameters) | "9" (UTC and Time Sync Parameters wrt GNSS) | "11" (EOP and Ionospheric coefficients) | "14" (Differential Corrections for one satellite) | "16" (Encryption key subset) | "18" (Text message)
	all_messages	::=	"0" (apply to specified message type) | "1" (apply to all message types)
	sequence_number	::=	Range is a function of message_type: "5" ("1-6") | "7" ("1-16") | "14" ("1-16") | "18" ("1-256") | All other message types - "1"
	all_sequences	::=	"0" (apply to specified page) | "1" (apply to all pages)
	start_time	::=	Time to apply the errors to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the errors (milliseconds from start of run)
	post_FEC	::=	"0" (Apply after FEC) | "1" (Apply before FEC)
	first_bit	::=	"1-600" (post_FEC = "0") "1-292" (post_FEC = "1")
	number_of_bits	::=	"1-600" (post_FEC = "0") "1-292" (post_FEC = "1")

	hex	::=	"0" Disable hexadecimal subframe message (requires first_bit and number_of_bits) | "1" Enable hexadecimal subframe message (overrides data in first_bit and number_of_bits)
	hex_subframe	::=	Up to 150 hexadecimal characters (post_FEC = 0) Up to 73 hexadecimal characters (post_FEC = 1)
Returns	Status.		
Example 1	Modify S-band navigation data for SVID 4. Set Message Type 7, Sequence 7, from 0 second into run to 3600 seconds into run to flip from bit 9 for 13 bits, post-FEC: `00:00:00,IRNSS_SNAV_DATA_ERR,TN_IRNSS,5,0,7,0,7,0,0,3600000,0,9,13`		
Example 2	Modify L5 navigation data for SVID 7. Set Message Type 9, Sequence 1, from 0 second into run to 3600 seconds into run (flip from bit 11 for 3 bits data present but hexadecimal subframe message overrides), pre-FEC, use hexadecimal subframe message ABCDEF0123456789012: `00:00:00,IRNSS_L5NAV_DATA_ERR,TN_IRNSS,7,0,9,0,1,0,0,3600000,1,11,3,1,ABCDEF0123456789012`		

8.10.11 BEIDOU_B1CNAV_DATA_MOD

Description	Remote input and insertion into action queue of BeiDou navigation data modifications already scheduled in current scenario		
Format	<timestamp>,BEIDOU_B1CNAV_DATA_MOD,TN_BEIDOU,<svid>,<start_time>,<end_time>,<message_type>,<all_svids>,<all_messages>,<subframe>,<data_mods>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"6-30" (satellite svid)
	start_time	::=	Time to apply the modification (milliseconds from start of run)
	end_time	::=	Time to cease the modification (milliseconds from start of run)
	message_type	::=	Choose from: "1" (UTC and IONO) | "2" (Reduced Almanac) | "3" (BGTO and EOP) | "4" (Midi Almanac)
	all_svids	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	all_messages	::=	"0" (specify using <message_type>) | "1" (all messages)
	subframe	::=	"1" | "2" | "3" **Note:** If you use either <subframe> = "1" or <subframe> = "2" (where there are no different message types), you must set <all_messages> = "1"

	data_mods ::= Modify each bit using: "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)
Returns	Status.
Example 1	At start of scenario, set BeiDou B1CNAV data modification on SVID 6 to begin at the start of the scenario and end 60 minutes into the scenario. Modify subframe 1, all message types, leave bit 1 as is, bit 2 set to 0, bit 3 set to 1, bit 4 invert: 00:00:00,BEIDOU_B1CNAV_DATA_MOD,TN_BEIDOU,6,0,3600000,1,0,1,1, -01X---- ------
Example 2	At start of scenario, set BeiDou B1CNAV data modification on SVID 7 to begin at the start of the scenario and end 60 minutes into the scenario. Modify subframe 2, all message types, leave bits 1-4 as is, bit 5 set to 0, bit 6 set to 1, bit 7 invert: 00:00:00,BEIDOU_B1CNAV_DATA_MOD,TN_BEIDOU,7,0,3600000,1,0,1,2, ----01X- --------
Example 3	At start of scenario, set BeiDou B1CNAV data modification on SVID 6 to begin at the start of the scenario and end 60 minutes into the scenario. Modify subframe 3, message type 2, leave bit 1 as is, bit 2 set to 0, bit 3 set to 1, bit 4 invert: 00:00:00,BEIDOU_B1CNAV_DATA_MOD,TN_BEIDOU,8,0,3600000,2,0,0,3, -01X---- --------

8.10.12 BEIDOU_B2ANAV_DATA_MOD

Description	Remote input and insertion into action queue of BeiDou navigation data modifications already scheduled in current scenario
Format	<timestamp>,BEIDOU_B2ANAV_DATA_MOD,TN_BEIDOU,<svid>, <start_time>,<end_time>,<message_type>,<all_svids>, <all_messages>,<data_mods>
Where	timestamp ::= See *Timestamp*, on page 8-2.
	svid ::= "6-30" (satellite svid)
	start_time ::= Time to apply the modification (milliseconds from start of run)
	end_time ::= Time to cease the modification (milliseconds from start of run)

	Message_type	::=	Choose from: "10" (Ephemeris 1) | "11" (Ephemeris 2) | "30" (Clock, IONO and Group Delay) | "31" (Clock and Reduced Almanac0 | "32" (Clock and EOP) | "33" (Clock, BGTO and Reduced Almanac) | "34" (Clock and BDT-UTC offset parameters) | "40" (SISAIoc and Midi Almanac)
	all_svids	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	all_messages	::=	"0" (specify <message_type>) | "1" (all messages)
	data_mods	::=	Modify each bit using: "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)
Returns	Status.		
Example	**Example** At start of scenario, set BeiDou B2a NAV data modification on SVID 9 to begin at the start of the scenario and end 60 minutes into the scenario. Modify message type 30, leave bit 1 as is, bit 2 set to 0, bit 3 set to 1, bit 4 invert `00:00:00.024,BEIDOU_B2ANAV_DATA_MOD,TN_BEIDOU,9,0,3600000,30,0,0,-01X------ ----------`		

8.10.13 BEIDOU_ D1_NAV_DATA_MOD and BEIDOU_D2_NAV_DATA_MOD

Description	Apply BeiDou D1 and D2 navigation data modifications		
Format	D1: <timestamp>,BEIDOU_D1_NAV_DATA_MOD,TN_BEIDOU,<svid>,<all_svid>,<page>,<all_pages>,<subframe>,<all_subframes>,<word>,<all_words>,<start_time>,<end_time>,<bit_modifiers> D2: <timestamp>,BEIDOU_D2_NAV_DATA_MOD,TN_BEIDOU,<svid>,<all_svid>,<page>,<all_pages>,<subframe>,<all_subframes>,<word>,<all_words>,<start_time>,<end_time>,<bit_modifiers>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"6-30" (D1 satellite svid) "1-5" (D2 satellite svid)
	all_svid	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	page	::=	"1-24"(D1 page range) "1-120" (D2 page range)

	all_pages	::=	"0" (specify a page) | "1" (all pages)
	subframe	::=	"1-5" (both D1 and D2)
	all_subframes	::=	"0" (specify a subframe) | "1" (all subframes)
	word	::=	"1-26"(for Word 1 only) "1-22" (for Words 2 to 10)
	all_words	::=	"0" (specify a word) | "1" (all words)
	start_time	::=	Time to apply the errors to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the errors (milliseconds from start of run)
	bit_modifiers	::=	Characters to specify each of the 24 bits of a message body. Spirent uses 8-bit sections separated by spaces. "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)
Returns	Status.		
Example 1	Now, modify BeiDou D1 navigation data for all SVIDs (6 to 30) as follows: all Pages, all Subframes, Word 2, start at 0 ms, end 60 minutes later, with modifications as shown: `00:00:00,BEIDOU_D1_NAV_DATA_MOD,TN_BEIDOU,6,1,1,1,1,0,2,0,0,3600000,------------111-11----`		
Example 2	Now, modify BeiDou D2 navigation data for all SVIDs (1 to 5) as follows: Page 1, Subframe 1, Word 2, start at 0 ms, finish 60 minutes later, with modifications as shown: `00:00:00,BEIDOU_D2_NAV_DATA_MOD,TN_BEIDOU,1,1,1,0,1,0,2,0,0,3600000,----------------11111`		

8.10.14 BEIDOU_B1CNAV_DATA_ERR and BEIDOU_B2ANAV_DATA_ERR

Description	Remote input and insertion into action queue of BeiDou B1C or B2a navigation data errors already scheduled in current scenario. These errors are added after parity correction, so parity will be corrupted		

Format	B1CNAV:
	`<timestamp>,BEIDOU_B1CNAV_DATA_ERR,TN_BEIDOU,<svid>,<start_time>,<end_time>,<msg_num>,<all_svs>,<all_msgs>,<fec>,<first_symbol_to_flip>,<num_symbols_to_flip>`
	B2ANAV:
	`<timestamp>,BEIDOU_B2ANAV_DATA_ERR,TN_BEIDOU,<svid>,<start_time>,<end_time>,<msg_num>,<all_svs>,<all_msgs>,<fec>,<first_symbol_to_flip>,<num_symbols_to_flip>`		

Where	timestamp	::=	See *Timestamp*, on page 8-2. Must be before <start_time>. Can be sent before starting the scenario
	svid	::=	"6-30" (satellite svid)

	start_time	::=	Time to apply the error (milliseconds from start of run)
	end_time	::=	Time into run to cease the error (milliseconds from start of run)
	msg_num	::=	"1" (UTC and IONO) | "2" (Reduced Almanac) | "3" (BGTO and EOP) | "4" (Midi Almanac)
	all_svs	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	all_msgs	::=	"0" (apply specified <msg_num>) | "1" (apply all <msg_num>)
	fec	::=	"0" (apply error after FEC) | "1" (apply error before FEC)
	first_symbol_to_flip	::=	The first symbol to flip(invert)
	num_symbols_to_flip	::=	The number of symbols to flip(invert)
Returns	Status.		
Example 1	At start of scenario, set BeiDou B1C Navigation data error on SVID 13. Begin at start of scenario, finish 60 minutes into scenario. Modify message number 2 (Reduced Almanac), to specified SVID. Apply error after FEC. First symbol to flip = 5, number of symbols to flip = 7 `00:00:00.024,BEIDOU_B1CNAV_DATA_ERR,TN_BEIDOU,13,0,3600000,2,0,0,0,5,7`		
Example 2	At start of scenario, set BeiDou B1C Navigation data error on SVID 14. Begin at start of scenario, finish 60 minutes into scenario. Modify message number 3 (BGTO & EOP), apply specified message to specified SVID. Apply error before FEC. First symbol to flip = 11, number of symbols to flip = 13: `00:00:00,BEIDOU_B1CNAV_DATA_ERR,TN_BEIDOU,14,0,3600000,3,0,0,1,11,13`		
Example 3	At start of scenario, set BeiDou B2a Navigation data error on SVID 11. Begin at start of scenario, finish 60 minutes into scenario. Modify message number 10 (Ephemeris 1), to specified SVID. Apply error after FEC. First symbol to flip = 1, number of symbols to flip = 2: `00:00.00,BEIDOU_B2ANAV_DATA_ERR,TN_BEIDOU,11,0,3600000,10,0,0,0,1,2`		
Example 4	At start of scenario, set BeiDou B2a Navigation data error on SVID 12. Begin at start of scenario, finish 60 minutes into scenario. Modify message number 30 (Clock, IONO and Group Delay), to specified SVID. Apply error before FEC. First symbol to flip = 10, number of symbols to flip = 20: `00:00:00,BEIDOU_B2ANAV_DATA_ERR,TN_BEIDOU,12,0,3600000,30,0,0,1,10,20`		

8.10.15 BEIDOU_D1_NAV_DATA_ERR and BEIDOU_NAV_DATA_ERR

Description	Apply BeiDou D1 and D2 navigation data errors

Format	D1
	`<timestamp>,BEIDOU_D1_NAV_DATA_ERR,TN_BEIDOU,<svid>,`
	`<all_svid>,<page>,<all_pages>,<subframe>,<all_subframes>,`
	`<start_time>,<end_time>,`
	`<first_bit>,<number_bits>,<force_hex>,<hex_chars>`
	D2
	`<timestamp>,BEIDOU_D1_NAV_DATA_ERR,TN_BEIDOU,<svid>,`
	`<all_svid>,<page>,<all_pages>,<subframe>,<all_subframes>,`
	`<start_time>,<end_time>,`
	`<first_bit>,<number_bits>,<force_hex>,<hex_chars>`

Where	`timestamp ::= See Timestamp, on page 8-2.`
	`svid ::= "6-30" (D1 satellite svid)`
	`"1-5" (D2 satellite svid)`
	`all_svid ::= "0" (apply to specified svid)`
	`| "1" (apply to all svids)`
	`page ::= "1-24"(D1 page range)`
	`"1-120" (D2 page range)`
	`all_pages ::= "0" (specify a page)`
	`| "1" (all pages)`
	`subframe ::= "1-5" (both D1 and D2)`
	`all_subframes ::= "0" (specify a subframe)`
	`| "1" (all subframes)`
	`start_time ::= Time to apply the errors to the frames/subframes/page (milliseconds from start of run)`
	`end_time ::= Time into run to cease the errors (milliseconds from start of run)`
	`first_bit ::= First bit (of 300 bits)to flip (invert)`
	`number_bits ::= Number of bits to flip (invert)`
	`force_hex ::= Use hexadecimal characters to represent the errors`
	`hex_chars ::= Use exactly 75 hexadecimal characters to represent the errors`

Returns	Status.

Example 1	Now, apply error to BeiDou D1 navigation data for all SVIDs (6 to 30) as follows: all Pages, Subframe 1, start at 0 ms, end 60 minutes later. First bit to flip is 44, number of bits to flip is 1 (do not use hexadecimal characters to represent error):
	`00:00:00,BEIDOU_D1_NAV_DATA_ERR,TN_BEIDOU,6,1,1,1,1,0,`
	`0,3600000,44,1,0`

Example 2	Now, modify BeiDou D2 navigation data for all SVIDs (1 to 5) as follows: Page 1, Subframe 1, start at 0 ms, finish 60 minutes later. First bit to flip is 48, number of bits to flip is 2 (do not use hexadecimal characters to represent error):
	`00:00:00,BEIDOU_D2_NAV_DATA_ERR,TN_BEIDOU,1,1,1,0,1,0,0,360000`
	`0,48,2,0`

Example 3	Now, apply error to BeiDou D1 navigation data for all SVIDs (6 to 30) as follows: all Pages, Subframe 1, start at 0 ms, end 60 minutes later. Use hexadecimal characters to represent error:
	`00:00:00,BEIDOU_D1_NAV_DATA_ERR,TN_BEIDOU,6,1,1,1,1,0,`
	`0,3600000,44,1,1,0123456789ABCDEF0123456789ABCDEF0123456789`
	`ABCDEF0123456789ABCDEF0123456789A`

Example 4	Now, modify BeiDou D2 navigation data for all SVIDs (1 to 5) as follows: Page 1, Subframe 1, start at 0 ms, finish 60 minutes later. Use hexadecimal characters to represent error:
	`00:00:00,BEIDOU_D2_NAV_DATA_ERR,TN_BEIDOU,1,1,1,0,1,0,`
	`0,3600000,48,2,1,0123456789ABCDEF0123456789ABCDEF0123456789`
	`ABCDEF0123456789ABCDEF0123456789A`

8.10.16 QZ_L1CA_NAV_DATA_ERR

Description	Apply Quasi-Zenith L1C/A navigation data errors		

Format	`<timestamp>,QZ_L1CA_NAV_DATA_ERR,TN_Quasi-Zenith,<svid>,`
	`<start_time>,<end_time>,<word-1>,<subframe-1>,<all_words>,`
	`<word3-10>,<subframe_all>,<corruption_type>`		

Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-10" (satellite svid)
	start_time	::=	Time to apply the errors to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the errors (milliseconds from start of run)
	word-1	::=	"0-8"('word' range is 1 to 10)
	subframe-1	::=	"0-4"('subframe' range is 1 to 5)
	all-svid	::=	"0" (apply to specified svid) | "1" (apply to all svids)
	all_words	::=	"0" (specify a word) | "1" (all words)
	word3_10	::=	"0" (specify a word) | "1" (use words 3 to 10)
	subframe_all	::=	"0" (specify a subframe) | "1" (all subframes)
	corruption_type	::=	"No corruption" | "Set all zero" | "Set word alternate 0 and 1"
Returns	Status.		

Example	At the beginning of the scenario, set Quasi-Zenith navigation data error on L1-C/A on all SVIDs. Start at the beginning of the scenario and end at 60 seconds into the scenario. Set error on Word 9, subframe 5, set the word to be alternate 0 and 1:
	`00:00:00,QZ_L1CA_NAV_DATA_ERR,TN_Quasi-Zenith,1,0,60000,8,4,`
	`1,0,0,0,Set word alternate 0 and 1`		

8.10.17 QZ_L6D_NAV_DATA_ERR and QZ_L6E_NAV_DATA_ERR

Description	Remote input and insertion into action queue of Quasi-Zenith navigation data modifications already scheduled in current scenario		
Format	<timestamp>,QZ_L6D_NAV_DATA_ERR[|QZ_L6E_NAV_DATA_ERR], TN_QUASI-ZENITH,<svid>,<start_time>,<end_time>, <all_svids>,<first_bit>,<no_of_bits>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-10" (satellite svid)
	start_time	::=	time at which error is applied, milliseconds into scenario
	end_time	::=	time at which error is completed, milliseconds into scenario
	all_svids	::=	"0" (specified svid) | "1" (all svids)
	first_bit	::=	First bit to modify
	no_of_bits	::=	Number of bits to modify
Returns	Status.		
Example	At start of scenario, set Quasi-Zenith L6D navigation data error to begin 1 000 milliseconds into the scenario and end 2 000 milliseconds into the scenario. For all SVIDs (overrides <svid>). First bit to apply error to is bit 1, number of bits to apply error to is 5: 00:00:00,QZ_L6D_NAV_DATA_MOD,TN_QUASI-ZENITH,1,1000,2000,1,1,5		

8.10.18 QZ_L1CA_NAV_DATA_MOD

Description	Apply Quasi-Zenith L1C/A navigation data modifications		
Format	<timestamp>,QZ_L1CA_NAV_DATA_MOD,TN_QUASI-ZENITH, <svid>,<start_time>,<end_time>,<word-1>,<page-1>, <subframe-1>,<all_svid>,<all_words>,<all_pages>, <subframe_all>,<bit_modifiers>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-10" (satellite svid)
	start_time	::=	Time to apply the modifications to the frames/subframes/page (milliseconds from start of run)
	end_time	::=	Time into run to cease the modifications (milliseconds into run)
	word-1	::=	"0-8"('word' range is 1 to 10)
	page-1	::=	"0-29"('page' range is 1 to 30)
	subframe-1	::=	"0-4"('subframe' range is 1 to 5)
	all_svid	::=	"0" (apply to specified svid) | "1" (apply to all svids)

	all_words	::=	"0" (specify a word) | "1" (all words)
	all_pages	::=	"0" (specify a page) | "1" (all pages)
	subframe_all	::=	"0" (specify a subframe) | "1" (all subframes)
	bit_modifiers	::=	Characters to specify each of the 24 bits of a message body. Spirent uses 8-bit sections separated by spaces. "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)
Returns	Status.		
Example	At the beginning of the scenario, modify Quasi-Zenith navigation data on L1-C/A on specified SVID 1. Start at the beginning of the scenario and end at 60 seconds into the scenario. Set error on word 1, page 1, subframe1 to do not change. `00:00:00,QZ_L1CA_NAV_DATA_MOD,TN_QUASI-ZENITH,1,0,60000,0,0,0,0,0,0,0,-------- -------- --------`		

8.10.19 QZ_L1S_NAV_DATA_MOD

This remote command uses the same format as *GPS_L2CNAV_DATA_MOD*, on page 8-40, with these exceptions:

→ Set <constellation> parameter to TN_QUASI-ZENITH
→ Range for <svid> ::= "1-10"
→ Select an appropriate <message_type> for L1S
→ The bit modifier is 226 bits (250-bit message minus 24-bit CRC) long

Example

At start of scenario, set Quasi-Zenith L1S Navigation data modification on SVID 1. Begin at start of scenario, finish 60 minutes into scenario. Use message number 47, apply specified message to specified SVID. Leave bit 1 as is, bit 2 set to 0, bit 3 set to 1, bit 4 invert:

```
00:00:00,QZ_L1S_NAV_DATA_MOD,TN_QUASI-ZENITH,1,0,3600000,47,0,0,-01X----
-------- -------- -------- -------- -------- -------- -------- --------
-------- -------- -------- -------- -------- -------- -------- --------
-------- -------- -------- -------- -------- -------- -------- --------
-------- -------- -------- --
```

8.10.20 QZ_L1S_NAV_DATA_ERR

This remote command uses the same format as *GPS_L2CNAV_DATA_ERR and GPS_L5NAV_DATA_ERR*, on page 8-37, with these exceptions:

→ Set <constellation> parameter to TN_QUASI-ZENITH
→ Range for <svid> ::= "1-10"
→ Select an appropriate <msg_num> for L1S
→ Errors are always applied post-FEC, so <fec ≥ 0

Example

At start of scenario, set Quasi-Zenith L1S Navigation data error on SVID 2. Begin at start of scenario, finish 60 minutes into scenario. Use message number 47, apply specified message to specified SVID. Apply after FEC. First bit to flip = 12, number of bits to flip = 133:

```
00:00:00,QZ_L1S_NAV_DATA_ERR,tn_QUASI-ZENITH,2,0,3600000,47,0,0,0,12,133
```

8.10.21 QZ_L6D_NAV_DATA_MOD and QZ_L6E_NAV_DATA_MOD

Description	Remote input and insertion into action queue of Quasi-Zenith navigation data modifications already scheduled in current scenario		
Format	<timestamp>,QZ_L6D_NAV_DATA_MOD[|QZ_L6E_NAV_DATA_MOD], TN_QUASI-ZENITH,<svid>,<start_time>,<end_time>, <all_svids>,<data_mods>		
Where	timestamp	::=	See *Timestamp*, on page 8-2.
	svid	::=	"1-10" (satellite svid)
	start_time	::=	time at which modification is applied, milliseconds into scenario
	end_time	::=	time at which modification is completed, milliseconds into scenario
	all_svids	::=	"0" (specified svid) | "1" (all svids)
	data_mods	::=	Characters to specify each of the 1695 bits of a message body. Spirent uses 8-bit sections separated by spaces, see the example. "1" (set to 1) | "0" (set to 0) | "X" (invert current setting) | "-" (do not change)
Returns	Status.		
Example	At start of scenario, set Quasi-Zenith L6D navigation data modification to begin 1 000 milliseconds into the scenario and end 2 000 milliseconds into the scenario. For all SVIDS (overrides <svid>). Modify bits: First bit to modify is bit 1, number of bits to modify is 20 (bits 1 to 8 set to '0', bits 9 to 16 set to '1',bits 17 to 20 invert), with no change for the remaining 1675 bits: `00:00:00,QZ_L6D_NAV_DATA_MOD,TN_QUASI-ZENITH, 1,1000,2000,1,00000000 11111111 XXXX----`		

8.11 Engine commands

Table 8-16: Engine commands

Command	Description
ANT_CHAN_MODES (see page 8-62)	Returns the possible output modes of a specific antenna (GSS9000 signal generators only)
LOAD_FILE (see page 8-59)	Load the specified file into the scenario
MSG_REPORTING_FILE_NAME (see page 8-58)	Returns name and path of current engine log file

Table 8-16: Engine commands (continued)

Command	Description
SET_ANT_FREQS (see page 8-59)	Determines constellations and frequencies simulated for a specified antenna
USER_SETTINGS_LOAD (see page 8-60)	Load user settings
USER_SETTINGS_SAVE (see page 8-61)	Saves user settings
USER_SETTINGS_UPDATE (see page 8-61)	Updates the currently loaded settings in the Engine.

8.11.1 Common parameters

Many of the engine commands use the following common parameters.

FileID	Use to identify specific scenario data files, where the file extension is present in more than one place in the scenario and cannot uniquely identify the file. The syntax is:		
	FileId	::=	<,obj_id><,parameter_1><,parameter_2>
	obj_id	::=	Identifies a scenario control object using this syntax: → Antenna: A → Antenna_pattern_ctrl: APC → Control options: APP_OPTS → Atmosphere: AT → Aiding: D → Motion model: M → Scenario options: OP → Reflection pattern multipath: RFL_MP → Transmitter constellation: TN → GPS assistance: ULTS → BeiDou assistance: ULTS_BEIDOU → Galileo assistance: ULTS_GALILEO → GLONASS assistance: ULTS_GLONASS → Vehicle: V → Visible transmitters: VT
	parameter_1, parameter_2	::=	Depends on file type. For example: → Antenna pattern files: • parameter_1 speficies frequency • parameter_2 specifies switch number → EVTP: • parameter_1 specifies EVTP filename → INS: • parameter_1 specifies INS model type
TOGGLE	Change the current state. For example, if current state is enabled <TOGGLE> sets the state to disabled.		

8.11.2 MSG_REPORTING_FILE_NAME

Description	Returns name and path of current engine log file
Format	`MSG_REPORTING_FILE_NAME`

Returns	The name and full path to the current engine log file.
Example 1	Return name and path of current engine log file for a GSS9000-series signal generator: `MSG_REPORTING_FILE_NAME` Returns: *`D:\posapp\logs\posapp\PosApp_engine_message_log_2015_06_02_15_30_00.txt`*
Example 2	Return name and path of current engine log file for a GSS8000-series, or earlier, signal generator: `MSG_REPORTING_FILE_NAME` Returns: *`C:\Program Files\Spirent Communications\Positioning Application\logs\PosApp_engine_message_log_2015_06_12_16_30_00.txt`*

8.11.3 LOAD_FILE

Description	Load the specified file into the scenario. If the file doesn't exist a default file with the given name is created.
Format	`LOAD_FILE,file_name(,FileId)`
Where	`See` *Common parameters*, `on page 8-58.` `File_name` `::=` `(Name of file to load)`
Returns	Status.

Examples	Set the atmosphere file “test.atm”:
	`LOAD_FILE,TEST.ATM`
	For vehicle 2 set motion reference file to “paignton.ref”:
	LOAD_FILE,PAIGNTON.REF,V2
	For vehicle 2 antenna 1, set the Offsets file to “lever_arm.aof”:
	`LOAD_FILE,LEVER_ARM.AOF,V2_A1`
	For vehicle 1 antenna 1, set the Offsets file to “lever_arm.aof”. If no object ID is given the first file found is set:
	`LOAD_FILE,LEVER_ARM.AOF`
	For vehicle 1, antenna 2, set the fourth antenna pattern file for GPS L2 to “low.ant_pat” (use <obj_id> parameter APC1)
	`LOAD_FILE,LOW.ANT_PAT,V1_A2_APC1,GPS_L2,4`

8.11.4 SET_ANT_FREQS

Notes:

1) To ensure backwards compatibility, this command supports use of parameters 'BeiDou_B1' and 'BeiDou_B2'.

2) You can enter the freq parameter using upper, lower or mixed case. For example, you may use ‘BEIDOU_B1I’, ‘Bei-Dou_B1I’ or ‘beidou_b1i’.

Description	Determines constellations and frequencies simulated for a specified antenna. The command contains a comma-separated list of frequency names, for example "GPS_L1”.
Format	`SET_ANT_FREQS,<ant_id>,<frequency_list>`
Where	`ant_id` `::=` `“v”x_“a”y (An existing antenna, specified in terms of vehicle_antenna, such as v1_a1)`

	frequency_list	::=	(Comma-separated frequency names, for example: GPS_L1,GPS_L2. Uses these frequency names: "BeiDou_B1I" | BeiDou_B2I" | "BeiDou_B3I" | "BeiDou_B2a" | "BeiDou_B1C" | "CAPS_C1" | "CAPS_C2" | "CAPS_C3" | "EGNOS_L1" | "EGNOS_L5" | "GAGAN_L1" | "GAGAN_L5" | "GALILEO_L1" | "GALILEO_E5" | "GALILEO_E6" | "GLONASS_L1" | "GLONASS_L2" | "GPS_L1" | "GPS_L2" | "GPS_L5" | "GTx_L1" | "GTx_L2" | "GTx_L5" | "GTx_GLN_L1" | "GTx_GLN_L2" | "GTx_BEIDOU_B1i" | "GTx_BEIDOU_B2i" | "GTx_BEIDOU_B2a" | "GTx_BEIDOU_B1c" | "GTx_BEIDOU_B3i" | "GTx_GALILEO_E1" | "GTx_GALILEO_E5" | "GTx_GALILEO_E6" | "Interference_F1" | "IRNSS_S" | "IRNSS_L5" | "LAAS_VDB" | "MSAS_L1" | "MSAS_L5" | "QZ_L1" | "QZ_L2" | "QZ_L5" | "QZ_L6" | "SBAS_L1" | "WAAS_L1" | "SBAS_L5" | "WAAS_L5" | "SDCM_L1"
Returns	Status.		
Example	For vehicle 1 antenna 1, enable Galileo E1 and GPS L1. Remove any previously enabled frequencies: SET_ANT_FREQS,V1_A1,GALILEO_E1,GPS_L1		

8.11.5 USER_SETTINGS_LOAD

Description	Load user settings given an optional ID. The user settings are loaded in memory at start-up of the PosApp Engine. The user settings are not saved back to file (spirent_posapp_user_settings.json) unless the user explicitly sends the command USER_SETTINGS_SAVE; or the user closes the PosApp Engine.		
Format	user_settings_load[,<user_id>][,<reload>]		
Where	user_id	::=	ASCII string (If the user name contains a space, you must enclose the name in "" (quotation marks)) If <user_id> is not found, the engine creates a new user with default settings applied. If user_id is blank, the command uses the last user name to issue this command.
	reload	::=	"reload_from_file" - reload from file rather than load in user from memory. The engine issues a full re-read of the user settings file and any memory changes are deleted

Returns	A JSON formatted string held within the <data></data> part of the XML response string.

Example	Load the user settings for user ASmith:
	`USER_SETTINGS_LOAD,ASmith`
	returns:
	`<msg>`
	`  <status> 0 </status>`
	`  <data>`
	`  {`
	`  "ASmith":`
	`  {`
	`  "aiding logging on": "false",`
	`  "motion logging on": "false",`
	`  "sat data logging on": "false",`
	`  ...`
	`  }`
	`  }`
	`  </data>`
	`</msg>`

8.11.6 USER_SETTINGS_UPDATE

Description	Updates the user settings
Format	`user_settings_update,<JSON_string>`
Where	`JSON_string ::=` ASCII string formated in the JSON notation. Encapsulate the string as a JSON object using curly brackets {}. Quotes are not required around the string. Spaces in the string are allowed. The ASCII string can represent the full, or partial, range of settings.
Returns	Status

Example	`USER_SETTINGS_UPDATE,{ "high rate period": "100" }`
	`Returns:`
	`<msg>`
	`  <status> 0 </status>`
	`</msg>`

8.11.7 USER_SETTINGS_SAVE

Description	Save user settings given an optional ID.		
Format	`user_settings_save[,<user_id>]`		
Where	user_id	::=	ASCII string (If the user name contains a space, you must enclose the name in "" (quotation marks)) Saves the currently loaded settings under that user. If user_id is blank, the command saves the currently loaded settings under the last loaded user

Returns	Status.

Example	`USER_SETTINGS_SAVE,ASmith`
	returns:
	`<msg>`
	`  <status> 0 </status>`
	`</msg>`

8.11.8 ANT_CHAN_MODES

Note: This command is only valid for GSS9000 signal generators.

Description	Returns the possible output modes of a specific antenna.		
Format	`ANT_CHAN_MODES,<veh_ant>`		
Where	`veh_ant`	`::=`	The antenna specified in terms of vehicle and antenna. For example using veh_ant = v1_a1 means use vehicle "1" and antenna "1"
Returns	All possible modes of the antenna you specify.		

Example	For antenna v1_a1, return all compatible modes:
	`ANT_CHAN_MODES,v1_a1`
	For example, returns two GPS L1 and Gal E1 compatible modes, as follows:
	`0,112 GPS/SBAS L1`
	`16 GAL E1`
	`112 QZ L1`
	`80 GPS/SBAS L1`
	`48 GAL E1`
	`80 QZ L1`		

9 Calibration

Use anti-static handling precautions during calibration.

9.1 GSS7000 calibration

Reference [23] describes performing GSS7000 calibration.

9.2 GSS6300M-I: 10 MHz reference calibration

Note: If you use two GSS6300-family signal generators, you must calibrate the frequency reference of the Master and Auxiliary signal generators as two separate units. You must disconnect all connections to the rear panel ports of each signal generator before proceeding to calibrate the signal generator.

This calibration requires a calibrated frequency counter capable of measuring 10.00 MHz with at least 10 digits of accuracy, for example an HP53131A. The frequency counter should be locked to a frequency standard accurate to $\pm 1 \times 10^{-9}$, for example, an HP5065A Rubidium standard. You can use a less accurate standard if you are willing to accept reduced frequency accuracy for your signal generator.

Spirent recommends you calibrate the 10 MHz reference oscillator annually.

To perform the 10 MHz reference calibration:

1. Turn on the signal generator and the frequency counter.
2. Allow at least thirty minutes for the signal generator internal oscillator to stabilise.
3. Attach the frequency counter to the rear panel 10 MHz OUT BNC connector.
4. Remove the ‘Calibration Void if Broken’ label covering the ‘10 MHz Ref Cal’ adjustment port.
5. Set the frequency adjustment potentiometer to achieve a frequency reading of 10 MHz $\pm$ 0.02 Hz.
6. Fit an appropriate calibration label over the ‘10 MHz Ref Cal’ adjustment port.

9.3 GSS6300M-I: Power level calibration

Notes:

1) The calibration algorithm employs the best constellation for power calibration from the constellations for which you have licences. Spirent recommends you set your power meter to measure at 1583 MHz (all constellations are within 22 MHz of this frequency).

2) If you use two GSS6300-family signal generators, you must calibrate the Master and Auxiliary signal generators while they are connected together.

Power level calibration requires either the SimCHAN Controller (GSS6300 and GSS6300M signal generators) or that the integrated controller on the GSS6300M-I signal generator is running SimCHAN. You also need a calibrated RF power meter whose specification satisfies the requirements shown in the following table, for example, an HP E4418B.

Measured power range (dBm)	Calibration offset range (dB)
-50 to -30	-7.31 to +3.96

Before using the power meter to calibrate the signal generator, ensure you correctly set any frequency sensitive power meter parameters.

Spirent recommends you calibrate the power level annually.

To perform the power level calibration:

Note: If your simulator uses two, or more GSS6300-family signal generators, you must follow the first step in the procedure below before starting Power calibration

1. If you are using two signal generators, disconnect the coaxial cable from the OPTIONAL AUX I/P port on the auxiliary signal generator at the MON/CAL port on the master signal generator.

   Note: To ensure the auxiliary signal generator locks to the master signal generator you must keep the auxiliary cable connected.

2. For single signal generators, remove the SMA termination from the signal generator MON/CAL port connector on the rear panel.

   Retain the SMA termination for later replacement.

3. Connect your GSS6300/GSS6300M signal generator to the SimCHAN Controller.

4. Run SimCHAN.

5. Select ***Tools > Configure Hardware*** and select the configuration you want to calibrate.

   You must select the correct configuration because the power utility only calibrates the signal generators in the configuration you select.

6. Select ***Tools–Power Calibration***.

   The utilityguides you through the power calibration of the signal generator, or the master signal generator if you are using two signal generators.

7. Connect your RF power meter to AC mains, turn on and allow it to warm up for the recommended period.

8. Follow the RF power meter manufacturer's instructions to zero and calibrate the power meter before use.

9. Select your signal generator and then click CALIBRATE.

10. Click NEXT to view the first stage of the calibration.

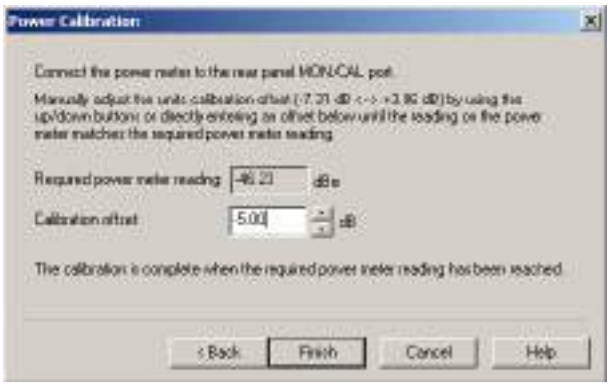
    The first stage advises you to allow the signal generator temperature to stabilise by turning on AC power to the signal generator for at least thirty minutes before calibration.

11. After thirty minutes, click NEXT and follow the instructions in the dialog.

12. Click NEXT, then connect the RF power meter to the MON/CAL port.

13. Enter a value in CALIBRATION OFFSET, within the allowed calibration offset range, so that the RF power meter displays the value shown in REQUIRED POWER METER READING.

    Note: The calibration routine does not check if the calibration offset you enter is within the allowed range.



14. When you have successfully matched the RF power meter reading with the value shown in REQUIRED POWER METER READING, click FINISH.

15. If your configuration includes a second signal generator, select it now and repeat the calibration process.

16. For single signal generators, replace the SMA termination on the MON / CAL port.

    Ensure you correctly torque the SMA termination.

17. If you are using two signal generators, connect the coaxial cable from the OPTIONAL AUX I/P port on the auxiliary signal generator to the MON/CAL port on the master signal generator.

10 Spirent Global Services

Spirent have a dedicated support portal called the Customer Service Center (CSC). The support portal has a wealth of resources, including the latest software releases, online scenario generation tools, and our searchable Knowledge Base. Customers can also raise Service Requests (SR's) directly with the support team.

http://support.spirent.com

For everything else you can contact the support team by email, or give us a call to discuss an issue in person.

When you first contact Spirent Global Services to report a fault, please provide the following information:

→ Your name
→ Your e-mail address
→ Your telephone or fax number
→ The types and version numbers of your Spirent software
→ The serial number of your signal generator
→ A comprehensive description of the incident

Where appropriate, also provide:

→ A copy of the [executable filename]_message_log.txt file
→ Copies of your scenario files, including all shared files. Provide a separate list, as a plain text (*.txt) file, of all files you send Spirent.
→ Details of the repeatability of the incident
→ Details of changes to the system, including any new software added and all upgrades (including Windows, new hardware, new drivers, Spirent software and so on)

This will enable a swift response and improve the service to you.

Spirent operates support offices in UK, USA, Republic of Korea and China.

We recommend that customers initially contact the support office nearest to them.

For customers outside Europe, where support enquiries or repairs cannot be completed in region then we would normally complete the work at our UK factory, based in Paignton, Devon, UK. For customers in Europe all support related work is with the UK factory-based support team.

Contact information for support offices is as follows:

In the US, government, contractors and universities

Spirent Federal Systems Inc.
Applications Support Center
1402 W State Rd,
Pleasant Grove,
UT 84062, USA
Tel:+1 817 508 6095
E-mail:help@spirentfederal.com
Dedicated Website: https://www.spirent.com/About_Us/Contact_Support

In the US, commercial and rest of Americas

Spirent Communications Inc
2708 Orchard Parkway, Suite 20
San Jose, California 95134
USA
Tel:1.800.SPIRENT
E-mail:support@spirent.com

Asia Pacific, including Republic of Korea

Spirent Communications Korea LTD.
#1609,
397, Seochu-daero
Seocho-gu,
Seoul, 06616
Rep. of KOREA
Tel: +82-10-6784-9777
E-mail: support@spirent.com

Asia Pacific, excluding Republic of Korea

Spirent Communications,
Shining Tower, No. 35, Xueyuan Road,
Room 1302,
Beijing 100191,
China
Tel (Toll free mainland China):4008109529
Tel (Outside mainland China):+86 4008109529
Tel (Outside Mainland China):+82 10 6784 9777
E-mail: support@spirent.com

All other regions and customers

Spirent Communications Plc
Aspen Way
Paignton
Devon
TQ4 7QR
United Kingdom
Tel:+44 1803 546333
E-mail:support@spirent.com