

# V2X SOLUTION

## V2V, V2I, and V2P communication in Intelligent transportation system

V2X (Vehicle-to-Everything) solutions enable real-time communication between vehicles, road infrastructure, pedestrians, and other vehicles to enhance traffic safety and efficiency. This technology helps reduce congestion, prevent accidents, and enable smarter traffic management.

Test Solutions

QULINK RSU

QULINK OBU




Provides performance testing capabilities required for the development process of V2X devices (RSU / OBU)

 V2X DrivingTest System


 V2X Congestion Generator

 RSU Performance Test System


 V2X Application Bench Test System

A roadside system designed for C-V2X signal transmission and reception


 Traffic optimization

 Accident Prevention and Warning

 Emergency Response

 Predicting infrastructure maintenance

Compact C-V2X signal transmitting and receiving device installed in vehicles

 Enable V2X communication with vehicles, RSUs, and pedestrians



### Test Solutions

WCEX-DRTS

WCEX-CGTS

WCEX-RPTS

WCEX-ABTS

QULINK RSU

RSU

QULINK OBU

OBU



# WCEX-DRTS V2X Basic Safety Message conformance test solution

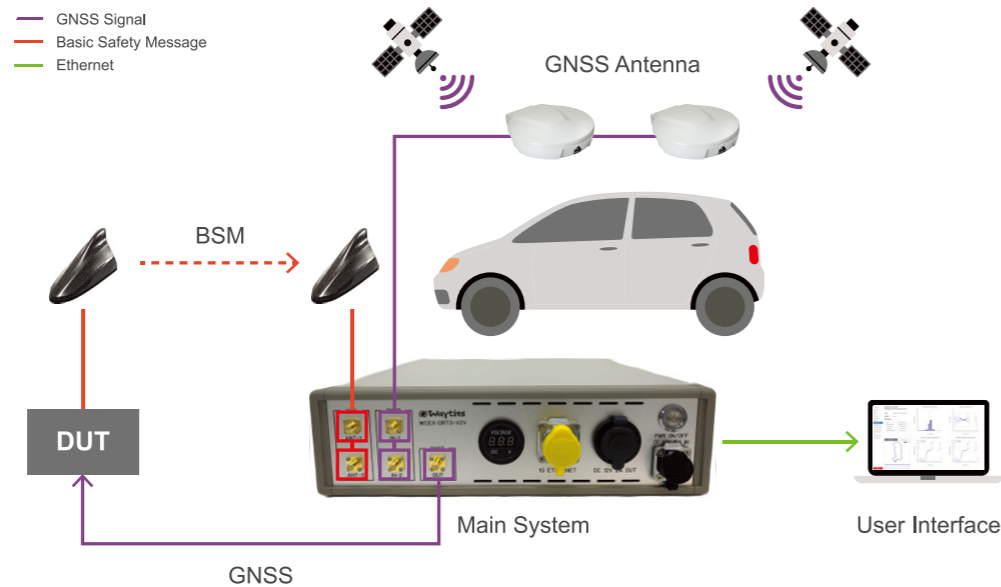
The Driving Test System (WCEX-DRTS) is a conformance testing tool designed to meet the SAE J2945/1 requirements for real-world road testing, specifically for On-Board System Requirements for V2V Safety Communications. This tool uses a V2X packet sniffer equipped with a high-precision GNSS system to analyze the Basic Safety Messages (BSM) received from the Device Under Test (DUT). Upon completion of the test, a detailed and comprehensive report is provided.

### Features

- \* BSM performance & conformance test solution compliant with SAE J2945/1, J3161/1, J2735
- \* Receiving BSM messages sent by V2X OBU in a real vehicle driving environment and assessing message accuracy and conformity to standards
- \* USA OmniAir Qualified Test Equipment (Nov. 2023)

### Functions

- \* Location, Altitude, Direction accuracy
- \* Route history and distance (horizontal/vertical distance)
- \* Hard braking
- \* Renewing certificate
- \* Real-time dashboard
- \* Automated report generation



Titles		Spec
CPU		Intel Atom x6425E Processor 1.5M Cache, up to 3.00 GHz
Core/Thread		4 core / 4 Thread
Memory		DDR4-3200 16GB
SSD		NVMe SSD 512GB
OS		Ubuntu 22.04
Size		330 x 360 x 90 (W x H x D, mm)
Weight		4.65kg
Ports		GNSS, V2X, Ethernet, Power
DGNSS	Signal	GPS, GLONASS, BEIDOU, QZSS
	Performance	1cm + 1ppm

# WCEX-CGTS V2X network congestion traffic generator

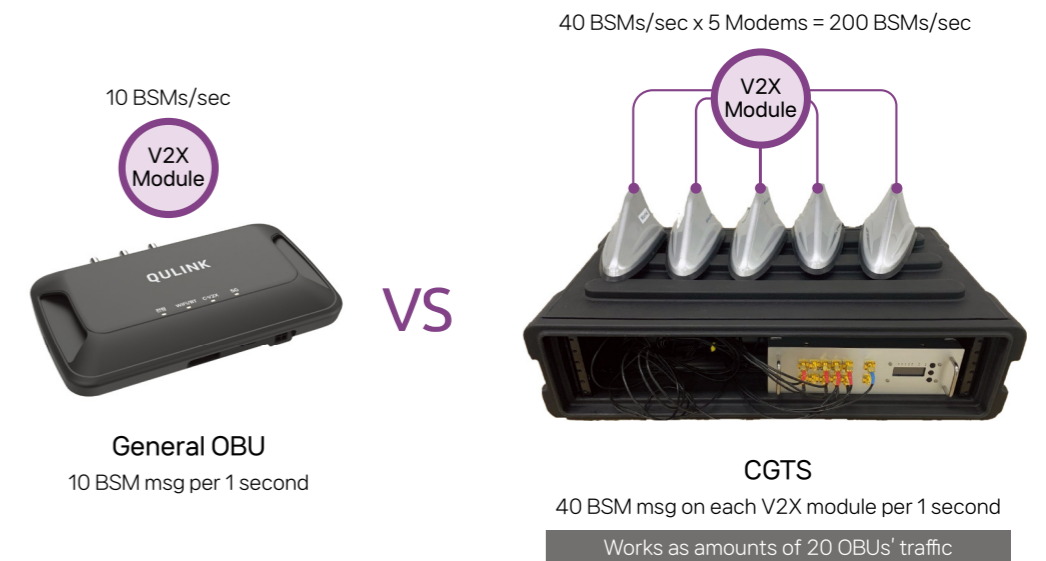
The WCEX-CGTS is a state-of-the-art virtual V2X message transmission test system capable of simulating V2X communication congestion environments. It supports the integration of up to 5 V2X modems and GNSS, providing a comprehensive platform for testing and evaluating the congestion control functionalities of V2X modems. It enables communication stack load testing, making it an essential solution for developers and research institutes aiming to enhance the efficiency and reliability of V2X communication systems.

### Features

- \* A system for transmitting large volumes of V2X messages to create V2X communication congestion environments
- \* Built-in support for up to 5 V2X modems and a GNSS system
- \* Used for V2X modem congestion control functionality, communication stack load testing, and more

### Functions

- \* Compatibility and transition between IEEE 802.11p and 3GPP Rel.14 PC5
- \* Up to 200 Hz for static V2X messages (200 messages per second) / Up to 80 Hz for real-time changing BSM (80 messages per second)
- \* Analysis of channel congestion impact in scenarios with a high concentration of devices (OBUs)
- \* Analysis of adjacent channel interference effects (DSRC & C-V2X)



Titles	Spec
V2X Conformance Test standard	SAE J2945/1, SAE J3161
V2X Radio Standard	KR(ITSK-00137-6), EU(Car-2-Car), US & CN(TBD)
V2X Message Set Standard	KR(KS R 1600), US(SAE J2735), EU(ETSI ITS TBD), CN(TBD)
V2X Message Security	IEEE 1609.2 bundle certificate support (TBD)
Modems in Unit	5
SPS Flow Period in Modem	50, 100, 200, 500 ms
Message Generation Method	Zero Filling, 1-Filling, Random Filling, User Preset, Actual BSM(TBD)
Message Retransmission	Support Blind Retransmission
Unit I/O Port	V2X Main & Sub Antenna pairs : 5, GNSS Antenna In : 1, 1PPS Out : 1, Ethernet : 1
Power Consumption	110V / 220VAC 1.8A Max
Unit Size (Inc. Exterior Housing)	403.2 x 155.6 x 562.0 (W x H x D, mm)
Unit Weight (Inc. Exterior Housing)	8.62kg



# WCEX-RPTS Roadside unit performance test system

The WCEX-RPTS is a specialized testing system designed to measure the basic performance of Roadside Units (RSUs) deployed on roadways. It ensures compliance with the basic performance requirements set as national standards for Intelligent Transportation Systems (ITS). WCEX-RPTS is an essential solution for verifying the adherence of RSUs to these national standards and has been successfully delivered as the core equipment for basic performance testing to the Korea Expressway Corporation (Kr-EX).

### Features

- \* A test system for measuring the basic performance of RSUs, including installation standards on roads
- \* Tests for compliance with the Ministry of Land, Infrastructure, and Transport's ITS basic performance requirements
- \* RSU basic performance testing equipment delivered to Korea Expressway Corporation (Kr-EX)

### Functions

- \* Performs basic, completion, and periodic evaluations of Roadside Units (RSUs)
- \* Equipped with a 4-channel V2X receiver and high-precision GNSS
- \* Supports testing of multiple RSUs within a driving section
- \* Generates test performance and results, and manages logs through a GUI-based interface



RSU #2 on Upbound Lane



RSU #1 on Down Lane

Titles	Spec
Laptop	Intel I7 2.5Ghz, RAM 16Gb, SSD 200Gb
V2X Radio	WAVE/DSRC, C-V2X
V2X Receiving Performance	PER < 5% for All V2X Channel/Datarate/Speeds(30/60/80kmph)
V2X Test Message Filter	Channel, Datarate, and PSID
V2X Antenna Specification	3dBm(±0.5), Cable:-5.2dBm(±0.26 Loss)/2.5m/2.5
Modems In Unit	4
Modem Group for Test	4x1 or 2x2 or 1x4 (Modem x Channel)
Unit I/O Port	V2X Main & Sub Antenna pairs : 4 , GNSS Antenna In : 1, 1PPS Out : 1, Ethernet : 1
Power Consumption	110V / 220VAC 1.8A Max
Unit Size (Inc. Exterior Housing)	403.2 x 155.6 x 562.0 (W x H x D, mm)
Unit Weight (Inc. Exterior Housing)	8.62kg

# WCEX-ABTS V2X application bench test system

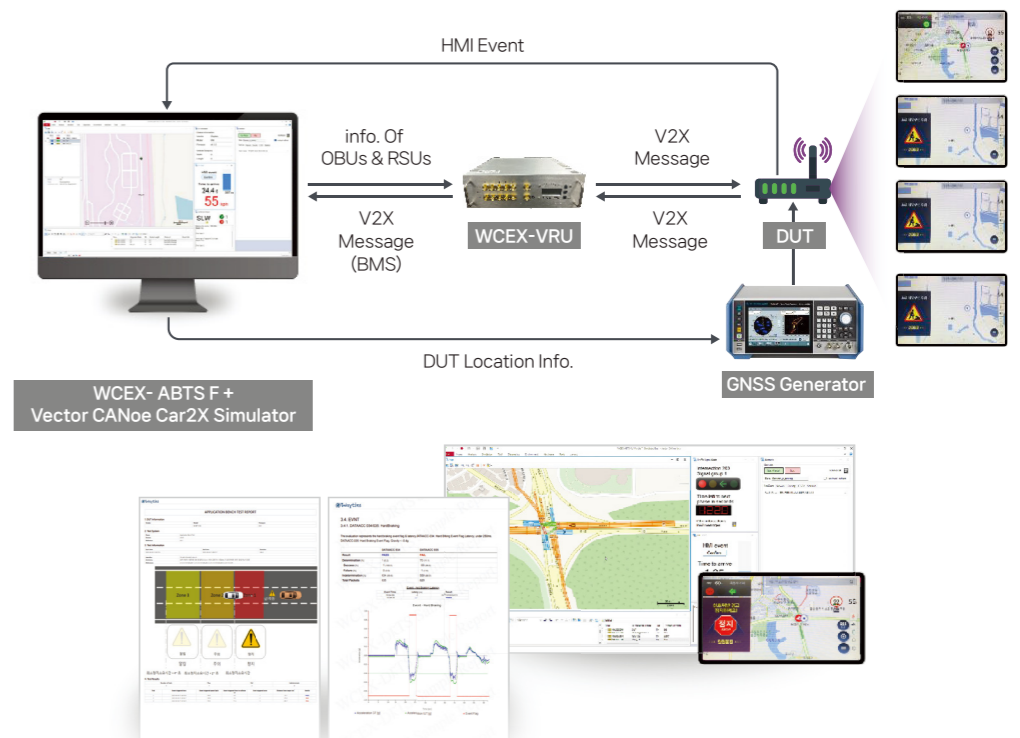
WCEX-ABTS supports functionality and performance testing of C-ITS services in a laboratory environment. It simulates real-time message transmission between RSUs (Roadside Units) and OBUs (On-Board Units) in a virtual real road environment, verifying and analyzing interactions in various traffic scenarios and situations. WCEX-ABTS provides an accurate and reliable testing environment, making it an essential tool for the development and verification of next-generation transportation systems.

### Features

- \* Simulation of field V2X environment in laboratory facilities
- \* Generation of V2X messages (BSM, SPaT, MAP, TIM, etc.) and GNSS signals

### Scenarios

- \* Red Light Violation Warning (RLVW)
- \* Forward collision Warning (FCW)
- \* Road Work Warning
- \* Disaster Information Warning (DIW)
- \* Pedestrian collision Warning



Titles	Spec
V2X Radio Standard	DSRC, C-V2X(3GPP PC5 Rel.14)
V2X Application Test Standard	KR(ITSK-00137-6), EU(Car-2-Car), US & China(TBD)
V2X Message Set Standard	KR(KS R 1600), US(SAE J2735), EU(ETSI ITS), China(TBD)
V2X Message Security	IEEE 1609.2 bundle certificate support
Application Test Type	V2V,V2I,V2P
Realtime GNSS Control	Various GNSS simulator protocol support
In-vehicle Signal Stimulus	User customizable SOME/IP, CAN stimulation support
Unit I/O Port	V2X Main & Sub Antenna pairs : 5 , GNSS Antenna In : 1, 1PPS Out : 1, Ethernet : 1
Power Consumption	110V / 220VAC 1.8A Max
V2X Proxy Unit Size	216 x 82 x 310.3 (W x H x D, mm)

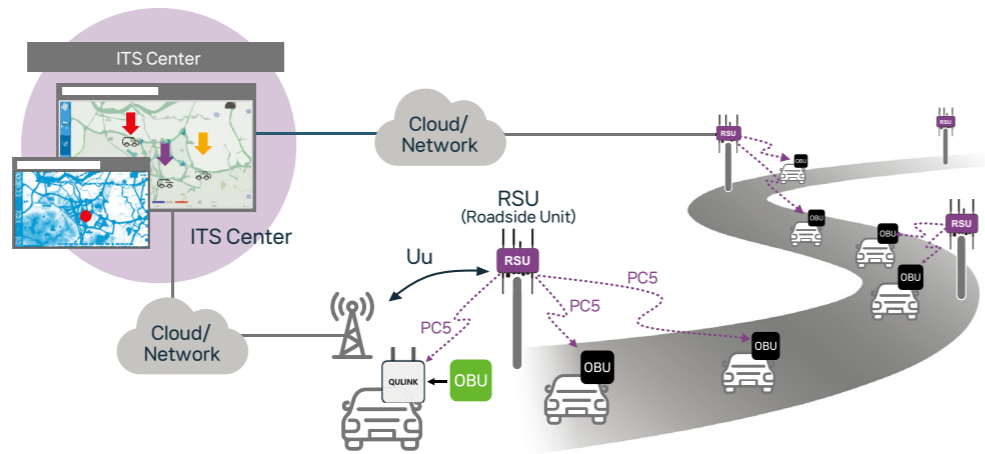


# QULINK - RSU Roadside Unit

A Roadside Unit (RSU) is equipment installed to support communication between vehicles and road infrastructure. RSUs play a crucial role in improving traffic flow, enhancing safety, and efficiently managing the overall traffic system by exchanging information between vehicles and the road. They are typically installed at key traffic points such as intersections, highways, and parking lots.

### Features

- \* Supports the latest C-V2X message specification
- \* 5G NR Ready RSU
- \* Versatile Connectivity
- \* Reliable V2X Stack



### Functions

- \* **Data Exchange :** Shares traffic and road information with vehicles.
- \* **Traffic Control :** Manages traffic signals and flow.
- \* **Safety Alerts :** Warns vehicles about hazards.
- \* **Data Collection :** Gathers traffic data for analysis.
- \* **Communication :** Uses V2X technology to connect with various traffic elements.



Item	Specification	Note
CPU	i.MX 8QuadXPlus	Cortex-A35 x 4 (Up to 1.2GHz) Cortex-M4F x 1
Memory	LPDDR4 4GB /eMMC 8GB	
Security	W/ECDSA Block	
Ethernet	1Gbps, RJ-45	2 ports(1 for PoE)
C-V2X	23dBm (2x2 MIMO)	B47(5855~5925, 30MHz)
5G NR/LTE	23dBm (TBD, 4x2 MIMO)	For Korea
Wi-Fi/Bluetooth	23dBm (TBD, single antenna)	For Debug (2.4/5G Hz)
Power	Green	
Status	Green, Red, Amber	
Size / Weight	< 368 x 212 x 55 (mm, TBD) < 4.5Kg (TBD)	W/O Accessories
Operating	-34 ~ +74°C	

# QULINK - OBU On-Board Unit

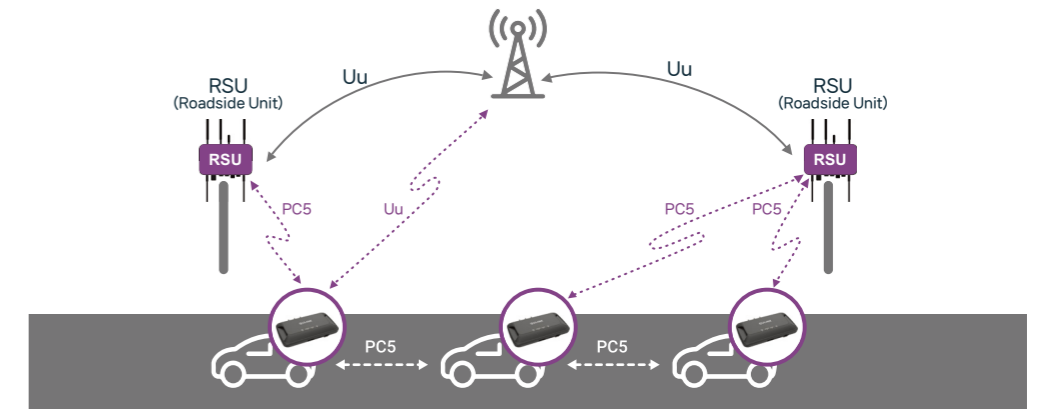
An On-Board Unit (OBU) is a device installed in a vehicle that enables communication between the vehicle and external systems, such as road infrastructure or other vehicles. The OBU plays a crucial role in facilitating data exchange for various applications, including traffic management, navigation, and safety systems.

### Features

- \* Compact C-V2X signal transmitting and receiving devices installed in vehicles
- \* Perform V2X communication with the surrounding environment (e.g. vehicles, RSUs, pedestrians)

### Functions

- \* **Communication :** Exchanges data with RSUs and other vehicles.
- \* **Data Handling :** Receives and sends traffic and vehicle information.
- \* **Navigation :** Provides real-time traffic updates and route guidance.
- \* **Safety :** Issues warnings about potential hazards.
- \* **Traffic Management :** Helps improve traffic flow and reduce congestion.



Item	Specification	Note
CPU	i.MX series	Cortex-A55(Up to 1.7GHz) Cortex-M33
Memory	LPDDR4 8GB /eMMC 8GB	
Security	W/ ECDSA Block	
Debug	UART 4PIN	For Debug (UART x 1)
C-V2X/DSRC	C-V2X : 23dBm / DSRC : 20dBm	B47
5G NR/LTE	23dBm (TBD, 4x2 MIMO)	For Korea (n77/B1/B3)
Wi-Fi/Bluetooth	Internal chip antenna	2.4/5G Hz
Power	Red	
Status	Green	V2X LTE/5G NR Wi-Fi/Bluetooth
Size	138.5 x 81 x 30.7 (W x H x D, mm)	W/O Accessories
Operating	-30 ~ +65°C	
Storage	-40 ~ +85°C	