



C-V2X Open Loop Test System



Many argue that fully autonomous vehicles will not be feasible without having widespread 4G/5G cellular connectivity. The current trends show the initial deployment of cellular V2X (C-V2X), especially around V2V and V2I will be based on the 3GPP Release 14 standard. To be competitive on this emerging market, automotive OEMs and suppliers are starting with the basic safety and efficiency features such as emergency brake warning and intersection assist, enabled by the technology, while trying to define the roadmap towards enabling advanced safety features to build safe and efficient vehicles. As the new standards get rapidly ratified, prototyping and validating the technical feasibility of the current V2X is a vital step before it gets integrated to the vehicle.

The NI+S.E.A. Advantage

- Flexible software-defined V2X open-loop solution that is 3GPP Release 14 compliant but also future-proof to be ready for upcoming standards
- Equipped to test the functionality of a DUT whether that's a V2X onboard unit, roadside unit, or TCU
- Expandable to include RF measurements and closed-loop HIL test for dynamic control/interactions with other traffic objects and sensors

Application Challenges

- Verify the V2X DUT behavior over the PC5 interface and seek the potential of the V2V and V2I technology to build safer cars
- Validate the function of V2X applications based on the EU, United States, and China regional standards
- Implement flexible software-defined testbed architecture to integrate both existing and upcoming technologies such as GNSS, DSRC, LTE-V2X, and 5G NR based V2X
- Shorten time to develop a testbed to accelerate technology due diligence

The NI + S.E.A. Solution

- Software-defined architecture to integrate both existing and upcoming wireless standards
- The higher-level V2X signaling stacks support regional standards for US (WAVE), EU (ITS-G5), China (CSAE)
- V2X Day 1 scenario catalogues provide efficient startup, and user defined test scenarios can be added

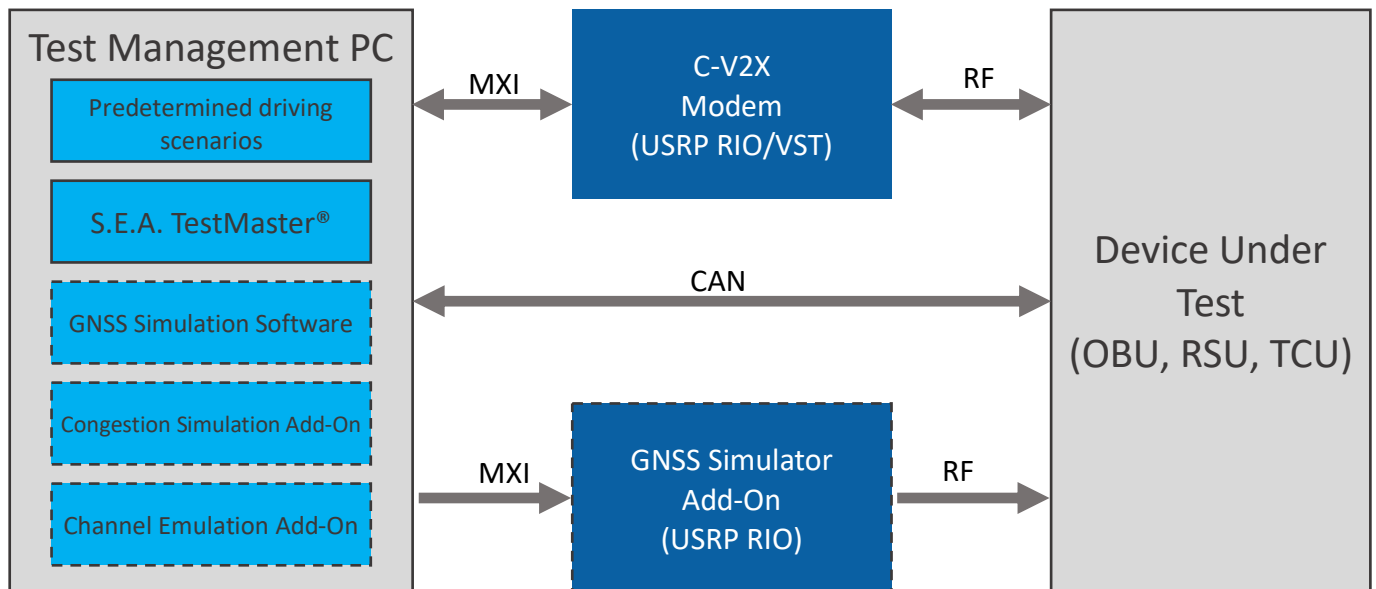
Continental collaborates with NI and S.E.A. to implement C-V2X communication

“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,
Head of System Test and Hardware Engineering

System Diagram



NI and our partner, S.E.A., also provide a solution for the closed-loop test for dynamic control and interactions with other traffic objects and sensors. S.E.A. also has a solution for 802.11p/DSRC providing the same feature set using the same platform.



Sample Configurations

The NI + S.E.A. C-V2X Open Loop Test system is completely configurable to allow for maximum scalability, cost efficiency and deployment options. Add-Ons are available for:

- Emulation of the surrounding environment multiple objects
- Emulation of the physical distortion of radio waves (4-tap)
- GNSS signal simulation (requires additional hardware)
- Telemetry data management and visualization software
- RF-compliance measurements as defined by 3GPP rel.14 mode 4

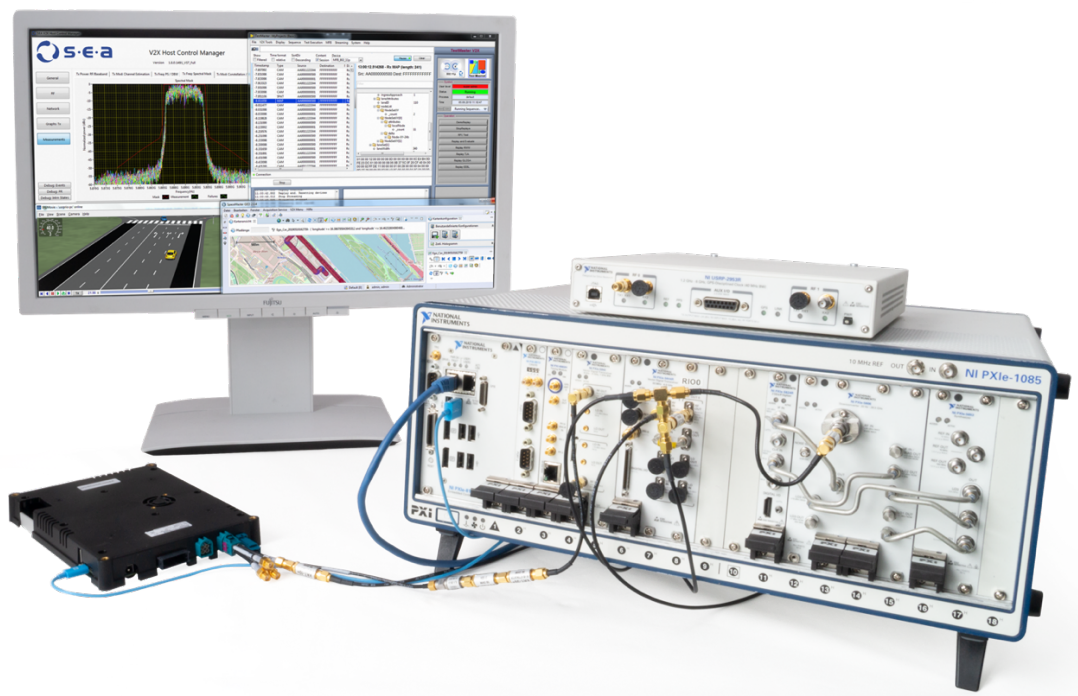


Figure 1 Recommended Configuration: PXI-based, C-V2X Open Loop with USRP and VST for RF measurements

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. To learn how you can increase product quality and shorten test timelines, contact your account manager or NI at (888) 280-7645 or info@ni.com.

Contact S.E.A. or your NI account manager to learn more about how we can help you increase product quality and accelerate testing timelines.

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