SOLUTION BRIEF

PNT X

Four NAVWAR use cases

Spirent™ Federal Systems

Spirent PNT X

Simplifying NAVWAR simulation for rapid deployment of robust PNT systems to the warfighter

- PNT X is the most powerful, capable, and realistic navigation warfare (NAVWAR) test platform in the industry, emulating NAVWAR environments to expedite the development and validation of PNT solutions.
- PNT X is an all-in-one solution built on advanced technology: purpose-designed FPGA cards for accurate, low-latency, high-fidelity RF signals and robust GPUs for rapid real-time calculations and modeling in a flexible software-defined radio (SDR) architecture that offers infinite scalability.
- The result is a future-proofed system with simulation integrity that delivers trusted results.

Developing robust PNT solutions for NAVWAR environments requires a comprehensive approach that evaluates offensive and defensive technologies.

PNT X tests it all: from emulating offensive threats like jamming and spoofing to integrating defensive measures such as controlled reception pattern antennas (CRPAs) and layered solutions with diverse signals and multi-sensor architectures.

Out of thousands of options, here are four specific use cases that are now possible with PNT X:

NAVWAR Use Case: CRPA Testing with Dynamic Jammers

OBJECTIVE: Characterize a CRPA system on a combat aircraft encountering novel mobile jamming waveforms.

SOLUTION:

Robust CRPA Testing. PNT X architecture ensures superior performance for characterizing CRPA systems.

- Spirent SDRs generate a precise wavefront with high phase stability and low noise.
- A continuous dynamic range of up to **140 dB** replicates high-power jamming threats with unprecedented realism.
- Remote commands enable on-the-fly modification of jammer parameters.

High-power Dynamic Jammers. In addition to the 140 dB continuous dynamic range, PNT X introduces a wideband 90 MHz AWGN jamming waveform and more matched spectrum interference to represent GNSS signals as noise waveforms. PNT X can generate custom, user-defined jamming waveforms with motion and dynamic signal effects using Spirent's **SimIQ spatial awareness capability** (see page 7).

Simplified Scenario Creation. PNT X simplifies CRPA testing with new features and tools for easily generating complex test scenarios.

- See real-time visual feedback of dynamic spoofers and jammers with embedded **3D terrain modeling** (see page 7).
  - Obscuration and multipath effects calculated for all RF signals, including jammers and spoofers
  - Multi-antenna and multi-vehicle capable
  - Open-source 3D maps such as Digital Terrain Elevation Data (DTED)

BENEFITS:

1. Precise calibration and superior phase stability ensure accurate results and avoid unwanted run-time phase compensation. With PNT X's industry-leading dynamic range and signal fidelity, high-power jammers can be simulated without unwanted parasitic effects, enabling CRPA developers to better characterize null-steering ability.
2. PNT X provides the broadest range of jamming signal options to represent an array of threat sources.
3. Advanced terrain-based spatial modeling of the dynamic jammers enables the most realistic and powerful NAVWAR scenarios yet.

NAVWAR Use Case: Hardware-in-the-loop with Ultra High Dynamics

OBJECTIVE: Evaluate the PGK (precision guidance kit) on spinning artillery with hardware-in-the-loop (HIL) in a GPS-contested environment.

SOLUTION:

High Dynamic Motion. Using its custom-built, powerful FPGA SDR engine, PNT X offers an unrivaled **2 kHz** update rate as standard. For applications such as missiles, space missions, and drones—where rapid acceleration and high-jerk dynamics are essential characteristics—a high update rate is essential for faithfully reproducing true motion dynamics in RF.

HIL Low Latency. For hardware-in-the-loop testing, PNT X maintains system latency of **<2 ms** in all scenarios and configurations. Enhanced interoperability enables plug-and-play in complex HIL environments.

Spin Model. PNT X features a spin model that boosts the system update rate **to 100 kHz** for the angular dynamics along the spinning axis.

BENEFITS:

1. Due to the **2 kHz** update rate, PNT X performs far beyond the specifications of modern vehicles, including hypersonic missiles. Competitive solutions are limited by lower update rates that plot inherently less accurate trajectories, potentially leading to false-positive test results and failure in the field.
2. With **<2 ms** system latency, HIL trajectory and motion data from third-party hardware and software systems can be processed faster and more precisely, minimizing error and uncertainty.
3. The **100 kHz** spin model truthfully accounts for the fast pseudorange changes produced by spinning vehicles.

NAVWAR Use Case: Military GPS User Equipment (MGUE)

OBJECTIVE: Test a military GPS user equipment (MGUE) receiver for resilience to jamming.

SOLUTION:

Encrypted Signals. PNT X uses GPS-Directorate-approved MNSA M-Code, AES M-Code, and server-based SDS M-Code. Galileo FOC authorized testing is supported with PRS and CS signals.

M-Code RMP. An industry-first, PNT X provides Regional Military Protection (RMP) simulation. Military users can test and integrate the nascent narrow-beam, steerable M-Code signal.

Secure by Design. PNT X continues Spirent's commitment to meet enhanced security requirements.

- Compliance with general CAT 1 and CAT 2 Defense Information Systems Agency (DISA) Security Technical Implementation Guide (STIGs)
- Secure boot capability
- Optional self-encrypting FIPS-compliant SSDs for Encrypted Data at Rest

BENEFITS:

1. PNT X offers proven military testing for GPS and Galileo for modernized multi-constellation architectures.
2. RMP can be integrated into MGUE receivers with other PNT signals and tested under a wide range of edge cases to ensure superior performance in the real world—all before operational deployment.
3. To address customers' security needs, PNT X ensures the protection of secure data and intellectual property.

NAVWAR Use Case: Alternative PNT

OBJECTIVE: Evaluate a GNSS system enhanced with alternative PNT on a ground vehicle for spoofing resilience.

SOLUTION:

All-in-one Alternative PNT. PNT X brings the most signals with the highest fidelity into one solution for testing diverse alternative PNT applications.

- ***LEO.*** Embedded, highly-accurate low Earth orbit (LEO) satellite models account for complex gravitational effects and physical properties such as atmospheric drag. Real-time simulation of user-defined PNT signals are generated alongside standard GNSS constellations.
- ***S-band.*** Beyond L-band, PNT X offers native S-band software-defined radios for regional GNSS and LEO.
- ***Inertial & Other Sensors.*** PNT X enables performance testing of integrated and embedded GPS/inertial systems (IGIs and EGIs) in the lab, along with other sensors.

Enhanced Spoofing. PNT X enhances realism for multiple spoofers in a scenario with independent and uncorrelated wideband thermal noise definition. PNT X also provides a simple approach to add a signal delay to spoofers for easy setup of meaconing transmitters in test scenarios.

BENEFITS:

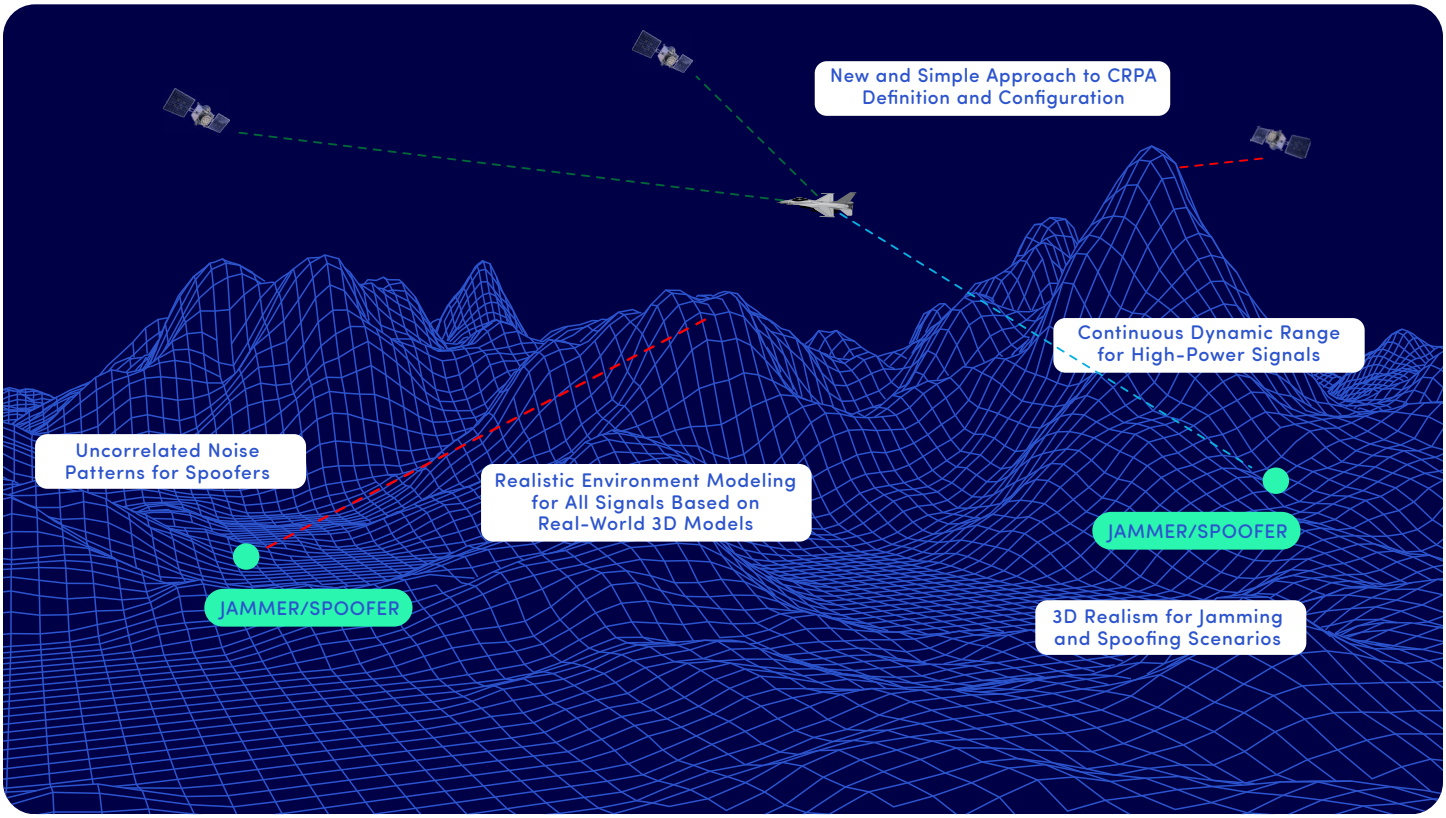
1. PNT X contains native alternative PNT capabilities for both military and commercial applications. From L-band to S-band, PNT X is future-proofed.
2. Achieve new levels of realism simulating signals broadcast to and from LEO satellites. Test experimental constellations with embedded LEO satellite models used in conjunction with native custom waveform generation capabilities.
3. PNT X can simulate either terrestrial or space-based signals of opportunity using user-supplied baseband I/Q data, in conjunction with data from other PNT sensors. PNT X overlays and synchronizes the motion characteristics for all signals in the simulation to simplify the creation of accurate and realistic scenarios.

3D Dynamic Terrain Modeling

3D Real-time Visual Feedback

PNT X transforms your lab into a real-world test range with 3D environment modeling for dynamic jamming and spoofing scenarios.

- Real-time calculation of obscuration and multipath effects on interference and GNSS signals
- Uses open-format terrain models such as Digital Terrain Elevation Data (DTED)
- Terrain effects extensible to multi-vehicle, multi-antenna scenarios for ultra-realistic CRPA testing with spoofers and jammers



SimIQ Spatial Awareness

I/Q-defined transmitters have become an effective way to simulate interference and novel PNT signals. However, this approach fails to model the inherent characteristics of a dynamic scenario, since I/Q data is pre-recorded and may not account for the relative position and movement between transmitter and the device under test (DUT).

Spirent's Solution

The **PNT X SimIQ spatial awareness** capability takes into account the transmitter-to-receiver relative motion to superimpose signal effects such as power levels, signal delays, and Doppler offsets onto I/Q data. Consequently, the same I/Q file can now define different transmitters (also across scenarios) as PNT X will generate the associated RF signal effects.

This solution enhances the realism of I/Q-defined transmitters and can be used together with 3D terrain modeling to simulate rich RF environments.

Note: This is a solution for I/Q-defined transmitters. For native generation of RF signals, SimGEN already calculates all signals effects from first principles.

Environmental Social & Governance (ESG)

Spirent's Positioning Technology business unit has been committed to ESG good practice and improvement since achieving ISO14001:2015 Environmental Managemental System certification in 2004.

ESG is a priority for Spirent 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 Spirent'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 Spirent representative. For more information on Spirent initiatives, visit https://corporate.spirent.com/sustainability.

Ordering Information

Available to Order from Spirent Federal Systems

- info@spirentfederal.com
- 801-785-1448

PNT X Part Numbers

- PNT X and associated products are commercial-off-the-shelf (COTS).
- **Due to PNT X's flexibility and wide range of use cases, there are several COTS options to fit your test needs.**
- Please contact us to determine which options will work best for you.

About Spirent Communications

Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks. We help bring clarity to increasingly complex technological and business challenges. Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled.

About Spirent Federal Systems

Spirent Federal Systems provides the world's leading PNT test solutions to the US Government and contractors to enable resilient PNT under any conditions and outpace evolving navigation warfare threats. As a US proxy company, Spirent Federal enhances Spirent's commercial offerings with classified and other sensitive military signal emulation capabilities. For more information visit **spirentfederal.com**.

MCD01001 Issue 1-00 | 05/25