Agilent E4438C/E8267D Option 422 Scenario Generator for GPS

Technical Overview

Create GPS Scenarios with Ease

The Option 422 scenario generator software enhances the functionality of the Global Positioning System (GPS) personality (Option 409) for the E4438C ESG and E8267D PSG vector signal generators by providing the ability to create custom scenario files for real-time playback using Option 409. The scenario generator allows users to specify the location, date, time, and duration for a GPS scenario. Static scenarios can be created to simulate a stationary GPS receiver, and dynamic scenarios can be created to simulate a moving GPS receiver. Up to eight satellite signals can be included. The software also provides an antenna pattern gain mask that can be applied to the GPS signals.

The software is available as a free download, allowing you to investigate the features of the scenario generator, create and save scenario files, or download them to an E4438C or E8267D signal generator. The signal generator must have licenses for Option 422 and 409 in order to use the scenario files created by the software.

Key Features

- Simulate up to 8 satellites
- Specify scenario location, start date and time, and duration
- Create scenarios with durations of up to 24 hours
- Generate scenarios for stationary and moving GPS receivers
- Input NMEA (GGA format) data for dynamic scenario generation
- Use tropospheric and ionospheric modeling for 3GPP W-CDMA and cdma2000® test cases
- Apply elevation mask to control satellite visibility
- Automatically or manually select satellites to include in a scenario
- Specify and apply an antenna pattern gain mask
- Edit scenarios:
  - Delete channel
  - Apply power offset
  - Equalize power in all satellites
  - Trim scenario length
- Visualize scenario edit results using the scenario graphics display
- Output A-GPS assistance data and ephemeris files for each scenario
- Download scenario files directly to E4438C or E8267D via LAN connection or save files to PC
- Save/recall scenario settings file or antenna pattern file

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Scenario Creation

Easily create both stationary and moving GPS receiver scenarios up to 24 hours in length for any date, time and location with Option 422 scenario generator software. To create a stationary scenario, the software requires the date, time, location (longitude, latitude, and altitude), duration, and an almanac file in the YUMA format. The almanac file is available from the URL: **http://navcen.uscg.gov/gps/almanacs.htm.** Creating a dynamic scenario for a moving GPS receiver requires trajectory information in the form of an NMEA GGA format file, in addition to the almanac file.

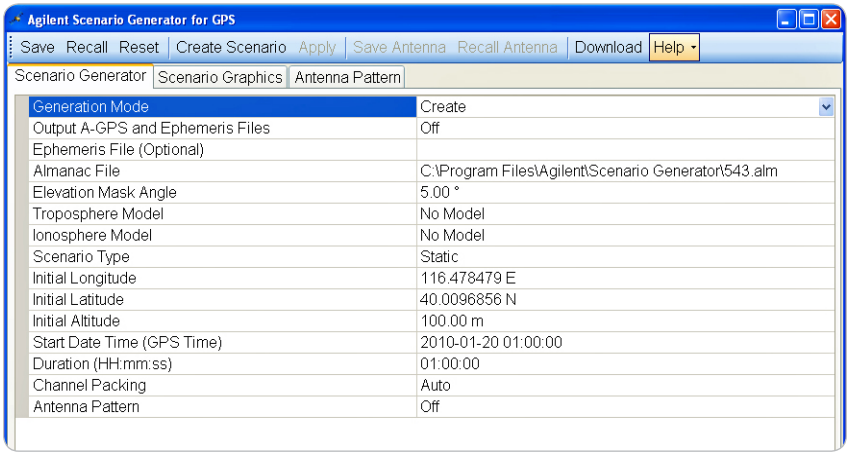

Figure 1. Scenario generator user interface- Static Scenario view

Available parameters for scenario creation include elevation mask angle and ionospheric and tropospheric atmospheric modeling. The elevation mask allows you to select only those satellites that are above a certain angle above the horizon. The ionospheric model (choice of Klobuchar model for W-CDMA or cdma2000) and tropospheric model (NATO) parameters are put into the GPS navigation message, and the GPS signal is impaired according to these settings.

Channel packing

The E4438C/E8267D Option 409 GPS personality simulates up to a maximum of eight satellite channels. There may be situations where more than eight satellites are visible to a GPS receiver. In these cases, some choices need to be made regarding which satellites should be included in the scenario. This function is referred to as channel packing and the software offers a choice of automatic or manual channel packing. In automatic channel packing mode, the software selects the satellites that result in the least number of transitions between satellites during the scenario. In manual channel packing mode, the software displays a Satellite Visibility view that allows the user to select which satellites to delete for each time span where more than eight satellites are present.

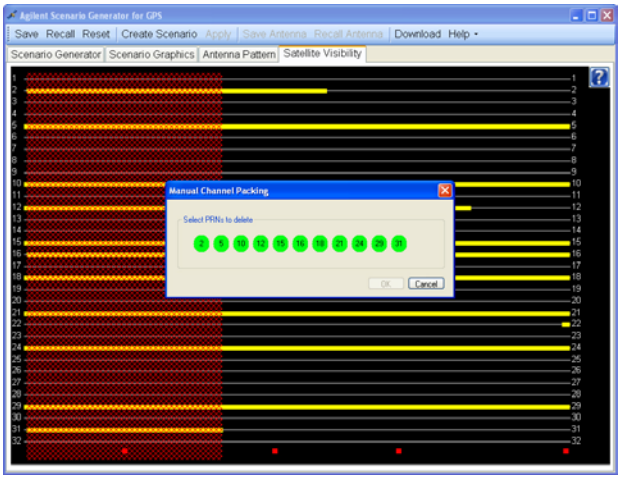

Figure 2. Satellite Visibility view showing the manual satellite selection for channel packing

Antenna pattern gain mask

In a static scenario, the software lets the user define an antenna pattern gain mask using a simple graphical user interface, as shown in the figure below. The software applies this gain mask to the GPS signal. For the gain mask, the user can define the resolution for the elevation and azimuth, and an azimuth rotation to apply to the pattern. This gain mask can also be used to simulate the effects of obstructions in the environment.

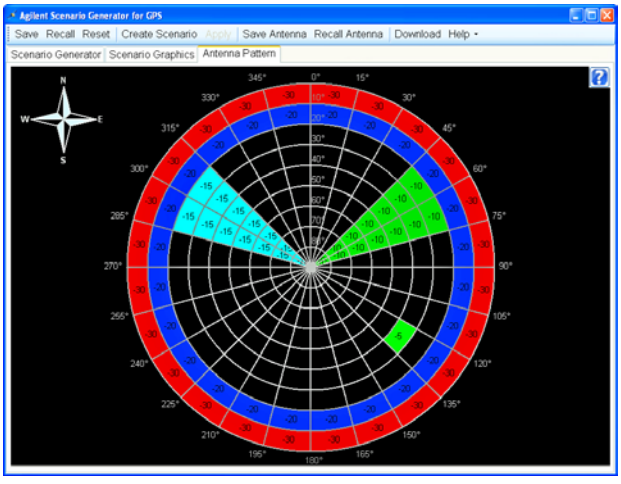

Figure 3. Antenna Pattern view— set the power offset for a cell, a circle, a sector, or any combination of the three

Scenario Editing

A scenario editing function is included in the Option 422 software to allow the modification of a scenario file with the following functionalities:

- Delete channel
- Apply power offset to an individual channel
- Equalize power in all satellites
- Trim scenario length by specifying the desired start and stop time

The Scenario Graphics tab allows you to visualize the scenario parameters such as satellite visibility vs. time and the channel designation for each satellite. It also contains a record of the changes that have been made during the editing session.

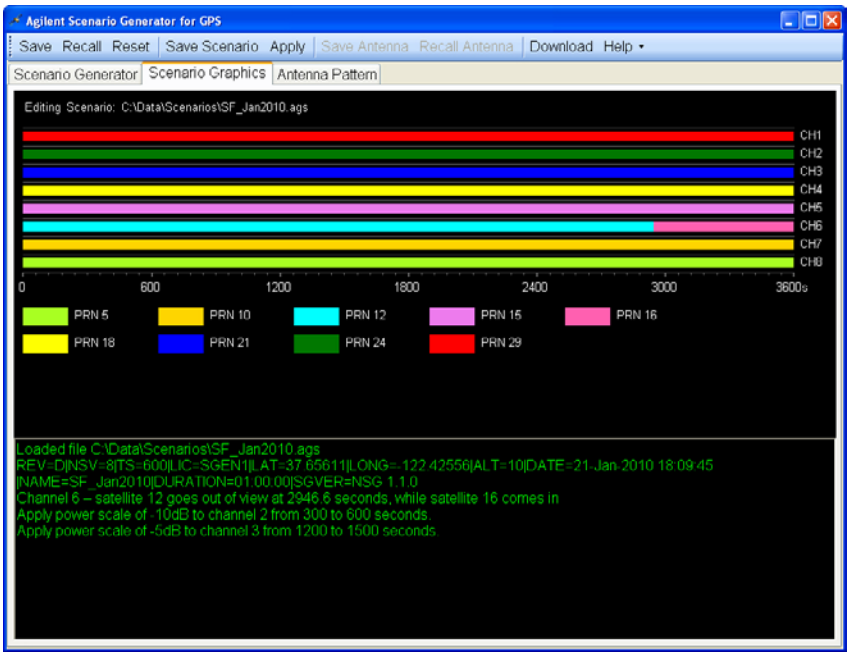

Figure 4. Scenario Graphics view

Assisted GPS (A-GPS) File Generation

For A-GPS applications, the software can accept an ephemeris file for use in scenario generation. It can also output the corresponding A-GPS parameter file and ephemeris file for each scenario. These files can be used with an E4438C signal generator in the Agilent GS-9000 Lite or GS-9000 Standard A-GPS design verification test systems.

GPS Solution Comparison

Agilent currently offers two solutions for real-time GPS signal generation:

- E4438C or E8267D with Option 409 GPS personality and Option 422 scenario generator
- N7609B Signal Studio for Global Navigation Satellite Systems (GNSS) software running on the N5106A PXB baseband generator and channel emulator, with an E4438C ESG or N5182A MXG signal generator for RF output

The table below provides a summary and comparison of the key features in these solutions:

Table 1. Comparison of GPS solutions

Feature	Option 409 GPS personality with Option 422 scenario generator	N7609B Signal Studio for GNSS
Real-time GPS signal simulation	Yes	Yes
Supports GPS receiver tests for time to first fix (TTFF), accuracy, and sensitivity	Yes	Yes
Maximum number of satellites	8	15
Maximum number of channels (including multipath)	8	24
Multipath signals	No	Yes
Real-time power and visibility control of individual satellites	No	Yes
Ionospheric and tropospheric effects	Fixed models for WCDMA and cdma2000 (Option 422)	User-defined parameters for ionospheric model
Moving GPS receiver scenarios	Yes (Option 422)	Yes
Custom scenario generation and editing	Yes (Option 422)	Yes (Option RFP)
Add calibrated AWGN	No	Yes (with N5106A-JFP)
Maximum playback time	24 hours	24 hours
A-GPS testing	Combine with 8960 in GS-9000 Lite bench-top system	Combine with 8960 in GS-9000 Standard pre-conformance test system

Recommended Configuration

To use the scenario files created by the scenario generator software, Options 409 and 422 are required in the E4438C ESG or E8267D PSG vector signal generators. Below are the recommended option configurations.

E4438C ESG vector signal generator recommended option configuration:

E4438C[1]	E4438C ESG vector signal generator
E4438C-502	250 kHz to 2 GHz frequency range (minimum)
E4438C-601	Internal baseband generator (8 MSa memory)
E4438C-005	6 GB internal hard drive
E4438C-UNJ	Enhanced phase noise (recommended)
E4438C-409	GPS personality
E4438C-422	Scenario generator for GPS personality

E8267D PSG vector signal generator recommended option configuration:

E8267D[2]	E8267D PSG vector signal generator
E8267D-520	250 kHz to 20 GHz frequency range
E8267D-602	Internal baseband generator (64 MSa memory)
E8267D-009	Removable flash memory
E8267D-409	GPS personality
E8267D-422	Scenario generator for GPS personality

1. *E4438C requires firmware revision C.05.74 or later. Download firmware from www.agilent.com/find/upgradeassistant.*
2. *E8267D requires firmware revision C.05.71 or later. Download firmware from www.agilent.com/find/upgradeassistant.*

Additional Information

Explore the online documentation

For more information about this GPS scenario generator software, explore the online documentation (help), which includes this technical overview, release notes, user interface descriptions, tutorials, and installation information.

Related websites

Signal Creation Software
www.agilent.com/find/signalstudio

Agilent GPS Solutions and Applications Information
www.agilent.com/find/gps

Agilent Assisted GPS (A-GPS) Solutions and Applications Information
www.agilent.com/find/agps

N7609B Signal Studio for Global Navigation Satellite Systems
www.agilent.com/find/n7609b

E4438C ESG Signal Generator
www.agilent.com/find/e4438c

E8267D PSG Signal Generator
www.agilent.com/find/e8267d

N5106A PXB Baseband Generator and Channel Emulator
www.agilent.com/find/pxb

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