

PNT Xe

PNT Test Precision Made Accessible

PNT Xe brings Keysight's trusted global navigation satellite system (GNSS) simulation performance to a wider range of users and applications, offering a cost-effective, compact solution without compromising signal fidelity or reliability.

Built on Keysight's proven signal generation architecture, PNT Xe supports multi-constellation, dual-frequency GNSS testing with the signal quality, stability, and repeatability needed for confident validation in real-world production workflows.

With its rack-mountable, lab- and field-ready form factor, PNT Xe is engineered for flexible deployment — supporting everything from fundamental system verification to more scalable operational testing.



Figure 1. PNT Xe simulation system

PNT Xe Signal Generator

PNT Xe consists of a single 2U rack-mountable unit with internal controller running the operating software. It supports one RF output and up to two generic software-defined radio (SDR) cards. All signals are combined and simultaneously routed to the front-panel primary radio frequency (RF) output and rear-panel high-level output.

Each SDR radio card can be configured to generate up to 64 channels of any signal type within one of four frequency bands. Multiple constellations can be generated within a single SDR radio card, as long as they operate within the same frequency band.

PNT Xe also supports in-field upgrades, offering a clear path for future scalability, including:

- In-field hardware upgrades for additional RF SDR radio card
- Software feature keys to enable additional GNSS constellations and signal capabilities

PNT Xe Control Software

The control software is ideal for essential testing. It provides the capability needed to perform fundamental verification tests. Keysight's precise constellation and navigation modeling is built in, delivering maximum ease of use. Simply set up a few key parameters and press "run."



Figure 2. PNT Xe control software

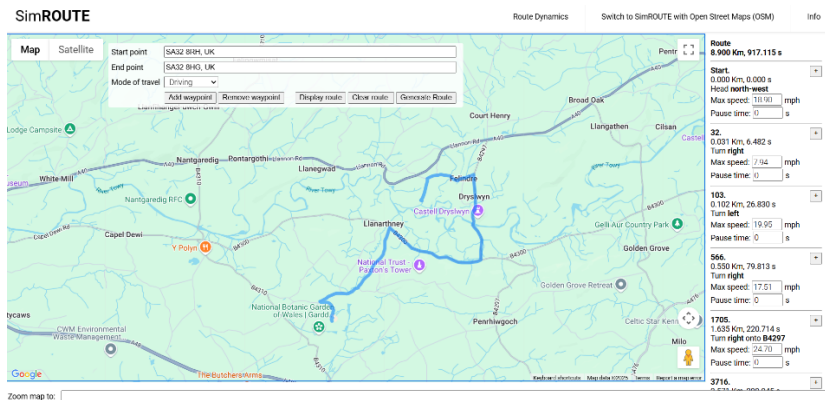


Figure 3. Google Maps User Motion Trajectory generation tool

Key features include:

- Edit and save time and date
- Enable/disable atmospheric modeling
- Enable/disable multipath
- Interactive power control of each individual constellation
- Load real constellation almanacs
- Choose static position, simple motion, “racetrack” motion, or Google Maps matched trajectories via the SimROUTE tool
- RX antenna level patterns editing
- Simulate leap second events
- Flexibly allocate available hardware channels across licensed constellations
- Display simulation parameters
- Display sky plot
- Selected remote control capability via Ethernet connection

Single Channel Utility (SCU)

PNT Xe supports the generation of a single channel satellite signal for each licensed constellation frequency. This allows individual control of several parameters, including a satellite’s carrier frequency, power level, velocity profile and pseudorandom noise (PRN), secondary code, and navigation data.

Single Channel mode operation can be controlled via the graphical user interface (GUI) or remote commands. Commands are formatted according to Keysight’s SimREMOTE ICD and are sent via transmission control protocol/internet protocol (TCP/IP). Single Channel mode operation is ideal for low-cost or targeted testing scenarios where single satellite control is required.

GPS-Authorized Testing

PNT Xe supports GPS-authorized AES M-Code testing, which requires the SimMCODE option. US customers can purchase directly from Keysight subject to approval by US authorities. Non-US customers can only purchase SimMCODE software via the Foreign Military Sales (FMS) program.

This option is available for authorized users only.

Detailed Performance Specifications

GNSS Constellations and Supported Signals

Table 1. GNSS Signals Supported

System	Carrier	Signal	Message Type	Level ¹	Notes
GPS	L1	C/A	Legacy	-130.0 dBm	
		P	Legacy	-133.0 dBm	
		L1c pilot code	CNAV-2	-128.25 dBm	
		L1c data code	CNAV-2	-133.0 dBm	
		M noise	-	-128.5dBm	AES-M requires SimMCODE
	L2	L2c or C/A	CNAV	-136.0 dBm	
		P	Legacy	-136.0 dBm	
		M noise	-	-132.5 dBm	AES-M requires SimMCODE
	L5	I, Q	CNAV	-127.9 dBm	
Galileo	E1	E1-B, E1-C (50/50 power sharing)	I/NAV	-128.0 dBm	OS Galileo Excludes SOL support
	E5ab	E5a(I+Q) and E5b(I+Q) (50/50 power sharing)	F/NAV, I/NAV	-122.0 dBm	OS Galileo — Supported FOC Galileo — Supported
	E6	E6-B, E6C (50/50 power sharing)	HAS	-128.0 dBm	
GLONASS	F1	C/A	Public	-131 dBm	
		P	-	-131 dBm	
	F2	C/A	Public	-137 dBm	
		P	-	-137 dBm	
	L1	CDMA	L1OC	-128.5 dBm	
	L2	CDMA	L2OCp	-128.5 dBm	
BeiDou	L3	CDMA	L3OC	-128.5 dBm	
	B1	B1I	D1, D2	-133 dBm	D2 does not include differential corrections or Iono grid
	B1	B1C	B-CNAV1	-130 dBm	

¹ Nominal power levels as defined by Keysight. Via the control software, the user can adjust nominal power levels to meet individual ICD conditions.

System	Carrier	Signal	Message Type	Level ¹	Notes
	B2	B2I	D1, D2	-133 dBm	
	B2	B2A	B-CNAV2	-127 dBm	
	B2	B2B	B-CNAV3, PPP-B2b_I	-130 dBm	
	B3	B3I	D1, D2	-133 dBm	
QZSS	L1	C/A, C/B	QZ-Legacy	-128.5 dBm	
		S	SLAS	-131 dBm	
		L1c data + pilot	QZ-CNAV-2	-127 dBm	
	L2	L2c	QZ-CNAV	-130 dBm	
	L5	I + Q	QZ-CNAV	-124.9 dBm	
		S		-127 dBm	
	L6	D+E	CLAS, CLAS-E (MADOCA)	-126.82 dBm ²	
IRNSS	L1	SPS	L1	-130 dBm	
	L5	SPS	L5	-130 dBm	
SBAS ³	L1	C/A	Data	-130 dBm	
	L5	L5-I	DFMC data	-127.9 dBm	

² Default power level setting is for Block II satellites.

³ SBAS includes WAAS, EGNOS, MSAS, GAGAN, SDCM, KASS, ANGA, SouthPAN and UKSBAS.

System Performance

Table 2. Performance Levels for PNT Xe

Parameter	Description	Units	Notes
RF Signal Level	Carrier level control Maximum	+15 dB	4
	Minimum	-40 dB	
	Resolution	0.1 dB	
	Linearity +15 dB to -30 dB	<0.10 dB	5
	-30.1 dB to -40 dB	<0.20 dB	
	Absolute accuracy Run to run repeatability	±0.5 dB ±0.1 dB	
Iteration Rates	Supported Simulation Iteration Rates (SIR)	10, 100 Hz	
	Hardware update rate ⁶	100 Hz	
	Bulk logging update rate	100 Hz	
	Latency (remote data to RF)	4 x SIR	
Limit of Signal Dynamics ⁷	Relative velocity	±20000 m/s	8
	Relative acceleration	±1800 m/s ²	
	Relative jerk	±15000 m/s ³	
	Angular rates (at 1.5 m lever arm) (indicative) (at 0.05 m lever arm)	>2π rad/s >10π rad/s	
Signal Accuracy	Pseudorange accuracy	5 mm RMS	9
	Pseudorange bias	0 mm RMS	10
	1PPS to RF alignment	< ±2 ns	11
	Inter frequency alignment	< ±250 ps (±75 mm)	12
Spectral Purity	Harmonics	< -40 dBc	13
	In-band spurious (highest limit applies)	< -182 dBW	
	Phase noise (single sideband)	<0.02 Rad RMS	14
Signal Stability	Internal 10.00 MHz OCX oscillator (after warm up)	± 5 x 10 ⁻¹⁰ per day	
Static Multipath Channels	Fixed path-length delay per path	0 to 1245 m	
	Resolution (approx.)	2.4 m	
Scenario Duration	The maximum duration of a single scenario	24 days	
Latency	For the operating in the HIL environment, the commands will take 4 times the SIR to be effective at RF	40 ms @ 100 Hz	15

4 The control range extends to -50dB but performance is unspecified below -40 dB. Operation below -20 dB is primarily to support antenna pattern and multipath functionality.

5 At 21 °C ±5 °C, +15 to -30 dB. ±1.5 dB 3-sigma all conditions.

6 The maximum rate at which any value can change is limited by SIR.

7 Note that the signal dynamic limits are dependent on the SIR and HUR.

8 For 6DOF data externally supplied via SimREMOTE or from data file.

9 Digitization-induced error for signal acceleration <45 m/s², jerk <50 m/s³, 100 Hz SIR.

10 Per carrier operating on a single SDR radio card. When the same signal is generated across SDR radio cards the inter radio card bias uncertainty is ±250 ps (±75 mm).

11 Between any RF carrier.

12 PRN code alignment between frequency band.

13 In-band spurious bandwidths (relative to center frequency unless otherwise stated):

GPS: L1 ±20.5 MHz, L2 ± 20.5 MHz, L5 ±20.5 MHz

Galileo: E1 ±20 MHz, E5a ± 25.5 MHz, E5b ±25.5 MHz

GLONASS: (relative to channel frequency 0) L1 ±20 MHz, L2 ±20 MHz

BeiDou: B1/B2 ± 20.5 MHz

14 Value is typical, integrated over a 1 Hz to 10 kHz bandwidth.

15 Simulation running at 10 ms SIR.

Extensions and Options

SimHIL

SimHIL enables integration of PNT Xe with third-party vehicle models and driving simulators for hardware-in-the-loop (HIL) testing use cases.

SimHIL is compatible with the third-party tools listed in Table 3. Hardware, firmware, and software compatibility of these tools should always be confirmed with your Keysight representative prior to placing an order. PosApp version compatibility should also be verified prior to deployment.

If the variant or tool you are interested in is not listed, please contact Keysight for further information.

Table 3. SimHIL Options

Option	Real-Time HW Supported	SW Versions Supported	Supported SIR
SimHIL for dSPACE	dSPACE SCALEXIO 2.0	dSPACE Release 2019-A dSPACE Release 2021-A dSPACE Release 2022-A dSPACE Release 2023-A	Up to 10 ms (100 Hz)
SimHIL for IPG	NI PXIe 8840 13.1	IPG CarMaker 8.1.2 (Windows) IPG CarMaker 9.1.2 (Windows) IPG CarMaker HIL 9.1.2 (NI RT Linux OS) IPG CarMaker 10.1 (NI RT Linux OS)	Up to 10 ms (100 Hz)
SimHIL for SCANeR		SCANeR Studio 1.7 SCANeR Studio 1.8 SCANeR Studio 1.9r65 SCANeR Studio 2021, 2022 and 2023	Up to 10 ms (100 Hz)

PNT Automation

PNT Xe supports automation via PNT Automation, a comprehensive test authoring and execution tool built for testers, developers, and automation teams. It addresses the needs of manual testers, automation specialists, and managers alike to improve the productivity of the entire test workflow.

PNT Automation enables multiple tests to be run without any external intervention while providing analysis and test report capabilities.

It is specifically designed for PNT testing and includes control software (based on SimREMOTE) to accurately achieve the interoperability between Keysight simulators and the DUT(s). The DUTs are configured and controlled with PNT Automation using a dedicated user interface.

For additional information, please refer to the PNT Automation Data Sheet.

STANDPOINT

PNT Xe is fully compatible with Keysight STANDPOINT, offering synchronization between the simulator and live-sky GNSS signals. It supports advanced testing scenarios such as spoofing, resilience assessments, and seamless transition between live and simulated environments. This integration allows users to conduct high-integrity tests with full control over signal conditions while leveraging real-world satellite data for enhanced realism.

For additional information, please refer to MS3121.

External Interference Simulator GSS7765

PNT Xe can be combined with Keysight's external interference simulator, the GSS7765, to provide a comprehensive solution for testing satellite navigation equipment in the presence of intentional or unintentional RF interference.

The GSS7765 supports a very broad range of interfering signal types, including Continuous Wave (CW), AM and FM (pulsed signals also available). The interference simulator also supports noise generation with variable bandwidth.

Seamless integration with PNT Xe ensures full support for GNSS scenario execution, with coordinated control over interference signal content and dynamics.

For further technical details, refer to MS3055.

Connectivity

Table 4. Signal Generator Connectivity

Port	Type	Parameter
Main RF Port	Output	N-type coax female, 50 Ohm, VSWR <1.2:1 AC coupled ± 50 V DC, maximum reverse RF 30 dBm
High Level RF Port	Output	N-type coax female, 50 Ohm, VSWR <1.2:1 AC coupled ± 50 V DC, maximum reverse RF 30 dBm
External Frequency Standard	Input	BNC coax socket, 50 Ohm -5 to +10 dBm at 1 MHz, 5 MHz, 10 MHz
Internal Frequency Standard	Output	BNC coax socket, 50 Ohm 10.00 MHz at +5 dBm nominal
1PPS IN	Input	BNC coax socket, 50 ohm, TTL level compatible
1PPS OUT	Output	BNC coax socket, 50 Ohm, TTL level compatible
Trigger IN	Input	BNC coax socket, 50 ohm, TTL level compatible
Timer	Output	BNC coax socket, 50 ohm, TTL level compatible. User configurable

Table 5. Internal Controller Connectivity

Interface	Type	Parameter
USB (x6)	I/O	Mouse, keyboard, and general file access (2 accessed from front + 4 on rear panel)
Ethernet (x1)	I/O	RJ-45 Ethernet interface standard. Used for general network access and available for remote control
Display Port	I/O	Video monitor port

Physical and Environmental Properties

Table 6. Physical and Environmental Properties

Part	Parameter	Value
Signal Generator	2U chassis dimensions (height x width x depth)	H: 88.1 mm W: 448.7 mm (enclosure only) W: 482.6 mm (including rack-mount ears) D: 495.5 mm (enclosure only) D: 513 mm (including front and rear ports)
	Typical weight	<15kg (33 lb) (configuration dependent)
	Operating environment	0 to +50°C (32 to 122°F) (40-90% RH, non-condensing) Altitude restriction of 2000m
	Storage environment	-40 to +60°C (-40 to 140°F) (20-90% RH, non-condensing)
	Electrical power	100-240 V 5A Max 50 to 60Hz

Accreditation and Compliance

Table 7. Safety and EMC Compliance

Compliance	Applicable Standard
Safety	Low Voltage Directive (LVD) 2014/35/EC IEC 62368-1:2014 (Second Edition) Audio/video, information and communication technology equipment. Safety requirements
EMC	EMC Directive 2014/30/EC EN 61326-1:2021 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
MET	MET Certification. Listing number E113897; MET Project Number 109752 UL 62368-1/CAN C22.2 CSA 62368-1, Second Edition: Audio/video, information and communication technology equipment. Safety requirements

System Calibration

PNT Xe is calibrated in accordance with ISO/IEC 17025 standards at the time of purchase. This calibration remains valid for up to 180 days in storage prior to initial receipt by the customer, provided the unit is stored under standard environmental conditions. The recalibration interval is recommended to be 12 months, starting from when the unit is first put into service. To maintain ISO/IEC 17025 accreditation, all recalibrations must be performed by Keysight or an authorized ISO/IEC 17025-accredited laboratory.

Please note:

Installation of additional SDR radio card or performing calibration outside of an accredited Keysight facility will invalidate the accredited calibration. This includes customer-initiated use of the Auto Calibration Utility (where installed) and certain hardware upgrade procedures.

Environmental, Social, and Governance (ESG)

ESG is a priority for Keysight across all aspects of our business, from sustainable buildings and sustainable product design to sustainable supply chain, manufacturing and shipping/export processes. As is best practice, we follow a continuous improvement process in respect of ESG.

Many of Keysight's test solutions rely on physical test equipment used in situ by our customers. We are working to reduce the lifecycle impacts of our products, and the environments in which they are used, in a number of ways:

- Designing for environment and end of life, including compliance with all legal requirements;
- Reducing the size, weight, noise, and power use of our products;
- Visualization and the development of Test as a Service via PNT Professional Services;
- Improving utilization and automation; and
- In field servicing and upgrades.

We use formal sustainability metrics in the product development process.

For more specific information on how ESG applies to our PNT test solutions, please contact your Keysight representative.

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



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