Datasheet with Product Specification

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Purpose of this document

This datasheet describes the functionality of SimREPLAY*plus* software and the performance achieved when operated as part of a GSS6700 Multi-GNSS constellation simulator system.

This datasheet also provides technical data and configuration information. Please speak to your Spirent sales representative before ordering.

Table of Contents

Purpose of this document 2
Table of Contents 3
List of Tables 4
List of Figures 4
About SimREPLAYplus and the GSS6700 Multi-GNSS Simulator 5
    Product range summary 5
What SimREPLAYplus and the GSS6700 Multi-GNSS Simulator do 6
How SimREPLAYplus and the GSS6700 Multi-GNSS Simulator work 8
    Hardware Description 8
    Software and Control 9
System Details – supported constellations 10
    Controller Options 10
Performance and Features 12
    Signal Capability 12
 Accuracy 14
 Calibration Requirements 14
Software Features 15
    Before testing - test definition 16
 Start time and date 16
 Vehicle Motion 16
 Satellite constellations 17
 Propagation conditions 18
 Obscuration 18
 Antenna Pattern 19
    During Testing – simulation control and logging 20
 User Actions 20
 Remote control 20
 NMEA Input / Output and RTCM 20
 Bulk Logging 20
 Dump Navigation Data 20
    Other control applications supplied 21
 Legacy SimPLEX scenario support 21
 Single channel operation 21
Physical and Environmental 22
    Mechanical 22
 Safety and EMC Conformity 24
Deliverables 24
Applicable Documents 24
Glossary of Terms 25

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

List of Tables

Table 1 Constellation ICDs 10
Table 2 Common (but not exhaustive) GSS6700 with SimREPLAY*plus* configuration options 10
Table 3 Signal Generator Performance 12
Table 4 Signal Generator Accuracy 14
Table 5 Physical dimensions and environmental limits (Signal Generator) 22
Table 6 Signal Generator Connectivity 23
Table 7 Safety and EMC Compliance 24
Table 8 Deliverable Items (may vary with specifics of system configuration) 24

List of Figures

Figure 1 Front and rear images of the GSS6700 signal generator chassis 8
Figure 2 Typical SimREPLAY*plus* screenshot 9
Figure 3 SimREPLAYplus test definition screenshot 15
Figure 4 Date and Time editor 16
Figure 5 Editing scenario source files in SimREPLAYplus 17
Figure 6 Reception Antenna Gain Pattern Editor 19
Figure 7 GSS6700 Signal Generator, front panel (typical) 22
Figure 8 GSS6700 Signal Generator, rear panel (typical) 22

About SimREPLAYplus and the GSS6700 Multi-GNSS Simulator

SimREPLAY*plus* is designed to allow the replay of pre-defined test scenario whilst providing a range of tools and capabilities to enhance usability before, during and after testing.

The GSS6700 Multi-GNSS Simulator is designed to support a range of development, verification and integration tasks where un-encrypted L1/E1/B1 GNSS signals from one or more constellations need to be generated.

For fully flexible software to generate exploratory scenarios Spirent recommends SimGEN.

For the generation of encrypted, military / government or multi-frequency signals Spirent offers the GSS9000.

Product range summary

- Multi-GNSS
  - GPS/SBAS/QZSS, GLONASS and Galileo supported together in a single chassis
  - GPS/SBAS/QZSS, GLONASS and BeiDou-2 supported together in a single chassis
  - System can be supplied equipped with 1, 2, 3 or 4 constellations enabled[1]
  - GPS L1 C/A Signal, SBAS L1 Signal and QZSS L1 C/A Signal[2]
  - GLONASS L1 C/A Signal
  - Galileo E1 B/C Signal (with CBOC)
  - Beidou-2 B1(I) code
  - 12 independent channels of each primary constellation[3] enabled

- Simple to use software
  - Interactive run time control
  - Share scenarios between systems to facilitate collaboration
  - Save and compare device under test data with logged simulation data
  - Receiver antenna pattern modelling
  - Edit and save time, date and location
  - Import motion from logged NMEA and Google Maps® matched trajectories via the SimROUTE tool
  - Save scenario for use by SimPLEX and SimREPLAY
  - Full test automation with TestDrive-GNSS™ Automation & Reporting tool

- Flexible and capable hardware
  - All digital architecture
  - Class leading accuracy, fidelity and reliability
  - Field upgrade minimises downtime as your needs grow

1 Systems with 4 primary constellations are supplied in two chassis
2 QZSS L1 SAIF is not supported
3 Primary constellations are GPS, GLONASS, Galileo and BeiDou

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

What SimREPLAYplus and the GSS6700 Multi-GNSS Simulator do

The GSS6700 Multi-GNSS Simulator provides a coherent simulated signal from GPS, SBAS (WAAS, EGNOS, GAGAN, MSAS and SDCM), QZSS, GLONASS, BeiDou-2 and Galileo satellites[4] at the L1 / E1 / B1 frequency.

Generation of signals from the various constellations is enabled by Electronic Feature key. If all Electronic Feature keys are present, the GSS6700 Multi-GNSS Simulator system can generate 12 channels of GPS/SBAS/QZSS[5], 12 channels of GLONASS, 12 channels of BeiDou-2 and 12 channels of Galileo concurrently.

When operated with SimREPLAY*plus* for Windows software the GSS6700 generates similar RF signals to those that would be seen by a GNSS receiver when installed on a vehicle with time, place and motion pre-defined in a test “scenario”.

This enables the performance of the receiver to be assessed in the laboratory as if it were receiving RF signals from real satellites whilst stationary or performing complex user defined manoeuvres.

“Truth” data from the simulation is available to facilitate results analysis which makes the GSS6700 with SimREPLAY*plus* ideal for quantifying and comparing the performance of GNSS receivers in such areas as:

- Design verification
- Production test in manufacturing
- Comparative evaluation
- Statistical data-generation through extended and repeated tests
- Incoming product test

Unlike testing with live-sky signals, the users of a GSS6700 with SimREPLAY*plus* can exactly replicate the test environment weeks, months or years apart to compare a number of receivers under identical test conditions.

4 Constellations may not all be present. Constellation may be enabled at the factory or in the field as an upgrade.
5 GPS , SBAS and QZSS have a shared allocation of 12 channels.

Figure 1 Complete system. Note the PC may be customer furnished or supplied by Spirent

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

How SimREPLAYplus and the GSS6700 Multi-GNSS Simulator work

The GSS6700 Multi-GNSS Simulator comprises two major sub-systems:

- RF signal generator[6]
- A controller consisting of SimREPLAYplus software running on a personal computer[7]

Together, these elements combine to generate RF simulations representative of a wide variety of environments.

Hardware Description

The signal generator uses direct digital waveform synthesis resulting in an accurate, stable generator capable of high fidelity and resolution.

Communication between the signal generator and the controller is by USB. Data transmission is synchronised by an embedded 1PPS 'tick'.

The GSS6700 Multi-GNSS Simulator signal generator chassis is housed in a 2U, full width rack-mountable case and is powered via the ac mains connector. The rear panel mounted fan provides forced-air cooling.

The primary RF output is fitted on the front of the unit. All other connections are accessed via the rear-panel. Calibration adjustments may also be made via the rear panel.

The GSS6700 Multi-GNSS Simulator is available with one or more of the GNSS constellations installed.

Note that constellations not specified at initial purchase may be enabled subsequently by a straightforward field upgrade process. This process does not require the unit to be returned to the factory and can be performed by the user.

The unit includes a temperature controlled crystal oscillator and its signal is made available for external use. Alternatively, the generator may be locked to an external frequency reference signal. A selection of external reference frequencies is supported.

The simulator can be synchronised with other test equipment using its 1PPS input and output signals.

Correct operation of the unit can be confirmed from the front panel indicators or remotely using BITE (Built in Test Equipment) interrogated by SimREPLAY*plus*.

Figure 1 Front and rear images of the GSS6700 signal generator chassis

6 Systems where Galileo and BeiDou2 are required simultaneously require two interconnected chassis
7 Note that the PC can be supplied by Spirent or may be supplied by the user.

Software and Control

The signal generator chassis is controlled by a simulation software application running on a personal computer. The PC can be supplied by Spirent or may be customer furnished. This document describes the performance of the GSS6700 system when using the controller application SimREPLAY*plus*.

SimREPLAY*plus* is supplied via a generic application, Spirent Positioning Application and a licence key which enables the SimREPLAY*plus* feature set. It is an easy to use software package driven via a graphical user interface (GUI) or remotely via TCP/IP interface on the controller. It is designed to prepare and replay pre-defined test cases. All the factors defining the simulated test environment are contained in a set of files known collectively as a scenario.

SimREPLAY*plus* is supplied with a variety of pre-prepared scenarios on CD-ROM, covering a range of simulated test environments for cars, ships and aircraft. Details of current scenarios available are contained in reference f).

In addition to replaying scenario, SimREPLAY*plus* can also edit scenario criteria such as time, date, location and vehicle motion.

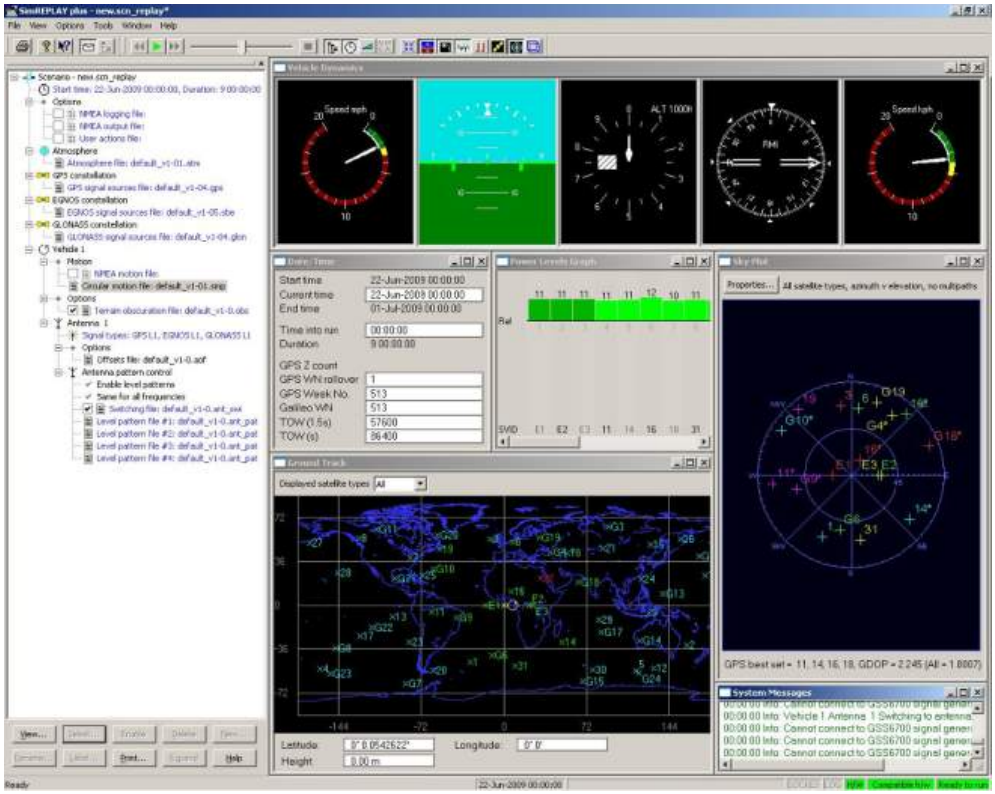

Figure 2 Typical SimREPLAY*plus* screenshot

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

System Details – supported constellations

The GSS6700 may be specified in a range of configurations from GPS only to GPS + GLONASS + Galileo + QZSS multi-GNSS systems.

Table 1 Constellation ICDs

GNSS	ICD
GPS	GPS System Specification ICD-GPS-200H
SBAS	SBAS System Specification RTCA-DO229D WAAS MOPS
GLONASS	GLONASS ICD Version 5.1(2)
Galileo	Galileo System Specification Galileo OS SIS ICD Issue 1.1
BeiDou-2	BeiDou SISICD Open Service B1I_ V2.0_Dec_13
QZSS	IS-QZSS Ver 1.6 Interface Specification

Some of the most common combinations are shown in Table 2

Table 2 Common (but not exhaustive) GSS6700 with SimREPLAY*plus* configuration options

Descriptor
GSS6700 GPS simulator with SimREPLAY*plus*
GSS6700 GPS / GLONASS simulator with SimREPLAY*plus*
GSS6700 GPS / Galileo simulator with SimREPLAY*plus*
GSS6700 GPS / BeiDou simulator with SimREPLAY*plus*
GSS6700 GPS / QZSS simulator with SimREPLAY*plus*
GSS6700 GPS / GLONASS / BeiDou simulator with SimREPLAY*plus*
GSS6700 GPS / GLONASS / Galileo / QZSS simulator with SimREPLAY*plus*

Note that constellations not specified at initial purchase may be enabled subsequently by a straightforward field upgrade process. This process does not require the unit to be returned to the factory and can be performed by the user.

Software upgrades (for example from SimREPLAY to SimGEN) are also available.

Controller Options

The system controller comprises a personal computer running the simulation controller software.

For SimREPLAY*plus* systems the user can elect to supply and configure their own PC in which case the software will be supplied on a CD-ROM for installation by the user.

There are currently four variants of PC available with GSS6700. The standard PC is the default PC option and is recommended in most cases.

Due to the rapidly changing nature of the commercial PC market, the PC's supplied by Spirent with the GSS6700 may change from time to time. PC's supplied by Spirent will be pre-configured by Spirent with the controller software pre-installed and tested.

Standard PC. This is a commercially available, compact desktop model supplied as standard with a 19” wide-screen monitor, UK keyboard and mouse. Other keyboards may be available upon request.

Laptop PC. This is a commercially available, UK specification laptop PC.

Rack-mountable PC. This PC is a 4U 19 inch rack-mountable industrial PC supplied with a free-standing 22” TFT monitor, UK keyboard and mouse. The rack-mountable PC is also supplied with a rack-mount kit for the GSS6700 signal generator chassis.

Full rack-mount PC. This PC is a 4U 19 inch rack-mountable industrial PC supplied with a drawer mounted 17” monitor, keyboard and trackball system for full rack-mounting. The full rack-mount PC is also supplied with a rack-mount kit for the GSS6700 signal generator chassis.

A customer furnished PC. Spirent recommends the use of a PC supplied by Spirent to ensure that the PC configuration is performed correctly to get the best performance from the system. However, users of SimREPLAY*plus* may provide their own PC if they prefer. Spirent can provide a minimum system specification and set-up guidance on request.

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Performance and Features

Signal Capability

Table 3 Signal Generator Performance

Parameter	Comment	Value	Units
GNSS Constellations	GPS or SBAS	12	channels
	GLONASS	12	channels
	Galileo	12	channels
	BeiDou	12	channels
	QZSS	47[8]	channels
Signals	GPS L1 C/A signal with data (SPS)	1 to 63	PRN
	SBAS L1 signal with data	120 to138	PRN
	GLONASS L1 C/A signal with data (SPS)	-7 to +6	Channels
	Galileo E1-B/C CBOC signal with data(OS)	1 to 50	PRN
	BeiDou-2 B1(I) signal with data (OS)	1 to 37	PRN
	QZSS L1 C/A signal with data	183 to 202	PRN
Signal Dynamics	Maximum Relative Velocity	±15,000	m/s
	Maximum Relative Acceleration	±450	m/s^2
	Maximum Relative Jerk	±500	m/s^3
	Maximum Angular rate (1.5 m lever arm)	2π	rad/s
Signal Bandwidths	GPS L1 , Galileo E1 and QZSS L1	20	MHz
	GLONASS L1	10	MHz
	BeiDou-2 B1	16	MHz
In-band[9] spectral purity	Referred to unmodulated carrier power at RF output	< -30	dBc
Out-of-band Spectral Purity (within Bands specified)	GSM 900 925 to 960 MHz GSM 1800 1805 to 1880 MHz GSM 1900 1930 to 1990 MHz 3G 2110 to 2170 MHz 4G 2500 to 2690 MHz	-165	dBm
Harmonics	Referred to unmodulated carrier power at RF output	<-40	dBc
Phase noise close to unmodulated carrier	Integrated between 1 Hz and 10 kHz (Single Sideband)	< 0.02	rad RMS
Time Synchronisation between GNSS signals	Adjustable pseudorange	± 1	ms
	Resolution	1	ns
Nominal signal power at Primary RF port	GPS	-130	dBm
	SBAS	-130	dBm
	GLONASS	-131	dBm
	Galileo[10]	-127.0	dBm
	BeiDou-2	-133	dBm
	QZSS	-130	dBm

8 GPS L1 channels are re-allocated to QZSS L1
9 'in band' refers to appropriate constellation signal bandwidth.
10 Power specified with B and C codes present.

Parameter	Comment	Value	Units
Primary RF to Mon Cal port power offset	See footnote[11]	Approx 57	dB
Parameter	Comment	Value	Units
Nominal carrier frequency	GPS L1 / SBAS L1 / Galileo E1 / QZSS L1	1575.42	MHz
	BeiDou-2 B1	1561.098	MHz
	GLONASS L1, Channel 0	1602	MHz
Master clock stability (internal)	Over temperature range	$\pm$ 1 x 10^{-8}	
	Over one day (24 hours warm up)	$\pm$ 5 x 10^{-10}	
	Over one year, continuous	$\pm$ 1 x 10^{-7}	
External Reference Frequency Input	Selectable	10, 5, 1	MHz
External Reference Power	5 or 10MHz (sine or square wave)	-5 to +10	dBm
	1MHz (square wave)	0 to +10	dBm
External Trigger Input	To control start of simulation (TTL logic levels, rising edge trigger)	>2	µs pulse
1PPS OUT to RF Delay (Per constellation)	Timing Uncertainty between a rising transition on 1PPS OUT port and its corresponding event on the Primary RF port.	0 ± 5	nsecs 1σ (RSS) ref: 1PPS OUT 1.5v into 50 Ohm
Channel Hardware Update Rate	Maximum rate for a single constellation	100	Hz
	Maximum rate for a multiple constellation	10	Hz

11 The GSS6700 provides both the calibrated front-panel RF output port (Primary RF) for testing, and a rear-panel output port (MON CAL) to allow MONitoring of the un-calibrated signal at a high-level, and a means of CALibrating the primary RF. Both ports are isolated to dc voltages.

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Accuracy

Table 4 Signal Generator Accuracy

Parameter	Condition	Definition
Pseudorange ± 0.002 m (RMS)	Dynamics<40 m/s^2 / 50 m/s^3	Uncertainty in SV code phase offset, that offset being calculated from range, ionospheric/tropospheric delay and SV clock error
± 0.01 m (RMS) including interchannel bias	Dynamics<450 m/s^2 / 500 m/s^3	
Pseudorange rate ± 0.001 m/s (RMS)	Dynamics<45 m/s^2 / 50 m/s^3	Uncertainty in rate of change of pseudorange measured with respect to the simulator reference oscillator (not cumulative)
± 0.01 m/s (RMS)	Dynamics<450 m/s^2 / 500 m/s^3	
Interchannel bias Zero		Difference in code phase at the RF output between any 2 channels simulating the same satellite
Interchannel carrier bias Zero		Difference in carrier phase at the RF output between any 2 channels simulating the same satellite
Satellite signal power ±1.0 dB (RSS), ±2.0 dB Max		Uncertainty in overall simulated power level under all conditions
<±0.2 dB		Run-to-Run variance under same environmental conditions
<<0.1 dB		Inter-channel level bias
± 0.1 dB ± 0.2 dB ± 0.5 dB	(range: +15 to -5 dB) (range: <-5 to -10 dB) (range <-10 to -20 dB)	Linearity
Carrier Frequency ±8 Hz to ±158 Hz at L1 after 1 year (absolute)		Master clock may be manually adjusted to < 0.05 Hz error at calibration interval (1 year). The unit can be phase locked to an external reference

Calibration Requirements

The digital architecture of the signal generator requires only limited annual calibration, for which a detailed procedure is provided.

Software Features

The software supplied with the GSS6700 Multi-GNSS Simulator is used for test definition before testing and to interactively control the signal generator during testing. This document describes the features and capabilities of the GSS6700 Multi-GNSS Simulator when used with SimREPLAY*plus* software.

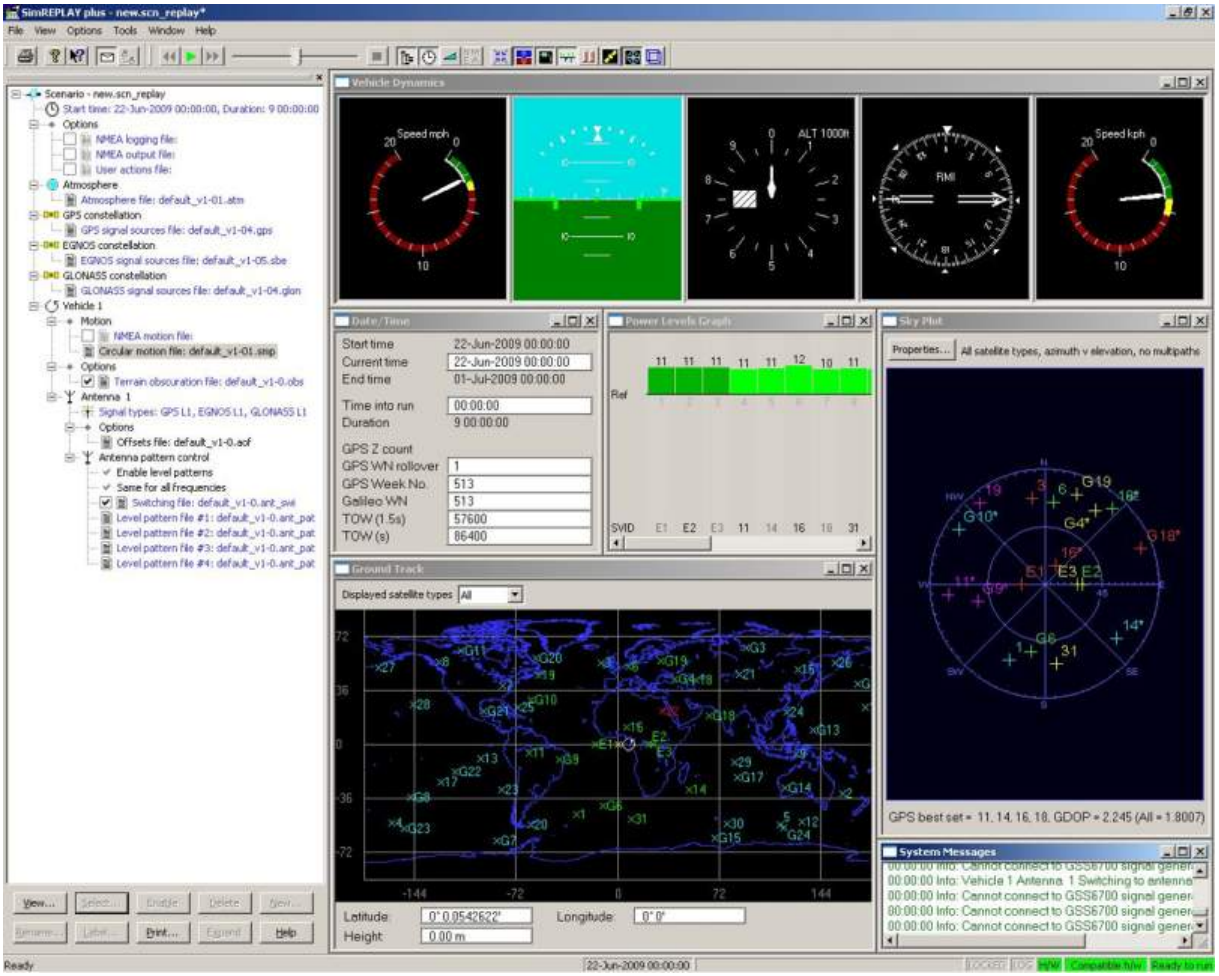

Figure 3 SimREPLAYplus test definition screenshot

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Before testing - test definition

The user defines and configures a set of test conditions, known as a Scenario, using the scenario editor accessible via a GUI, as seen in Figure 4.

The following parameters can be modified by SimREPLAY*plus*:

- Start time/date
- Vehicle motion
- Satellite constellation
- Propagation conditions

A typical screenshot of SimREPLAY*plus* during test definition is shown in Figure 4 above. In the screenshot, blue text indicates an element that is to some extent editable by SimREPLAY*plus*.

Start time and date

Scenario start time and date can be defined using a Calendar approach or using the GPS nomenclature of Week number (WN) (with WN 1024 rollover) and Time of Week (TOW).

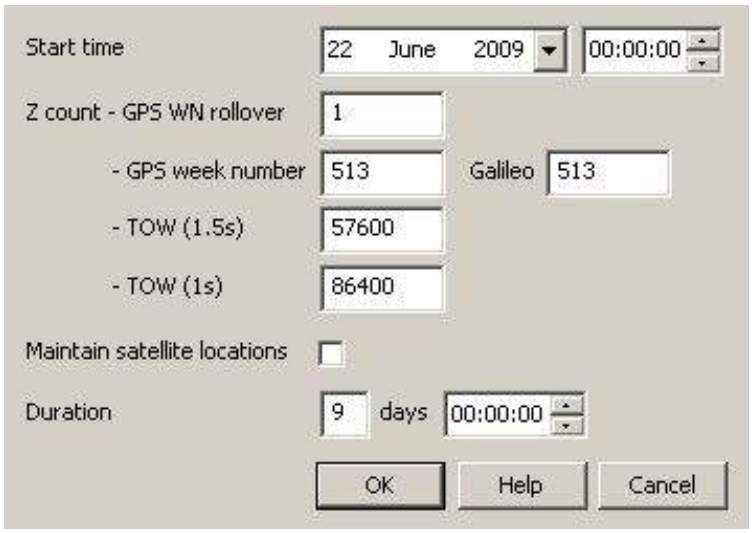

Figure 4 Date and Time editor

Vehicle Motion

SimREPLAY*plus* supports vehicle motion of four forms:

- Static position defined in terms of latitude, Longitude and height (above ellipsoid)
- Circular motion with a user defined centre, radius, speed and start bearing
- User motion presented in a file containing NMEA format data
- Google Maps® matched User motion presented in a UMT file via the SimROUTE tool

Satellite constellations

Note that in SimREPLAY*plus* all the characteristics of the scenario can be viewed. Those that can also be edited are shown in blue. For example, in the screenshot shown in Figure 6 the satellite orbits are displayed in black indicating that they cannot be edited.

In SimREPLAY*plus,* satellite orbits[12] are defined by the almanac file which for GPS can be downloaded from the internet[13] in Yuma format and imported into the scenario.

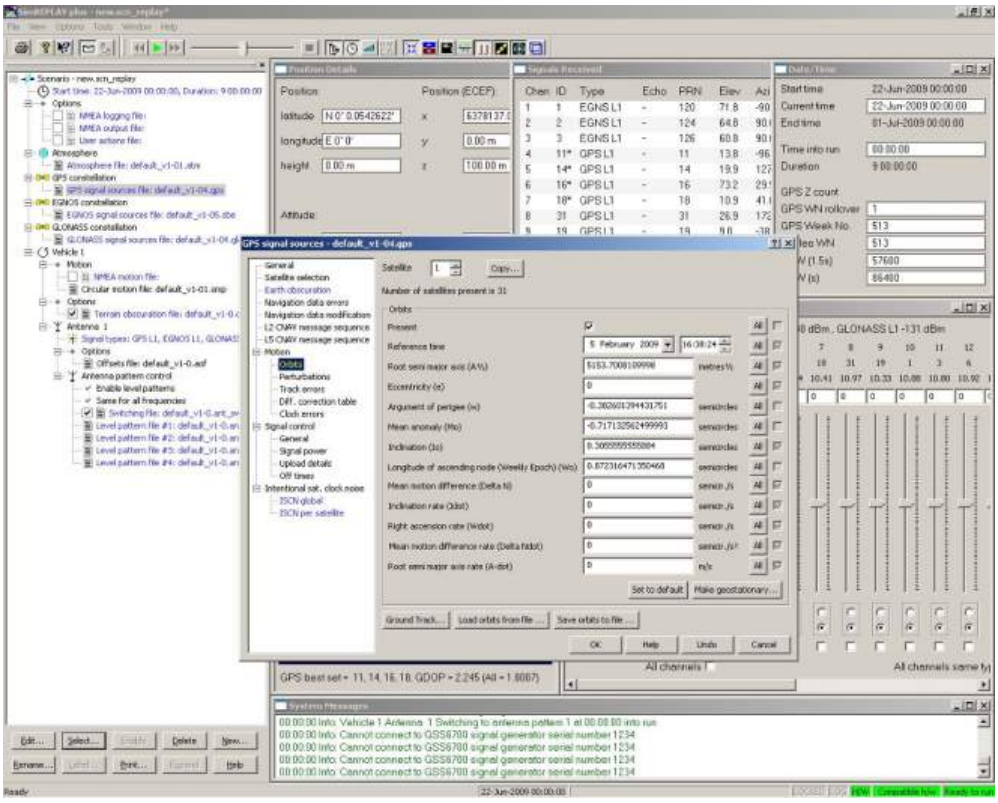

Figure 5 Editing scenario source files in SimREPLAYplus

Intentional Satellite Clock Noise (ISCN) can be optionally used to represent the application of Selective Availability to the GPS signals. A second-order Gauss-Markov process is used with a pseudorandom seed for each satellite. This effect is reflected in SBAS and RTCM corrections.

SBAS constellations are pre-defined to reflect the declared deployments for WAAS, EGNOS, GAGAN, MSAS and SDCM. The user is able to enable the satellite availability independently.

SimREPLAY*plus* calculates Almanac and Ephemeris data from this orbital description, suitably propagated to the date and time being simulated.

The satellites in view at the simulated vehicle position are generated simultaneously, up to a maximum of 12 for each enabled constellation.

When more than 12 are in view, the software regularly optimises the selection for simulation using the GDOP Dilution-of-Precision (DOP) algorithm. Additionally SBAS satellites are given priority over GPS for channel allocation. Real-time display of the resulting GDOP, PDOP, HDOP, VDOP and TDOP is included.

12 SimGEN can generate and edit all scenario variables and is available on the GSS6700 system.
13 US Coast Guard website http://www.navcen.uscg.gov/gps/almanacs.htm

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Propagation conditions

Modelled tropospheric and ionospheric delay can be added using the models described in reference a) and reference e). The effect of tropospheric and ionospheric delay on the RF signal generated can be switched on and off. The coefficients of the model can be viewed, but not edited[14], using SimREPLAY*plus*.

Obscuration

The effects of the horizon and obstacles blocking the line-of-sight path from the satellite to the receiver antenna can be reproduced by using an elevation obscuration mask and a terrain obscuration model which simulates the temporary and intermittent masking of satellite signals. Whilst this does not represent an actual region of the earth, the effects applied are typical of those experienced in terrain of the specified type.

The terrain is user selectable from a number of preset options defined in terms of the proximity of the terrain, its maximum and minimum height above the ellipsoid, and its maximum and minimum width.

Terrain height and width are varied pseudo-randomly within the specified bounds, and the pattern of interruption is accurately repeated on consecutive simulation runs with the timing of changes proportional to the vehicle speed. Changes in terrain type can be programmed to occur during the simulation at intervals determined by the horizontal distance travelled.

The input to the model is the vehicle height above the WGS-84 ellipsoid and the arrival elevation vector of the satellite signals.

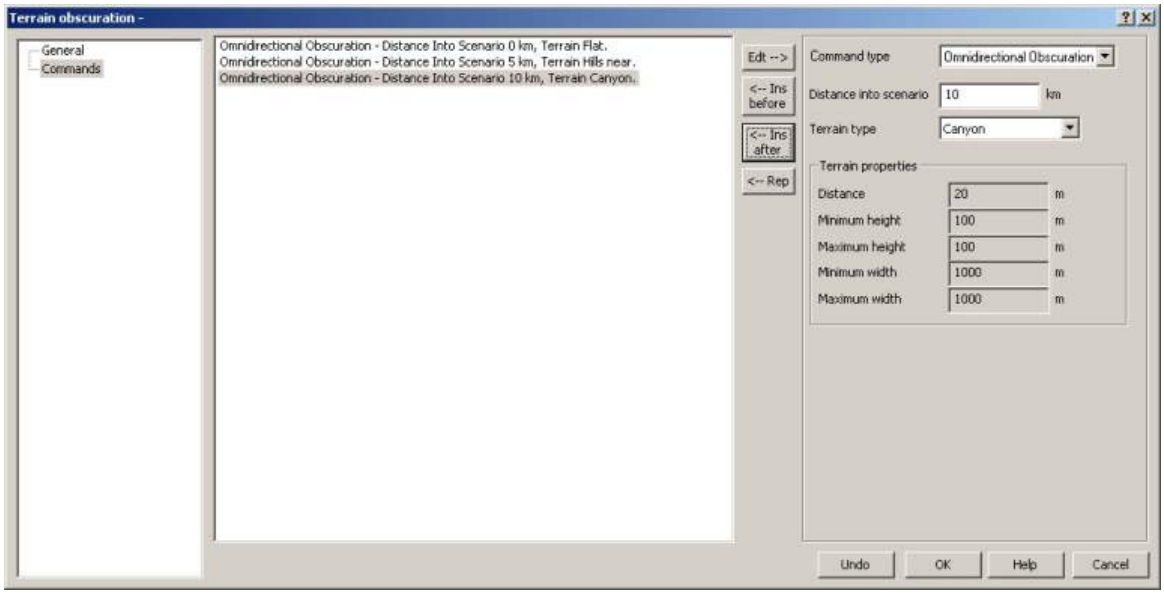

Figure 7 Terrain Obscuration Editor

14 SimGEN provides fully editable tropospheric and ionospheric models.

Antenna Pattern

The effect of the antenna pattern can be simulated by including an antenna gain pattern in the scenario. The gain pattern of the receiver antenna is defined with 5° resolution in both azimuth and elevation.

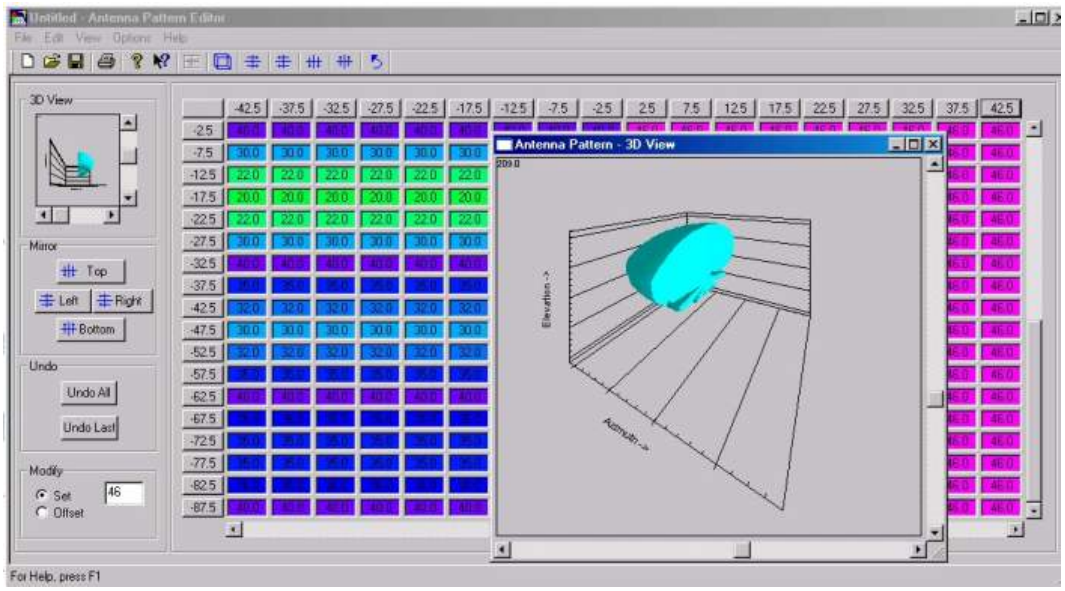

Figure 6 Reception Antenna Gain Pattern Editor

The gain pattern may represent the composite effects of the free-space reception pattern and the on-vehicle obscuration of the vehicle body.

The patterns are fully linked to the vehicle trajectory, allowing automatic simulation of masking of satellite signal due to vehicle obscuration during manoeuvres.

Up to 3 different antenna patterns can be associated with a scenario. A time ordered list defines which antenna pattern to use at any instant allowing antenna pattern switching mid-run to simulate the effect of changes in local obscuration (e.g. a PND being moved from a pocket to the dashboard of a car or having an external antenna connected).

Additional antenna pattern flexibility is provided by the facility to import data from a tabular file defined in the popular CSV (comma separated variable) format.

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

During Testing – simulation control and logging

SimREPLAY*plus* provides interactive control via the GUI and remote control from a command file or via a TCP/IP or RS232 connection.

User Actions

During the test the user can change some of the pre-defined conditions that were specified during test definition. This includes the ability to switch channels on and off, vary power levels and to apply pseudorange ramps.

These User Actions are recorded to a script file to aid post-run analysis or to allow the same actions to be replayed in subsequent runs of this or other simulations. It is also possible to edit user action files and script them using the supplied editor.

Remote control

SimREPLAY*plus* can be controlled remotely through either a user program or a command file. The following remote control commands are currently available:

- Select scenario
- Run scenario
- Stop scenario
- Rewind scenario
- Absolute and relative power control (per channel)
- Code ON/OFF (per channel)
- Trigger mode set-up

An optional GPIB (IEEE-488) control interface is also available.

NMEA Input / Output and RTCM

Vehicle trajectory ‘truth’ data generated during the test phase can be saved to a file in NMEA-0183 format. SimREPLAY*plus* also supports the logging and file-storage of data generated by the receiver under test if presented in the same NMEA format.

The NMEA input and output options allow the user to define how DUT generated and simulator generated NMEA messages are recorded.

Raw NMEA messages from the DUT can be stored to a file and the user may optionally store selected, decoded NMEA messages to a separate CSV file.

Simulator generated data, when enabled, streams messages in as-transmitted ASCII formats and these streams may be optionally stored to file.

The user may independently select from several NMEA message types for inclusion in the truth data set. The same dialogue enables inclusion of RTCM-SC104 differential correction messages, types 1, 3 and 9.

A single RS232 data port carries both message types (NMEA or RTCM) if both are enabled.

Bulk Logging

In addition to NMEA format logging, the user may enable bulk logging of all scenario data relating to vehicle position, velocity, etc and satellite data such as pseudoranges.

Dump Navigation Data

Navigation data may be optionally stored in readable form to a default file location.

Other control applications supplied

The CD-ROM supplied with SimREPLAY*plus* also includes applications for single channel operations (SimCHAN) and support of legacy SimPLEX scenario (SimPLEX 3.0).

Legacy SimPLEX scenario support

Users upgrading to the GSS6700 from Spirent's STR4500 may have existing SimPLEX scenarios that they wish to continue to use. This is facilitated on the GSS6700 by the inclusion of an updated release of SimPLEX that will allow these scenarios to be run on the GSS6700. SimPLEX scenarios remain un-editable.

Single channel operation

The GSS6700 is also supplied with SimCHAN, a single channel simulation controller application. This allows the GSS6700 to be used for single channel work and to develop test routines for use with Spirent's GSS6300 single channel multi-GNSS simulator. More details on SimCHAN are available on request.

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Physical and Environmental

Mechanical

The GSS6700 can be mounted in the following ways:

- Free standing horizontally on a desk
- Free standing vertically on a desk. The unit can be mounted on its side, using supplied feet for stability.
- Rack mounted within a 19” rack. Note that this will require the chassis to be fitted with a rack mount kit.

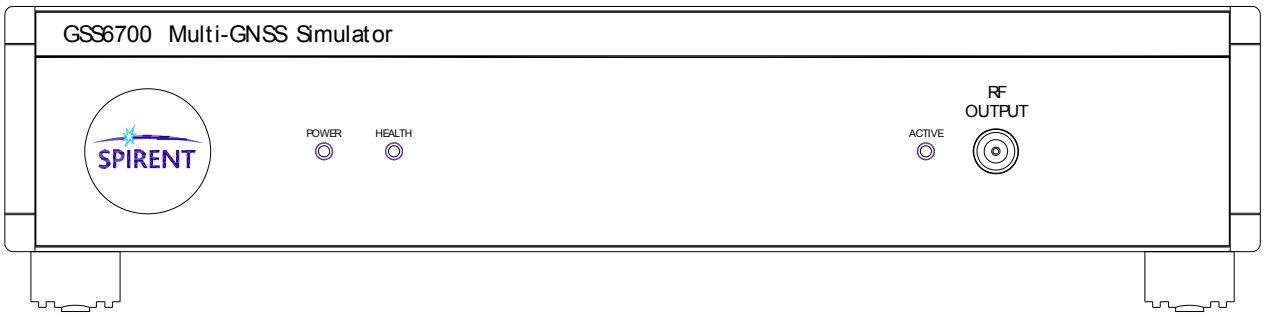

Figure 7 GSS6700 Signal Generator, front panel (typical)

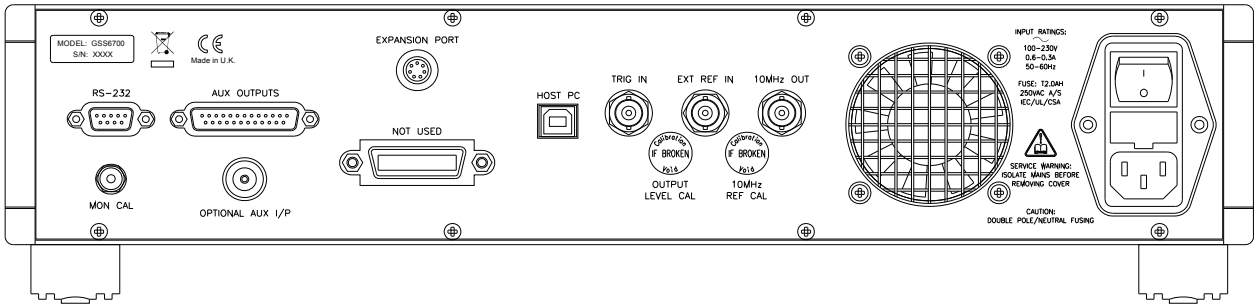

Figure 8 GSS6700 Signal Generator, rear panel (typical)

Table 5 Physical dimensions and environmental limits (Signal Generator)

Parameter	Value
Dimensions, nominal	449 mm x 386 mm x 89 mm (W x D x H) (17.75 inch x 15.25 inch x 3.5 inch)
Weight (approximate)	7.0 kg (15.5 lb)
Temperature Operating Temperature Humidity	 +10 to + 40°C (50 to 104°F) 40 to 90% RH (non-condensing)
Storage Temperature Humidity	-40 to + 60°C (-40 to 140°F) 20 to 90% RH (non-condensing)
Electrical Voltage Current Frequency	 100 - 240 V ac 0.6 - 0.3 A max 50 - 60 Hz

Table 6 Signal Generator Connectivity

Port	Type	Detail	Description
Primary RF (RF OUTPUT)	OUT	COAXIAL Type 'N' Socket Front Panel	Provides the primary RF GNSS signal output at specified power. 50 Ohm. VSWR <1.2:1 (in band). DC isolated[15].
Monitor Calibrate (MON CAL)	OUT	COAXIAL SMA Socket Rear panel	Provides a high power output suitable for calibration with a power meter. 50 Ohm. VSWR <1.45:1 (in band). DC isolated[15].
Internal Reference Oscillator (10 MHz OUT)	OUT	COAXIAL BNC Socket Rear Panel	10 MHz Sine 50 Ohm 0 dBm nominal
External Reference (EXT REF IN)	IN	COAXIAL BNC Socket Rear Panel	Allows the equipment to be locked to an external reference. 50 Ohm Required external reference accuracy <0.1 ppm.
External Trigger (TRIG IN)	IN	COAXIAL BNC Socket Rear Panel	Trigger input to control the start of simulation. 50 Ohm. TTL level compatible.
1PPS OUT[16] (1-pulse-per-second)	OUT	25-Way D-Type Rear Panel	50 Ohm Nominal width 100 ms TTL level compatible
1PPS IN (1-pulse-per-second)	IN	25-Way D-Type Rear Panel	In combination with the External Reference input, can be used to synchronise the simulator to an external system. 50 Ohm TTL level compatible
USB (single dedicated port)	IN / OUT	USB Rear Panel	Main interface with Controller.
Expansion	Multi-way	Rear Panel	For optional multi-generator use (SimGEN systems only).
Output Level Cal	ADJ	Rear Panel	Annual cal, power level adjustment pot.
10 MHz Ref Cal	ADJ	Rear Panel	Annual cal, frequency adjustment pot.

15 DC isolated ports can withstand a maximum DC level of ±60 V and reverse RF levels to a maximum of 1 W.
16 Programmable 1PPS Output with following settings: Ungated, Gated, Rising – High whilst box is active, High– High all the time, Low – Low all the time

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

Safety and EMC Conformity

Table 7 Safety and EMC Compliance

Criteria	Standard
Safety	Low Voltage Directive (LVD) 2006/95/EC BS EN 60950-1:2006 Information technology equipment. Safety. General requirements
EMC	EMC Directive 2004/108/EC EN 61326-1:2006 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements

Deliverables

Table 8 Deliverable Items (may vary with specifics of system configuration)

Item	Quantity	Description	Comment
1	1	Multi-GNSS Signal Generator	
2	1	Vertical mount foot	
3	1 (optional)	Personal Computer	See Controller Options
4	1	Data CD	Contains software (SimREPLAY*plus*, SimCHAN and SimPLEX V3-00) and manuals
5	1	USB cable	
6	1 set	Power cords	Country specific
7	1 (optional)	Expansion cables (Multi-box)	Optional (only required for multi-box configurations)
8	1 (+)	Electronic Feature Key	Defines the system capability. May be pre-installed or supplied electronically on registration (for upgrades)

Applicable Documents

a) GPS System Specification ICD-GPS-200

b) SBAS System Specification RTCA-DO229 WAAS MOPS.

c) Galileo System Specification Galileo OS SIS ICD

d) GLONASS ICD

e) IS-QZSS Interface Specification

f) MS3008 SimGEN for Windows Product Specification

g) BeiDou-2 SIS-ICD

See Table 1 for current issues

Glossary of Terms

Term	Meaning
1PPS	One Pulse-Per-Second
BeiDou-2	BeiDou Navigation System (China Regional Navigation System)
BITE	Built In Test Equipment
CSV	Comma Separated Variable - a text file format
DOP	Dilution Of Precision caused by satellite geometry
DUT	Device Under Test
EMC	Electro Magnetic Compatibility
Galileo	Proposed European GNSS
GLONASS	GLObal NAvigation Satellite System (Russian GNSS)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (US GNSS)
GUI	Graphical User Interface
QZSS	Quasi-Zenith Satellite System (Japanese GNSS)
ICD	Interface Control Document
LAAS	Local Area Augmentation System
Mon / Cal	A high power RF output port on Spirent simulators
PC	Personal Computer
PND	Personal Navigation Device
RF	Radio Frequency
SBAS	Satellite Based Augmentation System, a system that adds integrity and correction for GPS and/or Glonass errors
SimCHAN	Single channel simulator application
SimGEN	All inclusive controller software
SimPLEX	Controller software for STR4500
SimPLEX45	Optional controller software for STR4500
SVID	Satellite Vehicle Identity
Truth data	Data relating to the “true” simulated position of the vehicle or antenna.
USB	Universal Serial Bus

Spirent **SimREPLAYplus with GSS6700 Multi-GNSS Simulator**

spirent.com

Spirent Communications plc, Aspen Way, Paignton, Devon TQ4 7QR, UK
Tel +44 (0)1803 546300 Fax +44 (0)1803 546301
http://www.spirent.com/Solutions/GNSS-Developers
Registered in England Number 00470893
Registered office: Northwood Park, Gatwick Road, Crawley, West Sussex RH10 9XN, UK