

V2X Test Solution Benefits at a Glance

Measurement and Analysis with CANoe.Car2x

- > CANoe.Car2x supports the wireless standards WLAN IEEE 802.11p and 3GPP C-V2X PC5.
- > Protocols and application messages of the China, Europe and US regions are supported.
- > Flexible database concept for application messages (C-SAE 0053, ETSI, SAE J2735)
- > Interpretation and evaluation of the V2X-specific communication protocols
- > **Protocol Analyzer** with various checks, which can be configured and extended by the user.
- > **Visualization** of ITS Stations, warnings (DENM/BSM), intersections (MAP/SPaT), prioritization (SRM/SSM) and individual data in the Map Window
- > Security features to create and analyze security headers including signatures (based on imported or generated PKI)
- > Advanced analysis and testing: Programming API with access to application messages (e.g., CAM, DENM, BSM, etc.)

Simulation, Stimulation and Testing

- > **Scenario Editor** to setup a simulation of complex traffic scenarios in order to test V2X-based applications
- > Through expansion with Vector DYNA4, applications can be tested in a **closed-loop** environment.
- > Programming API to adjust and manage tests

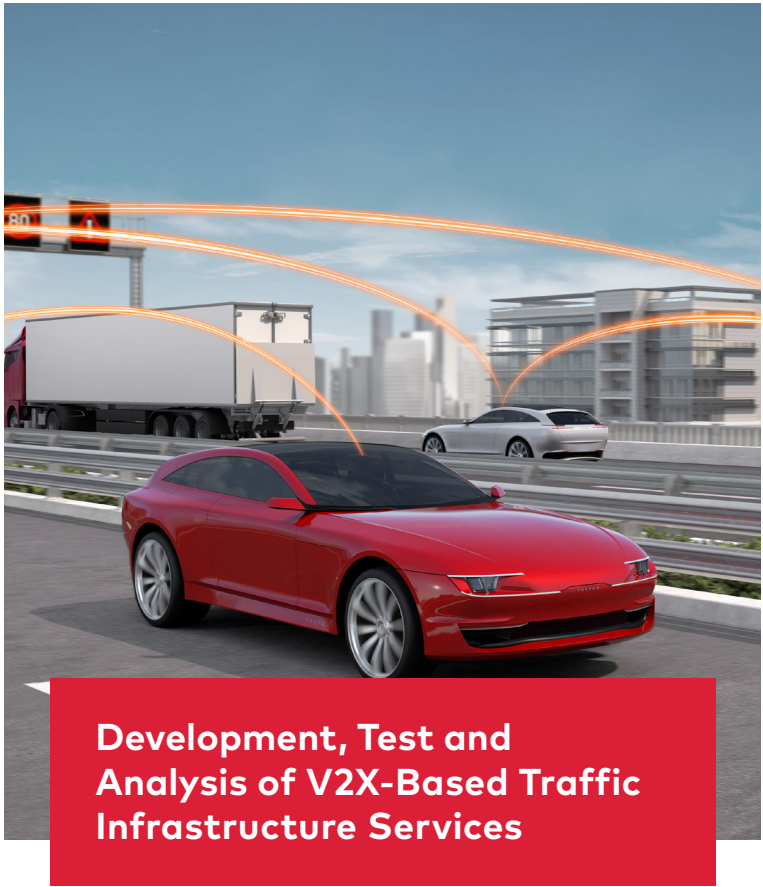


Get More Information

Visit our website for:

- > News
- > Products
- > Demo software
- > Support
- > Training classes
- > Addresses

www.vector.com/CANoe_Car2x/



Vector – Your Partner for V2X Development

The future of mobility is cooperative: Upcoming vehicle generations are becoming more and more integrated into a comprehensive data infrastructure that enables direct communication between vehicles (ITS Vehicle Station) on the one hand and with infrastructure (ITS Roadside Station) on the other hand.

The high degree of networking within the vehicle as well as with its environment entails a set of new challenges:

- > Evaluation of data in highly dynamic wireless networks taking into account position data and time stamps
- > Assurance of interoperability: Standardized communication among devices from different vendors
- > Generation and validation of signed communication
- > Simultaneous processing of information of internal and external data sources during development and testing of gateways, applications, and data fusion algorithms

Vector has many years of experience with tools for development, analysis, simulation, and testing of communication systems in vehicles.

Benefit from this expertise so that you can concentrate on what is really important for your V2X development: optimally controlled test activities throughout the project for quality assurance of your V2X-based applications.

Application Areas of CANoe.Car2x

V2X messages sent by the traffic infrastructure are only reliably processed by the receiving vehicles if they are filled with data in accordance with the relevant standards and the agreed profiles. The CANoe option Car2x is well-suited to support testing of these services like Road Works Warning, Signal Phase and Time Information or Prioritization. CANoe.Car2x supports all necessary protocols, security mechanisms and application messages specified for the China, European and the US region.

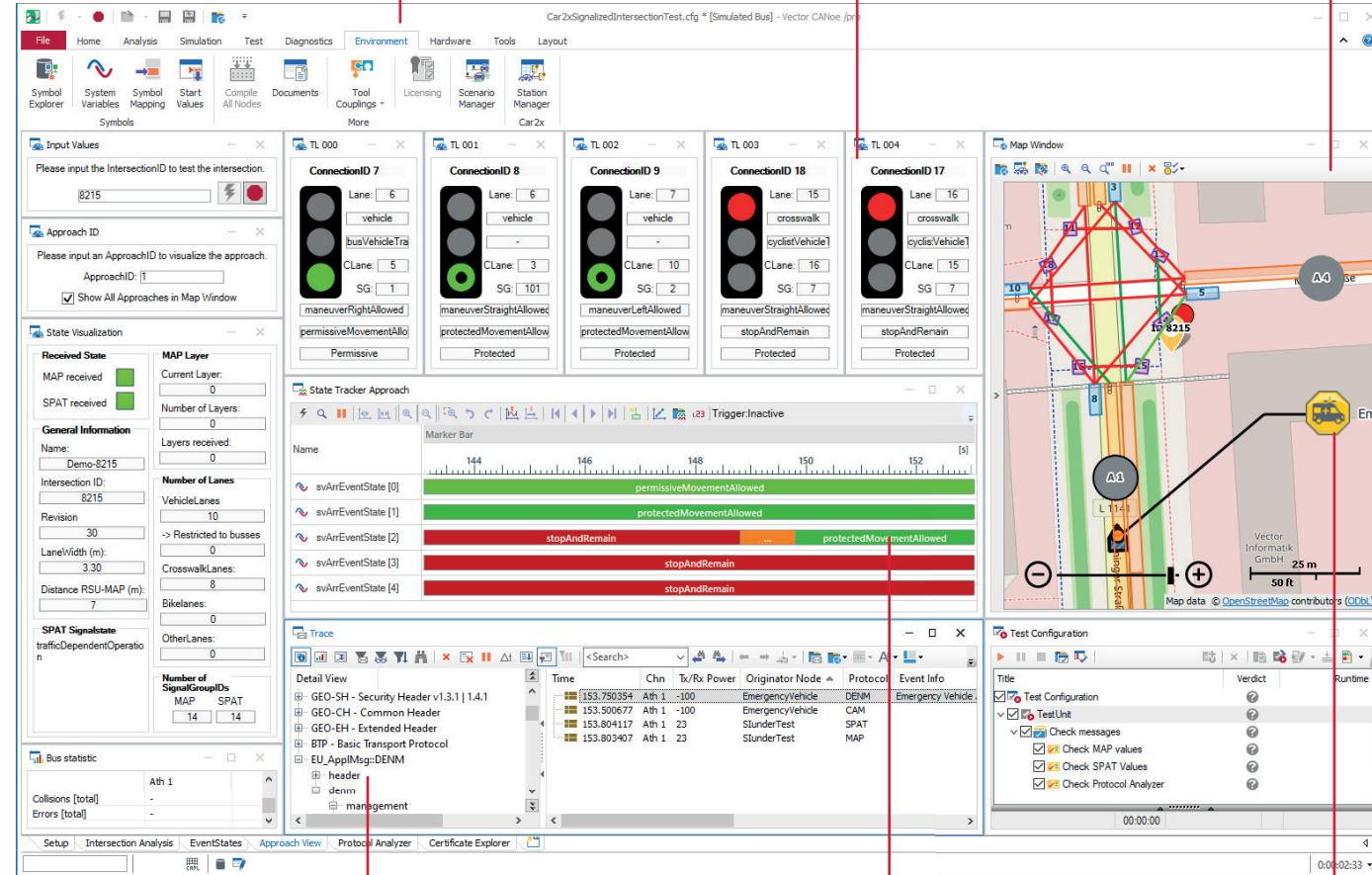
CANoe.Car2x supports the following standards:

- > Physical Layer
 - > IEEE 802.11p
 - > 3GPP C-V2X (Cellular V2X) PC5 Sidelink Communication
- > GB/T Standards (China)
 - > DSMP (DSRC Short Message Protocol) including the Adaption Layer (AL) (GB/T 31024.3) and Security Header
 - > C-SAE 0053 application messages
- > ETSI ITS Standards (Europe)
 - > GeoNetworking , BTP, Security Header
 - > ETSI ITS application messages, e.g., CAM, DENM, MAPEM, SPATEM, IVIM, SREM, SSEM, CPM,...
- > IEEE 1609 – WAVE (US)
 - > WSMP, WSA, WAVE Security Services (WSS)
 - > SAE J2735 – DSRC application messages, e.g., BSM, MAP, SPaT, SRM, SSM, ...
- > Cloud / Backend Communication
 - > HTTP, e.g., for calling REST APIs
 - > MQTT, e.g., for the connection to a backend

Stimulate your Device Under Test with a scenario generated by CANoe .Car2x

Visualize application-specific data in user-defined panels

Visualization of ITS intersections, ITS stations and ITS events in the Map Window



Interpretation of the protocol layers and application messages in the Trace Window

Analyze states, state transitions or signals in order to visualize temporal dependencies in the State Tracker Window

Stimulate your Device Under Test with simulated stations, for example an approaching emergency vehicle

Your V2X activities at a glance – Analysis and simulation of V2X communication of infrastructure and vehicles with CANoe.Car2x

Additional Functions of CANoe.Car2x

Analysis

- > Trace Window: display of packet properties, protocol interpretation, decoding of application messages, signature check, protocol analyzer
- > Map Window: visualization of application message content like ITS stations, warnings, MAP/SPaT, SRM/SSM and project specific data
- > Logging and replaying of V2X packets

Simulation

- > Scenario Editor
 - > GUI based creation of traffic scenarios
 - > Configuration of behavior on a timeline in order to design realistic driving scenarios
- > V2X Stack / Function Library (API for CAPL)
 - > Creation of valid V2X communication based on the configured scenario
 - > Access to protocol fields and signals
 - > Creation of the Security Layer including valid signature

Test

You perform comprehensive automated tests using environment and remaining bus simulations as well as basic functions of the CANoe Test Feature Set. This allows, for example, fast checking of interoperability. Complex scenarios can be reflected in identical or modified form. A high level of reuse can be achieved.

Supported measurement hardware (Rx+Tx):

- > IEEE 802.11p: Vector VN4610
- > 3GPP C-V2X PC5 (sidelink):
 - > Autotalks HW Craton2 EVK
 - > Rohde & Schwarz CMW500 network simulator
 - > Any device via generic UDP/IP communication