

GNSS SIMULATOR

**GENOS**™



# User Guide

## About this Guide

This user guide describes how to operate the Genos system. This guide is intended for GNSS technical personnel that will use Genos to emulate satellite-positioning signals for testing receivers.

This guide contains the following chapters:

- **Chapter 1, Introducing the Genos**, introduces the Genos functionality, system architecture and package content.
- **Chapter 2, Using the Genos User Interface**, describes the general work flow for using the Genos system and each of the options in its windows, toolbar and menu bar.
- **Chapter 3, Testing with Genos**, describes predefined and customized automatic tests, that could be performed using the Genos system, the appropriate way to run tests, to define them, and the way to retrieve the results.
- **Chapter 4, Creating a Trajectory**, describes the trajectory used by Genos, how to create it and its format (RMF).

This user guide describes all Genos user options, according to the license permissions. Some of the features described in this user guide may or may not be activated.

# Important Notice

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## Table of Contents

<b>About this Guide</b> .....	<b>i</b>
<b>Important Notice</b> .....	<b>ii</b>
<b>Chapter 1: Introducing Genos Simulator</b> .....	<b>1</b>
<b>Genos Simulator Description</b> .....	<b>1</b>
Genos Simulator Functionality .....	1
Genos Simulator Usage .....	1
Genos Package Contents .....	2
Genos Simulator Device .....	3
<b>Genos System Architecture</b> .....	<b>3</b>
<b>Closed Loop Testing</b> .....	<b>4</b>
<b>Chapter 2: Genos User Interface</b> .....	<b>6</b>
<b>Using Genos - Work Flow</b> .....	<b>7</b>
Main Window .....	8
Toolbar .....	10
Menu .....	10
<b>Simulator Properties - configuration</b> .....	<b>14</b>
Configuration Options .....	14
Configuring the Genos Simulator .....	14
<b>Sky Map Tab</b> .....	<b>18</b>
Removing/Adding Satellites .....	20
<b>Google Earth Map™ Tab</b> .....	<b>21</b>
<b>Trajectory difference</b> .....	<b>21</b>
<b>Results Tab</b> .....	<b>22</b>
<b>GNSS System &amp; Satellite Selection</b> .....	<b>23</b>
<b>Chapter 3: Testing with the Genos System</b> .....	<b>25</b>
<b>Using the Genos Simulator to Test a Receiver</b> .....	<b>25</b>
Configure the test .....	25
<b>Automatic Test</b> .....	<b>26</b>
Test Definition .....	26
Running Tests .....	26
During the Test .....	28
After the Test .....	29
<b>Defining New Tests</b> .....	<b>29</b>
Start simulation .....	31
Stop simulation .....	31
Attenuation .....	32
Add satellite .....	32
Remove satellite .....	33

---

IF Event .....	33
End Of File .....	34
Loop .....	34
<b>Create a test - example .....</b>	<b>35</b>
<b>Chapter 4: Creating a Trajectory .....</b>	<b>40</b>
<b>Syntax of RFM File .....</b>	<b>43</b>
<b>Technical Support .....</b>	<b>45</b>

**Table of Figures**

---

Figure 1. Genos System Architecture .....	4
Figure 2. Visual Test Report Using Google Earth Map™ .....	5
Figure 3. Difference Between Trajectories in meters .....	5
Figure 1. Genos Simulator Overall Trajectory Difference .....	22
Figure 2. Genos Simulator LLA Trajectory Difference .....	22

# Chapter 1: Introducing Genos Simulator

This chapter describes the Genos Simulator, its system architecture and some of the possibilities for its use.

## Genos Simulator Description

The Genos system is a high-dynamics, flexible, Global Navigation Satellite Systems (GNSS) signal simulator that can be used, among other things, for testing of any product that incorporates satellite navigation functionality.

It can be configured to simulate the satellite signals that will be visible to a GNSS receiver in any location in the world, at any time (both past and future) and along any trajectory.

The Genos system has an extremely high update rate up to every one millisecond, supporting unique high-dynamic trajectories.

The flexibility and features of this easy-to-use and intuitively designed software makes it ideal for product development, evaluation and testing environments. Genos system can simulate the signals from one or more of the following satellite systems according to user license:

- GPS
- Galileo
- GLONASS
- COMPASS
- QAZZ
- SBAS
- WAAS
- EGNOS
- GAGAN

## Genos Simulator Functionality

Genos Simulator accurately simulates the GNSS signals. The specific transmission is determined by the user, either by using predefined default settings, or by using the easy to use graphical user interface (GUI).

A broad range of configuration options are available to the user in order support a rich variety of test scenarios. User can use the Genos to simulate signals along a specific trajectory (the route's longitude, latitude, altitude), satellite constellation (Almanac or ephemeris), time period (both past and future), signal power, dynamics (plane, car pedestrian).

Another convenient option for configuring the Genos trajectory is through importing trajectories defined in Google Earth™ or using a textual script.

## Genos Simulator Usage

Genos Simulator helps the user to evaluate the performance and characteristics of a GNSS receiver, including the following:

- **Time To First Fix (TTFF):** Specifies the amount of time required for a GNSS receiver to acquire satellite signals and navigation data and then to calculate a position solution (also called a fix).
- **Acquisition Sensitivity:** Specifies the minimum signal level (dBm) at which a GNSS receiver can successfully execute a cold start TTFF within a specified time frame.
- **Tracking Sensitivity:** Specifies the minimum signal level (dBm) at which a specific GNSS receiver can successfully maintain a location fix within a specified degree of accuracy.
- **Location Accuracy:** Specifies the deviation between the positioning information that the Genos simulate and that the receiver detects. Typically, a GNSS receiver calculates and can be evaluated according to the following parameters:
  - Position: Longitude, Latitude & Altitude or Earth Center Earth Fix (X Y Z)
  - Velocity: Longitude, Latitude & Altitude or Earth Center Earth Fix ( $V_x V_y V_z$ )
  - Time
  - Frequency
  - Dynamics: the receiver dynamics limitations. (velocity, acceleration and jerk)

## Genos Package Contents

Genos is comprised of a 1U Genos signal simulator and a Genos PC that controls it. Both these devices come installed and ready to plug-and-play. The following describes the components provided in the Genos package:

- **Genos Simulator Device:** 1U 19" satellite RF signal transmission device.
- **Genos PC Computer:** 1U 19" PC computer Genos software installed.
- **Ethernet Cable:** 1Gbe Ethernet cable to connect between the Genos PC and the Genos Simulator device.
- **AC Cords:** Two AC power cords one for the Genos PC and the other for the Genos Simulator.
- **RF Cable**
- **Passive antenna**

## Genos Simulator Device



The front of the Genos device has the following features:

- **RF OUT Port:** Streams the simulated signal to receivers. This port can be connected directly to receivers via a standard RF cable. A splitter can be used in order to connect to two or three receivers. Future Genos versions will enable the connection of an antenna that will transmit the emulated signal.
- **Power On Indicator LED:** Indicates that the Genos firmware is properly loaded and operational.
- **Reset button**

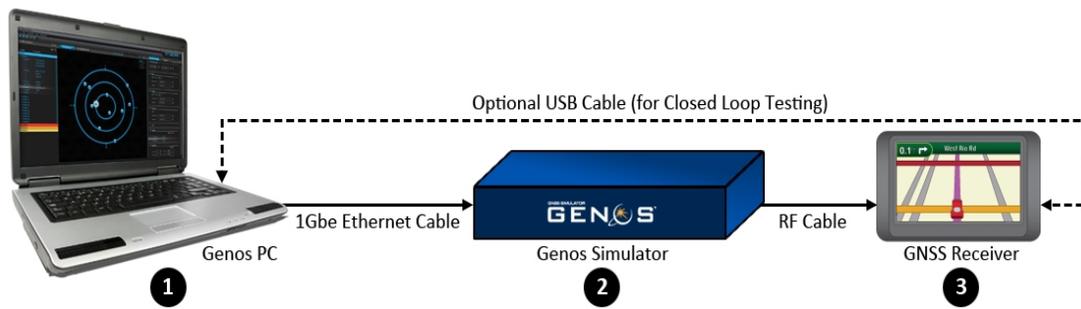


The back of the Genos device has the following features:

- **Ethernet Port:** Connects to the Genos PC via a Ethernet cable provided in the Genos package.
- **Power Button**
- **Power Inlet:** Universal AC power (110-230)

## Genos System Architecture

The following depicts the flow of a Genos system:



**Figure 1. Genos System Architecture**

1. **Genos PC:** The Genos GUI runs on the provided Genos. It enables you to configure the Genos system, to define and execute tests and explore the results. The Genos PC may be connected to the Internet in order to support displaying the trajectory using a Google Earth Map™.
2. **Genos Simulator:** The Genos Simulator is a high performance GNSS RF signal generator
3. **GNSS Receiver/DUT (Device Under Test):** The GNSS receiver receives an ongoing satellite signal and calculates user position. The DUT can be connected to a Genos PC USB port for performance testing.

## Closed Loop Testing

The DUT (GNSS receiver) can be connected via a USB port to the Genos PC. Genos PC displays the deviation (error) between the positioning information simulated and the position calculated by the device under test.

This information is presented in two ways, one is using Google earth map where both the transmitted trajectory and received trajectory are marked on the same map (Figure 2) and the second is the overall difference between these trajectories in meters (Figure 3).

In addition to the visual difference representation a textual test report is also provided comparing emulated positioning and DUT results.



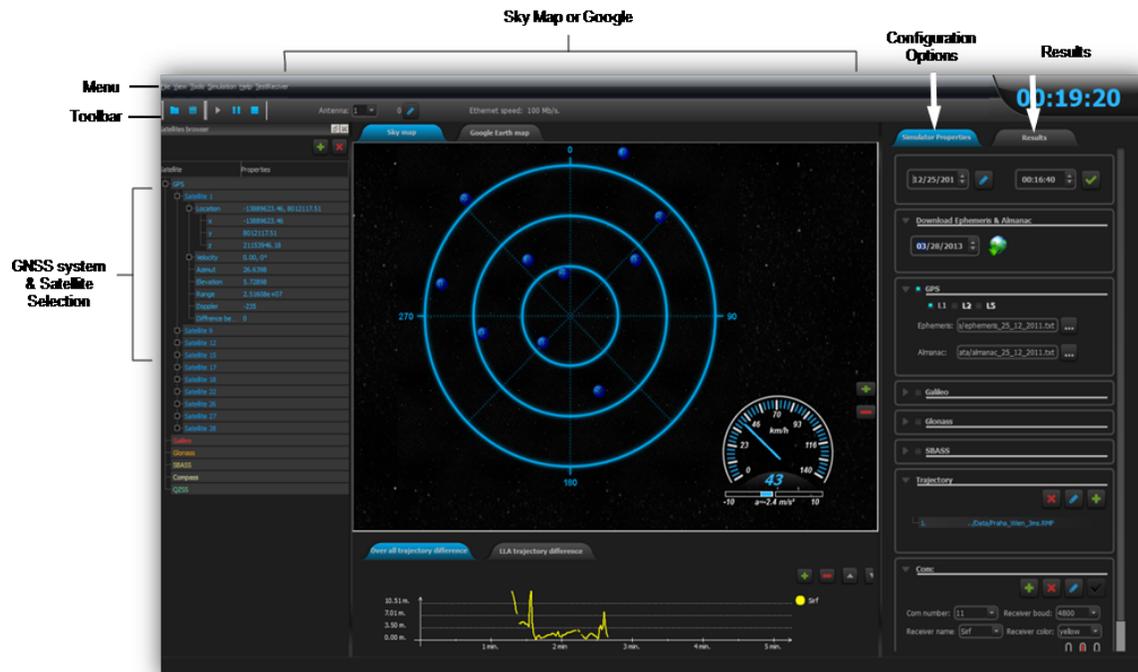
Figure 2. Visual Test Report Using Google Earth Map™



Figure 3. Difference Between Trajectories in meters

## Chapter 2: Genos User Interface

This chapter describes the main Genos window.



- **Toolbar:** Provides various tools for controlling the transmission of the emulated signal, the tool consist of : start simulation, pause and stop, open and save configuration.
- **Menu:** Provides various options for configuring and controlling the Genos. The menu can open Satellite System Selection Pane, Simulator Properties Tab, Automatic test and Help menu.
- **Configuration Options Tab:** Provides a variety of options for configuring the Genos Simulator, receiver connection and emulation behavior. Refer to the [General Properties Menu on page 11](#) for more information.
- **Sky Map Tab:** Displays satellite's relative position to the simulator user position
- **Google Earth Map Tab:** Displays the simulated trajectory versus the DUT calculated trajectory (in a Closed Loop configuration) on a Google Earth map.
- **Trajectory Difference:** Displays difference between that transmitted trajectory and the received trajectory (as was reported by the DUT) in meters is presented.
- **Results Tab:** Results tab have two functions:
  1. Displays the results of the closed loop test - compares the emulated position to the DUT results
  2. In case of Automatic Test shows test progress.

- **GNSS system & satellite selection:** Shows all the satellites that are visible in the currently defined trajectory. Satellites can be removed or added using the **Remove** / Add button.
- **MISC. - Clock and Speedometer Entries:** These entries provide information about the speed that the DUT is set to travel the specified trajectory and the exact time this trajectory was traveled.
- **Multi-path Tab:** TBD

## Using Genos - Work Flow

The following describes how to start using the Genos system.

- **To get started with the Genos:**
  1. Connect the Genos PC to the Genos Simulator using the provided Ethernet cable.
  2. Connect the RF Output port of the Genos Simulator to the DUT - up to three receivers can be connected using a RF splitter(not provided).
  3. For Closed loop option test connect each DUT to the Genos PC using a USB port. Each receiver should be connected to a different USB port on the PC.
  4. For viewing the trajectory on a Google Earth map Connect the Genos PC to the Internet
  5. Power on the Genos Simulator. Its power button is shown in Figure 2 on the back of the Genos Simulator.
  6. Power on the DUT.
  7. Power on the Genos PC. The Genos software automatically loads. The following window is displayed:



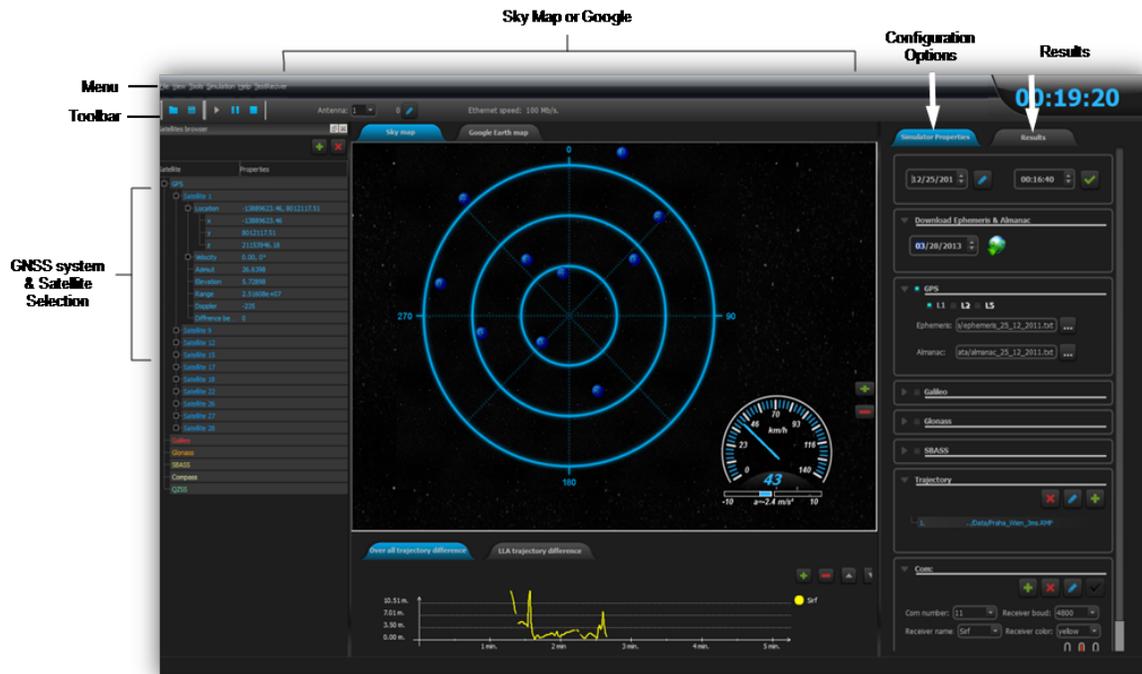
8. The Genos system transmits simulated signals by clicking the **Play** button. The Genos comes out-of-the-box with a default trajectory (ongoing longitude, latitude, and altitude), satellite constellation, time period, dynamic, attenuation, Ephemeris and Almanac so that it can automatically start transmitting when clicking **Play** button.

***Congratulations, your receivers should now be receiving the transmitted GNSS signal!***

9. Configure the Genos Simulator properties to define the type of DUT and the signal that the Genos should simulate. Please consult the following sections for that:
- **General Properties Menu** on page 11, for a description of how to define various general attributes of Genos system functionality.
  - **Simulator Properties Tab**, on page 14, for a description of how to define various attributes of the emulated signal.
  - **Configuring the Genos** on page 14, for a description of how to save and open various configurations that define how the Genos operates.

## Main Window

This section describes the Genos main window.



- **Toolbar:** Provides various tools for controlling the transmission of the emulated signal, the tool consist of : start simulation, pause and stop, open and save configuration.
- **Menu:** Provides various options for configuring and controlling the Genos menu can open Satellite System Selection Pane, Simulator Properties Tab, Automatic test and Help menu.
- **Configuration Options Tab:** Provides a variety of options for configuring the Genos Simulator, receiver connection and emulation behavior. Refer to the [General Properties Menu on page 11](#) for more information.
- **Sky Map Tab:** Displays satellite's relative position to the simulated user position
- **Google Earth Map Tab:** Displays the simulated trajectory versus the DUT calculated trajectory (in a Closed Loop configuration) on a Google Earth map.
- **Trajectory difference:** Displays difference between that transmitted trajectory and the received trajectory (as was reported by the DUT) in meters.
- **Results Tab:** Results tab has two functions:
  1. Displays the results of the closed loop test - compares the emulated position to the DUT results.
  2. In case of Automatic Test shows test progress.
- **GNSS system & satellite selection:** Shows all the satellites that are visible in the currently defined trajectory. Satellites can be removed or added using the Remove / Add button.

- **Misc. - Clock and speedometer entries:** These entries provide information about the speed that the DUT is set to travel the specified trajectory and the exact time this trajectory was traveled.
- **Multi-path Tab:** TBD

## Toolbar

Tools enable control of the simulated signal transmission, and selection and saving a simulator configuration file:



**Load Button:** Load a previously saved configuration XML file. The Load button will activate and used the new configuration. When you restart the Genos application, it automatically reverts to its default configuration, therefore use the Load button to select and load the required configuration.



**Save Button:** Saves the current loaded configuration (including all the latest changes) as an XML file that can be reloaded.



**Play Button:** Starts transmitting a signal via the Genos Simulator's RF output port according to the loaded configuration.



**Pause Button:** Pauses transmission of the signal. You can click the **Play** button to continue along the same trajectory.



**Stop Button:** Stops transmission of the simulated signal. When you click the **Play** button again, the loaded configuration starts from the beginning of its trajectory.



**Attenuation Select:** Use the attenuation button, to invoke the attenuation slider.

**Attenuation Adjust:** Use the attenuation slider, to select the required attenuation of the selected antenna. The attenuation (RF signal power) can be changed at any time, even while the Genos Simulator is playing.

Ethernet speed: 100 Mb/s.

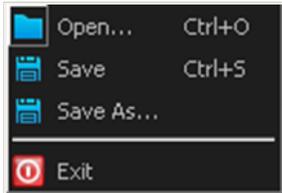
**Ethernet speed:** Displays the type of Ethernet connection (100 Mb/s or 1Gb/s) between the PC and the Genos

## Menu

The Menu is located at the top of the window.

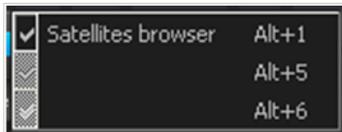
File View Tools Simulation Help TestReceiver

## File Menu



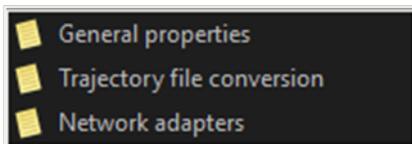
- The **Open** and **Save** options provide the same functionality as **Load Button** and **Save Button** described in section [Toolbar on page 10](#).
- **Save as:** let you save the currently loaded configuration under a different name.
- **Exit:** Closes the Genos application and stops Genos Simulator signal transmission.

## View Menu



The options in this menu display or hide the specified window pane.

## Tools Menu



## General Properties Menu

The **General Properties** menu lets you define various general attributes of Genos system , as described below.

Simulator Units

Speed

Supported devices:

Receiver Name	Cold Start Message	Warm Start Message	Hot Start Message			Edit
Sirf4	REDGHDg\$xybx...	REDGHDg\$xybx...	REDGHDg\$xybx...			
Ublox5						
Custom 1						

Emulator MAC Address

	1	2	3	4	5	6			Edit
1	0x01	0x05	0x01	0x06	0x01	0x01			
2									
3									
4									

Antenna configuration

	Trajectory	Mac Address	Delta X	Delta Y	Delta Z	Delta Roll	Delta Peach	Delta yoh	Antenna pattern			Edit
1			5.8	10.2	6.3	5.9	5.8	7.6	...			
2												
3												
4												

**Simulator units:** Speed: select speed units

**Supported devices:** Define device under test used.

**Simulator Mac Address:** Define simulator Mac address. This field needs to be configured only in the case of multi-simulator configuration.

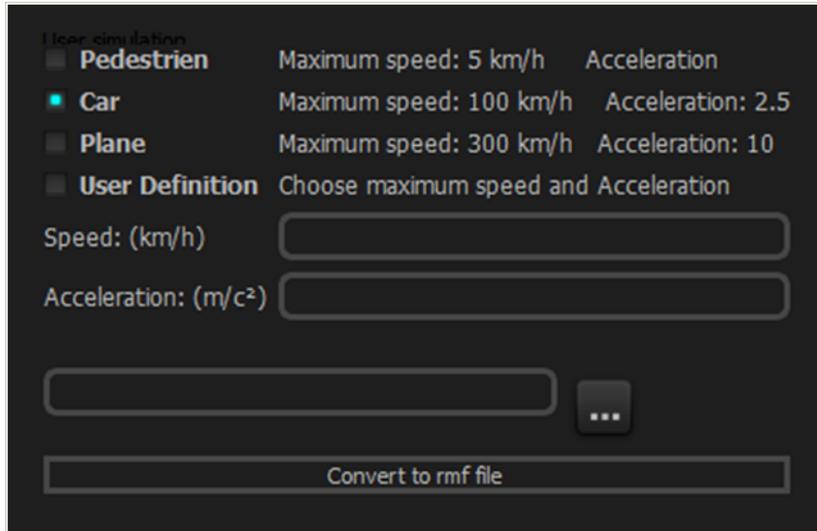
**Antenna Configuration:** This field needs to be configured only in the case of multi-simulator configuration.

**Ethernet Speed:** Sets the type of Ethernet connection (100 Mb/s or 1 Gb/s) between the PC and the Genos.

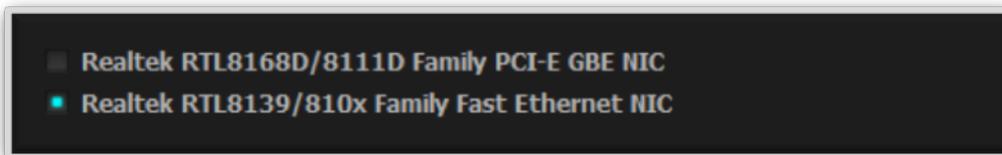
**Note**

User can configure parallel Genos Simulators in order to test multi-antenna systems. This feature is out of scope for this user guide. Contact [Frontline technical support](#) if you are interested in this option.

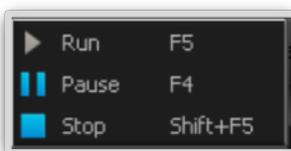
**Trajectory file conversion menu:** convert imported KML file from Google earth to Genos Simulator proprietary format. (RMF File), more detailed explanation will appear in [Chapter 4: Creating a Trajectory on page 40](#).



**Com Card Interface:** The Genos PC can be equipped with several network interface cards (NICs). This section presents all the cards that are installed in the PC, the user needs to indicate the appropriate card that is connected to the Genos. This selection does not affect connection speed or any other NIC's properties. These properties need to be configured using the NIC's attributes in Windows.

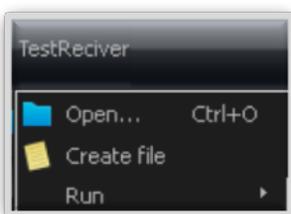


### Simulation Menu



The **Run**, **Play** and **Stop** options provide the same functionality as the Run, Play Stop tools in the toolbar, described in [Toolbar on page 10](#).

### Test Receiver Menu



- **Open:**
- **Create file:** can be used to define new tests using the script generation options provided by Genos system. Refer to [Defining New Tests on page 29](#) for more information.
- **RunTest Script:** can be used to activate predefined tests provided out-of-the-box, or a test that was created using the **Create file** option.

## Help

Provides information on setting up, configuring, and running the Genos Simulator.

## Simulator Properties - configuration

This section describes how to configure and define Genos simulator properties.

### Configuration Options

The configuration specifies the trajectory (ongoing longitude, latitude, and altitude), satellite constellation, Ephemeris and Almanac, time period (both past and future), dynamic, signal power and more. The configuration is saved in an XML file.

### Configuring the Genos Simulator

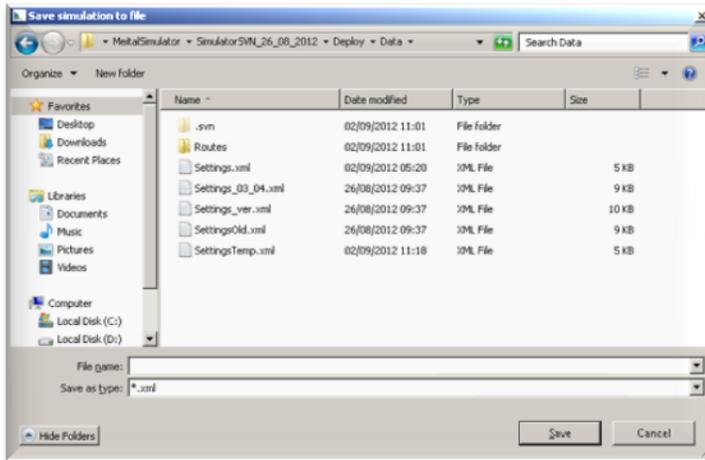
The Genos Simulator is an out-of-the-box ready-to-use simulation system. Its default transmitted signal is a route/path from the Lincoln monument in Washington DC to the White House on Capitol Hill on the 4<sup>th</sup> of July 2012.

The user only needs to modify the Genos configuration to change the default signal that is transmitted and/or to work in a Closed Loop testing mode (which compares the signal sent by the Genos Simulator with the signal calculated by the GNSS receiver being tested).

Changes in the configuration are applied after using the **Play** button. Save the configuration for reuse, otherwise the next time you Initialize the Genos application, it will revert to using the default (or previously defined) configuration again.

#### To save configuration changes:

1. Configure the Genos as required.
2. Select the **Save**  tool from the toolbar. The following window is displayed: is displayed:



3. Assign the configuration file a name and then click the **Save**  tool or use the **Save as** option in the **File** menu. The file must have an XML extension.

### To load a saved configuration:

1. Click the **Load**  tool.
2. Select the XML file of the required configuration.
3. Click the **Load** button.

### Properties and sub titles:

- Time and Date
- Satellite System,
- Ephemeris and Almanac
- Downloads Ephemeris and Almanac
- Trajectory
- Com port

### Time and Date

Defines the time period (start date) of the trajectory. Ensures that the Ephemeris and Almanac files specified by the current configuration support the relevant dates.



To specify the time and date of the emulated signal:

1. Select the **Simulator Properties** tab.
2. In the **Time and Date** area, click the **Edit**  button to enable the update of the date and time.
3. Change the Date and Time fields, as needed.
4. Click the  button to apply this change to the emulated signal.

### Satellite System Constellation, Ephemeris and Almanac

Ensures that suitable satellite Ephemeris (RINEX format) and Almanac file exist for each satellite system, for the time period to be simulated by Genos.



### Selecting the Satellite System

To enable a satellite system:

1. Check the check box to the left of the satellite system name to include it in the simulated signal, as shown above.
2. The frequency supported by a satellite system is indicated under the satellite system name. For example, the screen above shows **L1**, **L2** and **L5** for GPS. Select the check boxes of each one to be included in the simulated signal.

### Selecting the Ephemeris and/or the Almanac

The Ephemeris file specifies the latest and most precise satellite orbital data. The Almanac file specifies the general satellite orbital data for all satellites.

To modify the Ephemeris and/or the Almanac:

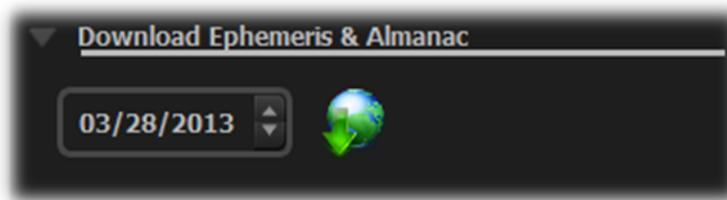
1. Select the **Simulator Properties** tab.
2. Ephemeris files can be downloaded from the Internet to the Genos computer. In the **Ephemeris** field, click the **Browse**  button and select the Ephemeris file that is suited to the currently selected date range.
3. Almanac files (file extension .txt) can be downloaded from the Internet to the Genos computer. In the **Almanac** field, click the **Browse**  button and select the Almanac file that

is suited to the currently selected date range.

4. Click the  button to apply this change to the emulated signal.

### Download Ephemeris and Almanac

In order to determine satellite position the Genos configuration requires an appropriate Ephemeris and Almanac file set. This information can be downloaded automatically from the Internet. Select the date for which these files are needed and select download. The Genos PC will download the files and store them at Deploy/Data



### Trajectory

The Genos Simulator is provided with a default trajectory (route) which is from the Lincoln monument in Washington DC to the White House on Capitol Hill on the 4<sup>th</sup> of July 2012. You also have the option to define your own trajectories by creating an RMF file using Google Earth, as described in [Chapter 4: Creating a Trajectory on page 40](#). According to your license, you may be provided with various additional trajectory files.

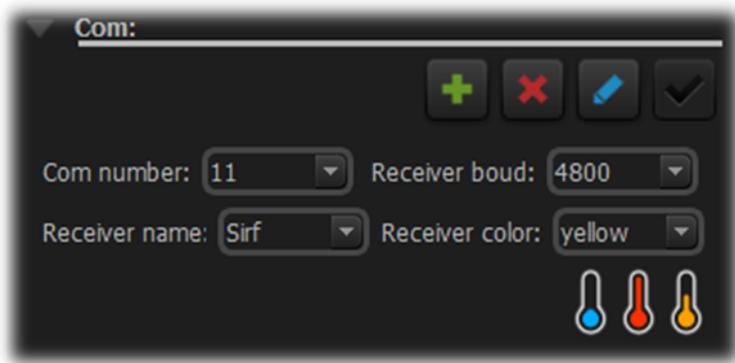


Select a trajectory using the **Add**  button.  
 To define the trajectory

1. Select the **Simulator Properties** tab.
2. In the **Trajectory** area, click the **Edit**  button to display the following window.
3. Click the **Browse** button and select the new RMF file.

### Com Port Options

Comport option define the communication properties for DUT. - Up to three DUT can be connected to the Genos Simulator. (If you want to connect an Unknown Genos DUT, set it at General Properties)



To configure the Com port:

1. Select the **Simulator Properties** tab and scroll down to its bottom.
2. In the **COM number** field, select the port used to connect the DUT to Genos PC
3. In the **Receiver Name** field, select the receiver to be configured. The receivers supported by Genos are defined in the [General Properties Menu on page 11](#).
4. In the **Receiver baud** field, specify the BAUD rate of the COM port connected to the receiver selected in the **Receiver Name** field, described above.
5. In the **Receiver Color** field, select the color that represents the receiver selected in the **Receiver Name** field. This color is shown graphically in the **Google Earth Map** tab and textually in the Genos application. Furthermore, this color will also be used in the error graph to represent the associated receiver.

Note

The trajectory transmitted by the Genos Simulator is represented in green.

6. While the Genos Simulator is playing, you can click the **Cold Start** button to send the receiver a cold start message. The Genos comes predefined out-of-the-box with the Cold Start command of the UBlox and SIRF receivers. To define the Cold Start command of other receivers, use the [General Properties Menu on page 11](#).



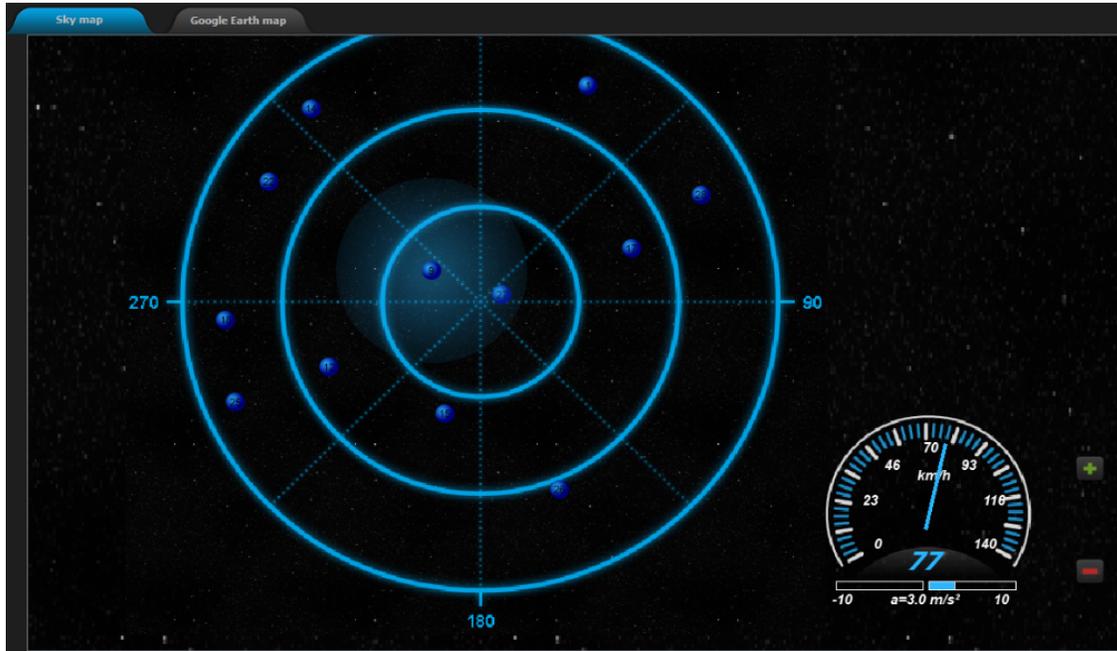
Click **Warm start** or **Hot start** button to send a Warm Start command or a Hot Start command (accordingly) to the receiver in the same manner as the **Cold** button. The Warm Start command and the Hot Start command of each receiver must also be defined in the **General Properties** menu.

## Sky Map Tab

The **Sky Map** tab displays the position of the overhead satellites' azimuth and elevation according to the currently loaded configuration. The satellite constellation reflects their position relative to the

user, at the defined date and time. As the simulated scenario progresses in time and along the trajectory, the Satellite Map visually reflects the satellites' movement along their orbits.

Click the **Play**  button or the **SkyMap** tab to display the following window:



By default the **SkyMap** tab is displayed showing the orbit of the satellites of the currently selected satellite systems. The color of a satellite indicates its satellite system, such as GPS, Galileo, GLONASS, SBAS and EGNOS, as shown in the Satellite System Legend in the bottom left of the window.

Each colored ball, representing a satellite, has an associated number, starting from 1 and going up to the number of satellites in that satellite systems. For example, the GPS satellite system shows satellites numbered from 1 to 32.

On the lower right-hand corner is a speed odometer that displays the current speed of the trajectory. Below the speedometer is an accelerometer. The accelerometer has two bars. The bar to the right shows acceleration, and the bar to the left shows deceleration. The length of the blue bar shows the amount of acceleration or deceleration.

The Satellite List, on the left of the Sky Map, shows the number of available satellites. By expanding a branch on the list, variety of additional information such as elevation, azimuth can be observed.

Satellite	Properties
GPS	
Satellite 1	
Location	-14252748.32, 5...
Azimuth	21.9423
Elevation	5.1578
Range	2.52236e+07
Doppler	-632
Difference betw...	0
Satellite 9	
Location	14429395.25, -1...
Azimuth	305.286
Elevation	72.1624
Range	1.99748e+07
Doppler	1071
Difference betw...	0
Satellite 12	
Satellite 15	
Satellite 17	
Satellite 18	
Satellite 22	
Satellite 25	
Satellite 26	
Satellite 27	
Satellite 28	
Satellite 14	
Galileo	
Glonass	
SBASS	
Compass	
QZSS	

The currently selected satellite appears highlighted in the Sky Map.

### Removing/Adding Satellites

Satellites can be removed such that the emulated signal does not include them.

To remove a satellite:

1. Select the satellite to be removed from the Satellite pane on the left.

2. Click the **Remove** button  in the top left of the window. That satellite then appears grayed out in the Satellite List and the ball representing it in the Satellite Map is removed.

To add a satellite:





Figure 1. Genos Simulator Overall Trajectory Difference

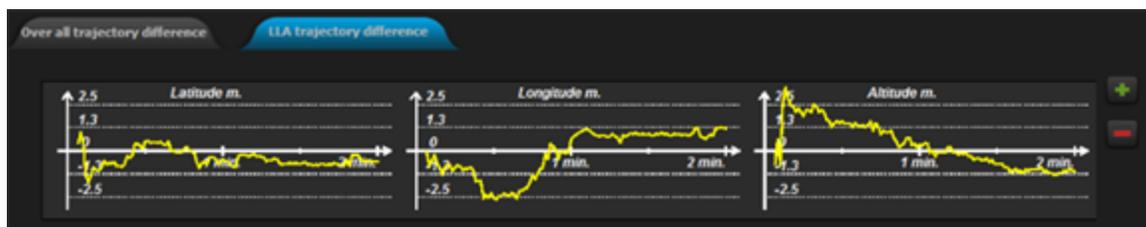


Figure 2. Genos Simulator LLA Trajectory Difference

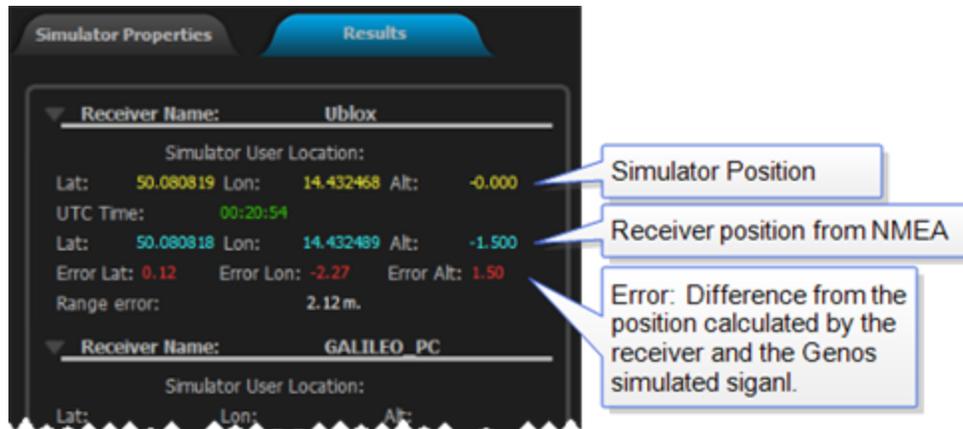
## Results Tab

This Tab is functionally divided into two parts, one is addressing test results and the other provides indication regarding the current state that is executed in automatic testing.

The test results part shows the following:

- Position transmitted by the Genos Simulator
- Position calculated by each of up to four receivers
- Receiver time.
- Errors between Simulator position and Receiver position in meters.

The bottom of the **Results** tab shows the commands of the test script as they are executed. The line that is currently running is displayed in red.



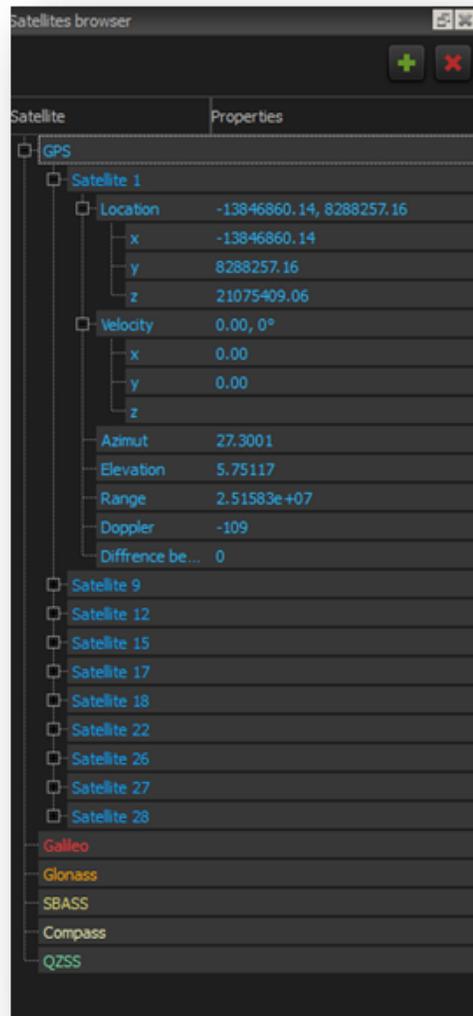
The Automatic test Logger part shows the current status of the test.

## GNSS System & Satellite Selection

The GNSS system and satellite selection tab shows the following:

- GNSS system that are transmitted
- Information regarding specific satellite data (location, velocity etc.)

This tab can also be used to select specific satellite to be highlighted on the sky map display



## Chapter 3: Testing with the Genos System

This chapter describes the types of tests that you can run using the Genos system, how to run tests, what you can do during and after a test and the results created for each test. This chapter also describes how to create your own tests using the Genos system.

### Using the Genos Simulator to Test a Receiver

#### Configure the test

- Set the appropriate time and date for the simulation
- Download the appropriate Ephemeris and Almanac files
- Set the required trajectory for the simulation in an RMF format
- Configure closed loop configuration

#### Closed Loop Configuration

Closed Loop tests provide a comparison between the simulated Genos signals to the trajectory calculated by the DUT. The DUT receives the simulated signals from the Genos device, calculates the position and sends the results to the Genos PC using a NMEA protocol.

- Connect the Port of DUT to the simulator
- Cold start DUT
- Start Simulation

#### Test results

- The calculated sky map is presented.
- The travel trajectory appears
- Simulation time advance
- The difference between the transmitted trajectory and the received trajectory is displayed in two ways:
  1. Google Map
  2. Error Graph

The bottom right of the window displays the **Simulation Results** pane, which provides the following information:

- **Location by Simulation:** Specifies the position of the trajectory in the simulated signal.
- **Location by Receiver:** Specifies the position calculated by each of the receivers. Up to three receivers are supported.

- **Error:** Specifies the difference between the signal transmitted by the Genos and the position calculated by the receiver. This **Error** indicates the total distance between these two positions in a direct line.
- **Simulator Time:** Specifies the time transmitted by the Genos Simulator.
- **Receiver Time:** Specifies the time calculated by the receiver.

## Automatic Test

The Genos system is provided with a [set of automatic tests](#) for common GNSS simulation.

### Test Definition

Genos system is provided out-of-the-box with a variety of tests that you can run immediately, such as: Time to First Fix (TTFF), Acquisition Sensitivity and Tracking Sensitivity. In addition, it provides you with scripting options for creating your own test configurations, that start, stop, raise and lower attenuation and simulate various dynamics, such as a car, airplane, pedestrian and so on. These customized test configurations are defined using the Genos GUI or through a script file.

You may refer to the [Genos Simulator Usage on page 1](#) for a description of the performance attributes that Genos enables you to test, such as Time to First Fix (TTFF), Acquisition Sensitivity and Tracking Sensitivity.

All tests run according to the currently loaded configuration. You may refer to [Configuring the Genos Simulator on page 14](#) for a description of a configuration.

This automatic testing feature allows the user to define a set of tests, execute them and get the results off line thus analyze DUT performance and produce test reports.

The Genos has the following predefined automatic tests:

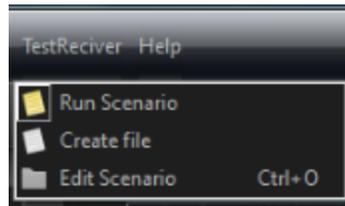
- TTFF - This test inspect the time the DUT requires in order to have a preliminary first result assuming that signals are received at 130 dB.
- Searching sensitivity– This test inspect DUT search sensitivity, the test starts by transmitting signals at -170 dB and inspecting if the DUT was able to recognize at least one satellite in this power level. If no satellite was found, after predefined time frame the Genos increases transmitted power and repeats the search. This test is repeated until at least one satellite is found and at this transmitted power level the system is looking for a position fix.
- Tracking sensitivity - This test inspect the DUT tracking sensitivity and report the positioning error of the DUT at every transmitted power level up to the point the DUT loses position.

### Running Tests

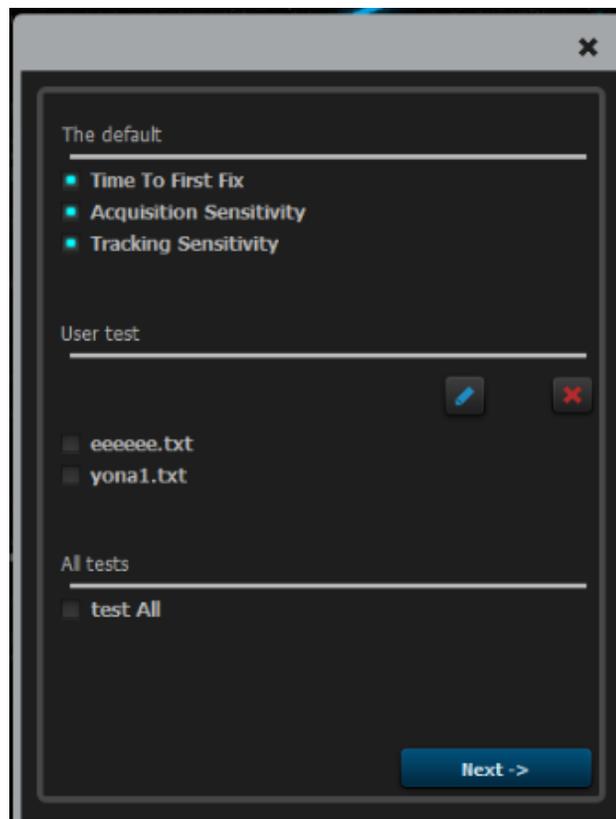
The following describes how to run Genos Simulator preconfigured tests or custom defined tests. Each test that you run is executed four times. The first test starts running immediately. Each subsequent test, runs at an offset of an additional three hours.

**To run a test:**

1. From the **TestReceiver** menu, select the **Run Scenario** option.



2. To run a preconfigured test, select the **Run Scenario** option to display the list of predefined tests provided with the Genos or custom user defined test. Each option performs the test suggested by its name, for example, **Time to First Fix** tests how long it takes the receiver to get first fix. The user can select one or all tests to execute by checking the box next to the test. Click on the **Next** button to proceed.



The user can select one or all tests to execute by checking the box next to the test.

3. You can then optionally fill in the test information window. This information is then included in the Genos results report.

The screenshot shows a configuration window for a test. It is divided into two main sections: 'Properties to file' and 'Properties to run'.  
 Under 'Properties to file':  
 - Examiner: FrontLine  
 - Result File Name: Rcvr1\_Results  
 - Unit Under Test Name: Ublox (selected from a dropdown menu)  
 Under 'Properties to run':  
 - Loop Scenario: 1  
 - RMF file: oy/data/RMF/Frontline to Dulles.RMF (with a file selection button '...')  
 - Comments: (empty text field)  
 At the bottom, there are two buttons: '<< Preview' and 'Start Test'.

- **Produced by:** Specifies the name of the person or business running the test.
- **Results File Name:** Specifies the name of the text file (.txt) into which the results are to be saved.
- **Unit under Test Name:** Select the name of the receiver from the drop down list of available receivers.
- **Loop Scenario:** The number of times to execute the test .
- decrease power level - in case of multiple tests transmitted signal power can be decreased by 30 dB following an additional 69 dB reduction.
- **RMF File:** selected RMF trajectory file for the test.
- **Comments:** added comments will be appeared in the result file.

4. Click the **Start Test** button to start running the test.

## During the Test

The following describes what the Genos PC shows during a test:

- [Sky Map Tab on page 18](#): Displays the active satellites in the simulation.
- [Google Earth Map™ Tab on page 21](#): Displays on Google Earth™ the real-time trajectory simulated by Genos . In closed loop testing the trajectory being generated by the Device Under Test (DUT) is also shown in a contrasting color.
- [Trajectory difference on page 21](#): Graphically displays the real-time trajectory error as well as the Longitude, Latitude, and Altitude (LLA) errors.
- [Results Tab on page 22](#): Numerically displays in real-time the Simulator LLA position, the receiver or DUT NMEA LLA position, the LLA error and Range error in meters.

## After the Test

The following describes what is displayed after a predefined out-of-the-box test is run. This section does not apply to customized tests that you create (using the **Create File** option).

After the test is completed, the results are displayed at the bottom of the window, as shown below:

The screenshot shows the 'Results' tab with the following data for three receivers:

Receiver Name	Simulator User Location	UTC Time	Receiver Position from NMEA	Error	Range error
Sirf	Lat: 50.079871 Lon: 14.430813 Alt: -0.000	00:21:03	Lat: 50.079870 Lon: 14.430818 Alt: -0.000	Error Lat: 0.09 Error Lon: -0.55 Error Alt: -0.00	0.369 m
GALILEO CEVA	Lat: Lon: Alt:		Lat: Lon: Alt:	Error Lat: Error Lon: Error Alt:	
Ublox	Lat: Lon: Alt:		Lat: Lon: Alt:	Error Lat: Error Lon: Error Alt:	
Ublox	Lat: Lon: Alt:		Lat: Lon: Alt:	Error Lat: Error Lon: Error Alt:	

Annotations in the image:

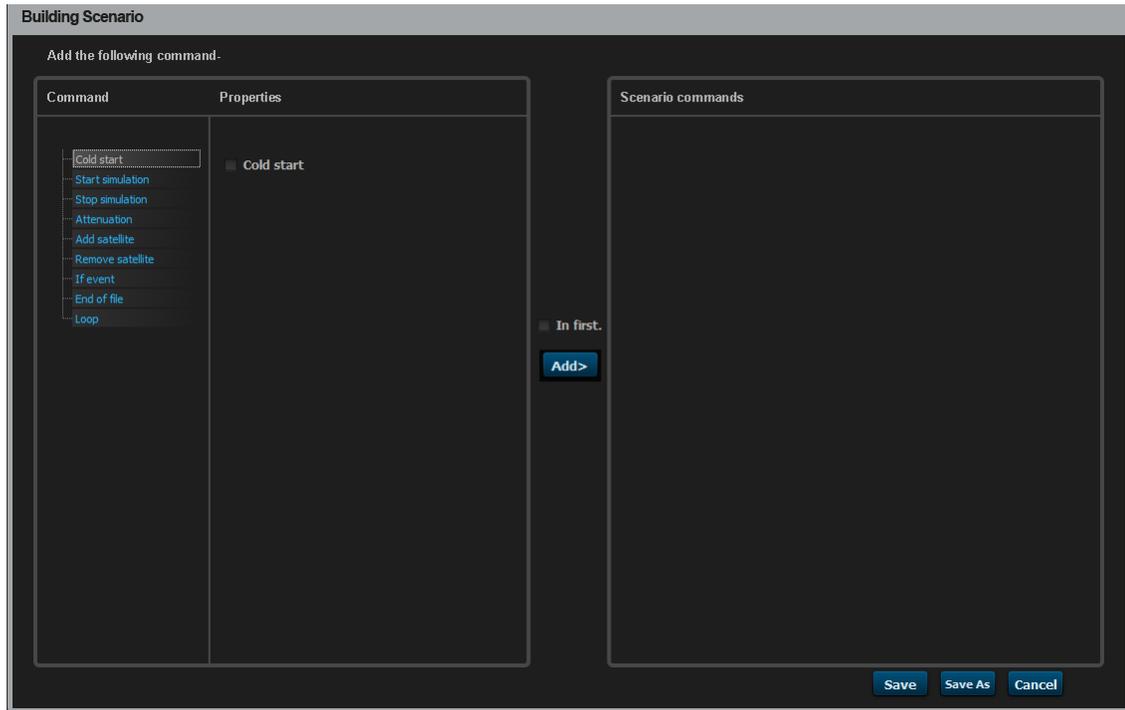
- Receiver 1's Position and Error (points to the Sirf receiver data)
- Simulator Position (points to the Simulator User Location for Sirf)
- Receiver Position from NMEA (points to the Receiver Position from NMEA for Sirf)
- Error: The difference between the position calculated by this receiver and the emulated signal. (points to the Error fields for Sirf)

## Defining New Tests

The following describes how to write your own Genos test script using the script generator provided in the Genos PC application. In addition, you can edit a text file and create your own script.

To define a new test

1. From the **TestReceiver** menu, select the **CreateFile** option. The following window is displayed:



2. From the **List** menu field shown above, select one of the commands to be executed by the Genos Simulator.

The following describes each of the Genos Simulator commands that you can add to the test and the fields to be filled out in order to define it.

- Cold Start
  - **Start simulation**, [on page 31](#)
  - **Stop simulation**, [on page 31](#)
  - **Attenuation**, [on page 32](#)
  - **Add satellite**, [on page 32](#)
  - **Remove satellite**, [on page 33](#)
  - **If Event**, [on page 33](#)
  - **End of file**, [on page 34](#)
  - **Loop**, [on page 34](#)
3. Click the **Add** button to display the command in the right side of this window. Repeat for each command and the command sequence you want for your test.
  4. Click the **Save as** button in the bottom right of the window to save this script as a text file.

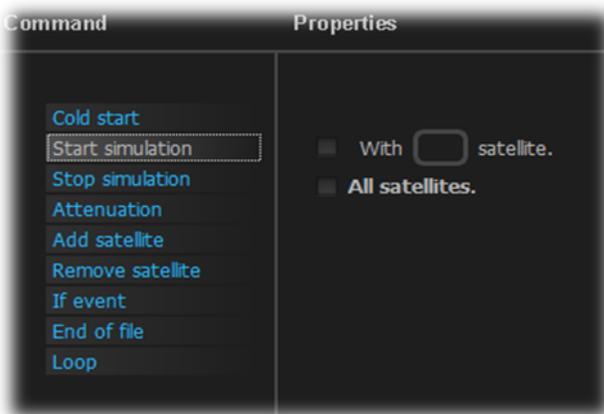
5. Click the **Save** button in the bottom right of the window to save this script as a text file.

### Cold Start

Specifies that the receiver's Cold Start message is sent at the beginning of the test. The DTU cold start message is defined accordingly. You may refer to the General Properties Tab section on page [Genos User Interface](#) for a description of how to define the cold start message.

### Start simulation

Starts transmitting the emulated signal (playing) - according to the currently loaded configuration.

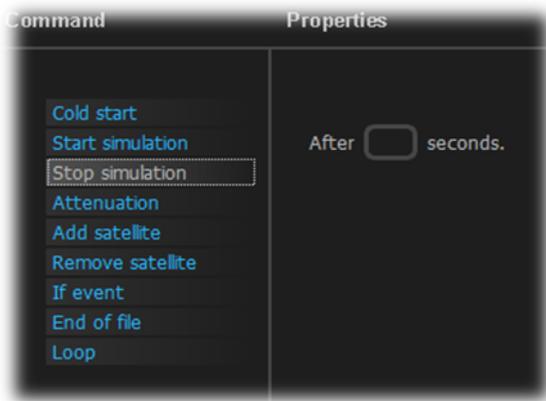


**With X satellites/All Satellites:** Select **All satellites** or specify the number of satellites to be included in the test. The Genos automatically selects all or this number of satellites from those that were overhead the trajectory at the time that you specified.

### Stop simulation

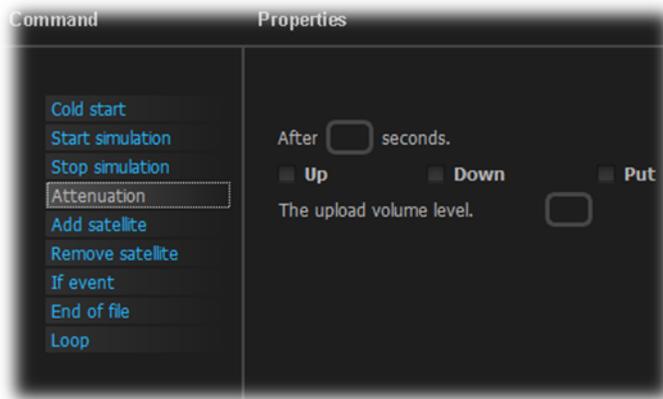
Stops transmitting the emulated signal that is currently playing.

Select one of the following options



**After X seconds:** Specifies the number of seconds after this command is activated.

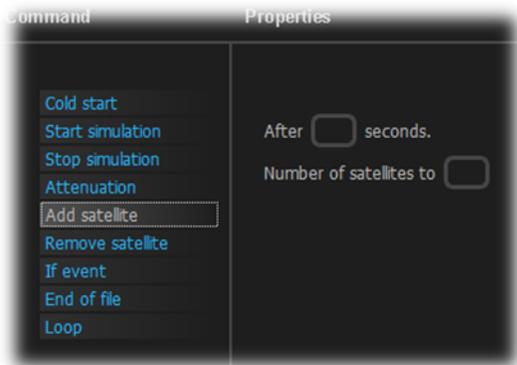
## Attenuation



- **After X seconds:** Specifies the number of seconds after this command is activated.
- **The upload level:** Specifies the number of dBms to change the current attenuation.
- **Up:**
- **Down**
- **Put**
- **The upload level:** Specifies the number of dBms to change the current attenuation.

## Add satellite

Adds the specified number of satellites, after the specified number of seconds.



- **After X seconds:** Specifies the number of seconds after this command is activated.
- **Number of satellites to X:** Specifies the number that the simulation was simulate.

## Remove satellite

Removes the specified number of satellites after the specified number of seconds.

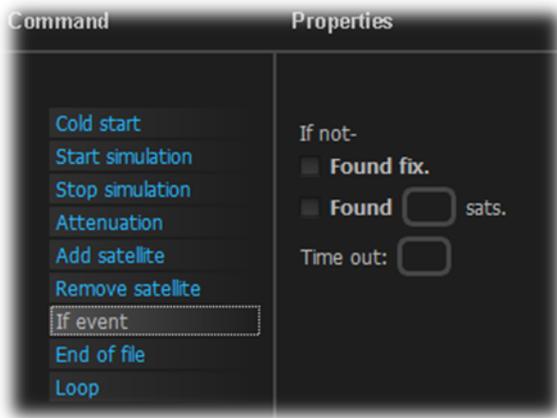


Fill in this area as follows:

- **After X seconds:** Specifies the number of seconds after this command is activated.
- **Number of satellites to X:** Specifies the number that the simulation was simulate.

## IF Event

Genos allows you to set conditions, if the event is happened do X, else do Y.



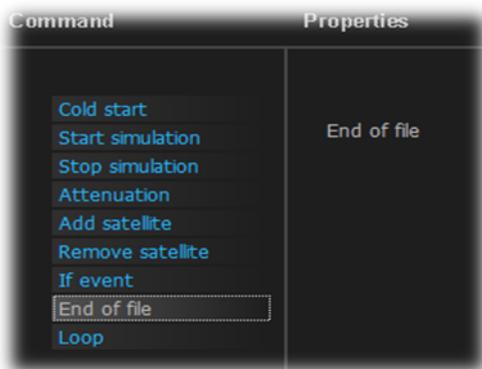
Selected the event that you want to test:

- **Found fix**- the DUT find fix or
- **Found X Satellite** – the DUT found number of satellites.

All commands that you fill bellow appeared in the case that the event doesn't happened in TO. When you select End IF button the commands occurred when the event happened.

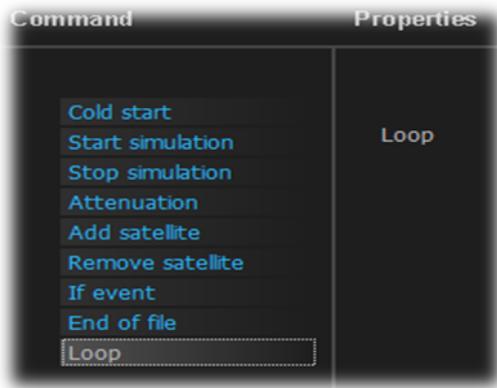
## End Of File

Select a command line in the list.



## Loop

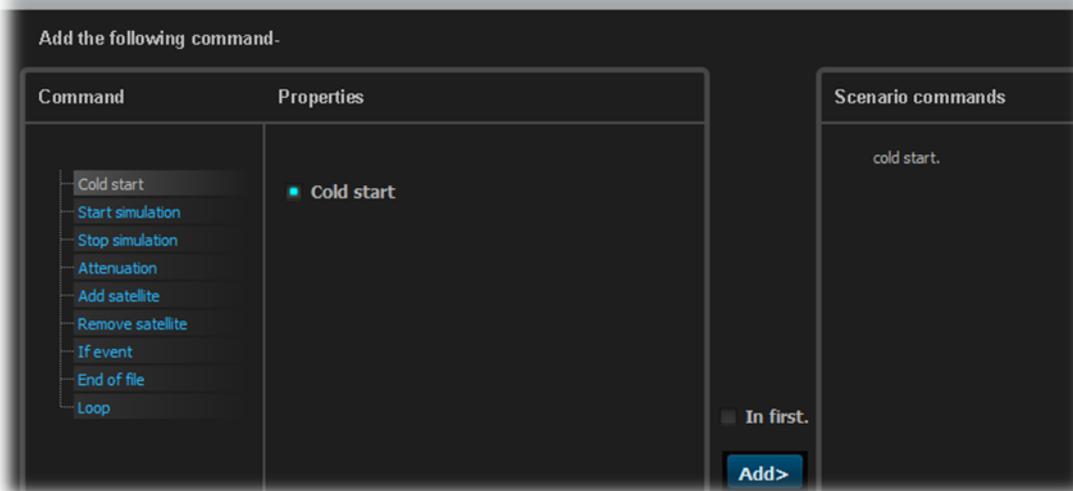
Loop – let the user to return commands Section several times.



## Create a test - example

First reset the DUT using a cold start command

Building Scenario



Next define transmitted signal power level (37dB)

Add the following command-

Then we start simulation

Look for 150 seconds if the DUT discovers at least 5 satellite, if not execute the following :

**Building Scenario**

Add the following command-

Command	Properties
<ul style="list-style-type: none"> <li>Cold start</li> <li>Start simulation</li> <li>Stop simulation</li> <li>Attenuation</li> <li>Add satellite</li> <li>Remove satellite</li> <li>If event</li> <li>End of file</li> <li>Loop</li> </ul>	If not- <input type="checkbox"/> Found fix. <input checked="" type="checkbox"/> Found <input type="text" value="5"/> sats. <input type="checkbox"/> SNR -130db Time out: <input type="text" value="150"/>

In first.

**Add>**

**End if**

**Scenario commands**

```

cold start.
Wait 0 seconds.
Set attenuation 37 DB.
Start simulation with all satellites
found 5 sats. time out: 150. If not:
          
```

Stop simulation (NOT the TEST) and End of File.

**Building Scenario**

Add the following command-

Command	Properties
<ul style="list-style-type: none"> <li>Cold start</li> <li>Start simulation</li> <li>Stop simulation</li> <li>Attenuation</li> <li>Add satellite</li> <li>Remove satellite</li> <li>If event</li> <li>End of file</li> <li>Loop</li> </ul>	After <input type="text" value="0"/> seconds.

In first.

**Add>**

**End if**

**Scenario commands**

```

cold start.
Wait 0 seconds.
Set attenuation 37 DB.
Start simulation with all satellites
found 5 sats. time out: 150. If not:
  Wait 0 seconds.
  Stop simulation.
          
```

Increase power level (decrease attenuation) by 3 dB

**Building Scenario**

Add the following command-

Command	Properties
<ul style="list-style-type: none"> <li>Cold start</li> <li>Start simulation</li> <li>Stop simulation</li> <li>Attenuation</li> <li>Add satellite</li> <li>Remove satellite</li> <li>If event</li> <li>End of file</li> <li>Loop</li> </ul>	After <input type="text" value="0"/> seconds. <input checked="" type="radio"/> Increase <input type="radio"/> Decrease <input type="radio"/> Set level <input type="text" value="3"/> DB.

In first.

**Scenario commands**

```

cold start.
Wait 0 seconds.
Set attenuation 37 DB.
Start simulation with all satellites
found 5 sats. time out: 150. If not:
  Wait 0 seconds.
  Stop simulation.
  Wait 0 seconds.
  Increase attenuation by 3 DB.
```

Loop back to the beginning of the test (Cold start) and execute again - UNTIL the DUT finds 5 satellites

**Building Scenario**

Add the following command-

Command	Properties
<ul style="list-style-type: none"> <li>Cold start</li> <li>Start simulation</li> <li>Stop simulation</li> <li>Attenuation</li> <li>Add satellite</li> <li>Remove satellite</li> <li>If event</li> <li>End of file</li> <li>Loop</li> </ul>	Loop

In first.

**Scenario commands**

```

cold start.
Wait 0 seconds.
Set attenuation 37 DB.
Start simulation with all satellites
found 5 sats. time out: 150. If not:
  Wait 0 seconds.
  Stop simulation.
  Wait 0 seconds.
  Increase attenuation by 3 DB.
  Loop.
```

After the DUT found five satellites - wait 20 sec, stop simulation and stop test (EOF)

### Building Scenario

Add the following command-

Command	Properties
<ul style="list-style-type: none"> <li>Cold start</li> <li>Start simulation</li> <li>Stop simulation</li> <li>Attenuation</li> <li>Add satellite</li> <li>Remove satellite</li> <li>If event</li> <li>End of file</li> <li>Loop</li> </ul>	End of file

In first.

**Add>**

#### Scenario commands

```

cold start.
Wait 0 seconds.
Set attenuation 37 DB.
Start simulation with all satellites
found 5 sats, time out: 150, If not:
    Wait 0 seconds.
    Stop simulation.
    Wait 0 seconds.
    Increase attenuation by 3 DB.
    Loop.
Found fix, time out: 150, If not:
    Wait 0 seconds.
    Stop simulation.
    Wait 0 seconds.
    Increase attenuation by 3 DB.
    Loop.

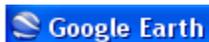
Wait 20 seconds.
Stop simulation.
EOF.
  
```

## Chapter 4: Creating a Trajectory

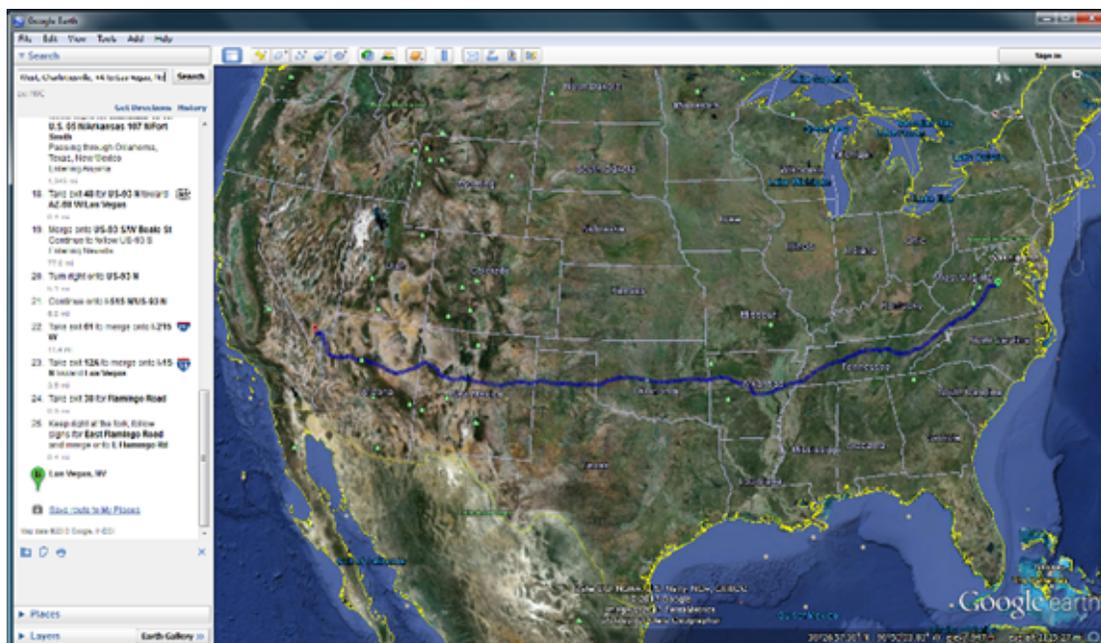
The Genos PC is provided with Google Earth™ installed. This chapter describes how to use Google Earth™ to create a new trajectory and to convert it into Galileo's proprietary trajectory format (RMF – RGSN100 MGSN100 FGSN100).

To create a new trajectory:

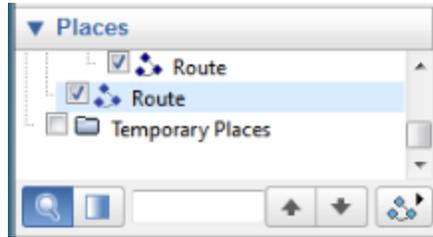
1. Launch Google Earth, by selecting **Start Google Earth** from the Genos PC Desktop.



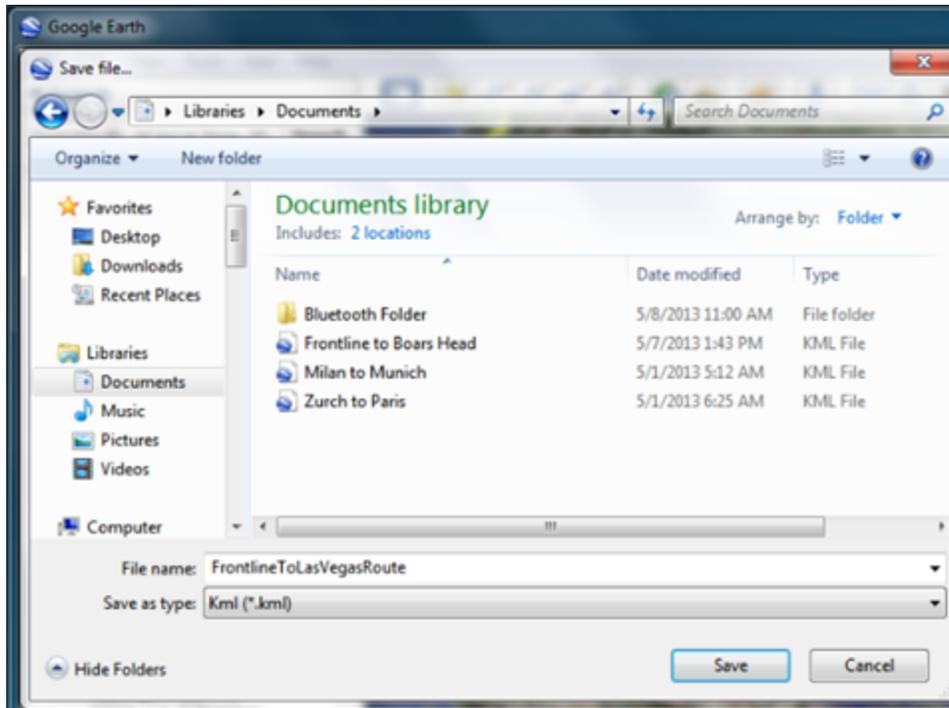
2. Select the **Directions** tab.
3. In the **Destinations** tab, in the **From** field, enter the starting location of the trajectory and in the **To** field, enter the destination.
4. Click the **Search** button. Goggle-Earth then draws the trajectory on the map, as shown below as a purple line.



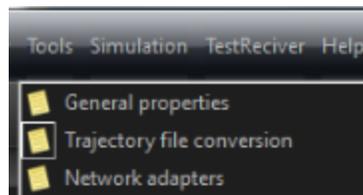
5. In Google Earth expand the **Places** and scroll to **Route**. Right-click on **Route** and then on **Save As...**



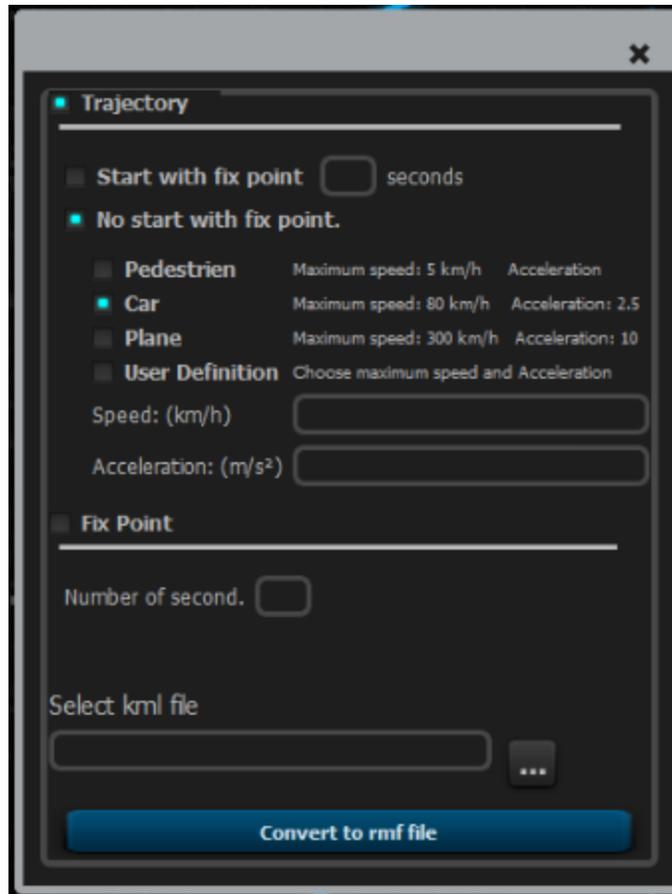
6. In the **Save file...** window that is displayed, save the route as a KML file anywhere on the Genos PC, and record or remember the location.



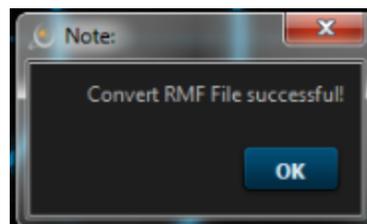
7. In the Genos **Menu** select **Tools, Trajectory File Conversion**.



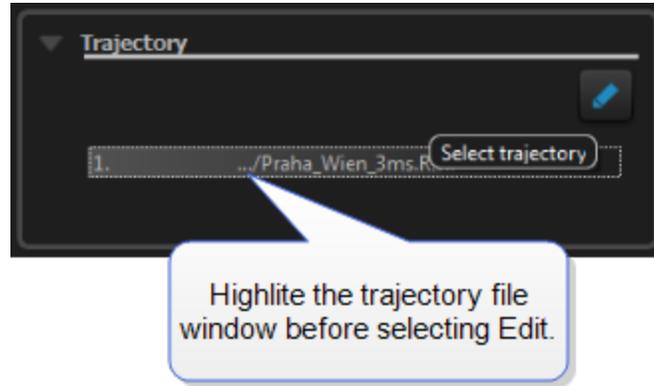
8. In the Genos Trajectory File Conversion dialog provide the **Trajectory** and **Fix Point** information. At the **kml file** field click the browser **...** button. Navigate to the [saved KLM file](#).



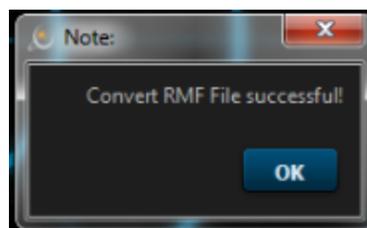
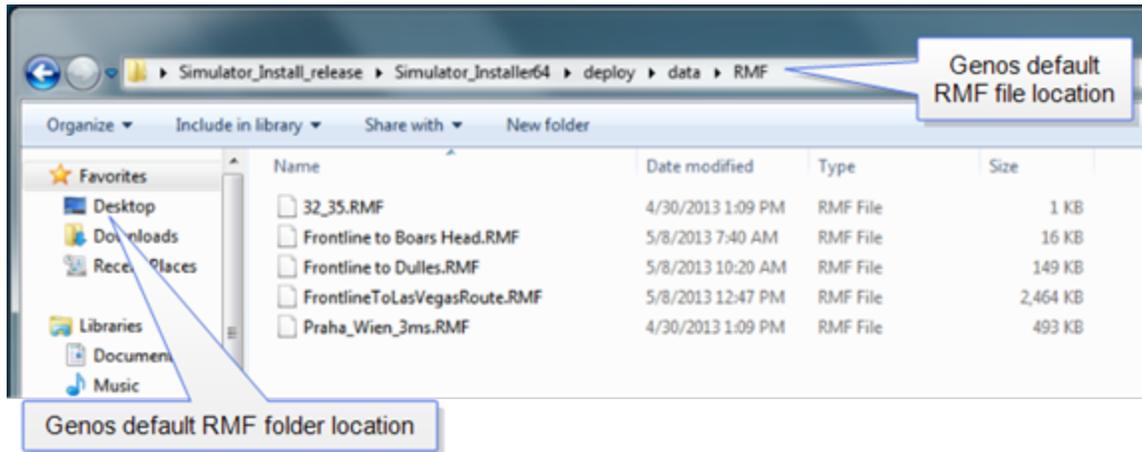
9. When the KLM file is selected click on **Convert to rmf file**. The RMF file is stored on the Genos PC Desktop in folder *Simulator-Install-release\Simulator\_Installed64\deploy\data\RMF\*. This is the default RMF file location. Once the conversion is completed you will be notified by the following window. Click the **OK** button.



10. In the Genos **Simulator Properties** tab expand the **Trajectory** pane. Click inside the trajectory field and click the Edit icon .



11. Select the trajectory RMF file that you just created, or what ever trajectory you want to simulate.



The RMF file is saved in the same folder as the KML file that you selected.

This RMF file can now be selected in the same way as any other trajectory in the Trajectory area of the [Simulator Properties - configuration on page 14](#)

## Syntax of RFM File

The following describes the format that is automatically generated when you follow the procedure described in this chapter.

You can also simply create a new text file according to this format description and enter the values that you require into the file.

Each row of this file specifies a change of direction and the number of milliseconds that the trajectory continues in that direction.

Position (in X, Y, Z) Velocity (in X, Y, Z) Acceleration (X, Y, Z) Time in milliseconds  
 For example, as shown below:

```

1 01/01/0001 00:00:00
2 ANTENNA_PAN_ANGLE 0
3 ANTENNA_TILT_ANGLE 0
4 RECEIVER_ORIENTATION 1,0,0
5 1333958.000972,-4653934.369418,4138436.597956 -0.000000,-0.000000,-0.000000 -1.846377,-3.381864,-3.186516 2621
6 1333951.660626,-4653945.982530,4138425.655657 -4.838734,-8.862727,-8.350786 1.846377,3.381864,3.186516 2621
7 1333945.320280,-4653957.595643,4138414.713358 -0.000000,0.000000,0.000000 -10.895436,3.533565,7.435571 1578
8 1333931.753128,-4653953.195597,4138423.972237 -19.831400,1.710135,8.259351 -4.601137,0.396773,1.916275 134
9 1333929.054411,-4653952.962877,4138425.096194 -20.447953,1.763302,8.516132 -0.000000,0.000000,0.000000 4168
10 1333843.827345,-4653945.613433,4138460.591432 -20.447953,1.763302,8.516132 4.601137,-0.396773,-1.916275 4444
  
```

The first four lines shown above must be in the file exactly as they are shown. If required, copy them from this user guide from the following text:

```

01/01/0001 00:00:00
ANTENNA_PAN_ANGLE 0
ANTENNA_TILT_ANGLE 0
RECEIVER_ORIENTATION 1,0,0
  
```

# Technical Support

Technical support is available in several ways. The online help system provides answers to many user related questions. Frontline's website has documentation on common problems, as well as software upgrades and utilities to use with our products.

Web: <http://www.fte.com>, click Support

Email: [tech\\_support@fte.com](mailto:tech_support@fte.com)

If you need to talk to a technical support representative, support is available between 9am and 5pm, U.S. Eastern time, Monday through Friday. Technical support is not available on U.S. national holidays.

Phone: +1 (434) 984-4500

Fax: +1 (434) 984-4505