

# 是德科技5G/C-V2X测试解决方案

助力中国车联网加速发展

是德科技无线技术支持部

2020.05.28

陆焱



# 5G Will Change The World Including Automotive...

**1 ms**

Latency for new level of V2V

**100 X**

Data rates for HD map downloading, AR based service, entertainment

**99.9%**

Reliability for mission critical V2X

**100 X**

Densification for urban V2X supports

**1000 X**

Capacity for cloud based service

# 5G NR C-V2X And Use Cases

HIGH/FULL AUTOMATION(L4/L5) WILL NEED 5G NR C-V2X

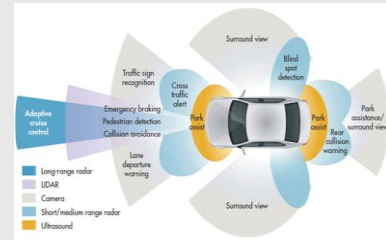


## Vehicle Platooning



- Cooperative driving for vehicle platooning
- Information sharing for platooning
- Reporting Needed for platooning

## Extended Sensors



- Cooperative collision avoidance
- Information sharing for automated driving
- Emergency trajectory alignment
- Intersection safety information
- Video sharing

## Advanced Driving



- Sensor information sharing
- Video sharing

## Remote Driving



- Information exchange between UE V2X application and V2X application server

# Accelerating Deployments Of V2X Evolution

DEVELOP WITH CONFIDENCE AS V2X EVOLVES



## CHALLENGE

Ensure Performance Meets Safety Requirement

Holistic approach to testing RF, protocol & application



Achieve quality, performance & safety goals



## CHALLENGE

Multiple wireless application integrated in telematics module

R&D RF Physical layer measurement



Reduce the time you spend on multiple signal creation and analysis



## CHALLENGE

Interoperability test become more complex

5GAA/OmniAir Contributing Member & Plugfest Participant



OMNIAIR CONSORTIUM

Test with Confidence and Leverage Ecosystem for Standards



## CHALLENGE

Conformance to Global and Regional Standards

OmniAir DSRC Certification

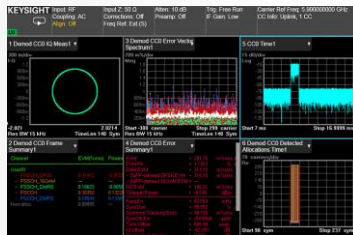


Single platform to be expanded for future V2X test needs

# SA8700A C-V2X Test Solutions

## PAVES THE WAY FOR CONNECTED CARS

- **RF, Protocol, Message & Application Layer test**
  - Covers both interfaces:
    - User-to-UTRAN (Uu)
    - Direct Communication PHY sidelink (PC5)
  - **ITS Stack and Application Layer Test**
    - Offline scenario creation (Nordsys waveBEECreator)
    - Execute scenario (NordsysITS stack + Keysight)
    - **Congestion Scenario Test**
- Accelerates deployment of advanced safety features
- Includes GNSS emulator



**C-V2X X-application**  
Sig Gen and X-series meas.



**C-V2X Test Application**  
UXM 5G Wireless Test Platform



**GNSS**  
MXG RF vector signal generator



5G NR Ready



Rel 14 C-V2X

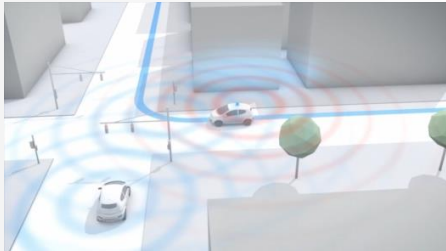


GNSS Emulation

# Keysight C-V2X ITS Applications



## NORDSYS AND KEYSIGHT SOFTWARE COMPONENTS



Real World



Generate real V2X messages of scenarios in-field  
waveBEE®creator



Live V2X traffic analysis in the lab  
waveBEE®touch



Reduce costs by simulating multiple car and ITS station at once.

### Offline scenario creation

(Nordsys waveBEEcreator)

- Easy-to-access and quick visual scenario creation via touch-gestures
- All types of V2X messages supported (traffic and infrastructure)
- Supports US, EU standards (China coming soon)
- Multiple entities (cars, traffic lights, etc.) and events in a single scenario
- Easy integration of DUT into scenario
- No need for auxiliary car system modulation (e.g. CAN-bus)

### Execute scenario

(NordsysITS stack + Keysight)

- Live-simulation and generation of V2X-messages
- Real, secured V2X-communication for realistic scenarios
- Network and physical layer uses UXM5G
- Congestion generation of up to 500 vehicles

### Analyze Scenarios

(Nordsys waveBEEtouch)

- Real-Time visual scenario view
- Human-Readable message information (path history, lane information, signal phases, vehicle dimensions, etc)
- Record and replay function for in-depth analysis
- Detailed message dissection of raw and interpreted values
- Customizable filters for multi-level message analysis

# 1<sup>st</sup> to Achieve 3GPP C-V2X RF Conformance TC Validation

[HTTPS://ABOUT.KEYSIGHT.COM/EN/NEWSROOM/PR/2019/21NOV-NR19142.SHTML](https://about.keysight.com/en/newsroom/pr/2019/21nov-nr19142.shtml)



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## Keysight First to Achieve 3GPP C-V2X Radio Frequency Conformance Test Case Validation

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**Keysight solutions enable the automotive industry to accelerate commercialization of connected cars and autonomous vehicles**

*SANTA ROSA, Calif., November 21, 2019*

Keysight Technologies, Inc. (NYSE: KEYS), a leading technology company that helps enterprises, service providers and governments accelerate innovation to connect and secure the world, announced that the company achieved 3rd Generation Partnership Project (3GPP) validation of the industry's first cellular vehicle-to-everything communications (C-V2X) radio frequency (RF) conformance test case. As a result, Keysight is enabling the automotive industry to accelerate commercialization of connected cars and autonomous vehicles.

Performance validation of C-V2X is crucial for C-V2X certification and commercialization. 3GPP validation of Keysight's conformance test case enables the C-V2X connected ecosystem to achieve performance compliance with the specifications of the 3GPP standards, both for Release 14 and 5G new radio (NR) Release 16. The test case

# RF/Protocol/RRM Test Case Matrix from GCF 3.78.0



UPDATED ON 30 APR 2020

Specification	Test Case	TC Description	WI	Type of Test
36.521-1	6.2.3G.1.1	Maximum Power Reduction (MPR) for V2X Communication / Power class 3 / Contiguous allocation of PSCCH and PSSCH / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.2.4G.1	Additional Maximum Power Reduction (A-MPR) for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.2.5G.1	Configured UE transmitted Output Power for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.3.2G.1	Minimum output power for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.3.3G.1	UE Transmit OFF power for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.3.4G.1	General ON/OFF time mask for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.3.5G.1	Power Control Absolute power tolerance for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.5.1G.1	Frequency error for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.5.2.1G.1	Error Vector Magnitude (EVM) for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.5.2.2G.1	Carrier leakage for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.5.2.4G.1	EVM equalizer spectrum flatness for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.6.1G.1	Occupied bandwidth for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	6.6.2.3G.1	Adjacent Channel Leakage power Ratio for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	7.3G.1	Reference sensitivity level for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.521-1	7.4G.1	Maximum input level for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-281-47	RF
36.523-1	24.1.2	V2X Sidelink Communication / Pre-configured authorisation /Utilisation of the pre-configured resources / Transmission	WI-281-47	Protocol
36.523-1	24.1.4	V2X Sidelink Communication/ Pre-configured authorisation /Utilisation of the pre-configured resources / Reception	WI-281-47	Protocol
36.521-1	6.2.2G.1	UE maximum output power for V2X Communication / Non-concurrent with E-UTRA uplink transmissions	WI-282-47	RF
36.523-1	24.1.16	V2X Sidelink Communication/ Pre-configured authorisation / Utilisation of the pre-configured resources / CBR measurement	WI-282-47	Protocol
36.523-1	24.1.19	V2X Sidelink Communication/ Pre-configured authorisation / Utilisation of the pre-configured resources / CBR measurement/Transmission based on CR limit	WI-282-47	Protocol

✓ 4 Protocol TCs validated by end of March 2020

✓ 16 RF TCs validated by end of April 2020



# Keysight Global Services – Test as a Service

UNPARALLELED GLOBAL REACH AND EXPERTISE



C-V2X Test Service  
Launch in Sep 2019

*Novi, MI*

*BBN,  
Germany*

*SIAC,  
China*

*Nagoya,  
Japan*



TBU



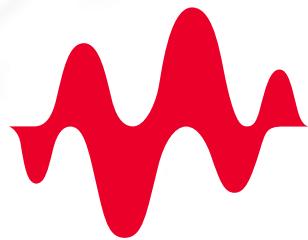
High Speed Digital Lab  
Santa Clara, CA



EMC Lab



Radar, Ethernet and  
E-mobility Test Lab



**KEYSIGHT**  
TECHNOLOGIES

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