# 5GAA Workshop: C-V2X Interoperability and Deployment

**Opening Session**

*Welcome to Plugtests Event.* Ultan Mulligan, ETSI  
*Welcome to DEKRA Automotive Test Center.* Thomas Jaeger, DEKRA  
*5GAA welcome and introduction to the workshop.* Maxime Flament, 5GAA

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 - 9:30</td>
<td><strong>Opening Session</strong></td>
</tr>
<tr>
<td>9:30 - 9:50</td>
<td><strong>Session 1</strong></td>
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<tr>
<td>9:50 - 10:20</td>
<td><em>Debrief of Klettwitz plugtests activities.</em> Saurav Arora, Plugtests™ Event</td>
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<tr>
<td>9:50 - 10:20</td>
<td><strong>Coffee Break</strong></td>
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<tr>
<td>10:20 - 11:35</td>
<td><strong>Session 2</strong></td>
</tr>
<tr>
<td>10:20 - 11:35</td>
<td><em>Road operator perspective: “German Perspective on C-ITS Deployment”.</em> Farzin Godarzi, BASt</td>
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<td>11:35 - 12:10</td>
<td><strong>Moderated discussion – Bringing C-V2X on the Roads: the Role of Interoperability for Deployment</strong></td>
</tr>
<tr>
<td>12:10 - 12:30</td>
<td><strong>Closing Remarks</strong></td>
</tr>
</tbody>
</table>
| 12:10 - 12:30 | Saurav Arora, Plugtests™ Event  
| 12:10 - 12:30 | Maxime Flament, 5GAA  

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Workshop:
C-V2X Interoperability and Deployment
Ultan Mulligan,
Director,
ETSI Centre for Testing and Interoperability
Thomas Jaeger,
Head of Technology Technical Service Management,
SVP, Service Division
Product Testing
DEKRA
Maxime Flament,
CTO
5GAA
5GAA welcome and introduction to the workshop
Connected mobility for people, vehicles and transport infrastructure

5GAA bridges the automotive and telecommunication industries in order to address society’s connected mobility needs bringing inclusive access to smarter, safer and environmentally sustainable services and solutions, integrated into intelligent road transportation and traffic management.

AUTOMOTIVE INDUSTRY
Vehicle Platform, Hardware and Software Solutions

TELECOMMUNICATIONS
Connectivity and Networking Systems, Devices & Technologies
5GAA Main Achievements

• 5GAA is regarded as the global lead organization on automotive connectivity

• 5GAA helped to transform C-V2X from a new standard into a market reality

• 5GAA has established 5G as the reference technology for future automotive connectivity
Challenges of the ecosystem related to communications

1. OEMs have different views about role and benefits of long- and short-range communications
2. Road operators have different views about role and benefits of long- and short-range communications
3. OEMs and road operators are divided on the right short-range technology
4. Too many small-scale technology oriented PoCs and trials not giving insights into impact on traffic safety and efficiency KPIs
5. Costs to digitalise “older” road infrastructure
6. Sustainable business and cooperation models for traffic safety and automated driving related applications
Market developments - 5G enabled vehicles

**First 5G enabled car on the road**
source, *Autonews Gasgoo*, December 2020

**GM to produce 5G-connected cars in 2023 with AT&T**
source: *RCR Wireless*, August 2021

**Audi is equipping its vehicles with the new 5G mobile communications standard**
source: *Audi*, August 2021

**BMW iX will be available with 5G connectivity via two network operators**
source, *BMW Blog*, September 2021
Growing momentum: Connectivity enables many safety use cases

Examples:

**C-V2X enabled vehicles in China**

“Intelligent Electric SUV Flagship Hongqi E-HS9 with C-V2X”, December, 2020

“First 5G enabled car on the road”, December, 2020

“BMW iX with 5G connectivity via two network operators”, September, 2021

**Objective:**
Create an SRTI Ecosystem to share safety critical data between OEMs, service providers and public authorities …”, Data for Road Safety

**Data for road safety initiative in the EU**

**The Netherlands – Talking Traffic:**
- 1.8 million users
- 800 Intelligent traffic light in operation
- extra 1000 planned, Source

**US: Georgia, Texas, .. TravelSafely-App**
- 1000+ intersections
- Emergency vehicles
- School zone warning
- Rail crossing warning ...

**Intelligent traffic with smartphone apps**

**Italy - ANAS:**
Deployment of C-V2X connecting 80Km of Smart Highway 51 to Cortina
Source

**China: G5021 Shiyu Highway (Chongqing)**
128km highway upgrade with 300+ C-V2X smart RSUs (12 tunnels, 5 dangerous spots), Source1 Source2

**8 SRTI Use cases:**
1. Temporary slippery road
2. Unprotected accident area
3. Short term road works
4. ...

**Deployment of C-V2X RSUs**

**Examples:**

- “BMW iX with 5G connectivity via two network operators”, September, 2021
- “First 5G enabled car on the road”, December, 2020
- “Intelligent Electric SUV Flagship Hongqi E-HS9 with C-V2X”, December, 2020

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C-V2X status in Europe and US

**USA:**
- Increasing momentum behind cellular solutions
- US FCC decided on new allocation of 5.9GHz ITS spectrum in favor of C-V2X, but reduction of ITS spectrum from 75 MHz to 30 MHz
- Several OEMs committed to deploy 5 million vehicles with V2X capabilities by 2025; e.g.: announcements from Ford and Audi
- Deployment of V2X Solutions across States ongoing, C-V2X in Colorado, Virginia, Georgia, Texas, DSRC in Detroit among others

**EU:**
- 5.9 GHz Spectrum for safety related services
- Delegated Act on C-ITS relying on ITS G5 only was rejected by EU Council (member states)
- Major cross-OEM/operator/border corridor projects kicked-off and further projects in preparation
- Exchange of safety related information between OEMs: EU Data task force finished – successor established: SRTI Ecosystem - Data for Road Safety RSU deployments announced; e.g.: Asfinag (ITS G5), ANAS (C-V2X)
- 5G Spectrum auctions ongoing – some countries with obligations on road coverage
Expected timelines for mass deployment of C-V2X use cases

<table>
<thead>
<tr>
<th>Year</th>
<th>Traffic efficiency (safety related)</th>
<th>Safety (traffic efficiency)</th>
<th>Advanced safety automated driving (step I)</th>
<th>Advanced safety automated driving (step II)</th>
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<tbody>
<tr>
<td>2018</td>
<td>3GPP Release 15</td>
<td>2016</td>
<td>2022</td>
<td>2025</td>
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<tr>
<td>2019</td>
<td>3GPP Release 16</td>
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<td>2022</td>
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<tr>
<td>2020</td>
<td>3GPP Release 17</td>
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<td>2025</td>
<td>2026</td>
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<tr>
<td>2021</td>
<td>3GPP Release 18</td>
<td></td>
<td>2026</td>
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- **Traffic efficiency (safety related)**
  - 2016: Local Hazard and Traffic Information
  - 2020: Market take off

- **Safety (traffic efficiency)**
  - 2022: Emergency Electronic Brake Light Left Turn Assist (part of Day 1/Phase 1)

- **Advanced safety automated driving (step I)**
  - 2025: Automated Valet Parking for AVs
  - 2025: Campus Area Tele-Operated Driving

- **Advanced safety automated driving (step II)**
  - 2026: Automated Valet Parking for AVs
  - 2026: Sensor Sharing for AVs

- **In-vehicle commercial mass deployment**
  - Direct
  - Network
  - Direct or Network
  - Direct and Network

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SESSION 1

Debrief of Klettwitz plugtests activities
Saurav Arora,
Technical Project Manager,
PlugtestsTM Event
C-V2X#3 Plugtests

Presented by:  Saurav Arora  
For:  Workshop  

31 March 2022
Motivation

✔ The purpose of C-V2X Plugtests interoperability event is to help enable interoperability of products, which is crucial to the successful deployment of new technologies.

✔ Provide feedback into standards-making, enhancing the quality of the final standards.

✔ Plugtests are an excellent opportunity for vendors to assess and demonstrate end-to-end interoperability, to validate the base specification(s) and to promote the technology in a neutral environment.

https://www.etsi.org/events/plugtests
Test Scope

- ETSI lab-based Interoperability test plan for ITS protocol.
- ETSI outdoor test plan for interoperability.
- C-V2X GCF Conformance Certification test cases and ETSI ITS conformance test cases.
- ETSI outdoor test plan for PC5 and LTE-Uu interface.
- 5GAA C-V2X lab-based Interoperability Test Plan for Mode 4 PC5.
Outdoor Test Plan

• UC1: Road Works Warning RWW
• UC3: Time to Green T2G
• UC5: In-Vehicle Signage
• UC6: Intersection Collision Risk Warning ICRW
• UC7: Longitudinal Collision Risk Warning LCRW
• UC8: Traffic Jams Warning TJW
• UC9: Road Hazard Warning RHW
Vendors
Registered Devices

**PKI Vendors** – Atos IDnomic, AutoCrypt, CTAG, ETAS, Microsec, Movyon(Autostrade), Vector

**OBU Vendors** – Allbesmart, Cohda Wireless, Commsignia, CTAG, Vector, Yogoko

**RSU Vendors** – Allbesmart, CTAG, Movyon Electronics, Vector

**TE Vendors** – Anristu, Keysight, Rohde & Schwarz, S.E.A. Datentechnik, Spirent

**LTE Network** – Vodafone
Testing Sessions (Snapshot)
Preliminary Results (End of Day 3)

Number of Test Sessions: 72

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<thead>
<tr>
<th>Interoperability</th>
<th>OK</th>
<th>NO</th>
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<tr>
<td></td>
<td>111 (94.0%)</td>
<td>7 (5.9%)</td>
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Interoperability Pie Chart
Thank You