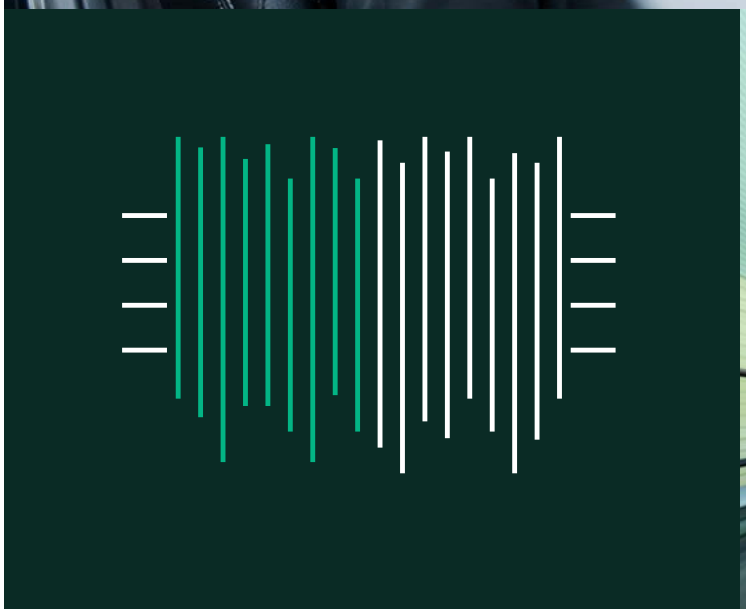


Solution Brief Collection

ADAS and Autonomous Vehicle Test

VIDYA RAMADOSS
ADAS CHIEF OFFERING MANAGER

Explore NI's Solutions

As advanced driver assistance systems (ADAS) and autonomous vehicles (AVs) introduce new technology into vehicles, they need adaptable, future-proof test systems. NI offers a software-connected toolchain to automotive test that covers data record, data replay, hardware- and software-in-the-loop, all the way up to sensor fusion and sensor characterization and manufacturing test applications to address today's and tomorrow's ADAS and autonomous driving (AD) technology.

Data Record For ADAS and AD

Record sensor and ground truth data during road testing to verify sensor capabilities and train ADAS and autonomous vehicle (AV) algorithms. AD software demands multiple high-bandwidth sensors, driving exponential data volume and movement growth. To cost-effectively keep up with technology, today's data-recording solutions must be simultaneously high-performance, forward-thinking, and adaptable.

Customer Needs

01

Synchronization—Provide microsecond-level accuracy for sensor and vehicle network interfaces.

02

Changing & Evolving Requirements—Adapt to evolving vehicle technology for current and future regulatory requirements.

03

Data Volume—Manage data creation and capture in GB/s while storing hundreds of TB per day and vehicle, along with the ability to visualize data during road testing.

04

Data Quality & Cost—Precisely measure I/O, lossless data handling, and data reduction at the start of the data lifecycle.

05

Integrated System—Eliminate multiple disparate sensor recording solutions to avoid installation complexity and decrease the risk of failure.

NI Solution

01

Increased Data Quality—Instrument-grade I/O, throughput, timing and synchronization, and edge computing capabilities for smart data reduction.

02

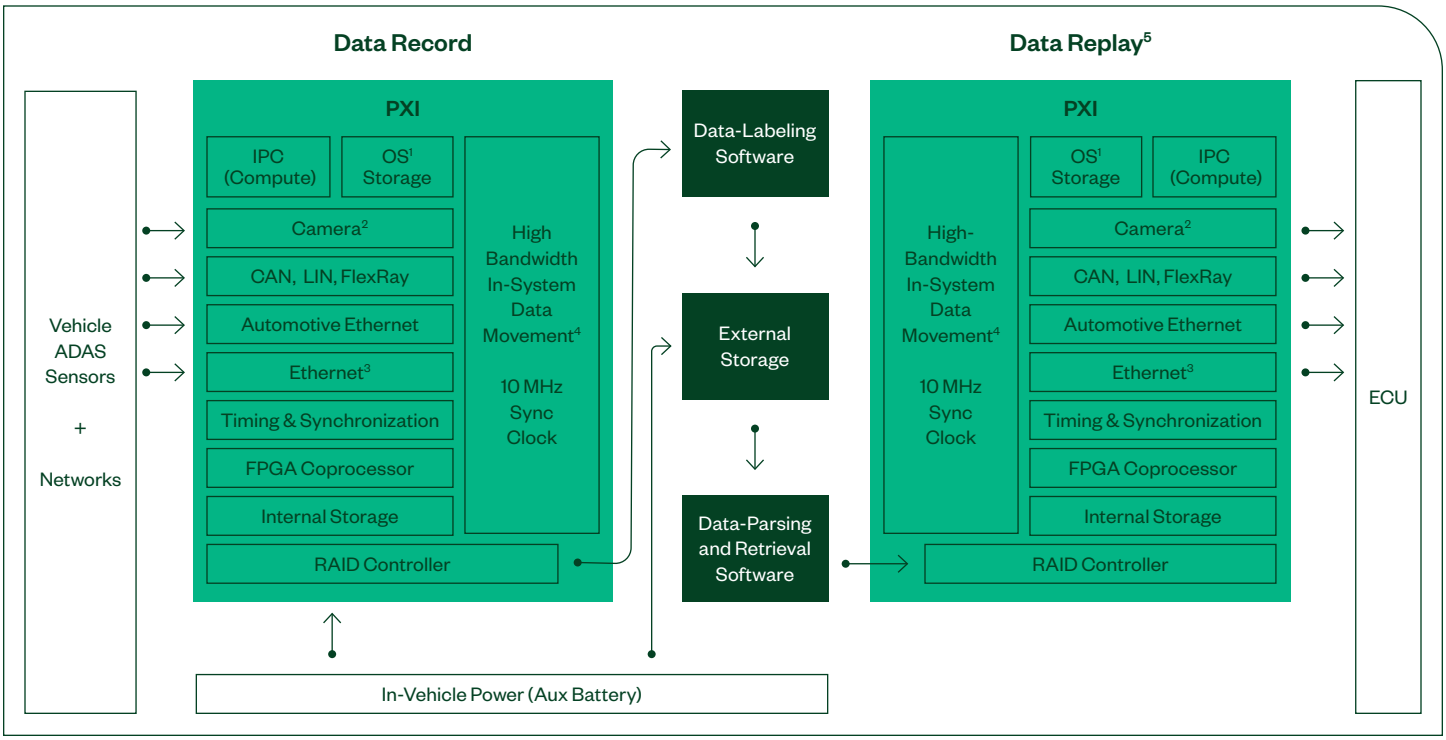
Maximum Security & Reduced Cost of Data—Fully encrypted enterprise grade storage solution and cost-efficient Storage as a Service (STaaS) subscription model.

03

Minimum System Complexity—One system for reduced footprint, power consumption, and error-proneness.

"We typically deploy a PXI chassis in a vehicle and interface it to live camera, ultrasonic, vehicle bus, and environmental sensor data from typical driving situations. We use this live data to train and validate our computer vision deep learning algorithms at the bench later."

Derek O'Dea
Measurement Equipment and Tools Development Manager, Valeo



[1]Operating System [2]GMSL, FPD-LINK, FPGA-Based [3]1 Gb to 50 Gb (incl. RDMA) [4]PCI Express Bus [5]Data Replay Not Covered in This Solution Brief

FIGURE 01

Block Diagram for Data Record Applications

THE NI ADVANTAGE

- **Future-Proof Systems**—Hardware and software customization, flexibility, and third-party openness
- **More Than Just a Logger**—A single unified toolchain for data record, data replay, and HIL
- **System Integration & Evolution**—NI Partner Konrad Technologies and a vast ADAS ecosystem of IT and cloud subject matter expert support

KEY SPECIFICATIONS	
Maximum Data Rate	6 GB/s (up to 15 GB/s using multiple storage devices)
Storage Capacity	Up to 200+ TB (through Seagate Lyve Mobile and third-party storage options)
Synchronization	<1 µs
Camera Interfaces	FPD-LINK, GMSL, Gigabit Ethernet, Ethernet, USB
Vehicle Networks Support	Automotive Ethernet, FlexRay, CAN FD, LIN
Radar, Lidar, Ultrasonics Support	Through Vehicle Networks and Ethernet
Ethernet Devices	Up to 50 Gb Ethernet
Operating Voltage Range	9 VDC to 30 VDC
Application Software	Data Record AD—High-Performance Data Movement and Data Synchronization Software
Supported File Formats	MDF4, TDMS, KITTI, Parquet, and others via file conversion and plug-ins
Data Labeling	Pre-Labeling Tool by Konrad Technologies interfacing with Data Record AD via gRPC API

Data Replay and Hardware-in-the-Loop For ADAS and AD

Validating the perception, planning, and control algorithms running on ADAS electronic control units (ECUs) is key to ensuring that ADAS and AD functions are safe and reliable when they reach the market. The industry needs to efficiently scale test coverage capacity by implementing different test methodologies such as replay and HIL, which increases test coverage by moving the bulk of testing from the road to the lab.

Testing complex algorithms on ECUs requires replicating scenarios by injecting real-world road data exactly as it was acquired in the vehicle. Testing must also expand coverage to include scenarios that are extremely difficult or dangerous to encounter on the road. Simulation enables you to create a nearly infinite number of edge scenarios that will be required to ensure the safe operation of ADAS and AD functions.

Replay Test Needs

01

Feed the system with external data in the same way as it would be done with the vehicle during actual test drives.

HIL Test Needs

01

Stimulate the perception systems with advanced processing and data manipulation techniques to convince the ECU that it is performing a real-world scenario.

02

Integrate hardware I/O with multiple environmental simulation and modeling tools.

Common Test Needs

01

Interface with the ADAS controller through multiple I/O and automotive bus signals with tight control over timing and data synchronization.

02

Maintain adaptability for future I/O and test requirements as systems continue to add more cameras, radar, lidar, and other ADAS sensor types.

03

Increase test coverage reliability and repeatability through direct injection techniques to insert faults, frame delays, and more into the sensor bitstream.

NI REPLAY AND HIL ADAS AND AD SYSTEM: ADVANTAGE

- Ensure **synchronous data feed** from either your NI record systems or other timestamped recording files.
- Integrate simulation from modeling software and inject signals from different sources for **maximum interoperability of test tools.**
- **Maximize test coverage** by running more test cases and scenarios in lab and simulation to decide which tests must be performed on the road.
- **Hardware and software customization, flexibility, and third-party openness** to future-proof your system.
- Develop faster by leveraging work across design and validation through NI's toolchain to perform **reliable test** at each stage.
- Keep requirements from outgrowing your test capability with NI's **range of I/O** for cameras, radar, V2X, lidar, and GNSS sensors and buses.
- A **unified test system** architecture to move back and forth between data replay and HIL test with the same system and single platform for data record.

NI REPLAY AND HIL SYSTEM AD SPECIFICATIONS

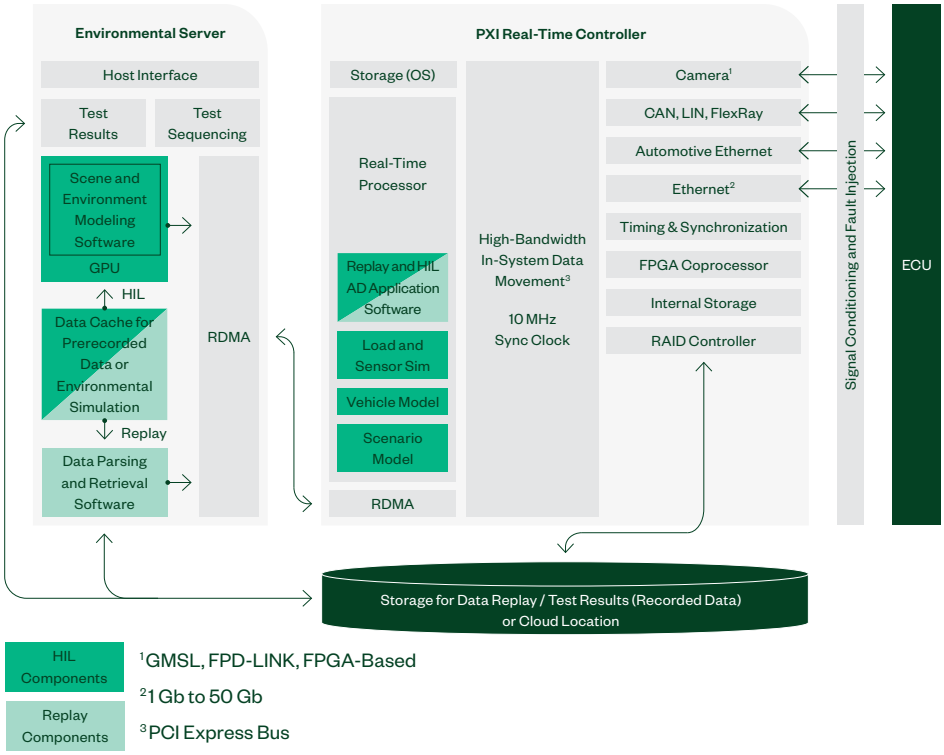


FIGURE 02

Block Diagram for open-loop Replay and closed-loop HIL Applications

"AD and ADAS require the combination of different test methodologies—which is challenging but essential to provide driver and passenger safety and, ultimately, for AVs to become a reality. With NI solutions, we can build up systems and move one step closer to a comprehensive test strategy consisting of both real-world and virtual test efforts."

Dr. Thomas Herpel,
Senior Manager, ZF Mobility Solutions

01

Replay and HIL AD software for data throughput, timing and synchronization, direct interface with ECU, full customization, data repositories, and simulation interfaces.

02

PXI technology provides hardware and software faulting capabilities—down to nanosecond synchronization and timing control for reliable execution of test cases.

03

Modular hardware generates signals to emulate ADAS sensors interfaces, vehicle bus traffic, and general purpose I/O to test sensor fusion on the ADAS controller.

04

Hardware integration openness to interface with Hexagon (Vires), Applied Intuition, IPG, Ansys, aiMotive, and more simulation and modeling software providers.

05

Open software-centric approach to interface and source data from IT infrastructure and cloud service providers like Microsoft Azure, AWS, Seagate, and more.

HPC Validation Test

AVs are among the most complex systems being tested today. At the heart of the AV sits a powerful high-performance computing (HPC) or a multidomain computing platform, that covers perception, planning, and control of the vehicle to determine the appropriate action to ensure safety of the car and its surroundings. The HPC platform must be able to take in synchronized data from multiple sensors; detect objects, their distances, lanes, and the environment; and plan the route and trajectory of the vehicle. As companies design and build their own AV supercomputers that combine automotive-specific networks and sensors with consumer electronic components, a critical balance must be struck between high-computing power and adequate efficiency. Testing this balance is crucial to building safe and reliable AVs.

Customer Needs

01

Validate features of the HPC platform, such as:

- Thermal performance
- Power consumption
- Automotive networks functionality
- AV sensor interface functionality
- PCB electrical measurements
- GNSS functionality

02

Quickly adapt the system following design changes of the HPC platform

03

Meet the time-to-market deadline for building AVs

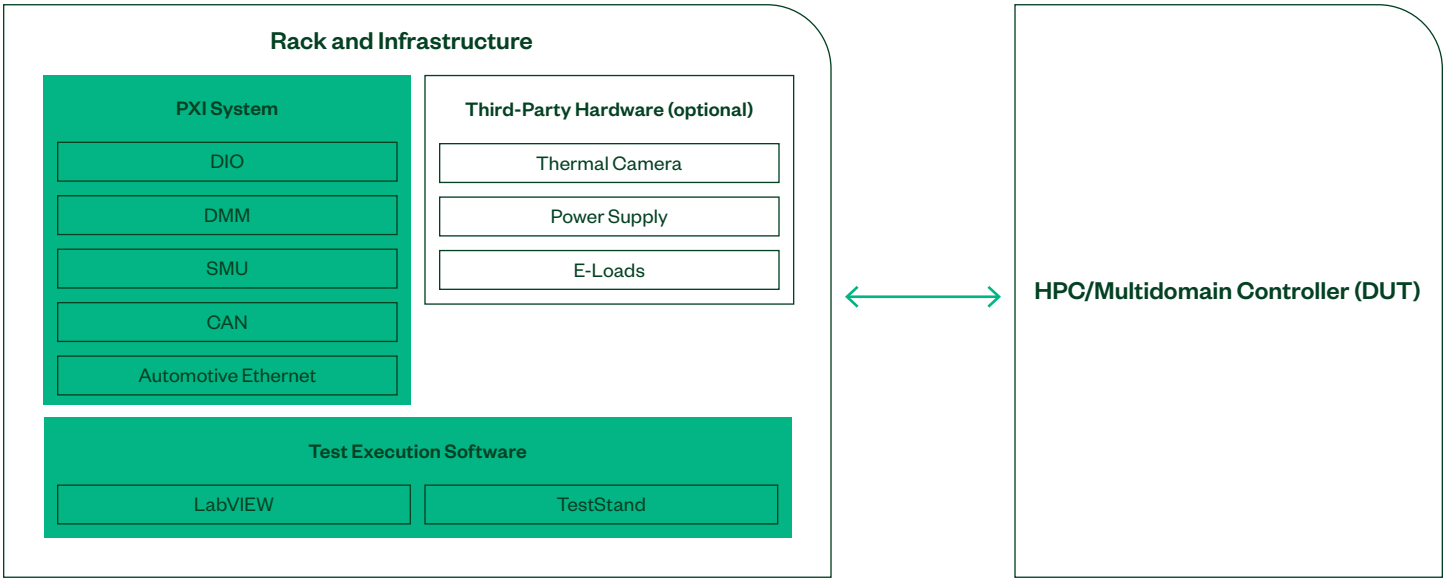


FIGURE 03

Block Diagram for HPC and Multidomain Controller Validation Test Applications

NI Solution

01

Modular hardware for CAN, Automotive Ethernet, current and voltage measurement/generation and more to customize a system that fits your exact I/O needs.

02

Flexible and interoperable with third-party hardware to complete the system with your existing hardware and/or with hardware that meets your requirements. Stream terabytes of data at up to 15 GB/s with NI or third-party RAID storage options that easily interface with a PXI system.

THE NI ADVANTAGE

- NI provides flexible software-connected systems with modular hardware and a configurable set of I/O.
- NI's solution is equipped to test multiple functionalities of the computing platform with one system, including the automotive network, network interfaces, thermal performance, power measurements, electrical measurements, and more.
- NI's modular and software-connected system can adapt quickly to new requirements or design changes.

Automotive Radar Test

Safety and ADAS features like autonomous emergency braking (AEB) or rear cross traffic alert (RCTA) rely on radars to function properly. As automotive radars evolve, testing becomes more challenging, because more test coverage is needed for both parametric and simulation test. Additionally, the reliability needed calls for higher levels of accuracy and repeatability in the test system. At the same time, organizations cannot lose sight of future requirements, such as higher bandwidth sensors or different antenna designs.

Customer Needs

01

Take parametric measurements and simulate radar obstacles for 77 GHz and 79 GHz with 1 GHz and 4 GHz bandwidths.

02

Perform repeatable, accurate, and reliable testing to comply with OEM requirements for validation and production test.

03

Integrate handling, actuation, and an anechoic chamber with the simulation and measurement instrumentation.

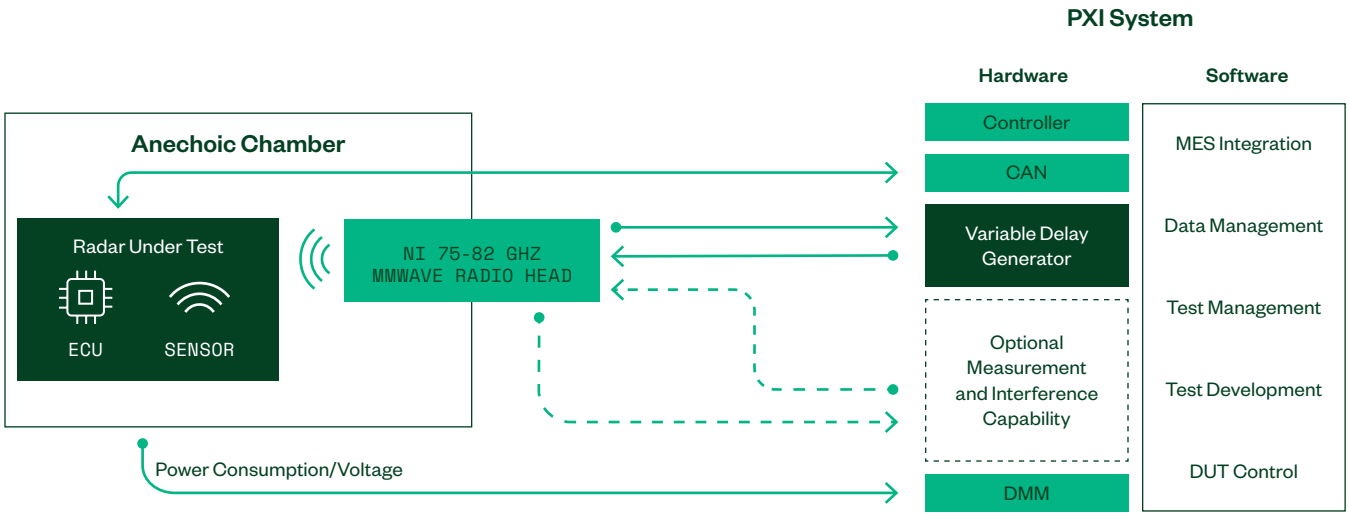


FIGURE 04

Block Diagram for Radar Test Applications

"NI's mmWave radar technology provides the industry's widest-bandwidth and low-latency software, which helps us develop automotive radar technology research in great depth. Through NI's flexible platform-based approach, we could finish both radar performance test and radar simulation, helping us accelerate the process of autonomous driving."

Geely Automotive

NI Solution

01

Vehicle Radar Test System (VRTS) performs highly repeatable and accurate radar obstacle simulation and parametric measurements in parallel to reduce test time.

02

Affordable and easy to upgrade, NI-based radar test solutions are modular, and flexible, bistatic or monostatic radar antenna configuration and capable of addressing all validation and production test and measurement needs.

03

VRTS integration partners provide solutions leveraging NI RF test systems, including anechoic chambers, mechatronics, actuation, and software development.

THE NI ADVANTAGE

- Reduce takt time, capital expenses, and footprint by performing parametric and simulation test in parallel for 77 GHz and 79 GHz automotive radars.
- Future-proof your investment with a modular solution that can be upgraded to add measurements, angles, and objects.
- Leverage work across design, validation, and production to speed up implementation by using a single toolchain and API.

KEY SPECIFICATIONS	
Frequency Range	76 GHz to 82 GHz with up to 4 GHz instantaneous bandwidth
Object Distance	2.5 m to 300 m excluding setup distance, 5 cm resolution
Object Velocity	0 km/h to +/-500 km/h with +/-0.5 km/h accuracy
Radar Cross Section (RCS)	50 dB dynamic range, with 0.25 dB resolution
Measurements	EIRP, phase noise, occupied bandwidth, radiation pattern, beam width, and chirp analysis
Bistatic Radar Antenna Configuration	Horizontal polarization, ≥80 dB, measured
Monostatic Radar Antenna Configuration	Vertical polarization, 20 dB, measured

Compact Antenna Test Range (CATR) System

Radar sensor technology plays a significant role in autonomous driving. Specifically, imaging radars are gaining traction due to high-resolution capabilities; multiple input, multiple output (MIMO) antennas; and a wide aperture with better long-range target recognition and longer far-field distances. All of these new test challenges require more complex test equipment. To cost-effectively keep up with technology, today's radar test solutions must be fast, accurate, smart, compact, and adaptable.

Customer Needs

01

A compact antenna test range (CATR) anechoic chamber to allow the creation of a high-quality quiet zone to perform at a significantly shorter distance

02

Simultaneous movement along individual dual-axis trajectories with a highly accurate DUT motion during the calibration process

03

Fast cycle times for testing and calibration and parallel handling of more than one DUT

04

Rare floor space or limited ceiling height to accommodate huge test chambers for increasing far-field distances

05

Full integration into the existing production environment with highly flexible tester control and application software

NI + NOFFZ ADVANTAGE

- Compact test bench tailored to your specific test and automation needs to fit your production environment
- Modular, flexible, and adaptable radar test system to keep up with new requirement requests and future-proof your investment
- Ready-to-use turnkey solution with global on-site support, service coverage, and short-term manufacturing capabilities
- Fast, accurate, and efficient test system optimized for production that facilitates the transition from radar sensor development to economical mass production

NI and NOFFZ Technologies partnered to develop a fast and accurate CATR test system optimized for production test. Save cost, use space more efficiently, and easily adapt to new requirements by combining the NOFFZ UTP 5069 chamber, automation, and software with NI VRTS for a system that is ready for the next generation of radar technology.

"The innovative CATR chamber design combined with NI's technology elevates our UTP radar test systems to a new level. Next-generation imaging and 3D/4D radar sensors can now be calibrated and tested in a state-of-the-art tester environment in high volume."

Oliver Poos
Principal Engineer, ADAS, NOFFZ Technologies

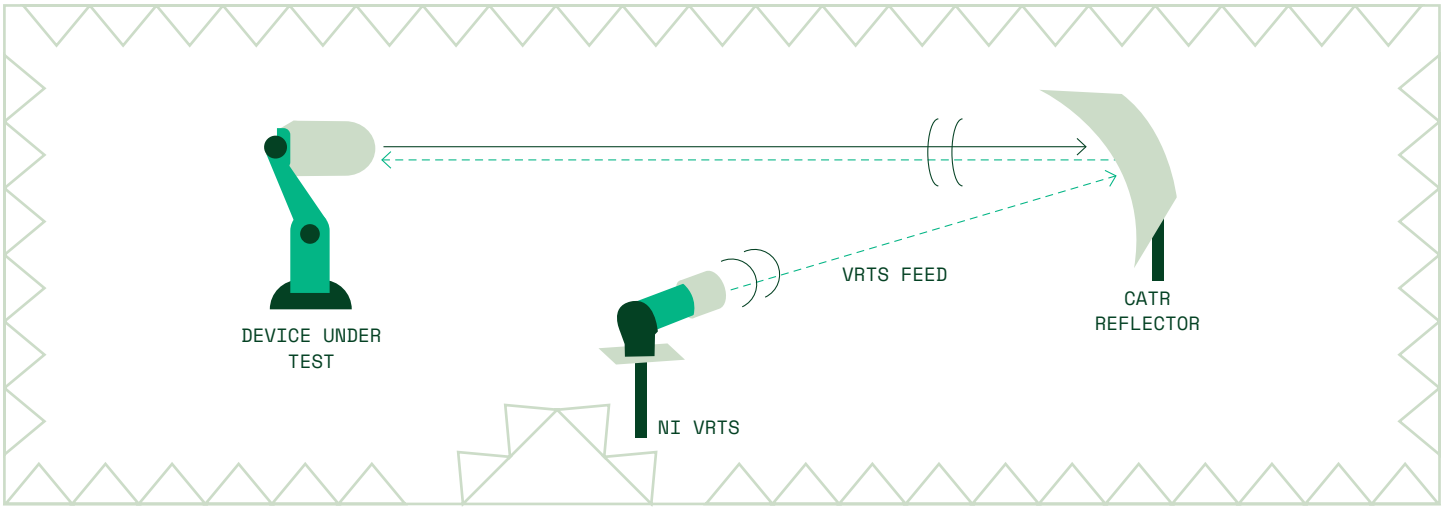


FIGURE 05

CATR Test System Internal Diagram Setup

NI + NOFFZ Solution

01

The UTP 5069 end-of-line (EOL) radar sensor test system features the best reflection suppression with absorption analysis inside the CATR chamber and a small footprint for big imaging radar sensors

02

The 4 GHz NI Vehicle Radar Test System (VRTS) helps you perform highly repeatable and accurate radar obstacle simulation and parametric measurements in parallel, which reduces test time

03

Optional dual nest loading and unloading station reduces test cycle time

04

The robot arm positions the DUT very precisely inside the quiet zone and allows highly accurate DUT motion in azimuth and elevation for best calibration results

05

Individual application software based on the NOFFZ UTP Suite helps you achieve synchronized DUT motion, parallel measurements, variant management, individual database connectivity, and more

KEY SPECIFICATIONS	
Quiet zone diameter	22 cm or more, depending on CATR reflector dimension
Frequency range	76–81 GHz
Bandwidth	4 GHz
Target simulation	NI.COM/VRTS
Dimensions of test chamber setup	1,200 x 2,700 x 2,200 mm (W x D x H)*

*Dimensions depend on frequency

V2X Functional Test System

Fully autonomous mobility will need widespread connectivity, according to many in the industry. V2X (Vehicle-to-Everything) for direct, network independent communication will be based on the 3GPP LTE-V or 802.11-based standards to meet this need.

To be competitive in this emerging market, automotive OEMs and suppliers start with the basic safety and efficiency applications, such as emergency brake warning and intersection assist. They also are developing advanced safety features to build safe and efficient vehicles. As the new standards are rapidly ratified, prototyping and validating the technical feasibility of V2X, as well as assuring interoperability, are vital steps as they are integrated with the vehicle and other infrastructure.

Customer Needs

01
Verify the V2X DUT behavior over the PC5 direct interface in all situations to build safer cars

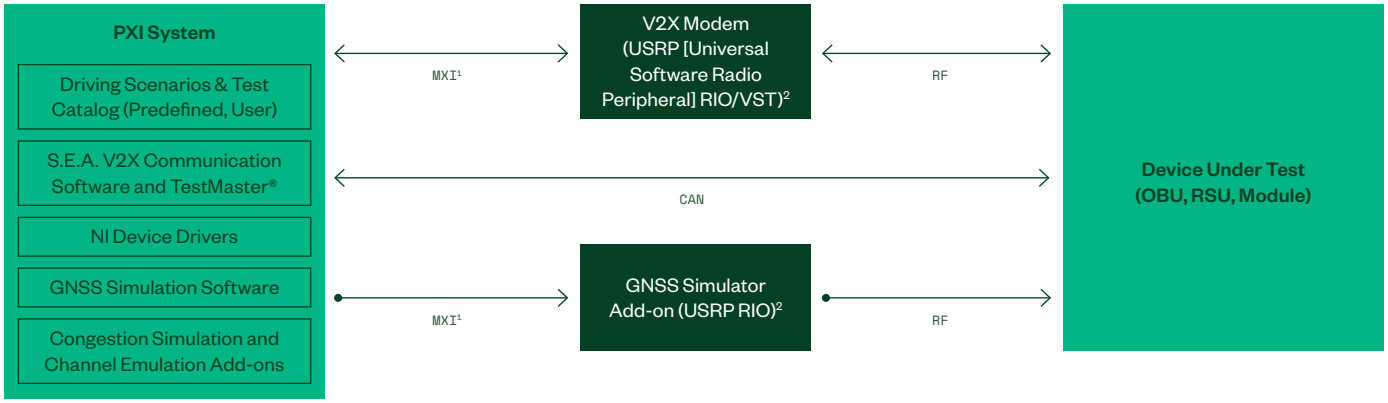
02
Validate the interoperability and functionality of V2X applications based on EU, United States, China, and other regional standards

03
Implement flexible software-defined testbed architecture to integrate both existing and upcoming technologies such as LTE-V2X, 5G NR-based V2X, DSRC, and GNSS

04
Shorten time to develop a testbed to accelerate technology due diligence

"The close cooperation with our partners, S.E.A. and NI, enables us to validate and verify our V2X devices corresponding to the high level of quality expected of Continental. The implementation of the V2X communication, RF measurement, and channel emulation for the 802.11p/DSRC and C-V2X on their software and hardware provides us access to the V2X technology and unique test features very early in the development. The SDR-based communication implementation and cooperation with S.E.A. ensure that we're able to react to new requirements in a short amount of time. Overall, the availability of V2X on the open NI platform enables us to be a leader in V2X technology."

Ingolf Koch
Continental, Head of System Test and Hardware Engineering



[1] Measurement eXtensions for Instrumention, high-bandwidth direct interface to the PXI system backplane [2] RF I/O interfaces

FIGURE 06

Block Diagram for V2X Functional Test Applications

NI + S.E.A. Solution

01

V2X Day 1 scenario catalog and turnkey system provides efficient startup and full ability for user-defined test scenario definition

02

NI PXI and USRP platform ensure the integration of the necessary standards, existing or new, with a software-defined architecture

03

The higher-level V2X signaling stacks support regional standards for US (WAVE), EU (ITS-G5), China (CSAE)

THE NI + S.E.A. ADVANTAGE

- Test the functionality of a V2X Device with synchronized emulation of driving scenarios using predefined Day 1 use cases and customer-defined use cases also for high-load situations (congestion)
- Flexible software defined radio V2X open-loop test solution is future-proof for current and developing standards such as 5G NR
- Expandable to include RF measurements and closed-loop HIL test for dynamic control/interactions with other traffic objects and sensors

SAMPLE CONFIGURATIONS

The NI + S.E.A. V2X Functional Test Software is configurable to allow for maximum scalability, cost-efficiency, and deployment options. Extension modules are available for:

- Day 1 use case test catalog for immediate start of test execution with the turnkey test system
- Emulation of the V2X surrounding environment up to several hundred objects (congestion)
- GNSS signal simulation including physical distortions
- Emulation of the physical distortion of radio waves (channel emulation with 8 taps)
- RF-compliance measurements in accordance with 3GPP
- Replay of real-world data logged in the field with S.E.A.'s V2X sniffer/logger systems

V2X Conformance Test System

V2X (Vehicle-to-Everything) communications will transform the mobility industry to improve the safety and efficiency of vehicles and autonomous systems.

For this application, V2X interfaces must conform to communication standards and RF regulations. These standards include 4G/5G cellular connectivity based on the 3GPP physical standard, along with protocol, security, and other application standards from SAE, IEEE, and others. Automotive suppliers, device manufacturers, and others involved in the V2X technology require a test system that:

01

Adapts to the latest standards as cellular technology continues to rapidly evolve

02

Supports physical, protocol, and application-layer testing

03

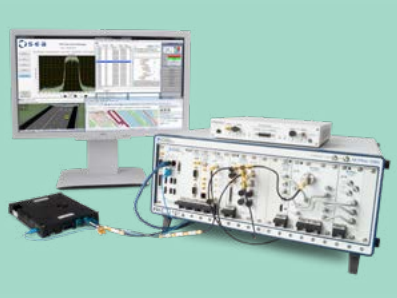
Provides and reliably executes conformance test procedures, defined by consortiums like the OmniAir Consortium®, to ensure interoperability with the V2X infrastructure and RF environment

04

Includes an integrated GNSS emulator for time, location information, and synchronization, in addition to RF physical-layer support

"The very dynamic communication technologies require deep technology competence and a flexible system concept. We have selected the NI modular hardware platform and its SDR-based radio technology, together with our modular test software and S.E.A. V2X software modules, which enable us to provide high-quality, efficient V2X test solutions for V2X test and measurement applications. We are honored that the value of our approach is confirmed by the successful OmniAir certification. The great work of OmniAir to ensure interoperability is key to the successful implementation of V2X technology."

Dr. Gerd Schmitz
CEO and Cofounder of S.E.A.



The NI + S.E.A. Advantage

- First OmniAir OQTE-certified V2X modular bench tester, enabling comprehensive V2X conformance testing
- Built with many years of S.E.A. experience with V2X and automotive integration, and as an NI RF and wireless specialty partner
- Modular architecture expandable to HIL test or other test and measurement needs in a larger road/traffic/vehicle system
- Solution for 802.11p/DSRC testing that uses the same base platform
- Open-loop test and closed-loop test system turnkey solutions for functional and V2X application-level test, including dynamic control and interactions with other traffic objects, sensors, and ADAS applications

NI + S.E.A. Solution

01

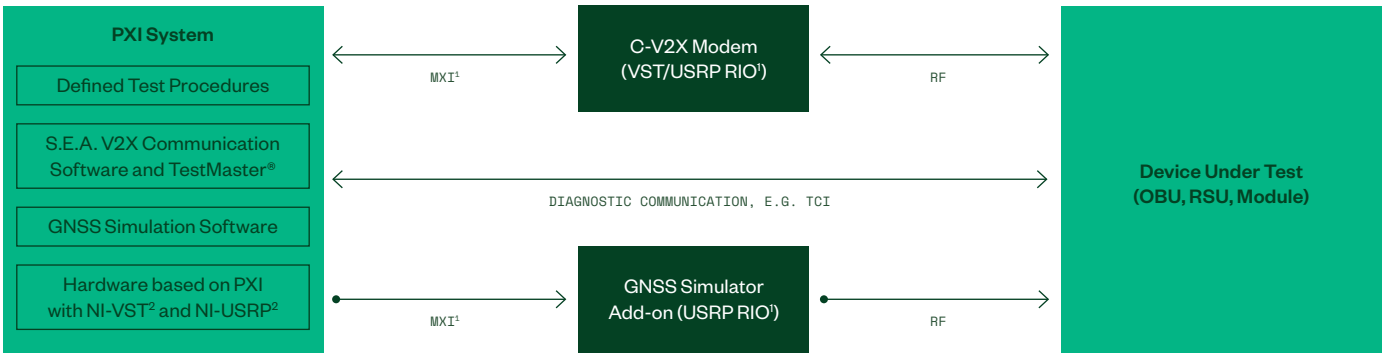
With a software-defined architecture and a modular platform, the PXI systems, combined with VST[2] and USRP[2], ensure the integration of the necessary standards, existing or new.

02

Turnkey solution with ready-to-run test catalogs for different standards available, proven in many tests with customer devices, certification, and plugfests.

03

Open system framework can include additional interface extensions like automotive Ethernet, cameras, and data management. This system can scale to an open-loop or closed-loop system for functional and application-level test, including dynamic control and interactions with other ADAS applications.



[1]Measurement eXtensions for Instrumention, high-bandwidth direct interface to the PXI system backplane [2]RF I/O interfaces

FIGURE 07

Block Diagram for V2X Conformance Test Applications

V2X Sniffer

To improve road safety and reduce congestion, the V2X communication system needs to interface and be interoperable with other vehicles, traffic infrastructure such as traffic lights, roadside units, and pedestrian devices.

Government agencies, automotive OEMs, and suppliers must validate and monitor the V2X signals in the V2X lab and field applications. Monitoring RF situations and packet-based V2X communication in a compact device is required for this task.

Customer Needs

01

Validate the V2X interfaces in all types of vehicles, traffic infrastructure, roadside units, and pedestrian devices

02

Monitor the V2X transmissions to confirm that the devices continue to function properly

03

Decode V2X signals, including basic messages, advanced protocols, and raw wireless signals for C-V2X (cellular) and DSRC (802.11p) concurrently with GPS/GNSS position signals

04

Record V2X messages captured from these interfaces

05

Monitor and provide overview about RF signal quality in real time

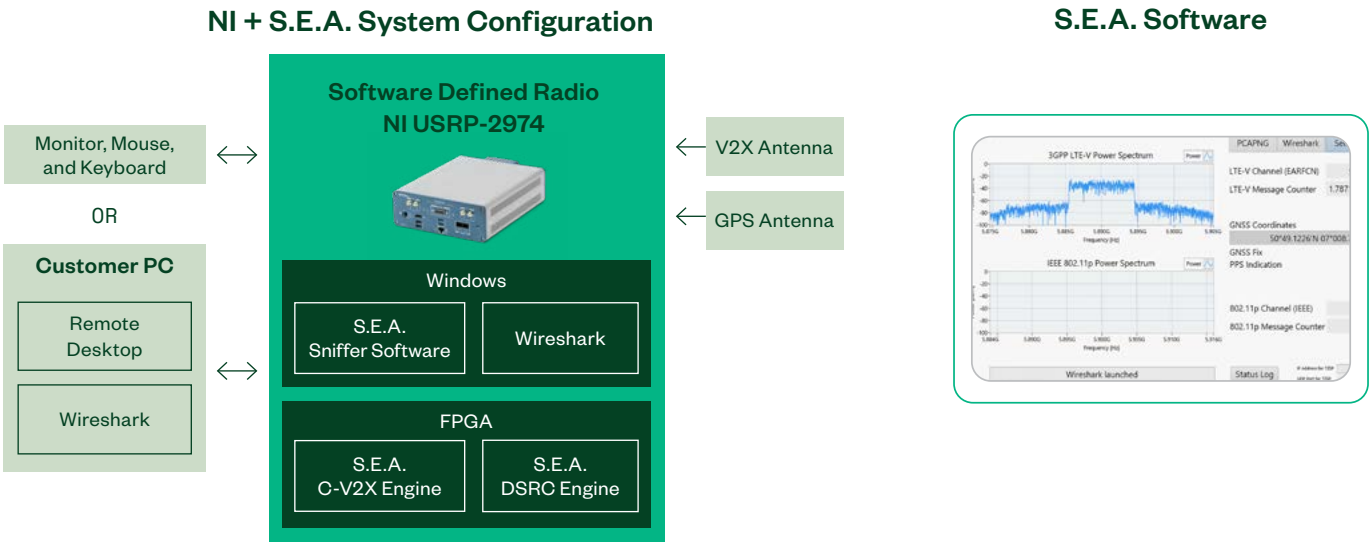


FIGURE 08

V2X Sniffer System

NI + S.E.A. Solution

01

The NI USRP-2974 software defined radio stand-alone device provides a high-performance Windows PC, FPGA, and the farthest RF signal support of known V2X sniffers.

02

S.E.A. 3610 V2X Sniffer software monitors C-V2X and DSRC RF signals, logs C-V2X and DSRC events, and records data in an industry-standard format.

03

An enhanced extension to Wireshark monitors and records packets with the V2X messages, supports advanced protocols such as TZSP, and uniquely provides MAC LTE information.

NI + S.E.A. ADVANTAGE

- Only V2X sniffer that is OmniAir certified for C-V2X (cellular) and DSRC (802.11p)
- Future-safe design with software defined radio technology and integration into the comprehensive NI/S.E.A. V2X test and measurement ecosystem
- Concurrent monitoring of C-V2X and DSRC communication and online monitoring of RF signal quality and messages
- Support of high-load (congestion) situations with hundreds of vehicles at a time
- Ability to extend for logging and IQ data recording

KEY SPECIFICATIONS	
S.E.A. 3610 V2X Sniffer Software S.E.A. C-V2X Engine and DSRC Engine on the FPGA	Monitors wireless V2X RF signals in addition to V2X messages Supports C-V2X and DSRC simultaneously Acquires GNSS information Includes the following RF signal views: spectrum, baseband, and constellation for C-V2X and DSRC (C-V2X added subframe timing) Saves packets in the PCAP file format Extends V2X message information with additional PHY/MAC information (SCI-1) for each packet Includes profiles for common parameter settings for US, European, and Chinese V2X applications
Enhanced version of Wireshark	Wireshark Packet Analyzer, extensions with advanced protocol decoding
NI USRP-2974 Software Defined Radio Stand-Alone Device Accessories Including Antennas	Includes an Intel i7 2 GHz quad-core processor, Windows OS, and Kintex-7 XC7K410T FPGA Connectors for antennas and other accessories

Sensor Fusion HIL with Scene Generation

Integrate scene generation tools with hardware I/O to simulate scenarios for validating the sensor fusion and decision-making algorithms on ADAS controllers. Scene generation increases test coverage and can be sourced through various simulation environments (pure synthetic data) and through recorded data turned into a digital twin.

Customer Needs

01

Integrate hardware I/O with scene generation tools from Hexagon (Vires), Applied Intuition, IPG, Ansys, aiMotive, and more simulation and modeling software providers.

02

Synchronously generate I/O signals to interface with the ADAS controller. With tight control over timing, you can test faults like frame delays or phase coherency.

03

Maintain flexibility for future I/O requirements as systems continue to add more cameras, radar, and I/O types like LiDAR.

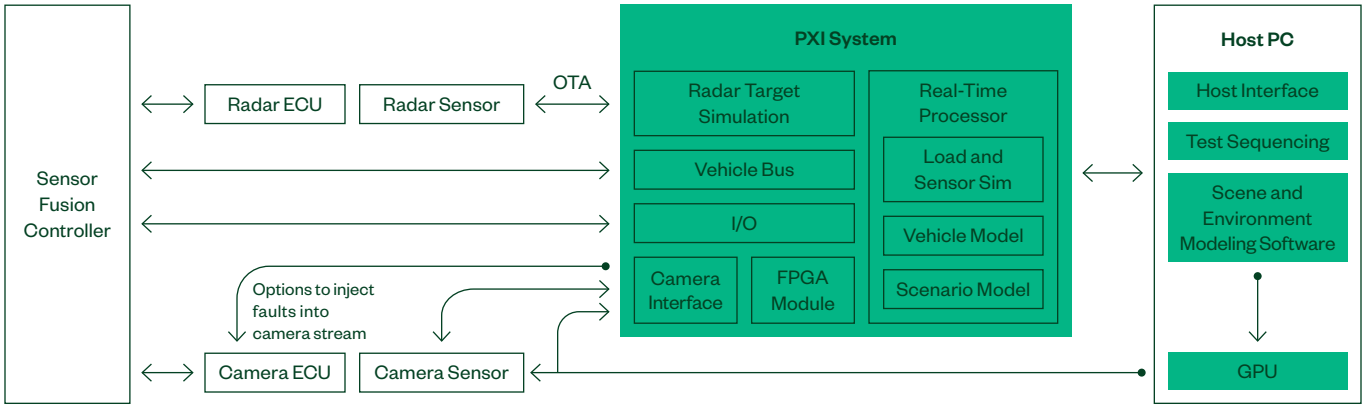
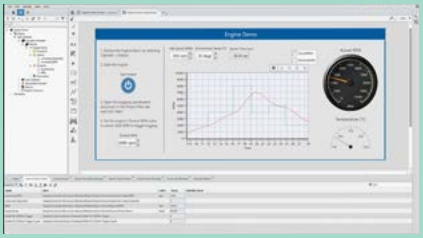


FIGURE 09

Block Diagram for Sensor Fusion HIL Applications



"The flexibility, modularity, and scalability of the NI system enable users to easily integrate it with other I/O as part of a comprehensive HIL tester for radar design and test applications—and to use the same system for both target emulation and radar device measurements, lowering the cost of device and system test."

Giuseppe Doronzo
Advanced Architect, Altran Italia

NI Solution

01

VeriStand real-time test software integrates with a wide variety of third-party scene generation tools, so you can choose the tool that works best for you, as well as utilize investments made in the past.

02

PXI modular hardware generates OTA radar signals, camera signals, vehicle bus traffic, and general-purpose I/O. It also features hardware and software faulting capabilities and nanosecond synchronization and timing control.

03

TestStand automated test software or Python scripting helps you implement test sequencing to automate test vectors and increase test coverage in shortened test schedules.

THE NI ADVANTAGE

- Achieve and maintain direct control over your test system and maximize your test coverage using the openness of the NI toolchain.
- Change camera interfaces, inject bitstream faults, and test radar sensors with real over-the-air (OTA) reflections, or add new sensor types without significant costs or hardware changes.
- Future-proof your validation test strategy with modular, software-connected systems by combining PXI with VeriStand. You can simply add an I/O module to the system as your requirements change.

KEY SPECIFICATIONS	
Synchronization	<1 µs
Scene Generation Support	Anything with an API (Hexagon/Vires, Applied Intuition, IPG, Ansys, aiMotive, and more)
Camera Interfaces	MIPI CSI-2, FPD-Link, GMSL, HDMI, Gigabit Ethernet, Ethernet, USB
Radar Sensor Support	77 GHz, 79 GHz
Minimum Emulated Radar Distance	2.5 m
V2X Emulation Protocols	DSRC, 4G C-V2X
Location Emulation Protocols	GNSS, GPS, GLONASS
Other I/O	General-purpose I/O, CAN, LIN, FlexRay, Automotive Ethernet, standard Ethernet, and many more

System Integration on Your Terms

NI offers a variety of solution integration options customized to your application-specific requirements. You can use your own internal integration teams for full system control or leverage the expertise of our worldwide network of NI Partners to obtain a turnkey system.

Contact your account manager or call or email us to learn more about how NI can help you increase product quality and accelerate test timelines at (888) 280-7645 or info@ni.com.

NI Services and Support

- Consulting and Integration
- Global Support
- Turnkey Solution Delivery and Support
- Prototyping and Feasibility Analysis
- Repair and Calibration
- Training and Certification