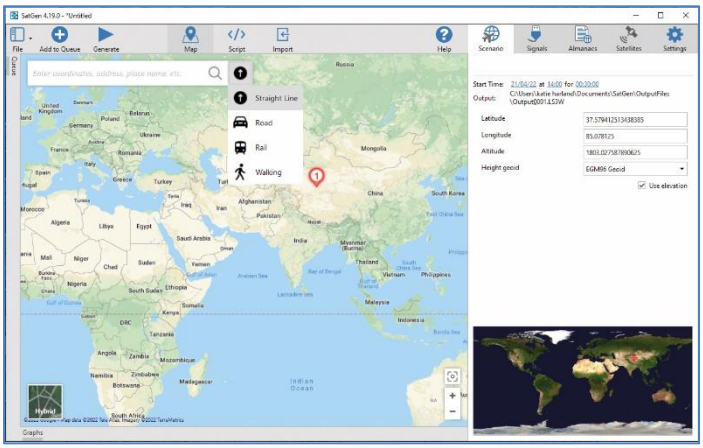
SatGen 4 software adds sophisticated signal generation capability to the **LabSat** range of GNSS Simulators.

By defining the time, place, and trajectory of your desired simulation, SatGen will generate an RF file which can be replayed by a **LabSat** into any GNSS enabled device.

SatGen 4 is available in three variants – **L1/B1/E1 Band**, **Real-Time** or **Wideband**. All versions allow users to define the Time, Position and Trajectory of the simulation, as well as almanacs, dynamics, elevation masks and signal to noise ratios. **SatGen** will then create a binary file containing simulated signals from all the satellites in view in the chosen almanac. This binary file is then transferred to the **LabSat** via SD card, USB Stick, Hard disk, or Ethernet, depending on the model. We can supply almanacs with all future signals included to complete the constellations.



A route can be defined in just a few clicks using the in-built mapping tool. Scenarios can include static testing or complex routes with multiple waypoints.

L1/B1/E1 Band

SatGen 4 L1/B1/E1 Band can generate GPS L1C/A, Galileo E1BC, GLONASS L1OF and BeiDou B1I signals.

Wideband

SatGen 4 Wideband can create multiple different signals across a very wide bandwidth. GPS signals simulated are L1, L2C, L5 and L2M (noise only), Galileo signals are E1BC, E5a, E5b & E6, GLONASS signals are L1OF and L2OF, BeiDou signals are B1I, B2I, B3I, B1C, B2a, B2b, B2b-PPP, and NavIC signals are L5-SPS and S-SPS.
A scenario containing all 13 available signals can be replayed on **LabSat 3 Wideband**.

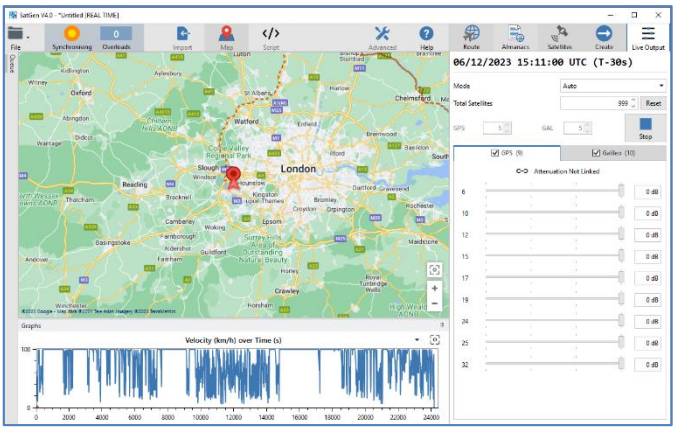
GPS	Galileo	GLONASS	BeiDou	NavIC
L1, L1C, L1P, L1M* L2C, L2P, L2M* L5	E1 E5a, E5b E6	L1OF L2OF	B1I, B1C B2I, B2a, B2b-PPP B3I	L5-SPS S-SPS

*Noise only

Real-Time (RT)

SatGen 4 Real-Time connects via USB to a **LabSat RT** and streams RF data in real-time starting at a user defined time or synchronised with the current UTC time. Synchronisation to UTC is typically accurate to within 2ms, enabling a quick changeover between live sky and replay without having to cold start the device. During real-time operation, individual satellites can be enabled/disabled, and their signal levels adjusted. The latency of the system is typically less than 400 ms.

The **LabSat RT** hardware can simulate up to two of the following signals: GPS L1C/A, Galileo E1BC, GPS L1C/A + Galileo E1BC, GLONASS L1OF, and BeiDou B1I.



SatGen Real-Time

SatGen 4 Variants

Description	Order Code	Output Capability	Signals Available
SatGen 4 Single Channel	RLLSSGSW04-1	One channel scenario file of all constellations available on L1/B1/E1	GPS L1 Galileo E1BC GPS L1 + Galileo E1BC GLONASS L1 BeiDou B1
SatGen 4 Dual Channel	RLLSSGSW04-2	One or two channel scenario file of all constellations available on L1/B1/E1	GPS L1 Galileo E1BC GPS L1 + Galileo E1BC GLONASS L1 BeiDou B1
SatGen 4 Triple Channel	RLLSSGSW04-3	One, two or three channel scenario file of all constellations available on L1/B1/E1	GPS L1 Galileo E1BC GPS L1 + Galileo E1BC GLONASS L1 BeiDou B1
SatGen 4 Real-Time	Contact your local LabSat distributor	Enables the Real-Time functionality within SatGen 4 allowing a live signal stream to a LabSat RT unit	GPS L1 Galileo E1BC GPS L1 + Galileo E1BC GLONASS L1 BeiDou B1
SatGen 4 Wideband	RLLSGSW04-W	Generates scenario data for all LabSat hardware subject to capabilities of the device. With LabSat 3 Wideband hardware all listed signals are available, however, not always simultaneously.	GPS L1 C/A, L1P, L1M*, L1C, L2C, L2P, L2M*, L5 Galileo E1BC, E5a, E5b, E6 GLONASS L1OF, L2OF BeiDou B1I, B2I, B3I, B1C, B2a, B2b, B2b-PPP NavIC L5-SPS & S-SPS (*noise only)

SatGen 4 Wideband Signal Description

Signals can be generally split into two categories: **narrowband** and **wideband**.

Narrowband signals have a modulation (chipping code) frequency of no more than a few megahertz, e.g., GPS L1C/A (1.023MHz), GLONASS L1OF (0.511MHz), BeiDou B1I (2.046MHz).

Wideband signals use a modulation (chipping code) frequency of 10 or more megahertz, e.g., GPS L1P (10.23MHz), GPS L5 (10.23MHz).

When **SatGen 4 Wideband** simulates signals transmitted on no more than 3 frequencies the following conditions will apply:

- Each frequency band is transmitted on a different **LabSat 3 Wideband** output channel.
- For narrowband signals the 10.5 MHz sampling rate and 10 MHz bandwidth is used.
- For wideband signals a wider bandwidth (e.g., 24, 30 or 32 MHz) is used depending on the actual signals used. If a single wideband signal is present, all output channels are forced to use a high sampling rate.

When **SatGen 4 Wideband** simulates signals transmitted on more than 3 frequencies:

- The signals transmitted on frequencies which are close to each other are grouped together to form very wide output channels.

The following groups are examples of the grouping that can be used:

L1 with GPS L1C/A, GPS L1P, GPS L1M, GLONASS L1OF and BeiDou B1I

B1-2I L2 with GPS L2C, GPS L2P, GPS L2M, GLONASS L2OF and BeiDou B2I

L5 with GPS L5I and GPS L5Q

To maximise performance, **SatGen 4** software will automatically select the correct centre frequency and bandwidth depending upon the signal required. The actual parameters used within the scenario can easily be checked by looking at the .ini file produced alongside the .LS3W scenario file on the PC.

Quantisation Selection for SatGen 4 Wideband

LabSat 3 Wideband supports generation of scenario data with 1, 2 and 3-bit quantisation. Depending on the **Labsat** hardware that data is generated for, quantisation may be automatically reduced to ensure that data bandwidth is not exceeded. For example, when selecting all available signals for use with **Labsat 3 Wideband** hardware, quantisation is limited to 2-bit.

Technical Specifications

Parameter	Value
Constellation all variants	GPS/Galileo/GLONASS/BeiDou/NavIC
Maximum simulated speed	515 m/s
Maximum simulated altitude	18,282 m
Data format	IF, I&Q
Quantisation	1 bit, 2-bit, 3-bit
File format	.bin / .ls2 / .ls3 / .LS3W
File Size	2 TB max. for .ls3 files Unlimited for .bin, .ls2, and .LS3W files
One hour scenario data size (depending on signal combination)	LabSat: 7 GB LabSat 2 & RT: 14.4 GB LabSat 3: 14.4 GB LabSat 3 Wideband: 169 GB
Almanac file format	.alm / .agl / .xml
NMEA Input File Format	$GGA
Operating System	Win 10 64-bit, Win 11 or newer

System Requirements

SatGen is very CPU intensive. However, most modern PCs are capable of running SatGen.

Minimum Requirements

- Windows 10
- 64-bit CPU

Simulating to File

- A faster PC will create the simulation file more quickly.
- To simulate L1 only signals, a CPU with 4 cores or more is recommended.
- To simulate multiple signals across different frequency bands quickly for a LabSat Wideband, we would recommend a strong PC with a CPU with 8 cores or more. A fast 16 or 32 core CPU will generate the output file much more quickly.

Real-time Output

- A faster PC will be able to simulate more signals and more satellites in real-time.
- To simulate a single constellation, we would recommend a modern CPU with 4 cores or more.
- To simulate multiple constellations, we would recommend a CPU with 8 cores or more.