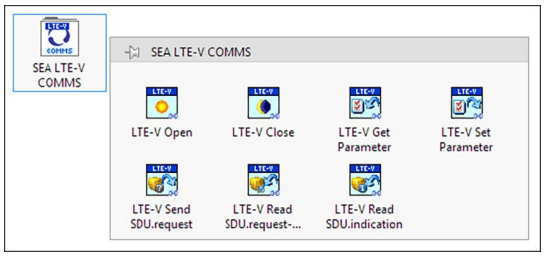
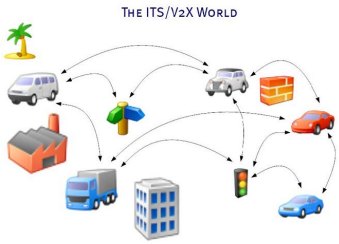
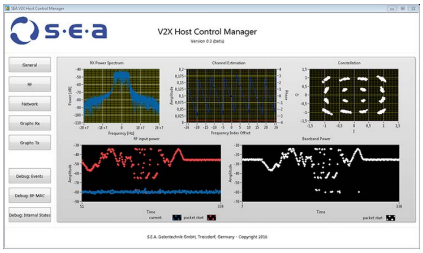
V2X
802.11p & LTE-V
Toolkits for LabVIEW™

Simulate • Manipulate • Monitor • Measure







- join the future of traffic communication and autonomous driving (ADAS)
- develop and test V2X with the National Instrument platform and LabVIEW

s·e·a Science & Engineering Applications Datentechnik GmbH

802.11p sea

LTE-V sea

Comprehensive tool set for V2X simulation, test and measurement

The modular S.E.A. V2X tool kits for LabVIEW implement the V2X (Vehicle-to-X) communication standards. User needs ranging from non-signaling over protocol tests to simulation are addressed by four different V2X toolkit types developed for the two different standards (802.11p/DSRC and LTE-V).
Two NI Software Defined Radio (SDR) technologies (USRP and VST Gen.1) and the SEA 97x9 V2X cRIO

Hardware / Software	SEA cRIO 97x9		NI-USRP 2953 or 2954		NI-VST PXI-5644R		
Protocol	802.11p	LTE-V	802.11p	LTE-V	802.11p	LTE-V	
API toolkit type							Functionality
Communication	free download	contact us	66000022	66000030	66000022	contact us	Rx, Tx
Monitoring							Rx, Tx Test extension
RF-Compliance			66000023 Non-traceable	66000031 Non-traceable	66000023 Traceable	66000031 Traceable	Rx, Tx RF-Measurements
Full package (complete bundle)			66000013 Non-traceable	66000032 Non-traceable	66000013 Traceable	contact us	Rx, Tx Test extension RF-Measurements

Supporting both standards (802.11p and LTE-V)

Using the SDR flexibility we have created tool kits for the 802.11p and the LTE-V protocol. Both protocols utilize the 5,9 GHz range for direct vehicle-to-x communication. The implementation follows the actual standards

- 802.11p is based on the applicable IEEE-standards
- LTE-V follows the 3GPP definitions for LTE-V mode 4 rel. 14 side link communication.

For both protocols the lower communication layers (802.11p: PHY, MAC / LTE-V:PHY, MAC,RLC,PDCP) are supported.

Monitoring toolkit – unique function extensions for development and validation

The Monitoring toolkit implements Rx, Tx and additionally outstanding extensions for

- precise timing (FPGA based) and message replay
- Communication monitoring on raw level (defect messages) even with standard tools like Wireshark
- flexible message manipulation, e.g for failure injection or simulation
- high load traffic simulation (using full air channel capacity)

by simple programming interfaces. The application of the NI platform provides excellent synchronization features with other related signals, e.g. GNSS, CAN etc.

RF-Compliance toolkit – fast online measurements against the standard

The RF-Compliance toolkit perfectly serves all demands for non-signaling measurements in production and compliance testing. It provides LabVIEW functions for all measurement functions and access functions to the related limits required by the standards. Measurements are performed in parallel to the communication.

Interactive interface access by Host Control Manager (HCM)

The SDR based Monitoring and RF-Compliance toolkit include a HCM which implements the interface between the SDR and the toolkit API. It executes under Windows. The HCM allows to interactively execute functions and monitor signal measurements. Additionally detailed trace logs are accessible by the user interface.

Seamless LabVIEW integration

The toolkits have been tested to be fully LabVIEW compliant. Each toolkit provides a related tools palette as well as help information and examples for easy startup.
Optionally a C++ API can be provided on request.

Turn-key test systems

We also provide standard or customized HIL and open-loop test systems. Please contact us.

www.sea-gmbh.com/v2x

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