m3 systems

StellaNGC
Scenario Replayer

GNSS Scenario Replayer

Datasheet

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I. Introduction

This document is StellaNGC Scenario Replayer product datasheet. s

Applicable Documents

[AD. 1] StellaNGC® GNSS Simulator - Users Guide

[AD. 2] 2016 12 - M3 SYSTEMS - CGU Version GB

Reference Documents

[RD. 1] NI USRP-2950R Device Specification

[RD. 2] NI 5840 Device Specification 376626A-01 March 16, 2017

[RD. 3] NI 5841 Device Specification 378128B-01 April 6, 2020

[RD. 4] NI USRP-2954 Device Specification

Abbreviations

AGC	Automated Gain Control
API	Application Protocol Interface
DUT	Device under test
ECEF	Earth-Centered, Earth-Fixed
FPGA	field-programmable gate array
GNSS	Global Navigation Satellite System
GPS	Global Positioning Systems
GUI	Graphical User Interface
Hw	Hardware
ICD	Interface communication document
IMU	Inertial Measurement Unit
LLA	Latitude, Longitude, Altitude
M3S	M3 Systems
N/A	Not Applicable
OEM	Original Equipment Manufacturer
PXIe	PCI eXtensions for Instrumentation
RAID	Redundant Array of Inexpensive Disks
RF	Radio Frequency
RP	Record & Playback
SDR	Software Defined Radio
Sw	Software
TBD	To Be Defined
TCP/IP	Transmission Control Protocol/Internet Protocol
TDMS	Technical Data Management Streaming: NI owner file format
OCXO	Over Controlled Cristal Oscillator
OS	Operating System
VST	Vector Signal Transceiver

II. System Overview

StellaNGC Scenario Replayer is a software deployed on NI hardware. It runs on a Windows platform (PXI controller or PC) associated to an FPGA/RF target. StellaNGC Scenario Replayer allows selection of the scenario to be replayed and visualization of monitoring information.

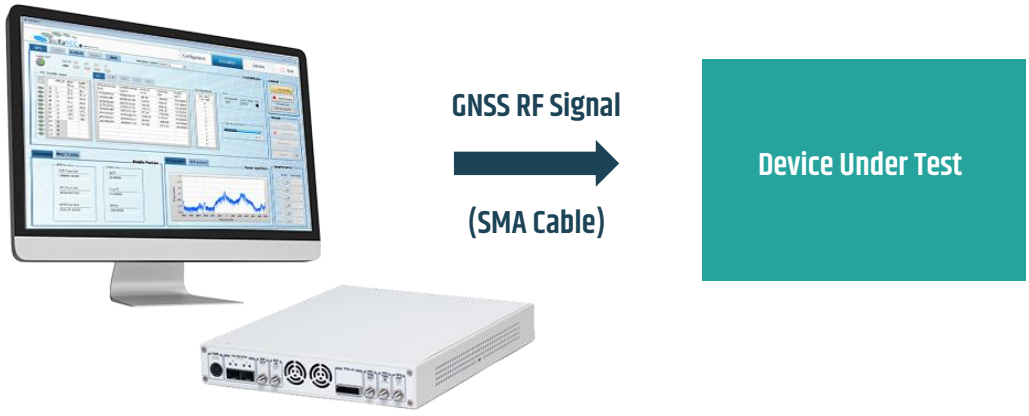

Figure 1 System Overview

II.1 Features

StellaNGC Scenario Replayer allows generation of a pre-defined GNSS simulation scenario.

It is intended for manufacturing use as it allows easy check of correct GNSS reception at receiver under test level.

II.2 Software

Software used is StellaNGC simplified to only enable selection of a pre-configured scenario to replay. During simulation, user has access to all monitoring and control possibilities offered by StellaNGC:

- Control of satellite/constellation power level
- Control of satellite/constellation activation
- Monitoring of currently simulated position
- Monitoring of all satellites raw data (power/ranges…)

II.3 Scenario

Default scenario is a single GPS L1C/A satellite with a static point. Custom scenarios can be generated upon request (see Adds-Ons section).

II.4 Data

In addition to the software and its pre-calculated scenario, the following set of data is given:

Figure 2 Scenario Replayer GUI

- **Scenario Description:** synthesis of the simulation scenario. This document is useful for fast start
- **Simulation Raw Data:** set of text files giving needed data of the simulation truth (simulated position, Sv position, Sv Doppler, SV pseudorange, etc.) allowing to compare the Receiver Under Test outputs with the expected data
- **Reference Receiver Raw Data:** log file of a COTS receiver (e.g. Septentrio PolaRX5) is given. This allows user to compare its receiver performance with a reference receiver

III. StellaNGC Scenario Replayer Add-Ons

StellaNGC Scenario Replayer provides a Multi-Purpose Platform where the hardware investment can be shared with other application, making it a versatile and scalable solution. Several options are available to complement the native features included in StellaNGC. More details are provided in the following sub-sections.

III.1 Additional Scenarios Generation

If needed, StellaNGC Scenario Replayer can extend its number of satellites 1 to 8. This is useful to assess receiver under test ability to perform a fix.

Upon custom request, additional scenario can be generated to:

- Extend number of satellites from 1 to 8
- Extend to other constellations (Galileo, GLONASS, Beidou, QZSS and SBAS)
- Follow a specific mobile trajectory
- Include specific ionospheric/tropospheric configuration

III.2 API for Scenario Replayer

The integrated API provides full access and control to Software functionalities through dedicated network messages for an integration into a test bench, based on the TCP/IP protocol.

This feature includes:

- Control of all software functionalities by specific commands
- Information and error feedback control for processing
- Operator support with specific sequences and modes

IV. Hardware Compatibility

StellaNGC is compatible with the RF targets described in the below sections. In addition to RF targets, it is required to have a complete system with a Controller (such as NI PXIe-8160 or a standard PC) which hosts the software and the related environment. For PXIe environment, a PXIe chassis such as NI PXIe-1092 will be required.

VST second generation

The NI-5840/5841 is the second generation of Vector Signal Transceiver from NI.

Direct outcome:

- 500MHz instantaneous bandwidth on L Band: One RF stage is needed for multi-frequency management.
- Calibrated target: the 5841 is factory-calibrated and can be yearly calibrated to ensure high end RF performance (e.g., IQ imbalance & frequency response)
- List of calibration item can be found here http://zone.ni.com/reference/en-XX/help/374564L-01/calexec/procedure_5840/

As an example, a possible standalone hardware configuration could be: NI PXIe-5841+ NI-PXIe-1092 + NI PXIe-8880 as shown hereunder. To address record and playback capability, an SSD PXIe Card is added (reference on demand)

USRP-RIO

USRP-RIO is widely used as an entry RF-target for functional verification applications. We do support both NI-2950R 120MHz and NI-2954. This target generates multi-frequency GNSS on L Band (L1, L2 and L5). USRP-RIO can be used along with a PXIe chassis or a standard PC (PCIe link is used in this case).

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