VIAVI Solutions

V2X Testing

V2X Virtual is a solution for conformance testing, functional validation and performance evaluation of devices and systems implementing V2X applications.

This integrated and scalable environment combines several components for testing V2X applications at any stage of the product development cycle, from early prototyping to pre-production.

The solution supports the execution of traffic scenarios on the testbench in a virtual environment that reflects all communication properties of field testing. This helps to optimize costly and risky field tests by making them more efficient and targeted.

V2X Virtual provides a simulated environment for the devices under test (DUTs) using dedicated traffic or vehicle simulators such as SUMO and using GNSS simulators to provide position data for DUT. It also observes the DUT behavior as HMI notification, based on the detected situation and the transmission of V2X messages. It also enables testing the scalability of V2X systems while providing their expected functionalities.

A sophisticated, complete solution for all (C)-V2X testing needs:

- Ensure V2X systems are robust, reliable, and capable of recognizing when they are under attack
- Validate conformance of V2X equipment against a comprehensive set of standards
- Test real-life conditions in the lab, not exclusively on the field

20+ years of industry experience & deep technical expertise:

- Helps you build efficient testing systems and ensure successful deployments
- First OMNIAIR qualified test equipment for DSRC certification
- First fully automated C-V2X protocols test solution

Addresses common testing needs across automotive OEMs, mobile network operators, road infrastructure & service providers, and device/chipset manufacturers:

- Reduce testing complexity with coherent, user-friendly tools
- Reduce time-consuming & costly field testing
- Save resources, efforts and costs while accelerating time to market

Meet all Challenges of V2X Testing

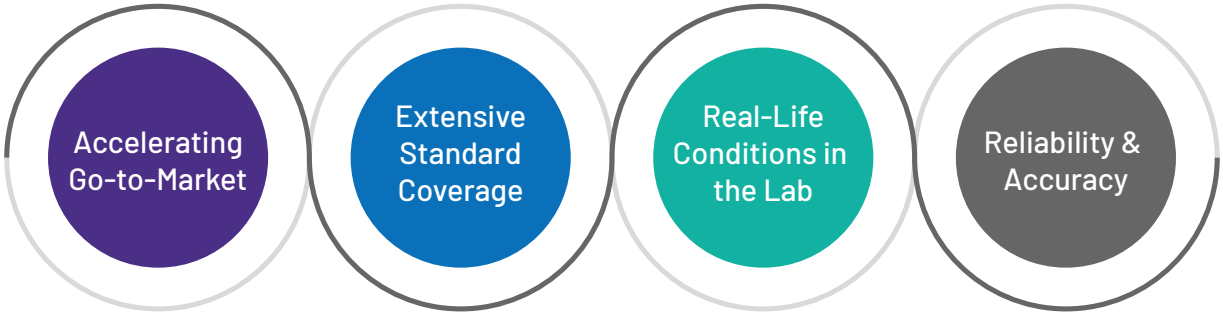
VIAVI test solutions enable engineers to test, validate and benchmark connected vehicles and devices to verify that V2X technology implementations are compliant to standards and work correctly under all possible conditions.

Customers can design and deploy sophisticated applications and systems based on V2X communications, while reducing expensive and time-consuming field testing.

VIAVI is trusted industry partner with a global support network. The world's leading automotive brands and sub-system developers rely on VIAVI to ensure outstanding user experience and market-leading performance.

Rely on solutions that match high-priority customer needs:

- Efficient turn-key solution for various (C)-V2X testing needs to
  - Ensure compliance to latest standards for successfully implementing new features and services
  - Verify devices & networks work correctly under all possible conditions & attacks
- Cost-effective solutions to validate V2X scenarios by optimizing the need for field drive tests
- Lab-based validation of V2X products
- Automated testing processes, including fast and simple test execution as well as result analysis
- Flexibility to integrate additional communication features
- Automated security testing options



Accelerating Go-to-Market

VIAVI helps customers overcome one of their biggest fears – delayed go-to-market. Our solutions ensure that customers meet the challenging time requirements and keep pace with constantly evolving technologies.

- Sophisticated, complete solutions for all (C)-V2X testing needs
- Coherent, user-friendly tool handling for fast testing processes
- Open platform to integrate existing test solutions at customer site
- Reduced testing complexity and full test automation

Extensive Standard Coverage

VIAVI works diligently in conjunction with government agencies, standard bodies, independent test labs and industry forums. Our industry leading conformance test suites provide an extensive standard coverage, enabling customers to successfully implement new features and services.

- V2X signaling protocols conformance testing
- V2X functional & performance testing
- Multi-PHY support (DSRC, C-V2X)
- Multi-protocol stack support (EU ETSI, US WAVE/OmniAir, China ITS)

Real-Life Conditions in the Lab

VIAVI solutions enable customers to perform comprehensive testing of real-life scenarios in the lab. They help ensure V2X devices and networks perform as intended and meet critical timing and safety requirements needed for autonomous driving.

- Reduce time-consuming and costly field testing
- Optimize costly and risky field tests by making them more efficient and targeted
- Perform virtual drive tests scenarios
- Reduce deployment, operation, and maintenance cost

Reliability & Accuracy

VIAVI helps customers to realize the full potential of complex V2X systems through deterministic testing to ensure they are robust and perform securely at the highest reliability.

- Benefit from VIAVI's long-term expertise in Automotive connectivity testing for high-quality V2X applications and systems
- Ensure your V2X systems are robust, reliable, and capable of recognizing when they are under attack
- Leverage test metrics that focus on precision, repeatability, and safety

Use Cases

Automotive OEMs & Device/Chipset Manufacturers

Utilize V2X Virtual to verify C-V2X support readiness for vehicle systems or subsystems and components. Define custom vehicle-to-vehicle or vehicle-to-infrastructure scenarios that can be run to validate Automotive products.

Testing options:

- Standard V2X Day 1 / Day 2 App validation for on-board units (OBUs)
- Test automotive DUT (OBU) behavior in pre-defined V2V/V2I application scenarios
- User-defined V2X app validation for OBUs
- Test automotive DUT (OBU) behavior in virtual drive test scenario

Use Cases

Network Equipment Manufacturers (NEMs)

Utilize V2X Virtual to test V2X devices like Road-Side Units (RSUs) either individually or as part of an infrastructure including a backhaul network and services to host applications.

Testing options:

- Infrastructure equipment scalability test
- Test infrastructure DUT (RSU) scalability (Traffic Simulator provides pre-defined environment behavior with scalability options)
- Infrastructure equipment functional test
- Test infrastructure DUT (RSU) behavior in pre-defined V2I application scenarios

Use Cases

Mobile Network Operators (MNOs) / Telco Service Providers

Utilize V2X Virtual to validate network readiness to support V2X applications served via the Uu interface through functional and performance tests allowing to assess scalability, measuring key performance metrics e.g. to validate Service Level Agreements (SLAs).

Testing options:

- Network/Infrastructure Testing
  - Validate/benchmark network equipment for C-V2X
  - V2X network/infrastructure benchmarking with the goal to test SUT (RSU + backhaul) behavior in scalability scenario
- Hybrid Lab/Field Testing
  - V2X network/infrastructure readiness validation with the goal to verify SUT (network/infrastructure) latency requirements

Product Components

VIAVI M1 C-V2X Hardware Kit

- Unified hardware to support conformance, functional and performance tests
- 8 C-V2X LTE-V PC5 (Side-Link) radio modules
- 4 Ethernet ports
- 2 CAN FD ports

V2X Virtual C-V2X Emulator Software

- Modular test platform for functional and performance testing of V2V, V2I/I2V, and V2P safety applications
- Multi-standard message set support (China, US, EU)
- Open architecture for 3rd party functions (Traffic Sim, Vehicle Sim, GNSS Sim, Test Control)

TTworkbench

- Conformance tests for US WAVE, EU ETSI ITS, China ITS stack
- Supports OBU and RSU tests
- Advanced toolset for test management, test automation, failure analysis
- Open framework for customized message set and test cases

Supported Scenarios / Test Cases

Communication	Application Name	Acronym
V2V	Intersection Collision Warning	ICW
V2V-Event	Emergency Brake Warning	EBW
V2I	Hazard Location Warning	HLW
V2V	Green Light Optimal Speed Advisory	GLOSA
V2V-Event	Abnormal Vehicle Warning	AVW
V2I	Speed Limit Warning	SLW
V2V-Event	Control Lost Warning	CLW
V2V	Forward Collision Warning	FCW
V2V	Emergency Vehicle Warning	EVW

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