



The Replicator A2-R4-Q14-U3 chassis .

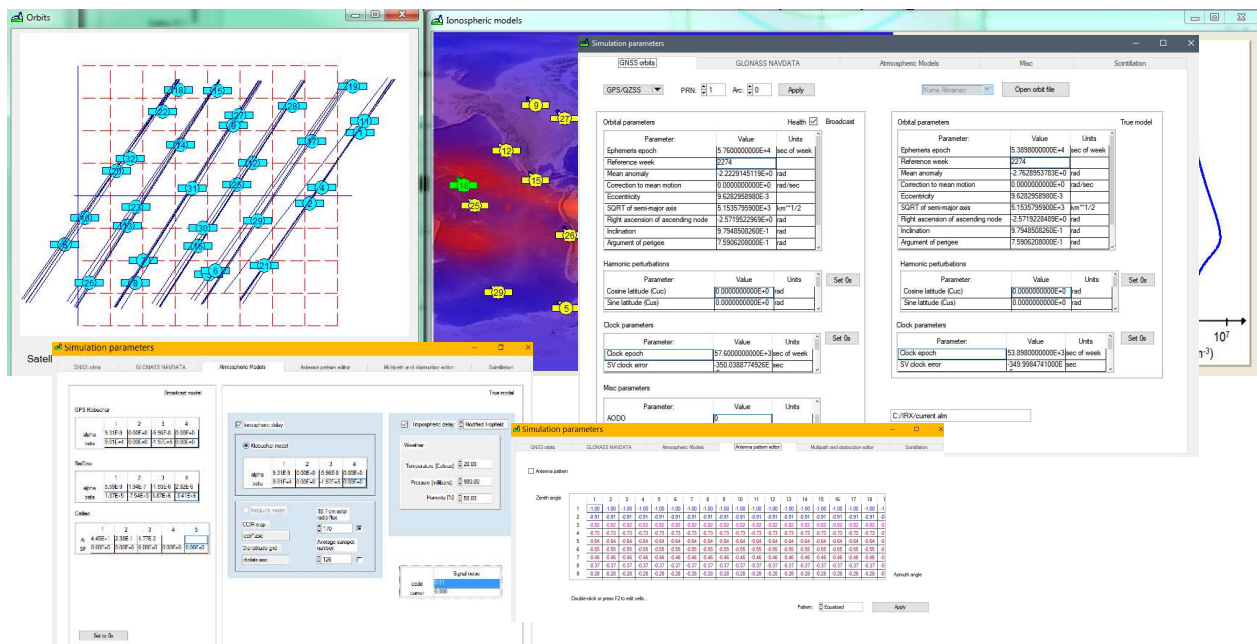
Since 2007, IP-Solutions has been committed to the research, development, and refinement of GNSS solutions. Our particular expertise in ionospheric scintillation monitoring has driven us to present novel models and approaches to simulation, a testament to which are our numerous publications and articles, including three textbooks on GNSS published with Cambridge University Press and Springer. Our simulator solutions represent the result of seven years of collaboration with the Japan Aerospace Exploration Agency (JAXA), offering high signal quality and industry-leading accuracy. Custom models and signals can be implemented through ANSI C Model API and Signal API.

The ReGen simulator features (including optional)

- Position, Start Time, Duration, Static Position or Dynamic Trajectory
- Simulated scenario CSV files with information on satellite navigation data, position, true range, atmospheric errors.
- Signal propagation models (true and broadcast) for ionosphere and troposphere (Klobuchar, Saastamoinen, Hopfield, Black model, etc.).
- Step, Ramp, Acceleration of Pseudorange and Carrier Phase Errors.
- All orbital parameters for broadcast and true ephemerides (including Cuc, Cus, Cic, Cis, Crc, Crs). Input from Yuma, GUI or RINEX (optional).
- Navigation message parameters and bits editing.
- User trajectory input.
- Spoofing simulation.
- Power level control.
- Cut-off antenna elevation angle (including negative)
 - user defined
 - based on Earth tangent
 - Based on local horizon

ReGen advanced features (professional version and optional items)

- Receiver antenna pattern editor.
- Satellite antenna pattern editor.
- Obstruction editor.
- HIL support.
- Trajectory simulator for land vehicle, aircraft, satellite 6-DOF movement.
- INS simulator.
- Satellite clock degradation models.
- SBAS, NavIC grid model.
- Additional tropospheric and ionospheric models including user defined.
- Extensions of Atmospheric models for LEO and GEO satellites
- Multipath simulation
 - Scenario defined attenuation, Doppler, range and phase shifts for two multipath channels for each GNSS channel.
 - Ground reflection model
 - Statistical model
- Advanced ionosphere simulation:
 - NeQuick model, ionospheric gradient error editor,
 - scintillation simulation, ionospheric bubble simulation
 - fault scenarios (RTCA LAAS ICD and FAA CAT-1 LAAS spec).



The ReGen Control Center screenshot showing satellite orbital deployment, NeQuick ionospheric model, vertical TEC distribution, atmospheric parameter models, orbital parameter editor and antenna pattern editor.

Hardware

The ReGen™ simulator is available in a range of configurable options, providing a balance of cost-effectiveness and performance to meet your testing needs. We also provide testing solutions where live satellite signals are recorded and played back.

The Replicator is a high-end simulator chassis model. It houses four RF cards, which are set to specific central frequencies through the GUI.



Replicator RF cards .

The Ninja chassis model provides additional functions for Simulated interference and spoofing (laboratory use). The simulator supports generation of controlled impairments applied to internally generated GNSS signals, including interference-like and spoofing-like conditions, for receiver testing, validation, and training.



*Simceiver™ Previous model is depicted.
New model has a different enclosure.*

The Simceiver™ variant allows to playback signals recorded either on four central frequencies or from four antennas in addition to simulation.

Interface Capabilities

Each simulator model is equipped with a multifaceted interface that includes the following signal and control options:

- One Pulse Per Second (1PPS) Input and Output
- Reference Clock Input and Output
- Trigger

This architecture ensures a seamless and efficient interaction between the simulator and any externally connected systems, facilitating time synchronization, reference clocking, and external triggering functions.

Certain models are available with an optional digital programmable interface offering enhanced customization and control capabilities.



Interface for Ninja and Replicator models

Record and playback solution

The Streamer playback software for Simceiver allows the playback of pre-recorded GNSS signals. PORTOS A1,A2, A4 Recorders are sold separately and also can operate as ARAMIS SDR receiver front ends.



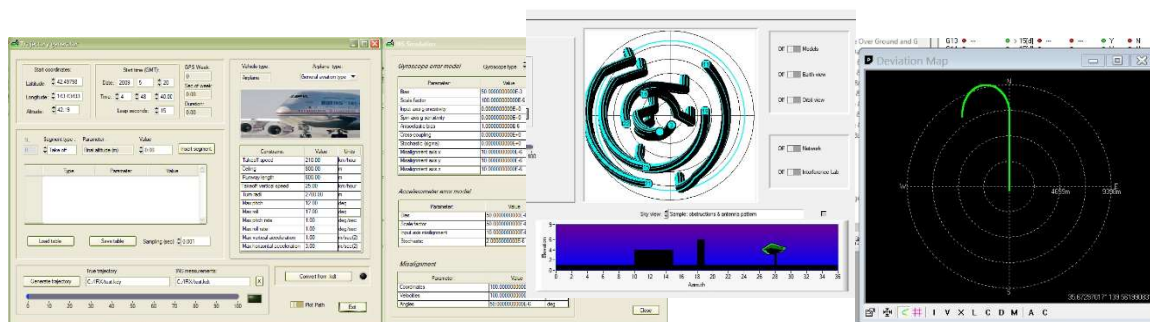
GNSS signal recorder PORTOS A1-R4-L-U2 (supports four frequencies).

Chassis model examples	RF outputs (Ax-)	RF cards (Rx-)	Signal resolution (Qx-)	Model
Simceiver	1-4	2-4	14 (2 for playback)	Development
Replicator A1-R2-Q8	1	2	8	Standard
Replicator A1-R4-Q14	1	4	14	High-end
Replicator A2D-R4-Q14	2	4	14	High-end differential
Ninja A8D-R4-Q14	8	4	14	CRPA

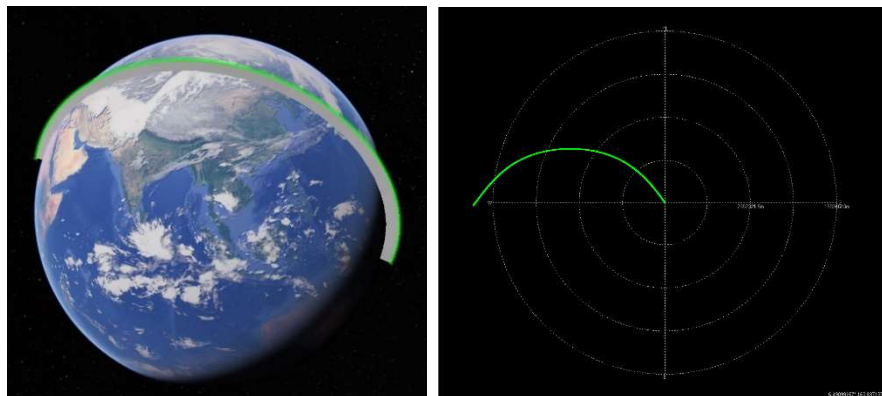
Simulator Chassis models

ReGen dynamic user simulation

ReGen™ supports dynamic trajectory for up to four vehicles. It can work with user-defined trajectory. Additionally, our Trajectory Generator software is also available to generate trajectories for ground vehicles, aircraft, and satellites, along with corresponding INS data using user-defined gyroscope and accelerometer models.

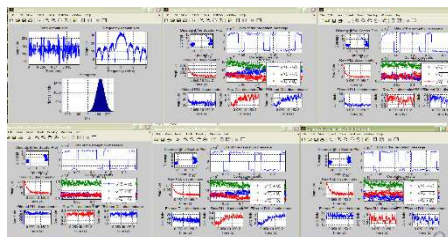


INS and trajectory generator add-on to ReGen. ReGen Skyview plot for simulated circling flight vehicle and uBlox deviation map with position estimate.



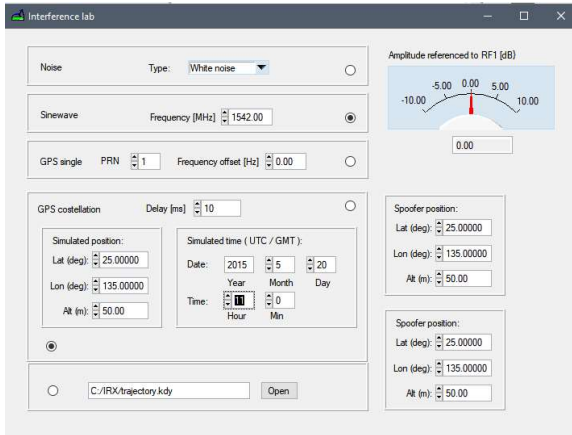
The ReGen™ simulates GNSS signals for a LEO satellite (the data are courtesy by ESA project team).

ReGen-DIF digitized IF simulation (separate product)



ReGen-DIF variant allows for the generation of a simulated digitized IF (DIF) signal similar to one recorded from live satellites. The signal can be played back by specific simulator models using optional Streamer software.

Spoofing and interference simulation



Various options are available to support spoofing simulation. The standard ReGen version can include a Model API, which allows for the simulation of a simple user-defined scenario for RAIM testing. An example of such a scenario is provided with the Model API. The Model API is provided with a ready-to-run Microsoft Visual Studio Project.

The Ninja variant supports controlled generation of signal impairments and interference waveforms for receiver robustness testing, validation, and operator training in laboratory environments. Capabilities are configurable per band and per signal, and are intended

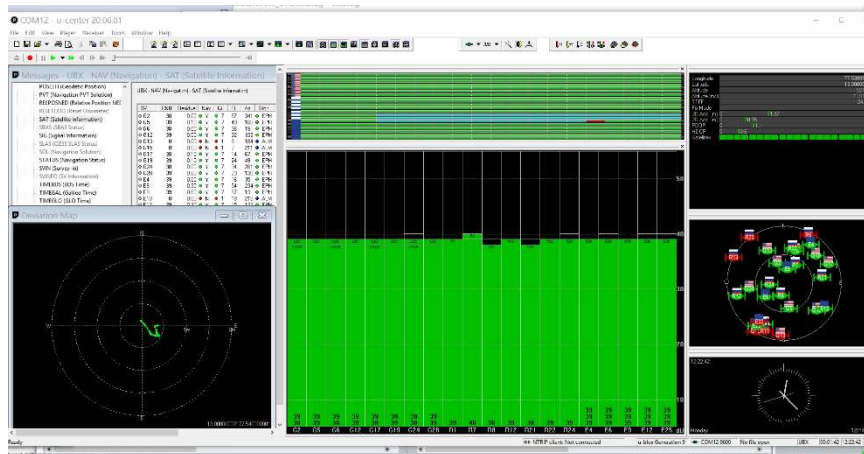
for R&D, verification, and certification support. Detailed configurations are provided on request.

Support and Warranty

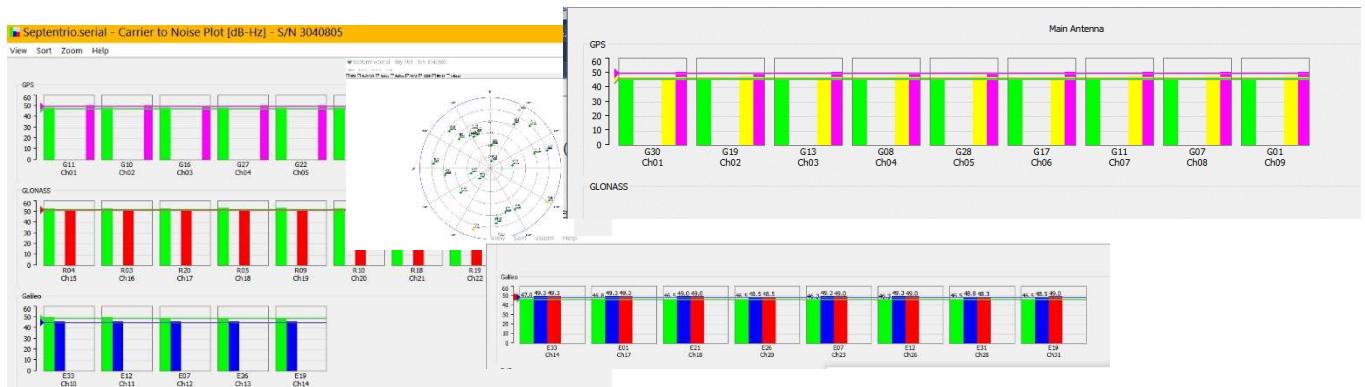
Our dedication to our clients extends beyond delivering products. We provide extensive post-sales support and a comprehensive warranty on our GNSS RF Simulator and recorder products. We also provide our customers with customized updates.

Compatibility with COTS receivers and receivers under development

Our GNSS RF Simulator delivers high-fidelity performance when interfacing with a variety of COTS receivers. Successful test scenarios have been conducted with receivers such as uBlox 9, Novatel OEM7, Septentrio, Trimble, AllyStar, with the simulator effectively provided dual and triple frequency signals. Notably, with the support from our simulator, high-end receivers can demonstrate decimetre-level accuracy.



uBlox 9 working with the Replicator A1-R4-Q8-U3 dual frequency GPS, GLONASS and Galileo simulated signals. The scatter plot is usually within 50 cm from true position.



Revision history

This section documents the changes made to the IP-Solutions Simulator product datasheet.

Version	Release Date	Description of Changes
v24_01	2024 / 01	Revision history section, ReGen software version list, chassis version list updated
v24_01_RFE	2024 / 02	Enhanced specification and adjusted values for tailored product features Ref.Q-0124AI
v24_02_RFE	2024 / 02	Custom unit only specification for clarification
v24_08	2024 / 08	Simceiver simulator version is updated to U3
v24_10	2024/10	Replicator is now supporting up to 8 RF cards , similar to Ninja model
v25_01	2025/01	SBAS L5 added
v25_02	2025/02	Simceiver standalone model is replaced by Simceiver Suite of simulator and receiver
v26_01	2026/01	Naming conventions are modified
v26_07	2026/07	Specification clarification on inter-channel bias

Note: Each version of the datasheet supersedes previous versions unless otherwise stated. For RFE (Request for Enhancement / Explanation) specific versions please refer to the version number appended with 'RFE', which indicates custom or additional features not included in the standard products.