

V2X

Functional Test Systems

Closed Loop • HIL • Open Loop • Test Catalogs

Day 1 Use Cases

Application Layer

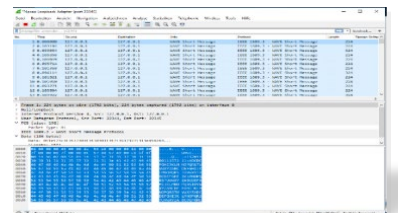
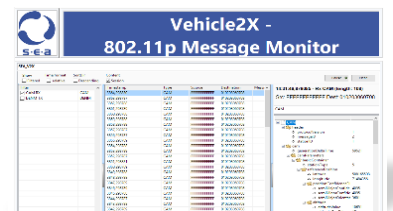
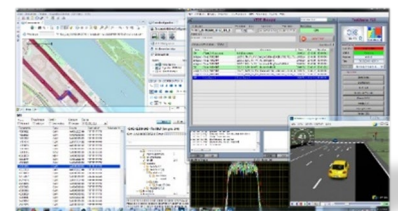
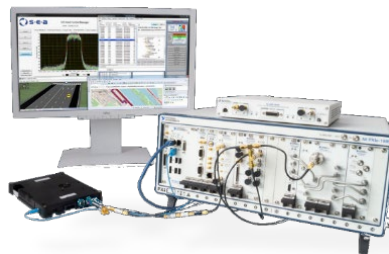
Speed, Longitude, Latitude...

Signaling Layer

WAVE, ITS-G5, CSAE

Protocol Layer

802.11p, DSRC, LTE-V, C-V2X, 5G-V2X



- Precise and comprehensive scenario definition
- Emulation, and automated V2X scenario test
- Supports all V2X side link communication technologies
- Test all major regional standards
- Future-Proof and scalable test solution





Comprehensive Emulation for the Test of V2X Applications

Functional testing of correct V2X functional behavior of in-vehicle electronics and applications (OBUs or TCUs) requires the complex, accurate and synchronous physical emulation of

- the V2X environment i.e., messages from remote vehicles and traffic signs
- GNSS signals of the ego-vehicle route
- In-vehicle status messages communicated, e.g., via CAN or Automotive Ethernet (AE).

For automated test execution the feedback from the device under test (DUT) must be analyzed and compared to the expected behavior of the DUT's application implementation.

Modular, Scalable and Future-Proof

The S.E.A. V2X test systems provide the seamless integration of the various software and hardware components required for efficient and reproducible scenario definition and V2X test execution. The systems including the Omniair-certified Conformance tester and V2X Sniffer are all based on a modular, open software architecture and the modular NI hardware platform. This unique approach provides scalability from a compact bench test system to a full HIL test system with the ability to integrate customer models, hardware, and software components.

V2X communication is implemented by software-defined radio (SDR) technology which provides unique capabilities to easily emulate the V2X environment including high-load (congestion) situations. Typically, a low-cost USRP radio is applied for functional test systems. All common side link protocols (802.11p, LTE-V2X, 5G-V2X) are supported. IPG CarMaker is integrated as a scenario simulation environment for the definition and execution of the roadmap, traffic scenario and vehicle scenario. GNSS simulation is based on M3Systems Stella NGC utilizing NI SDR technology.

The well-defined, open architecture (S.E.A. TestMaster) allows the integration of another scenario simulation environment of the customer's choice, GNSS simulation or any additional functionality on request. Automated and interactive tests with comprehensive reporting can be easily defined by the customer.

Open Loop and Replay Test System

The S.E.A. V2X Open Loop Test System includes all necessary physical emulation (V2X, GNSS, CAN/AE) and scenario simulation components. It is available as a compact benchtop test system or as a modular NI PXI-based variant which can be easily extended to a full HIL test system or with additional customer specific hardware interfaces. The open-loop approach focuses on unique real-time replay of user defined, pre-generated or recorded scenario data for functional testing of Day 1 use cases or the emulation of specific congestion scenarios or RF effects.

Closed Loop HIL Test System

The S.E.A. V2X Closed Loop Test System includes all necessary emulation components for real-time emulation of V2X test scenarios through the physical (V2X, GNSS, CAN/AE) or simulated interfaces. Customer models can be implemented as part of the real-time environment. The user-facing system software is identical to the Open Loop software and provides all features for interactive e.g., driver-in-the-loop and automated hardware-in-the-loop (HIL) test execution.

Day 1 Use Case Test Catalogs

S.E.A. provides ready-to-run test catalogs for open-loop and closed-loop test environments. The Day 1 Use case test catalog covers use cases as defined for the three main regions EU, US, and China. Execution of the test cases generates a full report with passed/failed parameters. The test scenarios and test cases are open and can be used as a perfect template to modify or implement customized test cases.

Customized test systems

S.E.A. is specialist for standard / customized HIL and open-loop test systems.

Contact us !



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