V2X Emulator
A Smart Way to Test V2X
Emulates Real world in lab for V2X Application Testing
Tata Elxsi is a leading provider of design and technology services for product engineering and solutions across industries. It also provides solutions for emerging technologies such as IoT, Big Data Analytics, Cloud, Mobility, Virtual Reality and AI.
V2X Communication refers to the exchange of information between Vehicles (V2V), Infrastructure (V2I), Network (V2N), Cloud (V2C) & Pedestrian (V2P) while they are moving.
V2X Emulator solution is based on Tata Elxsi’s unique test methodology, patented both in Europe and US.
Challenges of V2X Field Testing

**High Cost**
Huge costs in setting up test tracks and real vehicles for testing

**Simulation of High Traffic**
Setting up High density traffic scenarios is practically challenging & cost intensive

**Safety Concerns**
Certain traffic scenarios are Fatal to test with humans.

**Spectrum Availability**
Non-availability of specific spectrum a deterrent to testing on real roads

**Scenario Repeatability**
Replicating Test Scenarios in the Real World is Challenging.
Challenges of V2X Field Testing

Tata Elxsi’s V2X Emulator addresses the Field Testing challenges by creating Real World conditions in a Lab and making the V2X ECU Field Test Ready.
V2X Emulator

Emulate Real world in Lab
V2X Test environment

- MODEM
- GNSS Emulator
- CAN Emulator
V2X Emulator in National Instruments Platform

- **NI CAN** - This emulates in-vehicle CAN Signals
- **NI GNSS** - This emulates GPS/GLONASS signals
- **DSRC Modem**
- **ECU under Test**

**Connections:**
- **HDMI**
- **NI CAN**
- **NI GNSS**
- **DSRC Signal**
- **GNSS Signal**

**Networks:**
- [Red] Ethernet
- [Blue] RF
- [Green] CAN
V2X Emulator – C-V2X (Roadmap)

NI CAN - This emulates in-vehicle CAN Signals

NI GNSS - This emulates GPS/GLONASS signals

E CU under Test

HDMI

NI CAN

NI GNSS

LTE-V Modem

LTE Base station

C-V2X Signal

Combiner

Ethernet

RF

CAN
Supported scenario

- Forward Collision Warning (FCW)
- Intersection Collision Warning (ICW)
- Hazardous Location Warning (HLN)
- Blind Spot Warning (BSW)
- Do Not Pass Warning (DNPW)
- Emergency Brake Warning (EBW)
- Speed Limit Warning (SLW)
- Stationary Vehicle Warning (SVW)
- Emergency Vehicle Warning (EVW)
- Cooperative Adaptive Cruise Control (CACC)
- Left Turn Assist (LTA)
- Abnormal Vehicle Warning (AVW)
- Control Loss Warning (CLW)
- Green light optimized speed advisory (GLOSA)
Types of testing

Functional Testing

- **Software in Loop Testing** - Testing of V2X Algorithms
- **Security Testing** - Testing against Sybil attack, Time elapsed certificates, Data Playback, Data alteration and GNSS Spoofing
- **GNSS Standards Testing** - GPS, GLONASS, GALILEO, QZSS and Baidu

Performance Testing

- **GNSS Performance and Accuracy Testing** - No. of visible satellites, Attenuation, Atmosphere Impacts and Different Terrains
- **RF Impairments Testing** - Attenuation, Speed (Doppler) and Multipath (Different Terrain)
- **Load Testing** - Crowded Highway involving hundreds of cars
**Business benefits**

**Cost**
- Significant reduction in Field testing cost
- Saves logistical cost associated with the Field testing

**Time**
- Faster Time-to-Market as it reduces Field testing efforts
- Time taken for field testing will be reduced to a great extent

**Quality**
- Comprehensive test coverage w.r.t Signal strength, terrain and channel conditions
- Can be tested for ECU performance, assuring the quality of the solution being tested
AR-V2X

Augmented Reality based V2X Application Tester
AR-V2X Field Tester
Operating AR-V2X is fairly simple, it needs a Car, a Road and a Cohda Wireless Modem (which will act as an AR-V2X device) with a Valid Tata Elxsi AR-V2X License. **This Product will convert any Road into a Test Track.**

**Configure**
- Configure Test Topology in AR-V2X Device

**Place**
- Place the AR-V2X Device in Ego Vehicle

**Drive**
- Receive DSRC messages from ARD based on your location and time
AR-V2X Road View – Normal Road turned into a V2X Test track

Alert: Forward Collision Warning!
AR V2X Analyser

Scenario recorded in Field

V2X Messages captured in Field
AR-V2X – Business benefits

AR-V2X will prove extremely beneficial for someone who wishes to perform V2X Testing in Real roads, considering the fact the Roadblocks such as Cost of Setting-up the Test Tracks, Logistics and Risks associated with the Field Testing.

- OEMs & Tier-1s can conduct Test track like Field trials with minimal Infrastructure.
- Varying Test Topology & Parameters on-the-go.
- No real road deployments needed
- Spending quality time in testing, rather than on Infrastructure and logistical issues.
- Drastically reduces the Field testing cost
Q&A
Thank you

Please visit us @ Booth # 404

For more info:

http://www.ni.com/en-in/innovations/white-papers/19/software-defined-approach-for-v2x-use-cases.html