Thomas Jaeger,
Head of Technology Technical Service Management,
SVP, Service Division
Product Testing
DEKRA
The importance of Certification for 5G Automotive

Thomas Jaeger
Senior Vice President DEKRA SE
31st March 2022
Content

- Requirements and Complexitites
- Certification is the glue
- Certification Impact
- Regulatory Requirements Testing
- Interest Group and Standardization Requirements and Testing
- Private 3rd Party and Supplier to market Requirements and Testing
Requirements and Complexities

- Regulatory Requirements and Testing
- Interest Group and Standardization Requirements and Testing
- Private 3rd party and supplier-to-market requirements and Testing
- Application Layer
- Higher Layers
- Lower Layers
Certification is the glue

- Conformance
- Interoperability
- Performance
- Security
- Efficiency
- Sustainability

Regulatory Requirements and Testing

Interest Group and Standardization Requirements and Testing

Private 3rd party and supplier-to-market requirements and Testing

Application Layer

Higher Layers

Lower Layers
Certification Impact

- Conformance
- Interoperability
- Performance
  - Security
  - Efficiency
- Sustainability

Platform for Success of Technology

Generates Trust & Acceptance

## Vehicle direct communication mode

DEKRA provides regulatory testing and certification services for (PC5) vehicle direct communication (V2V, V2P, V2I) requirements.

### Regulatory Requirements

<table>
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<th>Technology</th>
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<th>Type</th>
<th>Scope</th>
<th>Test standard (subject to change)</th>
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... and others
PC5 Lower Layer Testing

The Global Certification Forum (GCF) is operating a C-V2C certification program in cooperation with 5GAA based on the current GCF Work Items 281 and 282.

Test Specifications:
- 3GPP 36.521-1
- 3GPP 36.521-3
- 3GPP 36.523-1

Test Purposes:
- 3GPP C-V2X Device Testing for Radio Frequency Conformance
- 3GPP C-V2X Device Testing for Protocol Conformance

DEKRA provides GCF testing and certification services related to cellular V2X listed as C-V2X RTO
PC5 Lower Layer Testing

Omniair in North America is operating a C-V2C certification program addressing PC5 lower layers testing based on 3GPP and SAE specifications. It overlaps with the GCF/5GAA program.

Test Specifications:

- 761-OA-TSS&TP-3652X (Based on 3GPP 36521-1 & -3)
- 762-OA-TSS&TP-J31611 (Based on SAE J3161/1)

Test Purposes:

- 3GPP C-V2X Device Testing for Radio Frequency Conformance
- On-Board System Testing for LTE-V2X V2V Safety Communications (SAE)

DEKRA was the first lab providing Omniair DSRC & LTE- V2X OBU and RSU certification services as an authorized OATL
C-V2X Higher Layer Testing

The C-V2C certification program of Omniair in North America also covers higher layer testing based on US related standards. It derived from the requirements that have been used for DSRC.

**Test Specifications:**
- 763-OA-TSS&TP-16092
- 765-OA-TSS&TP-16093
- 767-OA-TSS&TP-J29451
- 770-OA-TSS&TP-RSU41

**Test Purposes:**
- Security Services (IEEE 1609.2)
- Networking Services (IEEE 1609.3)
- On-board System Requirements for V2V Safety Com. (SAE J2945/1)
- RSU functional testing

DEKRA has been hosting many plugfests successfully to promote successful interoperability of higher layer protocols.
C-V2X Higher(Lower) Layer Testing

ETSI ITS is developing standards for testing higher/lower layers. It derived from the requirements that have been used for ITS-G5.

**Test Specifications:**
- ETSI TS 103 794
- (includes references to 3GPP)
- ETSI TS 102 868
- ETSI TS 102 869
- ETSI TS 102 859
- ETSI TS 102 870
- ETSI TS 103 096
- ETSI TS 103 191
- ...

**Test Purposes:**
- LTE-V2X Access layer for ITS (RF, Tolling protection, congestion control,…)
- Conformance for Cooperative Awareness Basic Service (CA)
- Conformance for Decentralized Environmental Notification Basic Service (DEN)
- Conformance for Transmission of IP packets over GeoNetworking (GN6)
- Conformance for GeoNetworkingBasic Transport Protocol (BTP)
- Conformance for GeoNetworking (GN)
- Conformance for ITS security
- Conformance for Facilities layer protocols and communication requirements for infrastructure services (MAPEM/SPATEM, IVIM, SREM/SSEM)
- ...

ETSI test cases are available for conformance assessment and DEKRA tests devices accordingly.
Application Testing (PC5 – Lab based)

Application Testing in Laboratory Environments build the initial bridge to full scale verification and validation in vehicles on roads.

Test Specifications:
Test specifications are deriving from core requirements defined in various (standards) groups such as SAE, C-IAE but also based on 5GAA use cases (Omniair intends to implement one based on SAE J2945/1)

Test Purposes:
Validate V2V & V2I applications such as FCW (Forward Collision Warning), EEBL (Electronic Emergency Brake Light, already Omniair conform), IMA (Intersection Moving Assistant), LTA (Left Turn Assist), CLW (Control Loss Warning), BSW (Blind Spot Warning), …

DEKRA has been involved in the development of core requirements and has implemented several hundred related test cases
Private 3rd party and supplier-to-market requirements

PC5 – Application Testing Examples

**What is tested?**

- Generation of appropriate signaling messages
- Reception of signaling messages and generation of the corresponding warnings to the driver

- Forward Collision Warning (FCW)
- Emergency Electronic Brake Lights (EEBL)
- Intersection Movement Assist (IMA)
- Vehicle Turning Right in Front of a Transit Vehicle (VTRFTV)
- Blind Spot Warning (BSW)
- Lane Change Warning/Assist (LCA)
- Work Zone Warnings (WZW)
- Spot Weather Impact Warning (SWIW)
- Speed & Curve Compliance
- Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)
- Red Light Violation Warning
- …
Application Testing (PC5 on Test Tracks)

Validation of Simulation and Lab Testing happens on dedicated test tracks

DEKRA supports all testing activities on operated test tracks by providing several hundreds of V2x application tests (Omniair, 5GAA, SAE, C-SAE, ETSI, …)
THANK YOU
Robert Banks, Technology Development Manager, Vodafone
WHAT IF ...

WE COULD MAKE EUROPEAN ROADS SAFER FOR EVERYONE?
Vodafone launches platform to improve road safety in Europe
STEP | Introduction

Vodafone is committed to make European Roads safer for all

Platform to distribute, broker and validate V2X messages in real-time leveraging 5G and Edge Cloud

STEP aims to scale – Starting in the V2X / Connected Mobility space and using it for all types of real-time data broker applications

Safer Transport for Europe Platform (STEP)

Hazard Warnings

VRU Assistance

Infrastr. to Vehicle

Through partner Apps

OTT via integration with partners’ apps

V2X-enabled vehicles

Road side infrastructure

Non-connected and non-V2X enabled vehicles

Vulnerable road users

Road authorities

Municipal transport authorities

Platform access delivered directly via SaaS model
V2X Platform at the Edge

Edge Services

- GNSS correction
- Digital Roads
- Intersection Assistant
- VRU Awareness

V2X Message Broker

Road operators
Municipal transport authorities

V2X messages (ETSI ITS)
Connected Vulnerable road users
Road side infrastructure
V2X-enabled vehicles

Video Stream
Advanced VR

Un-connected road users

Road User Path Prediction
Why network edge? Scalability and reliability

Scalability

• V2X type C-ITS messages (CAM, DENM) are sent from the vehicle to the STEP platform
• As the number of participating vehicles/devices increases, the amount and associated transport cost of data will increase – costs can be minimised if the data path is minimised
• STEP functions (MQTT and data processing) are deployed at the mobile edge and so all data originating from vehicles is terminated at the edge, thus reducing the data transport costs
• Without the network edge, much of the value of collecting data from vehicles will be spent on data transport

Reliability and service assurance

• The Mobile Edge enables the whole of the service (servers, client, connections) to be kept within the mobile network and so the potential for moving towards a QoS-enabled, targeted QoS approach is enabled
• Services outside the mobile network are generally provided by Best Effort means
• QoS enabled service have predictable, low latencies during network congestion and so timely delivery of C-ITS data is always reliable
Connecting vehicles, VRUs and infrastructure seamlessly

Test environments
- Off-road (controlled) test environments
- On-road (live) test environments

C-ITS services
- Apps, services and licensing
- Mobility Data Exchange

Road Operators
- Traffic systems

Data
- Data Service Providers
- Mobility Service Providers
- National Access Points
- National Data Spaces
- OEM Cloud(s)

Apps and services
- MNOx Distributed Edge Cloud

Distributed Mobility Edge Cloud
- V2X
- VF app
- RSU

Apps and services

Commsignia

Vodafone

Nokia
V2X services optimised for mobile networks

• STEP hosted at Vodafone’s Mobile Edge in London (AWS Wavelength)
  – A dedicated test track (private road) configuration for UTAC and Horiba-Mira
  – STEP will also be used to support public road-based services (testing & customer/consumer)

• Local hosting enables
  – Lowest e2e latencies
  – Data remains in country

• STEP will be deployed across Vodafone’s major European markets during 2022
V2X services optimised for mobile networks

• V2X through UTAC and HORIBA-MIRA mobile private networks, live commercial networks for public roads
• Data partitioning
  • Private road data only viewable by individual test track customers
  • Businesses can only see their own data on public roads
• V2X service evolution – OEM/Fleet applications can be hosted on STEP
  • ADAS integration
  • Sensor fusion
  • Vehicle autonomy support
Next steps

Phase 1

• Use UTAC and Horiba MIRA as a practical (hands-on) education facility for ecosystem stakeholders – spread the word on what can be achieved today
• Discussions with OEMs/Tier1s about connectivity via in-vehicle unit and presentation via head-unit / infotainment system and additional use cases
• Discussions with Road Operators about additional use cases and connection to their road network data
• Discussions with other 3rd party app developers about integration of V2X SDK

Phase 2

• Testing of vehicles connected via TCU – head-unit
• Testing of interface to road operator data
• Testing of additional use cases
• Testing of 3rd party apps
Outlook: Edge-based use cases
Candidate proposals

**GLOSA**

**VRU**
- VRU (car → VRU & VRU → car)
- VRU incl. fusion with road side sensors (cameras)

**CAM**
- Road Obstruction
- Stopped/broken-down Vehicle
- Real-time lane restriction
- Aggregated CAM (coop. awareness msg.) data to be offered road operators (rev. share)

**DENM**
- EEBL as an info service
- Local weather-related events

**Any App**
- (hosting)

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Prepare the future for
Data fusion to support cooperative automated driving
Afternoon demo

- Back seat of vehicle real-time experience of STEP around the outdoor test area
  - 2 different handset OS (Android and iOS)
  - Integration into Android Auto and Apple Car Play
  - 3 different MNOs (VF DE, VF UK, 1 other)
  - 2 different applications (VF Driving Academy, Eloy Drive) + engineering app
  - Deploying Road Operator messages (IVIM and DENM)

Please come and join us
MODERATED DISCUSSION

Bringing C-V2X on the Roads: the Role of Interoperability for Deployment
CLOSING REMARKS

Maxime Flament, 5GAA
Saurav Arora, Plugtests™ Event
Vodafone: Application and MNO Interop of Vodafone STEP

• Demonstrate the interoperability between the Vodafone Safer Transport for Europe Platform (STEP) and three different Android OS and Apple OS applications, as well as between the different mobile networks from Deutsche Telekom and Vodafone:
  • APP1 developed in house (Vodafone Demo, used for technical internal testing and showcase)
  • APP2 developed in house in conjunction with a 3rd party (Vodafone Driving Academy)
  • APP3 developed by a 3rd party (Eloy Drive)
• All the applications embed the Vodafone STEP SDK.
CTAG: Interoperability between OBU and RSU

• CTAG will demonstrate the generation of the events for their RSU and the reception in the OBU.
  • The events will be shown in a tablet that runs an Android App
• The following use cases will be performed:
  • UC1 Road Works Warning
  • UC3 Time to Green / Traffic Sign Violation
  • UC5 In-Vehicle Signage
  • UC8 Traffic jams
  • UC9 Hazard on the road
Allbesmart: C-ITS Platform

• Allbesmart will demonstrate their C-ITS platform integrated in a Cohda Wireless MK6 RSU
  • They will be able to issue events with minimal configuration and check on the health status of the RSU, and a Cohda Wireless MK6 OBU integrated with Allbesmart’s onboard application
  • An onboard application running in a tablet allows to visualise the messages

• The following use cases will be performed:
  • UC1 Road Works Warning
  • UC8 Traffic jams
  • UC9 Hazard on the road
Networking lunch
12:30 – 13:30

Live demos
13:30 – 15:00