Spirent **PT TestBench GNSS Automation and Report Generation Tool**

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Purpose of this document

This datasheet describes the functionality of PT TestBench, a GNSS test automation and results reporting tool based on Spirent iTest software.

With pre-defined test suites, it provides an integrated test solution to enable performance characterisation and vulnerabilities assessment of GNSS receivers.

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About the PT TestBench GNSS Automation and Report Generation Tool

PT TestBench builds on Spirent's popular iTest software, an integrated test authoring and execution tool built for testers, developers, and automation teams that address the needs of manual testers, automation specialists, and managers alike to improve the productivity of the entire test organization.

PT TestBench enables multiple tests to be run without user intervention as well as providing analysis and reporting capabilities.

It is developed and implemented for the use as a workspace in iTest and is comprised of test suites, test cases and configuration files. It is specifically designed for GNSS testing and includes the control software required to accurately emulate the bi-directional end-to-end serial connection between a Spirent RF constellation simulator and the Device under Test (DUT). Additionally, PT TestBench can control GSS7765 and GSS7725 Spirent's interference simulation systems directly, in a test setup for execution of interference test cases.

The DUT is configured and controlled via PT TestBench over a communications link. A high level block diagram showing the principle architecture of PT TestBench is given in **Figure 1**.

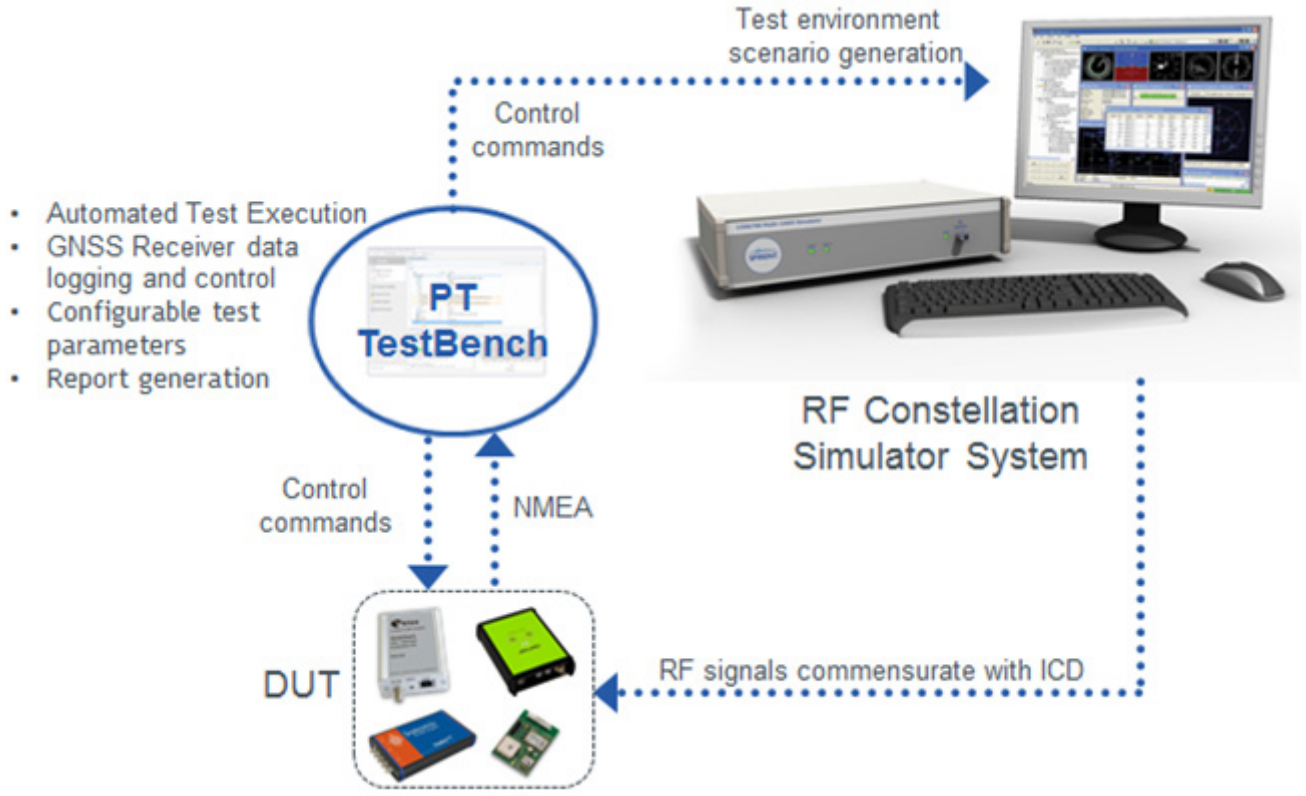


Figure 1 Typical automated GNSS Test environment using PT TestBench

PT TestBench can be ordered with pre-defined test suites. Examples currently available include:

- GNSS Fundamental tests: The test suite comprises of fundamental GNSS test cases required to characterize performance of any GNSS receiver.
- GNSS Threats and Vulnerabilities: The test suite comprises of test cases for typical vulnerabilities and threats to a PNT system, allows for robustness of the system to be assessed quantitatively.

Important note: Appropriate hardware and control software is required to run test suites within PT TestBench. Information on requirements is included in this document.

PT TestBench also contains a plugin to connect to PT Cloud, enabling users to automatically download (per user entitlements) latest updates for the GNSS Threats and Vulnerabilities test suite. PT Cloud is a constantly-updated library of real-world GNSS challenges: PPD interference waveforms, GNSS segment errors and receiver transitions – as well the latest observed space weather, scintillation, jamming and spoofing events. It's an excellent way to build robustness testing into your GNSS simulation setup.

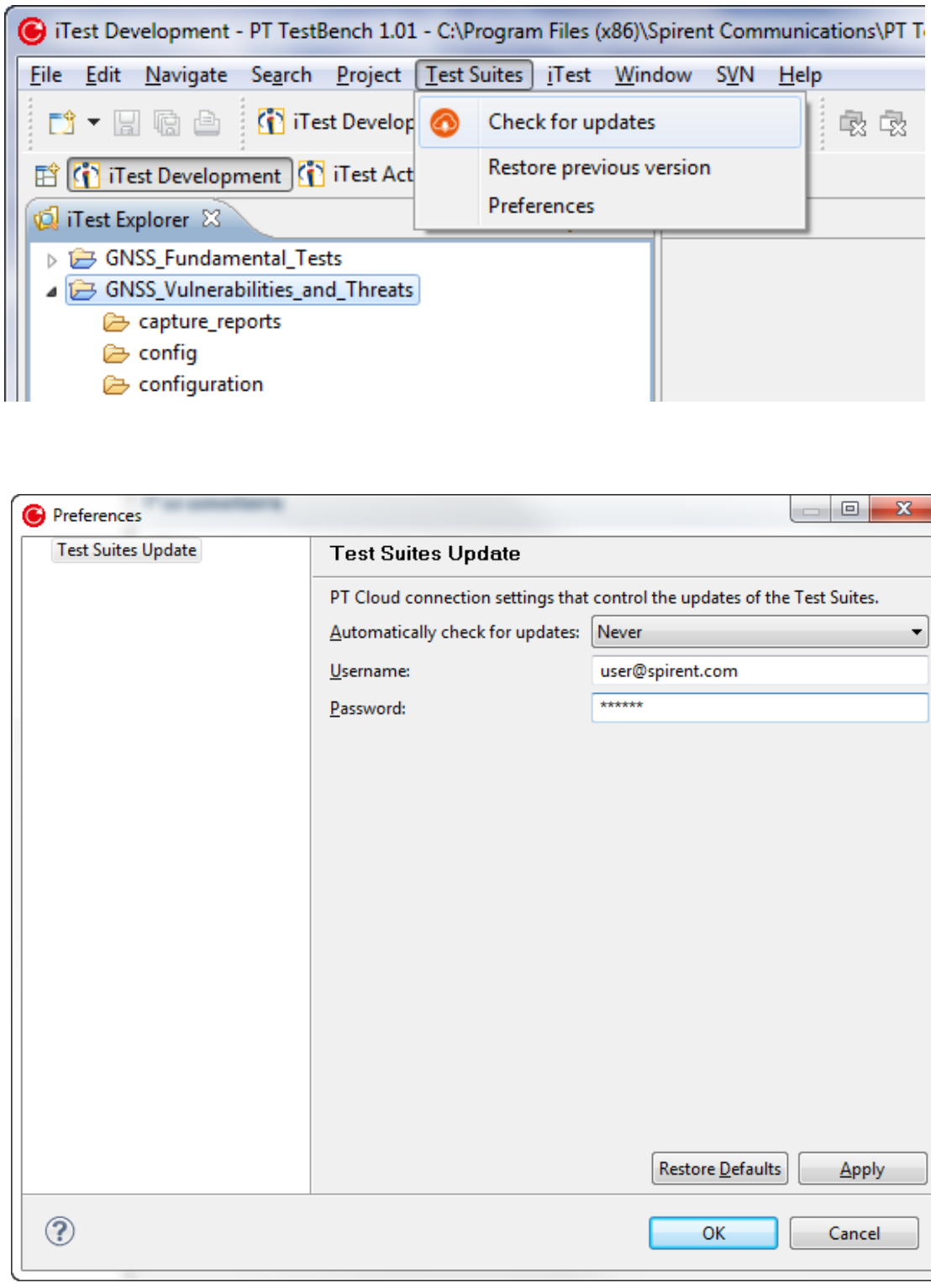


Figure 2 PT Cloud plug-in configuration and use

Key features

PT TestBench enables thorough testing of the PNT technology incorporated into GNSS receivers in a laboratory environment. This ensures accurate and repeatable test results, allowing performance problems to be detected, isolated, and corrected in the shortest possible time. Test automation also helps to make repeat testing more efficient.PT TestBench easily sets up all equipment in the test system and performs the following elements of a test:

- Executing comprehensive automatic multi-GNSS tests
- Analysing, logging and displaying results
- Storing all test results to a relational database
- Generating test reports
- Establishing communication with DUT
- Managing test information
- Configuring instruments
- Mapping test parameters to instrument settings

Test Configuration

PT TestBench can be configured according to user's target GNSS application requirements – See **Figure 3**.

The following parameters can be changed \ modified by the user:

- General parameters – Simulator can be setup by the user.
- DUT parameters – Connection settings and thresholds can be set by the user
- Test cases parameters – Number of measurement and thresholds can be set by the user.

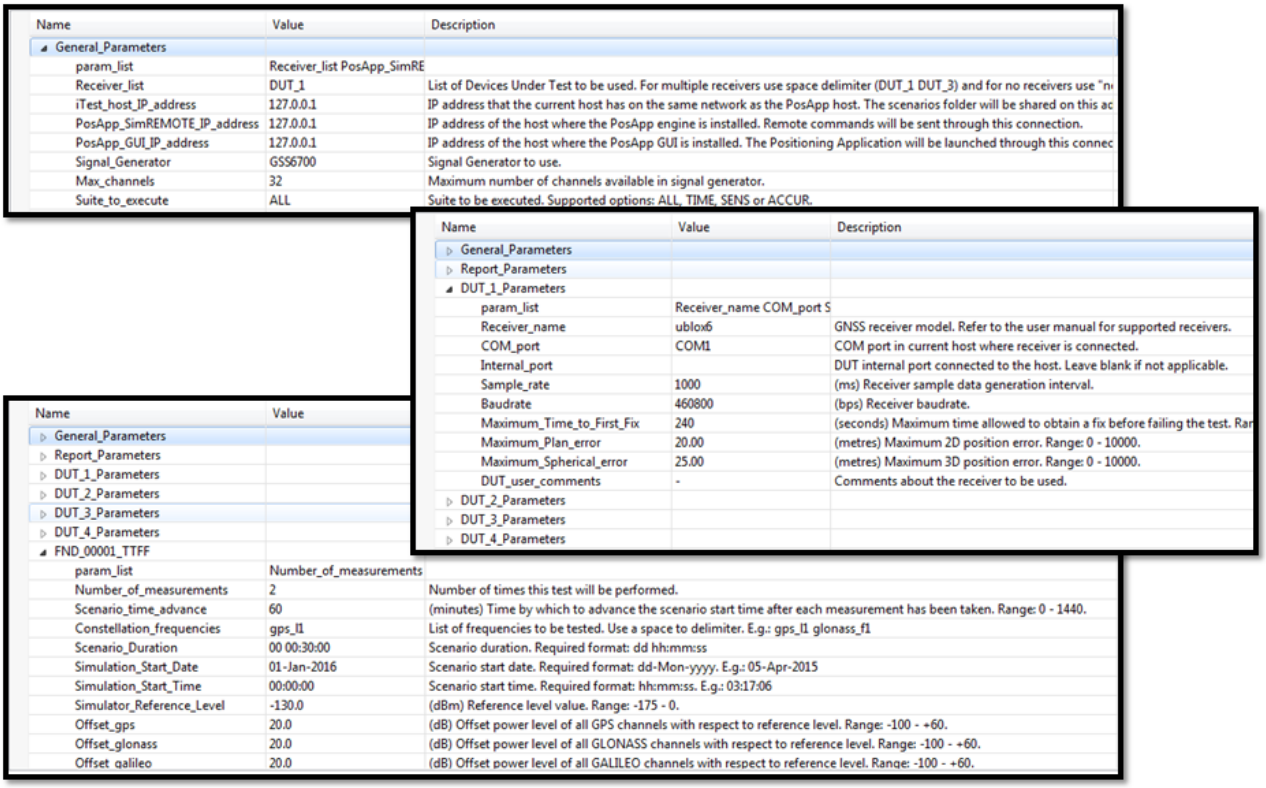


Figure 3 Typical Modify Parameters Files to specific testing conditions

Test Execution

Complete test suites or single test cases can be executed by clicking on the Play button. Once the test execution has completed, a test report is generated. See example in **Figure 4**

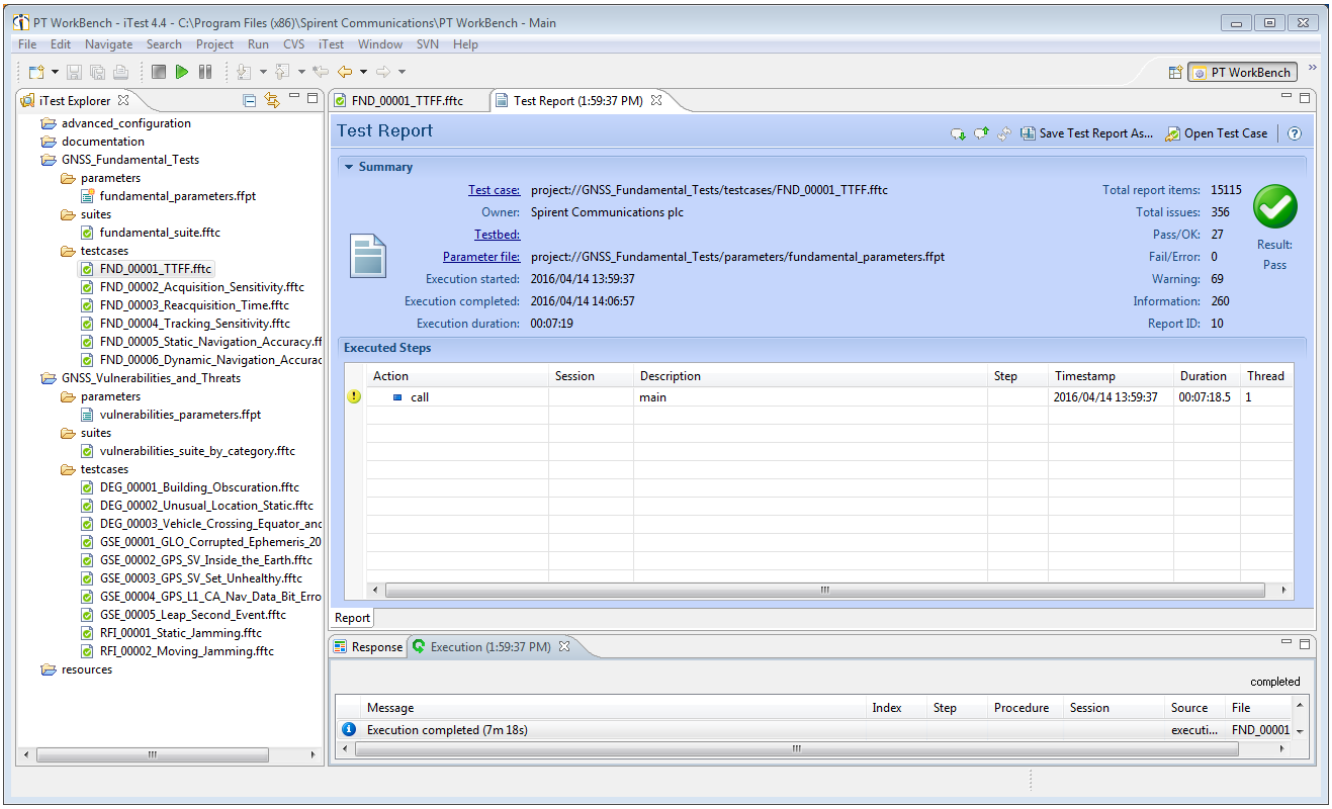


Figure 4 Typical test execution completion – Results and report

Test reporting

Test Reports are generated from each test case and test suite executed in PT TestBench. Reports in HTML format are automatically stored in a configurable folder. Inside this folder the report summary, the logs folder and a detailed test report for each DUT can be found.

The Test Results Summary is a HTML file that provides summary results of the test cases executed with each one of the devices under test configured. If more than one GNSS receiver is used, the test cases executed will be shown more than once to show the results for all the DUTs. See **Figure 5** for a sample report.

Test Results Summary includes:

- Suite executed. Only shown if a test suite was executed.
- Tests executed: number of tests that were executed.
- Tests passed: number of tests that were passed.
- Test/Suite duration

It also details pass/fail result for each test case:

- Test #: represents the test number in sequential order.
- Timestamp: displays the date and time when the test was executed.
- Title: name of the test case executed.
- Device Under Test: displays the GNSS receiver configured.
- Result: indicates the outcome of the test. This field is set to Pass or Fail.

When the user clicks Test #, a detailed test report is opened. See **Figure 6** for a sample report.

GNSS Fundamental Suite report summary

Suite executed:	ALL
Tests executed:	6
Tests passed:	6
Suite duration:	12 mins 28 secs

Test #	Timestamp	Title	Device under test	Result
1	30-08-16_13-29-26	FND_00001_TTFF	DUT_1_ublox6	PASS
2	30-08-16_13-31-06	FND_00002_Acquisition_Sensitivity	DUT_1_ublox6	PASS
3	30-08-16_13-33-43	FND_00003_Reacquisition_Time	DUT_1_ublox6	PASS
4	30-08-16_13-36-17	FND_00004_Tracking_Sensitivity	DUT_1_ublox6	PASS
5	30-08-16_13-38-08	FND_00005_Static_Navigation_Accuracy	DUT_1_ublox6	PASS
6	30-08-16_13-40-02	FND_00006_Dynamic_Navigation_Accuracy	DUT_1_ublox6	PASS

Note: Click on 'Test #' link for detailed testcase report.

Figure 5 Sample report – Test Results Summary

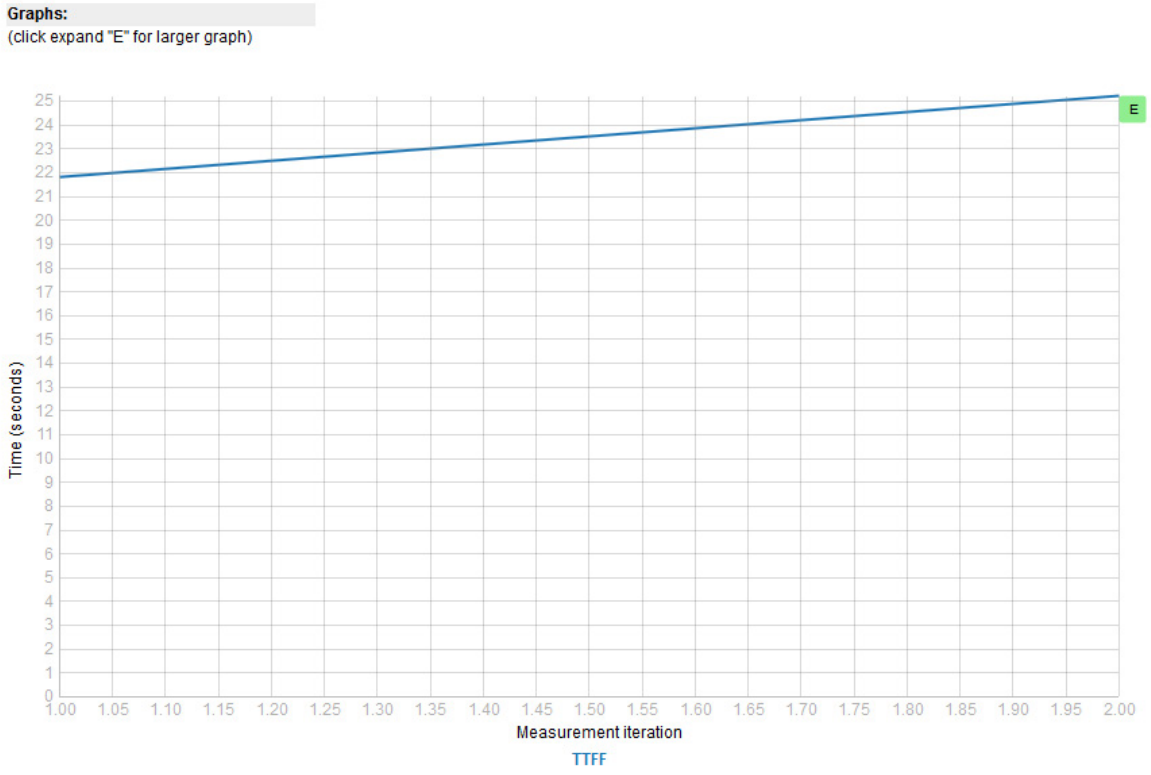


Figure 6 Sample report – Detailed test report & graphs

General Overview

PT TestBench communicates with the Spirent Positioning Application software suite (SimTEST, SimCHAN, SimREPLAYplus or SimGEN software levels) and makes the necessary test scenario parameter changes automatically depending on the requirements of the test. The user does not need to interact with the Positioning Application user interface itself.

The system is designed to operate in a physical machine with a 64 bit Microsoft Windows 7 operating system installed.

Test Suites

The test suites are collection of test cases, with set pass \ fail criteria. The user can set the criteria according to their target application.

1. **GNSS Fundamentals test suite**

This test suite is designed to enable users to characterize performance of their GNSS receivers against key test parameters, including:

- TTFF
- Acquisition Sensitivity
- Tracking Sensitivity
- Reacquisition Time
- Static Navigation Accuracy
- Dynamic Navigation Accuracy

2. **GNSS Vulnerabilities & Threats test suite**

This test suite enables a GNSS-based receiver, system or application to be subjected to representative real-world GNSS vulnerabilities and threats in a controlled test environment. The intent is that a range of vulnerabilities can be assessed quickly under controlled laboratory conditions. It comprises of the following test cases:

- Radio Frequency Interference: Intentional jamming with detected waveforms
- GNSS Segment Error: Outages, erroneous data, SVs faults, clock errors
- Spoofing: Typical spoofing signal attacks (available from late 2016).
- Degradation: Obscuration, multipath
- Atmospheric: Specific space weather and scintillation type atmospheric effects.

Purchase of this test suite provides access to latest updates to tests for 12 months, accessible via PT Cloud. After this period, a subscription to enable access to test scenarios that represent new threats in Spirent's library would need to be purchased.

Further information on Tests included in the current issue of the test suite for GNSS vulnerabilities and threats are defined and described in a companion document (ref a). GNSS fundamental test are defined in (ref b).

These test suites can be modified \ changed, as professional service, to suit target user application. Please speak to your Spirent sales representative for more information.

3. **Custom test suites**

   Our professional services can help with creation of various test suites including ERA-GLONASS, eCall, RED. Please speak to your Spirent sales representative for more information.

NOTE: The test suites are subject to the terms and conditions in Spirent's Software Licence Agreement (ref c).

Supported Software

PT TestBench is designed to operate with:

- SimGEN / SimREPLAYplus / SimTEST v6.01 SR02 (and beyond)
- SimCHAN v3.03 SR05 (and beyond)
- iTest v6.0

NOTE: GNSS Vulnerabilities & Threats test suite is currently not supported with SimCHAN.

Supported Hardware

PT TestBench is designed to operate with the following Spirent GNSS signal generators:

- GSS9000-series
- GSS8000-series
- GSS7000
- GSS6700
- GSS6300-family (multi-channel systems only)

For the Radio-Frequency Interference tests Spirent GSS7765 or GSS7725 Interference Simulation System can be used.

Supported Devices under test

The GNSS receivers are configured and controlled via a USB or RS-232 serial communications link. The drivers of the receivers must be installed so the Windows OS is capable of assigning a COM port to the device.

PT TestBench is responsible for restarting and setting up all receivers in the system before each test using specific protocol drivers, and for gathering the data using the NMEA 0183 protocol.

The following GNSS receivers are supported:

- u-blox EVK-M8
- Javad Delta
- Septentrio PolaRx4

The integration of one receiver is included with PT TestBench.

Additional receivers can be integrated / supported, as a professional service. Please speak to your Spirent sales representative for more information.

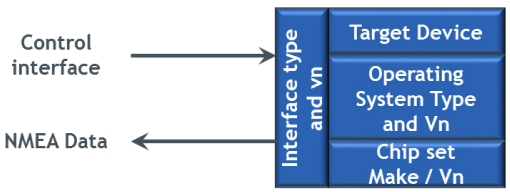
NOTE: Device integration requires specification definition as several aspects of the device can be varied. As a minimum, the following information is required:-

a. Device make

b. Device control interface type & version

c. Device OS version type & version

d. Chip make & Version



Should these parameters change, a separate integration is required, and will be quoted separately.

Minimum PC specification

- Computer running Windows 7 64 bit.
- CPU: Quad core 2.0 GHz or similar as a minimum requirement (Not Celeron)
- 4GB RAM Minimum, 8GB RAM preferred.
- 80GB hard disk minimum. NOTE: We have experienced problems with laptop hard drives with “Free Fall sensors”, if at all possible a hard disk WITHOUT this feature should be chosen.
- USB: 2 ports minimum, 4 preferred.
- RS232: 1 port minimum, 2 ports preferred
- 2 x Gbit Ethernet ports
- Graphics: 15” WXGA+ LCD minimum.
- Autosensing power supply 100V to 240V. 50Hz & 60Hz recommended.

Ordering Information

Table 1 Orderable parts

Note: PT TestBench software needs to be ordered together with at least test suite and one of controller PC's.

Part Number	Description	What's included?
3000-4010	PT TestBench (Runtime, Perpetual) software	• iTest Runtime(Perpetual) license and software • System commissioning quick start service • Integration of GNSS receiver (qty 1)
3000-4011	GNSS Fundamental test suite	• Test suite files
3000-4012	GNSS Vulnerabilities test suite	• Test suite files
3000-5001	Standard PC Controller	• Windows 7 64 bit Desktop PC • Quad core 2GHz or better • Min. 1 x RS232, 2 x USB ports • Min. 4GB RAM, 256GB HDD • Min. 2 x Gbit ethernet port • Monitor – 19“ • Keyboard & Mouse
3000-5002	Advanced PC Controller	• Windows 7 64 bit Desktop PC • Quad core 2GHz or better • Min. 4 x RS232, 6 x USB ports • Min. 8GB RAM, 256GB SSD • Min. 2 x Gbit ethernet ports • Monitor – 19“ • Keyboard & Mouse • Capable of running with high loads in a 24/7 continuous environment
SVC-1015-GSSPSTB-1Y	PT TestBench – 1year extended support	• 1 year warranty extension for PT TestBench
3000-3026	Test Pack Device Integration Service	• Integration service for an additional GNSS receiver

Deliverables

Table 2 Deliverable Items

Item No.	Quantity	Component	Comment
1	1	DVD or .ftp	Software installation files, user manual and configuration guides
2	1	Electronic license key	Defines the system capability. May be pre-installed or supplied electronically on registration (for upgrades)
3	1	PC	Desktop or laptop

Applicable Documents

Table 3 Applicable Documents

Reference	Title	Issue
a)	MS3096 Issue 1-00 Test Pack for GNSS Vulnerabilities & Threats	Latest Issue
b)	MS3099 Issue 1-00 Test Suite for GNSS Fundamental testing	Latest Issue
c)	DGP00956AAA Software Licence Agreement	Latest Issue

Glossary of terms

BeiDou	Chinese GNSS System
DUT	Device Under Test
GALILEO	EU GNSS System
GPS	Global Positioning System US GNSS system
GNSS	Global Navigation Satellite System (Galileo +GPS+SBAS+GLONASS+IRNSS+BeiDou)
GLONASS	GLObal NAvigation Satellite System (Russian Federation)
GUI	Graphical User Interface
ICD	Interface Control Document
PNT	Position, Navigation & Time
RF	Radio Frequency

Spirent **PT TestBench GNSS Automation and Report Generation Tool**

For more information

For more information on any aspect of performance evaluation of positioning, navigation & timing systems, please contact your Spirent representative or Spirent directly:

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