V2X Communication Technologies and Crucial Testing Solutions
車聯網測試解決方案

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車聯網關鍵技術及測試方案

- 車聯網通訊技術概述
- 互聯駕駛技術介紹
- DSRC / C-V2X 測試認證要求

ABOUT DEKRA

DEKRA has been active in the field of safety for +90 years. Founded in **1925** in Berlin as Deutscher Kraftfahrzeug-Überwachungs-Verein e.V., it is today one of the world's leading expert organizations.

With qualified and independent expert services, we work for safety in more than 50 countries.






What we do – service portfolio

SAFETY TESTING

- Electrical safety
- Quality & performance
- Software assessment
- Battery safety
- Functional safety
- Environmental
- Performance & benchmark
- Material & chemical
- Reliability & failure analysis
- Usability

EMC & WIRELESS TESTING

- Electromagnetic Compatibility (EMC)
- Radio Frequency (RF)
- RF-Exposure: SAR & MPE
- Conformance (PTCRB/GCF)
- Interoperability (Wi-Fi & Bluetooth)
- Carriers acceptance testing
- Cyber Security Evaluation
- Field (usability) testing
- Connected and automated driving

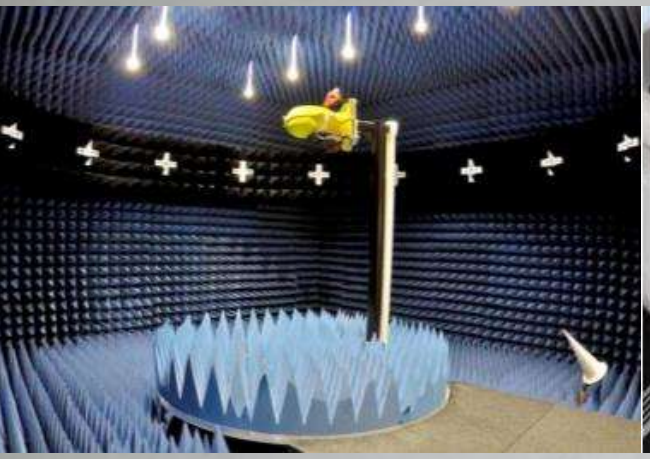
CERTIFICATION

- EU Notified Body for Radio Equipment Directive (RED)
- EU Notified Body for the EMC Directive
- IECEE Certification Body (CB scheme)
- US (FCC) Telecom Certification Body (TCB)
- Canadian (ISED) Foreign Certification Body(FCB)
- North America NRTL (MET,CSA)
- Inmetro (Brazil), GCC (Gulf Countries)
- Cyber Security Certification (Common Criteria/ISO 15408, etc.)

MARKET ACCESS

- International Market Access
- International Type Approval
- Access to more than 200 countries

Wireless testing & certification services




- Open Connectivity Foundation
- Thread Group
- LoRa Alliance™
- SigFox
- Continua®
- Zigbee® Alliance
- OneM2M

- MirrorLink
- Ultra Low Energy (ULE) Alliance
- CTIA *Bluetooth*® Interoperability
- Omniair
- C-V2X
- eCall

- *Bluetooth* SIG - *Bluetooth* Qualification Test Facility (BQTF) and *Bluetooth* Qualification Expert (BQE/BQC)
- Wi-Fi Alliance® (incl. Converged Devices CWG, LTE-U coexistence)

- Near Field Communication (NFC Forum)
- ENVCo
- Wireless Charging: AirFuel Alliance (Rezenze and PMA)

車聯網通訊技術概述

A Wireless Intelligent Vehicle Networking

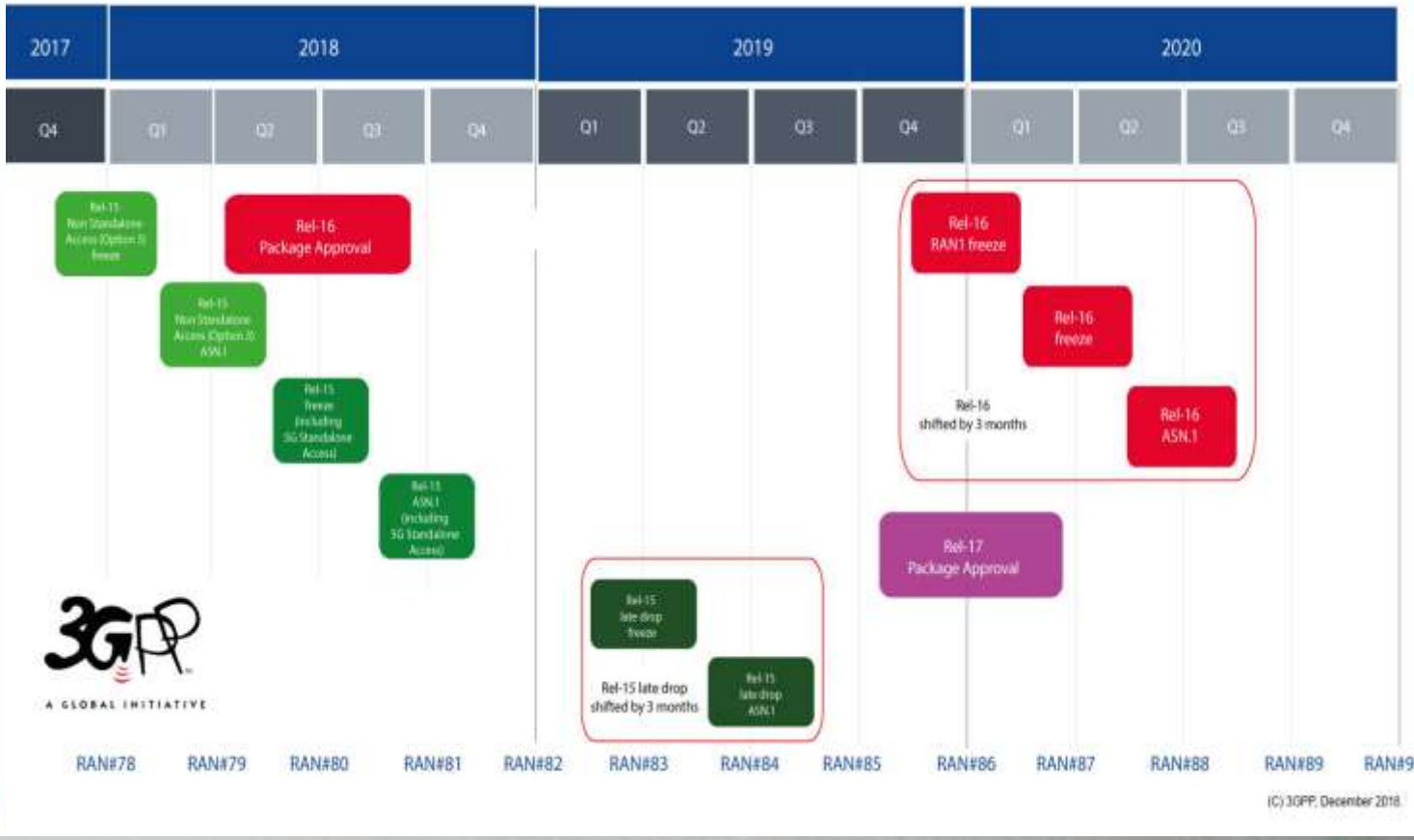
5G Release Schedule

Release 15

- NR
- The 5G System – Phase 1
- Massive MTC and Internet of Things (IoT)
- Vehicle-to-Everything Communications (V2x) Phase 2
- Mission Critical (MC) interworking with legacy systems
- WLAN and unlicensed spectrum use
- Slicing – logical end-2-end networks
- API Exposure – 3rd party access to 5G services
- Service Based Architecture (SBA)
- Further LTE improvements
- Mobile Communication System for Railways (FRMCS)

Release 16

- The 5G System – Phase 2
- **V2x Phase 3:** Platooning, extended sensors, automated driving, remote driving
- Industrial IoT
- Ultra-Reliable and Low Latency Communication (URLLC) enhancements
- NR-based access to unlicensed spectrum
- **5G Efficiency:** Interference Mitigation, SON, eMIMO, Location and positioning, Power Consumption, eDual Connectivity, Device capabilities exchange, Mobility enhancements
- Enhancements for Common API Framework for 3GPP Northbound APIs (eCAPIF)
- FRMCS Phase 2



Still 5G but be ready for next generation

Release 17

- NR MIMO
- NR Sidelink enh.
- 52.6 - 71 GHz with existing waveform
- Dynamic Spectrum Sharing (DSS) enh.
- Industrial IoT / URLLC enh.
- Study - IoT over Non Terrestrial Networks (NTN)
- NR over Non Terrestrial Networks (NTN)
- NR Positioning enh.
- Low complexity NR devices
- Power saving
- NR Coverage enh.
- Study - NR eXtended Reality (XR)
- NB-IoT and LTE-MTC enh.
- 5G Multicast broadcast
- Multi-Radio DCCA enh.
- Multi SIM
- Integrated Access and Backhaul (IAB) enh.
- NR Sidelink relay
- RAN Slicing
- Enh. for small data
- SON / Minimization of drive tests (MDT) enh.
- NR Quality of Experience
- eNB architecture evolution, LTE C-plane / U-plane split
- Satellite components in the 5G architecture
- Non-Public Networks enh.
- Network Automation for 5G - phase 2
- Edge Computing in 5GC
- Proximity based Services in 5GS
- Network Slicing Phase 2
- Enh. V2x Services
- Advanced Interactive Services
- Access Traffic Steering, Switch and Splitting support in the 5G system architecture
- Unmanned Aerial Systems
- 5GC LoCation Services
- Multimedia Priority Service (MPS)
- 5G Wireless and Wireline Convergence
- 5G LAN-type services
- User Plane Function (UPF) enh. for control and 5G Service Based Architecture (SBA)

These are some of the Rel-17 headline features, prioritized during the December 2019 Plenaries (TSG#86)

Start of work: January 2020

Full details of the content of Rel-17 are in the Work Plan: www.3gpp.org/specifications/work-plan

timeline

* These milestones show a 3-month shift compared to previously approved timelines

Connected Car to Autonomous Driving

In recent decade, M2M with broadband wireless communications have been implemented into several use cases where Connected Car is one of major developed market for better usage of service access like Navigation, Infotainment and Emergency Service (e-Call).

The Connected Car is expected soon move to next technology generation like Autonomous Driving to offer **Increased Safety**, **Increase Fuel Efficient** and **Better Driving Experience.**

From ADAS to SAE Level 5

While being future proof and scalable to meet the requirements of use cases of tomorrow, e.g., Advanced Driver Assistance Systems (ADAS), where vehicles can cooperate, coordinate and share sensed information, and ultimately Driverless.

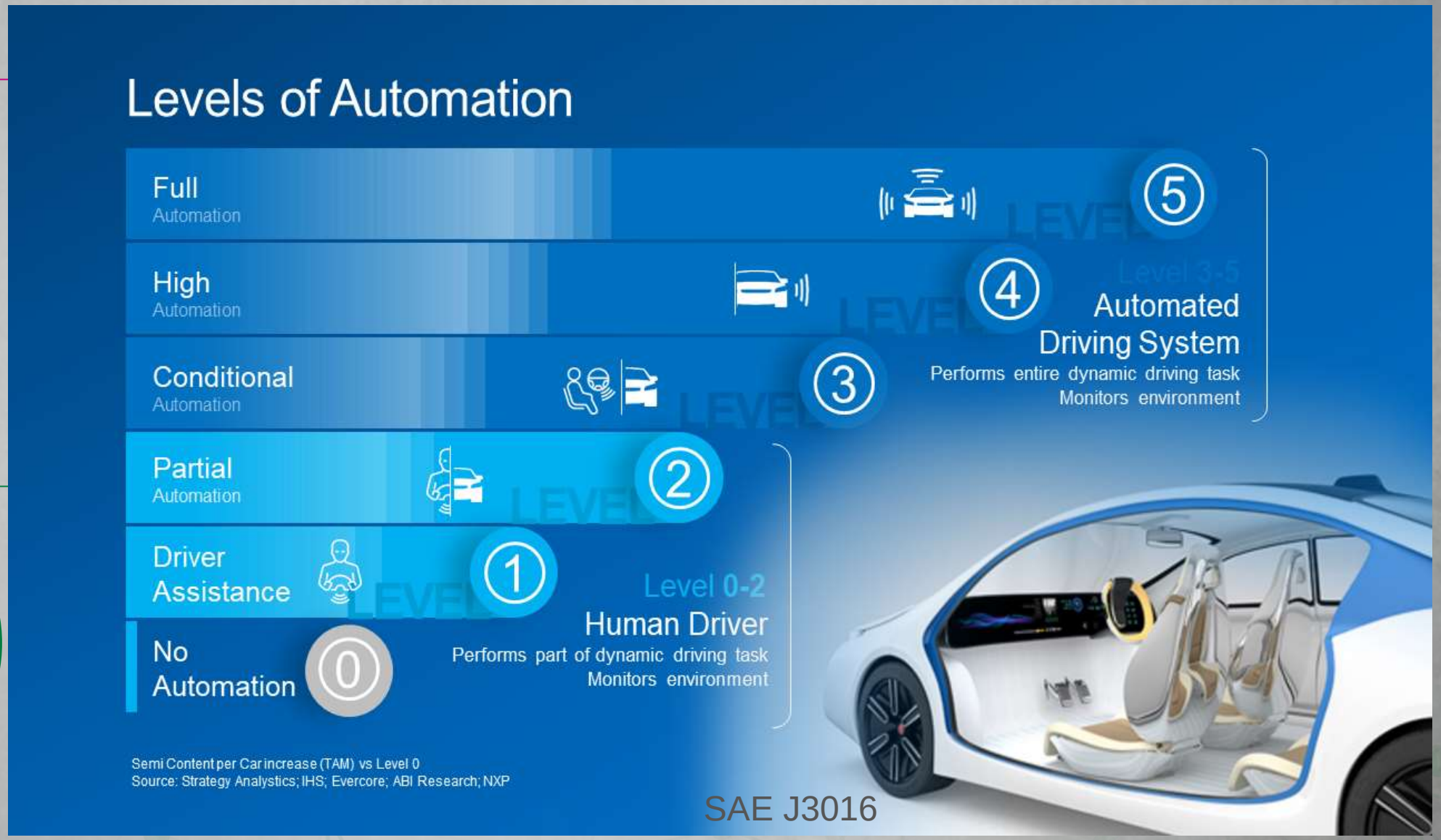
How to reach SAE Level 5

- AI(Artificial Intelligence)
- Cloud Computing.
- IoT(Internet of Things)
- V2X(Vehicle to Everything)

DEKRA Own Know-How across the Full Spectrum

Automated Driving

Connected Driving



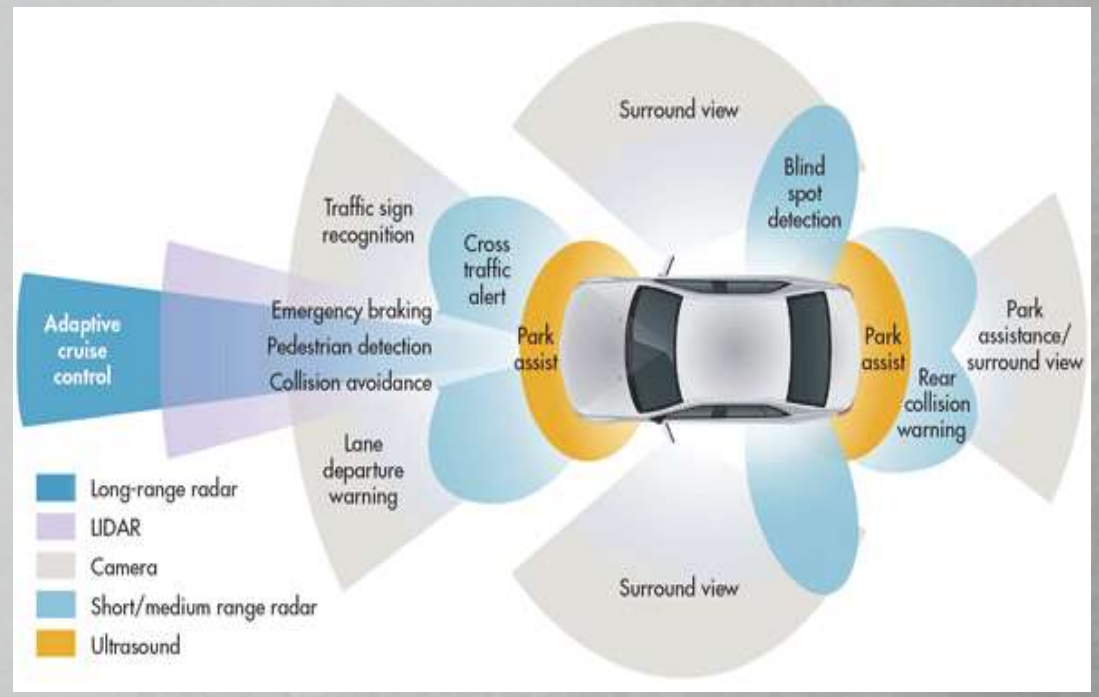
互聯駕駛技術介紹與測試認證要求

V2X (DSRC / C-V2X) Technology, Applications and Certification Requirements.

V2X – Enhanced Safety, Enabling Higher Levels of Automation

V2V, V2I, V2P, V2N …

Technology to enhance driving experience, prevent accidents and collisions, assist traffic flow, enable higher levels of automated driving.

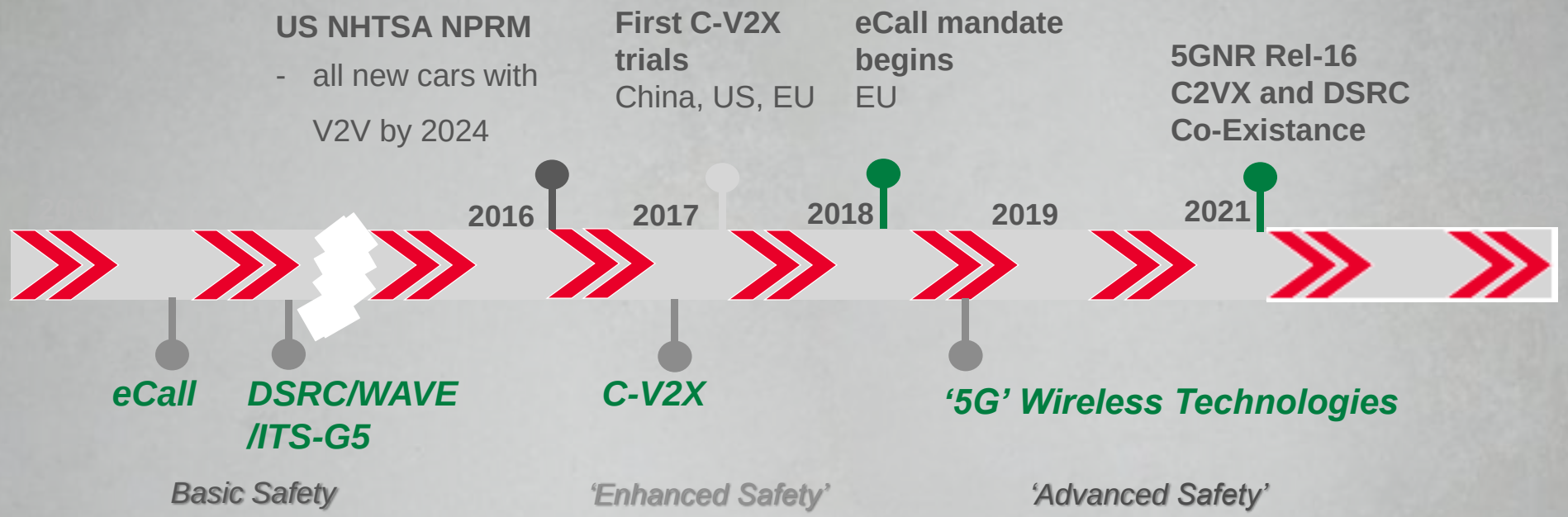


2 wireless technologies are currently being proposed -

- ❑DSRC (based on IEEE 802.11p)
- ❑C-V2X (based on 3GPP Rel-14 LTE-A Pro & Rel-15 5GNR)

Secure V2X considered necessary for L3/L4 ADAS

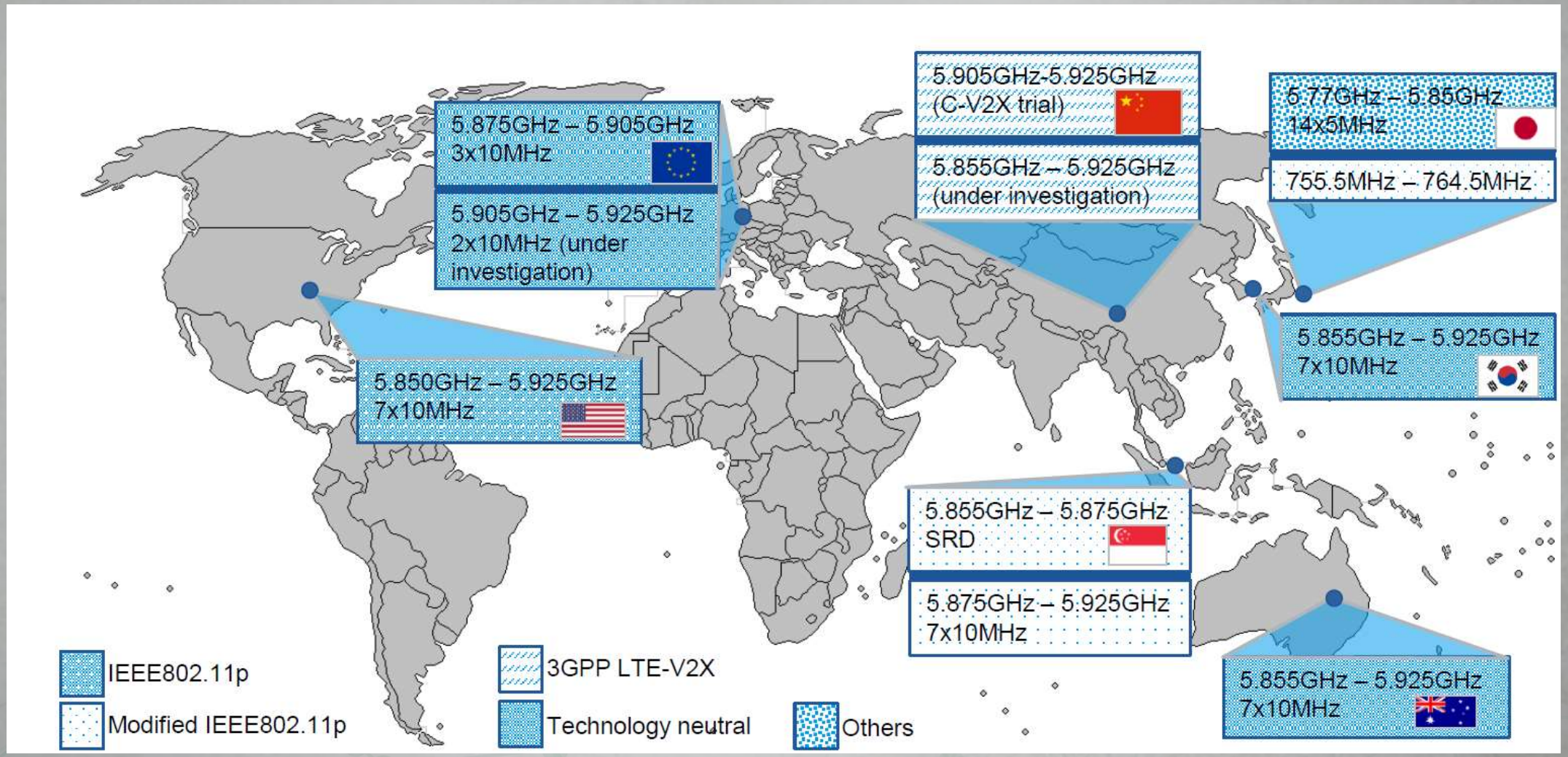
V2X Technologies: Evolution



- DSRC - IEEE802.11p based
  - Based on 802.11a
  - Products ready with actual deployments, extensive interop tests and field trials.(DOT/NHTSA)
  - Adopted or being considered by some regions.

- C-V2X – 3GPP LTE-based
  - Reuses LTE UL frame structure (Rel 14)
  - Longer symbol and GI durations
  - Leveraging more recent PHY technologies:
    - Improved air interface : Uplink: SC-FDM. Downlink: OFDM
    - Multi-antenna technology : Diversity, MIMO, Beam-forming
    - High spectrum flexibility
  - Still on going extensive field trials/testing.(more and more coming)
  - Qualcomm, Huawei and 5GAA are promoting heavily.

3GPP LTE-V2X and IEEE802.11pTechnology Overview



Global C-ITS Policy

FREQUENCY BANDS PER REGION

	5.9GHz						700MHz
GEOGRAPHY							
ITS Service Frequency	5905~5925 MHz	5850~5925 Mhz	5905~5925 MHz	5855~5875 MHz	5855~5925 MHz	5855~5925 MHz	760MHz, 5.8GHz
Regulatory, Standards	EC, ECC ETSI	FCC, US DOT IEEE,3GPP	CCSA C-ITS	IMDA	ACMA	TTA ITS-Korea	ASL ARIB
Technology	Hybrid connection SR : ITS-G5 LR : Cellular	DSRC, C-V2X	LTE-V2X (C-V2X)	Based on 802.11p, WAVE	EN 302 571	802.11p and C-V2X	DSRC, C-V2X

OMNIAIR Authorized Test Laboratories (OATL)

DEKRA

DEKRA is an (OATL)

OMNIAIR CONSORTIUM

It runs approved test systems under the certification program and ultimately provides the certification to the OBU or RSU tested.

CERTIFICATE OF LABORATORY AUTHORIZATION

OMNIAIR CONSORTIUM

DEKRA

OMNIAIR CERTIFIED

AUTHORIZED TEST LAB

2018101901

DEKRA

Malaga, Spain Test Laboratory

For passing the audit requirements to become an OmniAir Authorized Test Laboratory

DSRC-V2X Conformance Release 1

CERTIFICATE 2018101901 Awarded this 19th day of October 2018

Randy Roebuck / Technical Director
OmniAir Consortium, Inc.

Jason Conley / Executive Director
OmniAir Consortium, Inc.

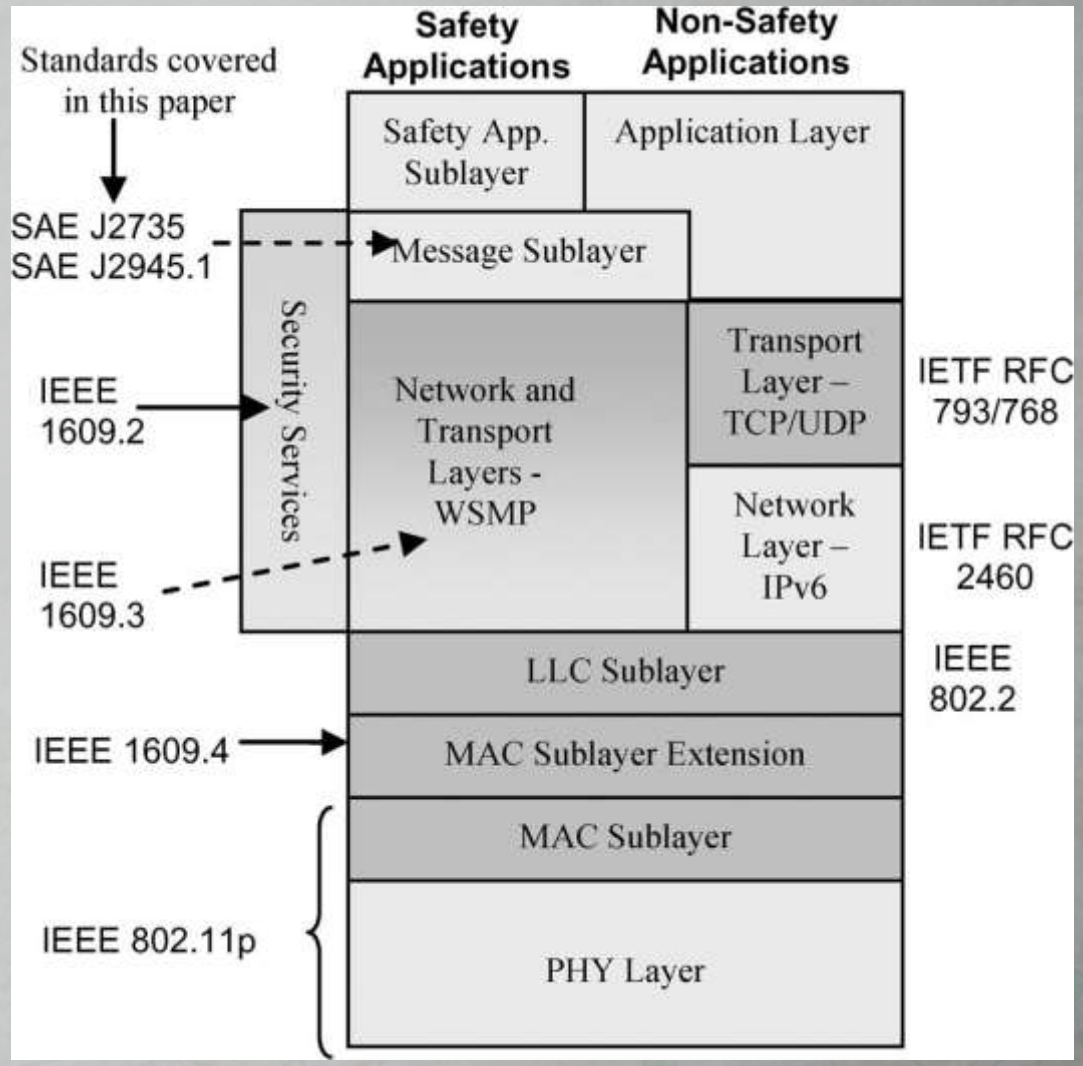
Interest Group and Standardization Requirements

OMNIAIR Certification

OMNIAIR Release 1 test procedures:

Standard	Scope	# R1 TCs
802.11p	Physical Layer	14
IEEE1609.4	Multi-Channel Operations	4
IEEE1609.3	Network (WSM & WSA)	23
IEEE1609.2	Security/Certificates	16
SAEJ2945/1	Requirements for BSM	24

Release 2 will include: field testing, interoperability & cybersecurity.



OMNIAIR - Plugfest

- **MNIAIR European Plugfest - Hosted by DEKRA - Málaga, Spain (9/30 ~10/4 2019)**
- for both C-V2X and DSRC/ITS-G5 devices, including OBUs and RSUs.
- in both Lab and Field environments. Testing to be offered in the following areas:
  - Radio testing for C-V2X PC5 and DSRC
  - Conformance testing against OmniAir specifications for DSRC
  - Conformance testing against existing OmniAir specifications (draft) for C-V2X
  - Testing against ETSI specifications for ITS-G5
  - BSM(Basic Safety Message) Performance & Location Accuracy Testing for DSRC
  - BSM Drive Comparison Testing for DSRC and possibly C-V2X
  - SCMS(Security Certificate Management System) Security Certificate Testing (including new OmniAir security test cases)
  - Reference Device Testing Availability for Certified DSRC Device with Stakeholder (limit two total)

https://youtu.be/bWocRhXwZsU

Regulatory Requirements

DSRC-WAVE

- OBUs: FCC Tittle 47, Part 95, Subpart L - Dedicated Short-Range Communications Service On-Board Units (DSRCS-OBUs)
- RSUs: FCC Tittle 47, Part 90, Subpart M - Intelligent Transportation Systems Radio Service

*WAVE: Wireless Access in Vehicular Environments

ITS-G5

- EN 302 571 Intelligent Transport Systems (ITS); Radio-communications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

DEKRA provides regulatory testing services for FCC (US) and RED (EU) requirements

FCC Spectrum for ITS Operations

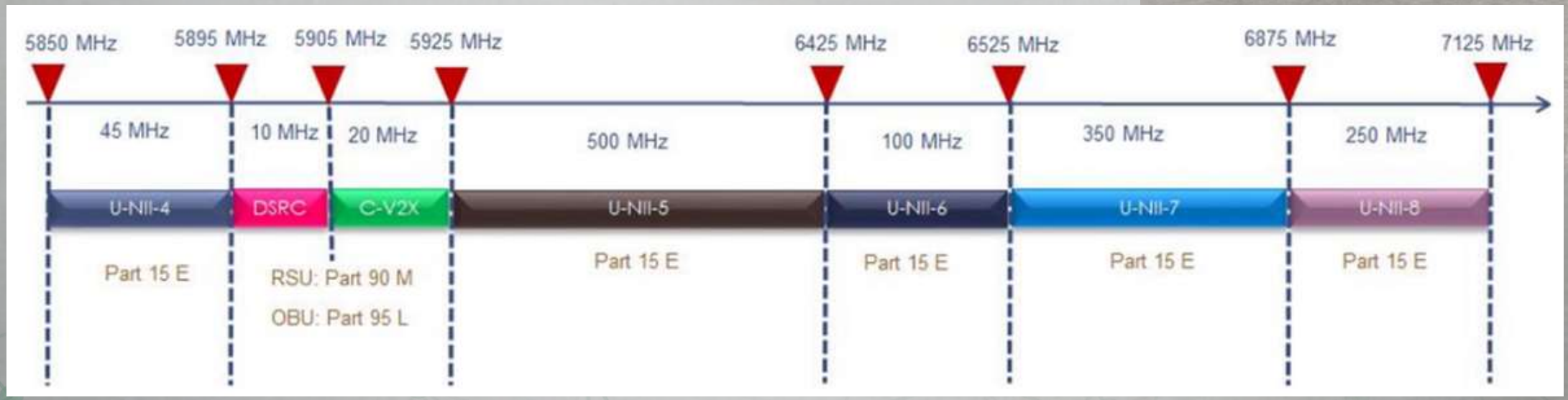
FCC Spectrum Plan

DSRC: 5895MHz ~5905MHz

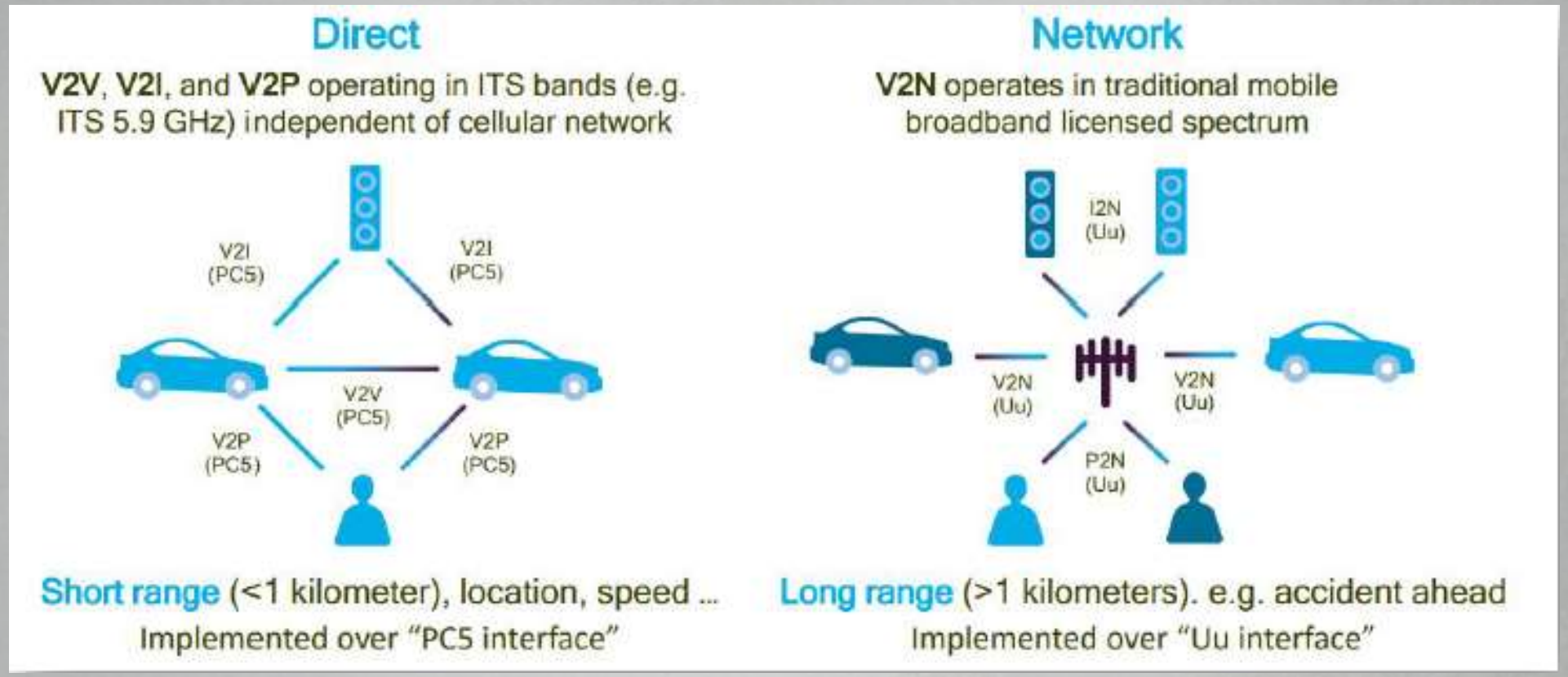
C-V2X : 5905MHz~5925MHz (ET Docket No. 19-138, FR Doc. 2020–02086)

RSU: 47CFR Part 90

OBU: 47CFR Part 95



C-V2X Communication



Source: Keysight

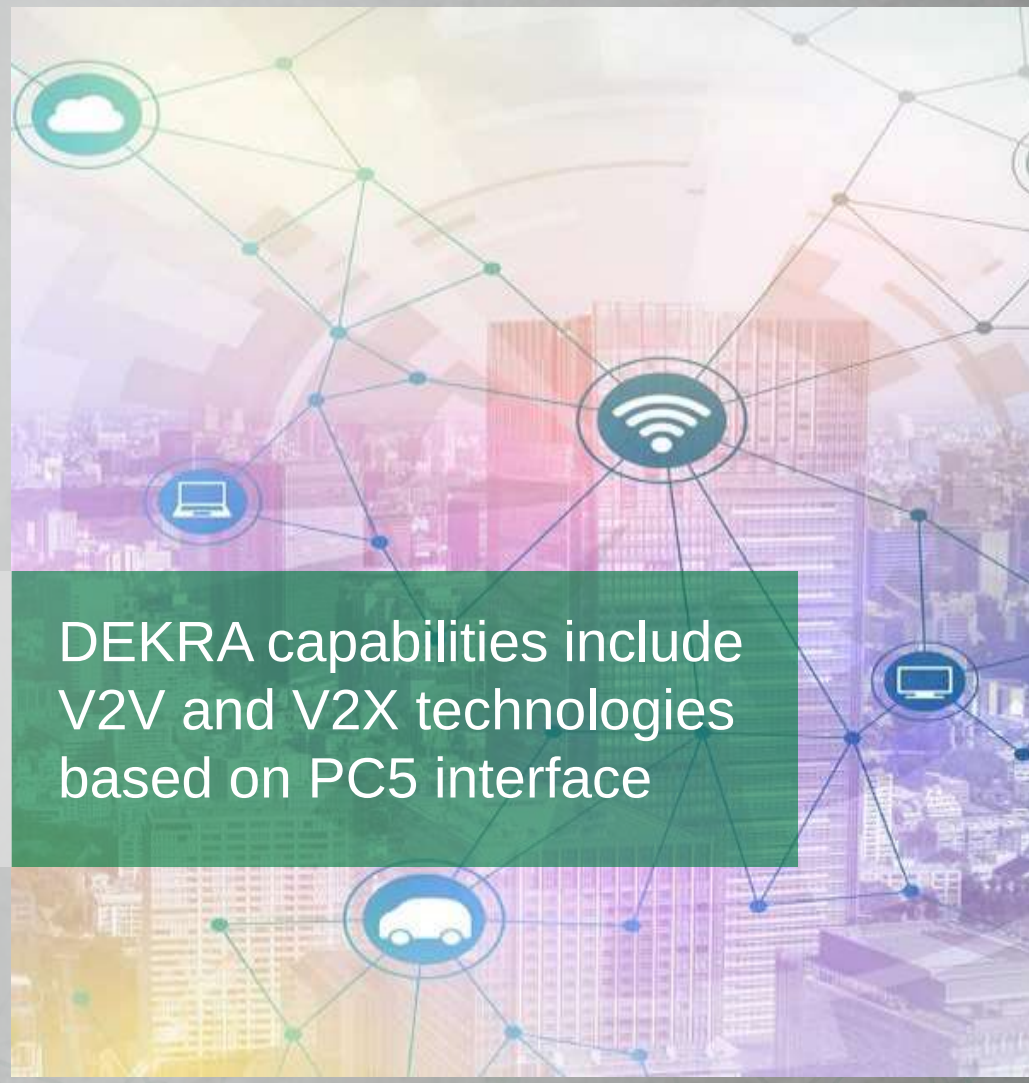
Cellular V2X - GCF testing and certification

The Global Certification Forum (GCF) has announced the inclusion of cellular based V2X and V2V communication technologies within its certification programme

- LTE-V2V GCF Work Item 281
- LTE-V2X GCF Work Item 282

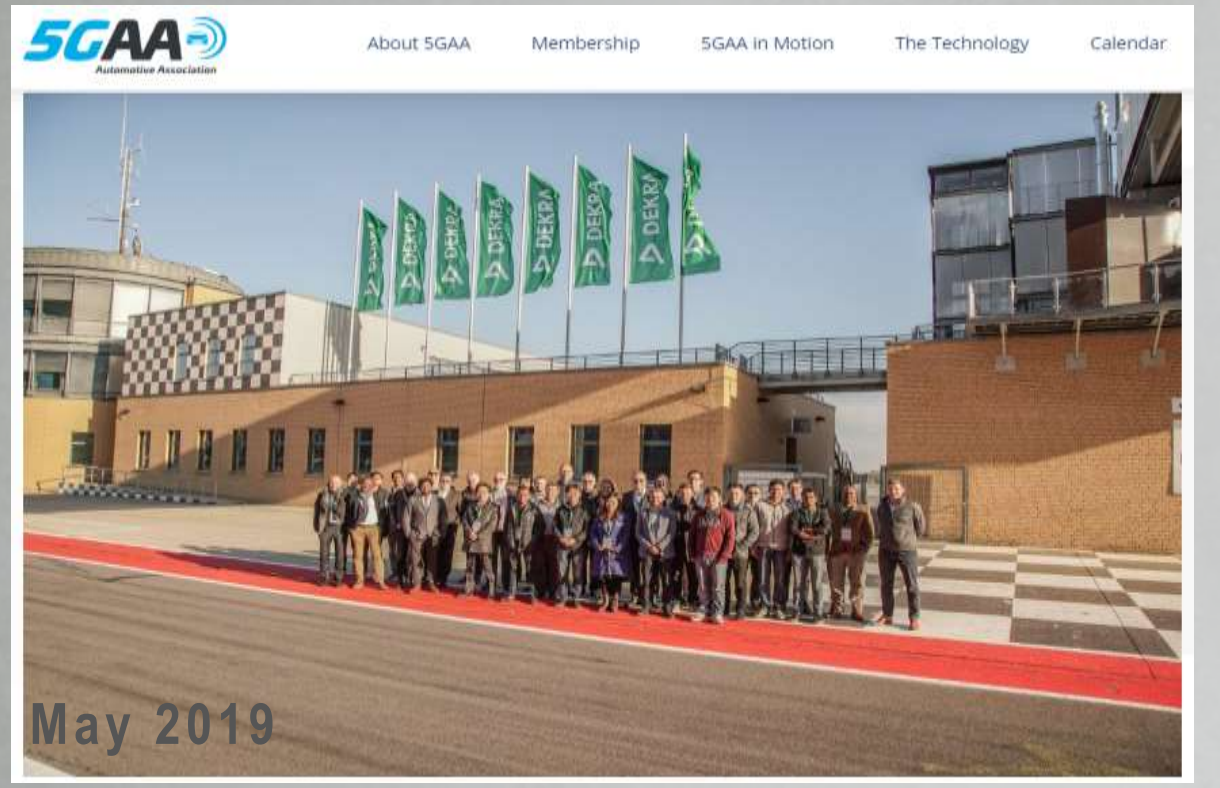
The air interface covered by this certification program in based on PC5.

DEKRA operates complex and fully approved GCF and PTCRB accredited laboratories for LTE testing and related V2X services (Uu interface)



DEKRA Capabilities

International network



- DEKRA host private test areas featuring closed tracks, safe environments, wireless infrastructure and pre-defined test set-ups.

Start of an international testing network for connected and automated driving in Klettwitz, Germany

Test area Málaga, Spain

ETSI and 5GAA Plugfest in DEKRA,SP

The ETSI Plugtests service hope to make the C-V2X tests a key event, allowing suppliers to:

- Assess the market readiness of implementations
- Validate the ETSI ITS and 3GPP V2X standards
- Test end-to-end interoperability
- Highlight early bugs and their fixes

Places are free of charge and all participants – testers and observers - will be able to evaluate the test statistics in the TRT (Test reporting Tool) provided - once they have signed the event's NDA.

> *When: December 2nd – 6th 2019*
> *Where: Malaga, Spain*
> *Co-located with: The ETSI-5GAA Plugtests workshop (December 4th)*

https://www.etsi.org/events/1659-cv2x-plugtests?jjj=1571733885483

DEKRA Capabilities

Test Track Availability Services

- Verification of the correct implementation of V2V / V2X safety applications, including:
  - generation of correct messages
  - reception of messages generated by the infrastructure of other vehicles
  - generation of appropriate warnings to the driver
- Performance testing; against speed, V2X congested scenarios, etc.
- Coexistence with other wireless technologies
- Certification field tests for OmniAir certification
- Development of customized test plans, to adapt to specific customer requirements
- Renting of test area and tools, with or without engineering support

Summary

DEKRA V2X Solutions

- V2X –Enhanced Safety, Enabling Higher Levels of Automation
- eCall and NGeCall
  - EU 2017/79 (EN16454 Conformance testing)
- DSRC (based on IEEE 802.11p, 5.8GHz)
  - FCC Part 95 (OBU), FCC Part 90 (RSU)
  - ITS-G5 (EN302 571)
  - OmniAir Certification
- C-V2X (based on 3GPP Rel-14 LTE-A Pro, Band 47)
  - FCC Part 95 (OBU), FCC Part 90 (RSU)
  - CE EN301 908-1, EN302 571
  - GCF WI-281(V2V), WI-282(V2X)

C-V2X Test Application
UXM 5G Wireless Test Platform

Q & A

DEKRA

On the safe side.

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好友募集中

搜尋ID @dekra.taiwan

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