ANNUAL REPORT 2023

5GAA - Connected Mobility For People,
Vehicles and Transport Infrastructure

5GAA
Automotive Association

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All data comprised in this report reflects
the situation until 31 December 2023.

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FOREWORD

Christoph Voigt
Chairman of the 5GAA Board

"This year's report celebrates the significant strides we've made in advancing Cellular Vehicle-to-Everything (C-V2X) technology in the market and fostering cross-industry alignment."

The 5G Automotive Association (5GAA) is proud to present its Annual Report for the calendar year 2023. 5GAA brings together automotive, technology, and telecommunications companies on a global level to develop end-to-end solutions to make future mobility and transportation services smarter, safer, and more sustainable.

This year's report celebrates the significant strides we've made in advancing Cellular Vehicle-to-Everything (C-V2X) technology in the market and fostering cross-industry alignment. For example, the U.S. Department of Transportation's Road Safety Call to Action, the decision by European automakers representing more than 70% of the market to adopt 5G-V2X as the future reference technology for automotive direct connectivity, and South Korea's announcement that it was adopting Cellular Vehicle-to-Everything (C-V2X) direct communications as its technology of choice were all major milestones in the evolution of the market.

With a keen focus on the evolution to 5G, we continue to explore and develop advanced use cases that will redefine the landscape of future connected mobility. Our 2030 visionary roadmap charts a course that places C-V2X technology at the heart of our endeavours. This roadmap is a pivotal instrument, offering a consolidated view of the global introduction of advanced use cases for connected and automated driving as well as guiding 5GAA's work towards deployment.

International collaboration remains integral to our approach. Regular engagement between 5GAA members and road operators facilitates invaluable exchanges on connectivity-related topics and the infrastructure essential for a truly connected ecosystem.

As we reflect on the past year's achievements and set our sights on the horizon of possibilities, we extend our gratitude to the dedicated members, partners, and collaborators who have played an instrumental role in shaping the narrative of 5GAA. Together, we pave the way for a connected, automated, and sustainable future of mobility.
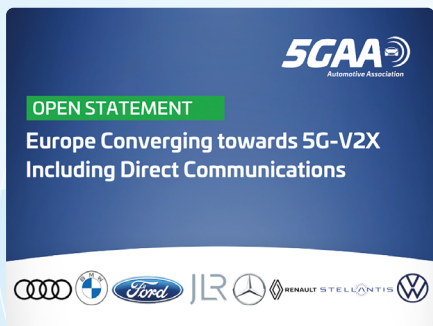
HIGHLIGHTS OF 2023

1. The Hague F2F and workshop on 'C-V2X mass market deployment in real-life traffic' in the Netherlands and Flanders (Belgium) (January).
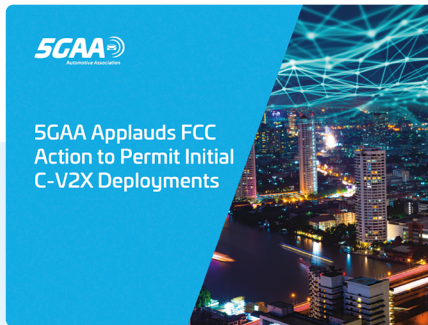
2. FCC grants initial C-V2X deployments waivers (April) -- growing number since then.

3. Seoul F2F meeting and live showcase about school-zone safety (May).

4. 5G-V2X multi-OEM letter on Europe converging towards 5G-V2X featuring direct communications (September).

5. Comprehensive guidance for deployment of C-V2X Day 1 safety services using 5.9 GHz (October).
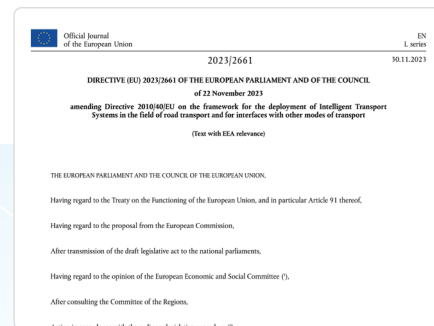
6. EU Adopts revised ITS Directive including technology neutrality principle (October).

7. Detroit F2F and showcases including interoperability of VRU protection services (October).

8. USDOT announces the Draft National V2X Deployment Plan and opens $40 million grant opportunity for V2X.

9. Korea announces it will adopt C-V2X (December).

Vision and Strategy

5GAA bridges the automotive and telecommunication industries 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.

Successfully unlocking the societal benefits of V2X requires untangling complex technical, regulatory, and go-to-market issues. This is 5GAA's core mission. It implies the challenge of achieving alignment and cooperation between automakers and their suppliers, Mobile Network Operators (MNOs), service providers and Infrastructure Owner-Operators (IOOs). The cornerstones of this vision are synergies between C-V2X direct and mobile network communications modes and technology evolution.
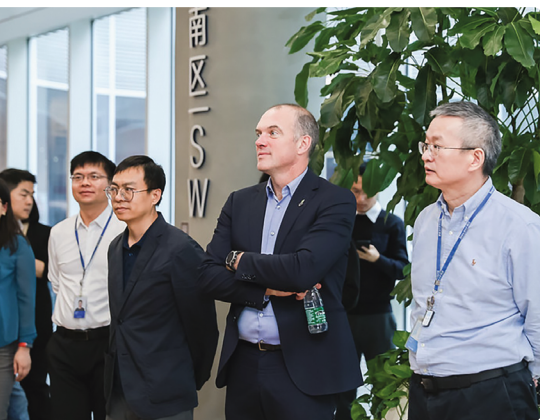
Our collective success will be benchmarked against the realisation of our Visionary Roadmap 2030 and its deployment milestones. This global ambition translates into specific regional strategies led by sub-groups in our policy working group. In 2023, 5GAA paved the way to expand its geographical scope to India, a promising V2X market, with the creation of a new dedicated sub-group in 2024.

5GAA continues to prioritise the execution and implementation of readily available ("Day 1") technology and services even as it explores and

tests future technologies and services. This necessity triggered the 2023 launch of a new, overarching Work Item (WI) Go-To-Market tasked with identifying roadblocks or gaps parallel to those already covered by specific WIs or spanning our thematic WGs.

Globally, the automotive industry has started deploying 5G mobile network connectivity in production models to enable new connected vehicle services. A core priority of 5GAA is thus to **speed up the wide-scale deployment of Day 1 V2X services over mobile network communications**. Building upon the previous BRIDGE and DI4US Work Items (WIs), 5GAA in 2024 will deliver on WI V2N2X architecture, messages, and profiles, as well as leverage the latest innovations in **distributed cloud and edge computing capabilities** (WI 5GMEC4AUTO).
5GAA will pursue and intensify the engagement initiated in 2023 with stakeholders, especially governmental bodies, e.g. US FHWA, to offer our expert advice to the future US Digital Infrastructure Plan. 5GAA proposes a transformative approach based on scalable digital data exchange and a federated architecture to manage road traffic information efficiently in the digital age.

After three successful technology showcases in 2023, 5GAA will continue advancing interoperability between members' **Vulnerable Road Users (VRUs)** protection solutions based on both direct and mobile network communications and identify the shortest go-to-market routes.

Another 5GAA priority is to **tackle the remaining technical or political hurdles preventing the mass roll-out**

of LTE-V2X direct communications in targeted markets. Last year, 5GAA issued Day 1 deployment guidance (WI US DPLOY) to stakeholders who wish to deploy LTE-V2X at 5.9 GHz. Building upon the momentum of South Korea's adoption of C-V2X and the USDOT Draft National V2X Deployment Plan, 5GAA members are leveraging lessons learned from China to (re)design a successful launchpad for direct communications in 2024-2025.

Similarly, to make Automated Valet Parking (AVP) a market reality as of 2026, 5GAA is developing an **end-to-end AVP service implementation description** (incl. standards and interoperability tests) and plans testing in 2024 in Europe.

Recognizing that V2X is evolving within different regional markets at

different speeds and may lead to different deployment options, 5GAA started **laying the groundwork for 5G-V2X Direct deployment** (operated with or without LTE-V2X Direct in the 5.9 GHz band) in Europe. 5G-V2X Direct communication mode will be the future reference technology for automotive direct connectivity and an important enabler of advanced driving use cases. The 5GAA Roadmap targets global mass deployment as of 2026-2029, starting in Europe. We will need to continue to make significant efforts to solve challenging standardisation, regulatory, and spectrum access issues.

5GAA also started scoping the required work effort to achieve the **integration of V2X with in-vehicle automated actuation functionalities**, building on previous work on functional

safety (WIs STICAD I and II). This will enable the most advanced connected cooperative driving use cases on our 2030 Roadmap.

Looking ahead, 5GAA will continue to **scope the automotive connectivity potential of new technology enablers including positioning-as-a-service** (WI ConSens), **non-terrestrial networks** (WI NTN-RAS), and **integrated sensing and communication** (WI ISAC), **within and beyond 5G** (WI 5GEB). As a Market Representative Partner, 5GAA provides automotive requirements essential to 3GPP specifications, such as for Release 19 in 2023-2024, and provides input to regional Standard Developments Organisations (SDOs) such as ETSI, SAE, C-SAE and others.

Even as it embraces the continuous evolution of connected mobility technologies, 5GAA needs to collectively charter a **transition path or mitigation measures to ensure continuity of legacy services**. Examples include non-3GPP technology in the 5.9 GHz range in Europe (WI 5G-V2X-EU), the sunset of 2G and 3G mobile network services, the transition from type-approved

112 eCall, and future international mobile telecommunications (IMT) spectrum allocations, for instance with respect to a wide-band operation.

By working together towards implementing our vision and this strategy, 5GAA and its members will collectively continue to nourish a thriving V2X ecosystem, delivering upon our ambition for society while fostering new business opportunities for our members.

C-V2X READY

Updating our Visionary Roadmap 2030

As this report goes to press, 5GAA is in the process of releasing a third update of the Roadmap 2030[1], which was first published in November 2022. This update will define the path ahead for advanced 5G developments, enabling the mass deployment of new use cases. We plan to publish the updated Roadmap 2030 in the course 2024.

Alignment with key stakeholders, such as Infrastructure Owner-Operators (IOOs)[2], is a core objective of the updated Roadmap release. 5GAA has been engaging intensely with European and North American IOOs to better understand their views and priorities for the digitalisation of road infrastructure and smart cities. This cooperation should materialise in a timeline depicting the deployment of C-V2X use cases from the perspective of the IOOs.

5GAA organised dedicated calls and two events with IOOs in 2023. Building on our first series of such events in 2022, 5GAA held roundtables both during the Meeting Week in The Hague (Netherlands) and at the ITS Europe conference (Lisbon) with a large group of European IOOs. Among the issues on the agenda were the priority use cases from IOOs' standpoint, the deployment of C-V2X technologies, and IOOs' data needs as well as the anticipated evolution of road infrastructure in the context of digitalisation. Similar discussions were being planned with some of the North American IOOs during 5GAA's Meeting Week in Orlando, Florida.

Lastly, the updated roadmap will highlight the important role that Non-Terrestrial Networks (NTNs)

play in the development of the automotive and telecommunications industries as well as in the wider deployment of connected and intelligent vehicles.

In cooperation with public actors, including the European Space Agency (ESA), with which 5GAA signed a Memorandum of Understanding in 2022, 5GAA has begun developing a specific roadmap visualising the mass deployment of NTN-related use cases.

5GAA's core priorities in the field of space-based connectivity and industry requirements will be further detailed in the upcoming Technical Report from the Work Item on Non-Terrestrial Networks in V2X – Requirements and Standards (NTN-RaS) in 2024.

DEPLOYMENT

Advancing C-V2X deployment

Lift barriers
Accelerate
time-to-market

STANDARDS

Contributing to standards

Plan pre-standardisation of automative connectivity with a multi-release perspective

ADVOCACY

Advancing to policymakers

Proactively address opportunities and threats Position 5GAA around strategic ecosystems

INNOVATION

Supporting innovation

Leverage innovative solutions together to advance connected mobility

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1. https://5gaa.org/5gaa-publishes-updated-2030-roadmap-for-advanced-driving-use-cases-connectivity-technologies-and-radio-spectrum-needs/
2. IOO is used as an umbrella term for several actors, e.g. road authorities, road operators, cities, and parking area providers.

Who we are,
how we work

The Association is comprised of Members, an Executive Committee, Board, General Assembly, and Working Groups that together ensure the successful governance and operation of the association. We also partner with many other organisations working on connected mobility.

5GAA: a global cross-industry association

11
of the top
15 OEMs

8
of the top
10 MNOs

2
top smartphone
vendors

Sept. 2016
In September 2016, **8 companies** teamed up to create 5GAA to help develop, test, and promote 5G standards.

Q4 2023
Today, 5GAA unites **126 members** from around the world working together on all aspects of C-V2X.

5GAA membership update (evolution in 2023)*

Regional split

Americas
25% **31** Companies

Europe and Middle East
45% **56** Companies

Asia-Pacific
30% **39** Companies

126 MEMBERS

Out of which 11 new members in 2023

American Center for Mobility · cavnue · DESAY SV · MEDIATEK · NIO · RANIX

UNIVERSITY OF MICHIGAN · SAESOL TECH · TATA COMMUNICATIONS · UNIO ENTERPRISE · INSTITUT VEDECOM

Membership overview

Member companies (126 total)

Year	All members	New members
2019	134	30
2020	137	12
2021	132	11
2022	125	10
2023	126	11

■ All members as of Dec 31, 2019-2022 / as of November 1, 2023
■ New members as of Dec 31, 2019-2022 / as of November 1, 2023
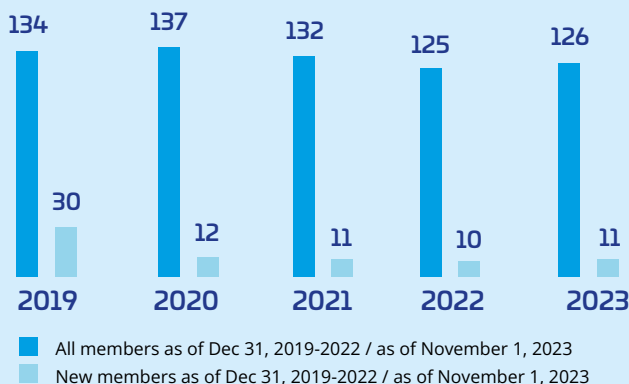
Members by category

- 7% General-NPO
- 9% Platinum
- 16% General-SME
- 13% Gold
- 55% General
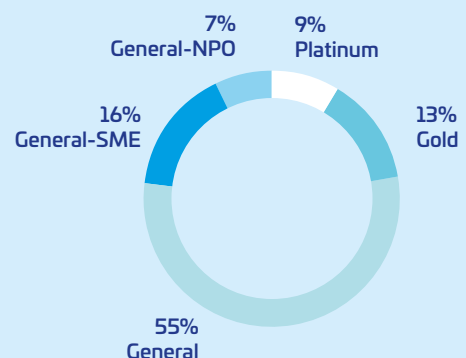
Structure and Governance

GENERAL ASSEMBLY

BOARD

CHAIRMAN
Christoph Voigt

VICE CHAIR
Uwe Pützschler

- ▶ 5GAA Board supervises and advises the Executive Committee in all material respects, in particular regarding strategy.
- ▶ The Board is composed of 17 members, elected by the General Assembly every year (11 Platinum and 6 Gold Members). ★

Christoph Voigt Jörg Plechinger	**Joachim Göthel** Georg Schmitt	**Andreas Schaller** Kurt Eckert	**Wei Chen** Yinxiang Zheng	**Tim Leinmüller** Lutz-Peter Breyer	**Friedhelm Ramme** Thomas Nylander	**Ivan Vukovic** TBC	**Yingpei Lin** Chan Zhou

Markus Muesk Jonathan Wood

Collin Lee Clara Gutierrez Echeverria	**Rainer Krumrein** Osman Aydin	**Uwe Pützschler** Thierry Klein	**Jim Misener** Vince Park	**Michael Kang** Suman A. Sehra	**Francesco Lilli** El Khamis Kadiri	**Thomas J. Fox** Jyoti Sharma

Luke Ibbetson Tony Sammut

EXECUTIVE COMMITTEE AND CTO

The Executive Committee is the legal representative body of the association and is responsible for the day-to-day management of the 5GAA.

The Executive Committee reports to the Board.

DIRECTOR GENERAL
Johannes Springer

SECRETARY
Markus Dillinger

TREASURER
Silvia Schönberger

CTO
Maxime Flament

WORKING GROUPS

WG1	WG2	WG3	WG4	WG5	WG6	WG7
Use Cases and Technical Requirements	System Architecture ans Solution Development	Evaluation, Testbeds and Pilots	Standards and Spectrum	Business Models and Go-To-Market Stagies	Regulatory and Public Affairs **WG6 US (2019)** **WG6 EU (2019)** **WG6 Japan (2020)** **WG6 China (2021)** **WG6 Korea (2021)**	Security and Privacy

Partners

In addition to its internal activities, 5GAA invests a considerable amount of time in working with different partners to explain and promote the benefits of C-V2X technologies.

Ecosystem Partners - formal collaboration

SDOs	Certification Bodies	Regional 5G Organisations	Public Administration	Industry Associations

Renewed
New

Ecosystem Partners - informal collaboration

SDOs	Public Administration	Industry Associations

In the process of being formalised

MoUs signed in 2023

5G Forum/ITS Korea MoU renewal
5GAA has renewed its cooperation with two key ITS stakeholders in South Korea: 5G Forum and ITS Korea. The cooperation will enable information exchange on 5G and 6G mobile communications technology related to automotive and road transport, analysis of technology trends, global standardisation trends and promotion of 5G and C-V2X ecosystem growth. This cooperation agreement was signed on the occasion of the 5GAA Meeting Week in Seoul in May 2023, where our members had the opportunity to meet representatives from industry and academia to discuss the future of connected mobility in South Korea.

ITS America
5GAA signed a cooperation agreement with ITS America in 2023. The cooperation scope includes connected infrastructures and vehicles and V2X technologies, including C-V2X direct and mobile network developments. The cooperation also foresees coordination of public advocacy activities in relation to connected mobility and V2X, especially in the context of the new draft US DOT V2X Deployment Plan. With this agreement, 5GAA broadens its network of partner organisations in the United States and is looking forward to working on joint activities.

Enabling **C-V2X deployment**

2023 highlights by region

FCC grants waivers to 31 entities including state DOTs and auto OEMs

USDOT opens $40 million grant opportunity for connected vehicles

Verizon partners with Arizona DOT and MAG for successful 5G pilot

JLR, Qualcomm bring 5G connectivity to next-gen JLR vehicles

Audi and Navistar showcase C-V2X tech to enhance school stops

Millions of Jeep, Dodge vehicles getting connected to safety

T-Mobile revs up 5G for Halo, C-V2X

AT&T and HAAS Alert to collaborate on connected vehicle innovation

North America

Europe & Middle East

Europe converging towards 5G-V2X including direct

Deutsche Telekom jump-starts new emergency call in the car

Monotch's TLEX unlocks C-ITS capabilities in RSMP

Commsignia's V2X OBU Lite set to protect vulnerable road users

Keysight RF calibration and verification testing support for Autotalks

Saudi Arabia to use 5.9 GHz V2X tech to enable autonomous vehicles

Asia-Pacific

South Korea chooses C-V2X to build next-generation road safety system.

LG Innotek unveils new 5G communication module

Keysight, Ettifos achieve 3GPP Rel16 sidelink radio conformance

MediaTek presents its next-gen automotive platform

Ford China deploys C-V2X service in Changchun, Jilin Province

Huawei, China Mobile complete 5G-V2X technology validation

World's first GCF certification for C-V2X module awarded

ITS Australia publishes V2X progress report

Indian government panel wants car ratings tied to improved

Advancing our work plan

Throughout 2023, 5GAA was active on 28 different Work Items (WI), 12 of which were completed by end of year and three more were concluded in early 2024. The year saw a total of 18 publications including technical reports, white papers, and position papers. Looking ahead at the Work Programme for 2024, 5GAA continues to work on 18-20 WIs covering topics related to use cases, system architecture, testing, standards, security, and others.

28
active Work Items throughout 2023-2024

12
completed Work Items

18
publications including technical reports

Automated Valet Parking

In May 2023, 5GAA issued a comprehensive Technical Report on Automated Valet Parking (AVP) Technology Assessment and Use Case Implementation. The report delves into the deployment of AVP utilising different technologies: cellular networks, Standalone Non-Public Networks (SNPN), and direct communication. Secure communication links, interfaces, trust, and privacy are among the concepts the AVP system architecture emphasises. Protocols such as IP stacks and ETSI TC ITS protocols are introduced.

After the publication of the latest AVP report, 5GAA members decided to establish a follow-up WI called AVP-Ready as means of making further progress on AVP market readiness by addressing profiling and testing for conformity. All the newly gathered information will be included in an updated TR publication by the end of the second quarter of

2024. In addition, the WI keeps track of the standardisation developments in regional and international SDOs including ISO, ETSI and SAE. These developments include the Vehicle Motion Control (VMC) protocol for Automated Vehicle Marshalling (AVM). AVP-Ready also seeks to collaborate with relevant ecosystem stakeholders (e.g. the European Parking Association). By defining the respective responsibility area, e.g. for message interface standardisation, 5GAA could focus on the vehicle's connectivity side only during an AVP system take-over.

↘ Scan the QR code to read the publication.

New priority work items Work programme 2023

Started Q1 2023	**Started Q1 2023**	**Started Q1 2023**	**Started Q2 2023**	**Started Q2 2023**
Show Uu-based V2X real life deployment of Day 1 services	5G-V2X Profiles for each use cases along roadmap (PC5/Uu)	End-to-end AVP service implementation description (incl. standards and interop tests)	Go-to-market for each Use Case on roadmap (WG5)	VRU protection to be demonstrated on larger scale
— New WI V2N2X (architecture, messages, and profiles over Uu)	— Start with 3 priority Use Cases (Hazard Location Information 2.0, Cooperative Lane Merge and VRU protection)	— New WI AVP-READY for development of the AVP Interface Implementation Profile	— Started analysis of a sample of Use Cases (Local Hazard Warning, AVP)	— Technology showcases in Seoul (Korea) and Detroit (MI, USA)
— Ongoing dialogue with US FHWA	— 5G-V2X Direct first demonstration in Q4 2024 (F2F Berlin)	— Test Specification on Vehicle Motion Control (VMC) interoperability testing	— Interating on core methodology to scale across other Roadmap Use Cases	— VRU-DEMO WI pending final Report publication

5GAA deployment objective

2016 — 5GAA foundation

2018 — LTE-V2X 2020 Roadmap

2020 — 2030 Roadmap including 5G-V2X

2024
> Make an impact on the ecosystem
> Work and contribute to the evolution of the roadmaps and their implementation
> Remove roadblocks on the way to deployment

2030 — Make it happen!
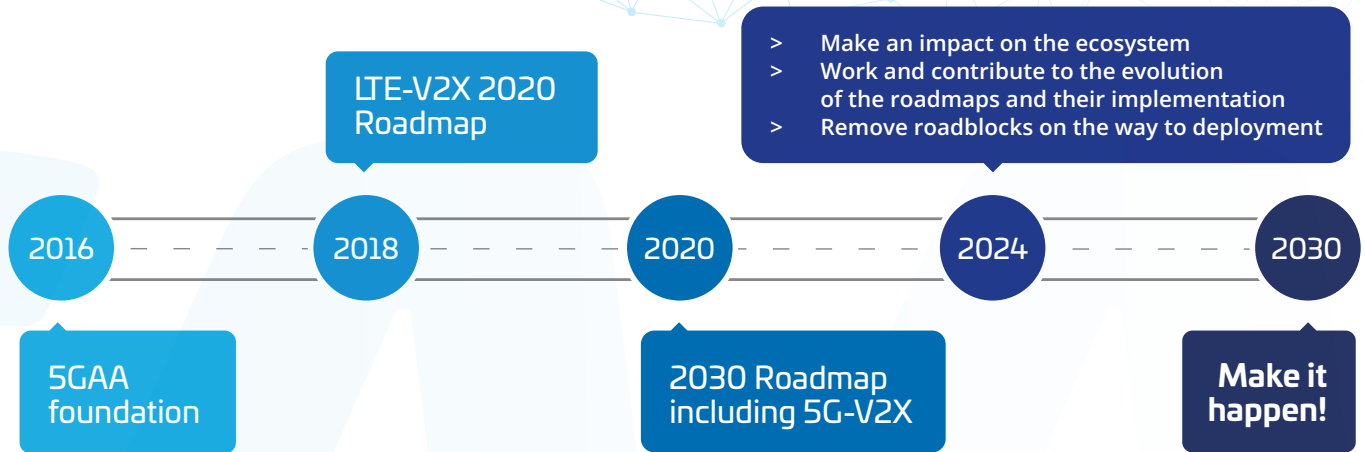
Market-enabling frameworks and go-to-market strategies

The Market Pull (MaPu) Work Item finalised a report on accelerating 5G adoption for Connected and Autonomous Mobility Services. It highlights the wide array of new business opportunities that 5G will enable for the connected mobility ecosystem in four areas.

On coverage and spectrum transition, 5G comes with new frequency bands that are globally harmonised and with plans for road coverage in many countries. The 2G and 3G sunset and the refarming of those frequencies will accelerate automotive industry interest in adopting 5G as the only future-proof technology that guarantees advanced connectivity for the coming years.

5G offers great potential for network evolution, for example high performance and innovative features for data exchange between the car and the outside world, helping to blur the borders between on-board and off-board worlds.

Slicing, local breakout and the edge rollout are features to unleash the full possibilities of 5G. These data-exchange mechanisms pave the way for new vehicle software development. The possibility of moving features from the car to the cloud to benefit from artificial intelligence/machine learning performance power, the need for software updates to constantly improve the algorithms based on usage, and a trend towards subscription models are elements only possible with a 5G-enabled car.

From a customer perspective and beyond increased safety and security, 5G connectivity will enable a great step forward in new road user experiences, both enhancing current services and enabling the launch of new services that we cannot even imagine today.

To realise 5GAA's overall objective to actively address current market entry barriers preventing the mass-market deployment of C-V2X services listed in our Roadmap 2030, the Board in 2023 initiated a new Work Item Go-to-Market (G2M). The G2M WI aims to analyse those barriers and identify potential solutions to provide business feedback on the use cases in the current 2030 Roadmap.

The work started by focusing on the 'Local Hazard Warning' use case, which is already commercially available but suffers from some shortcomings. The report is expected to be finalised by Q4 2024.

↘ Scan the QR code to read the publication.

C-V2X technology readiness – testing and demonstrations

Vulnerable Road Users (VRU) Protection

The ability to protect Vulnerable Road Users (VRU) is among the key benefits expected from C-V2X technology, but also among the most challenging use cases.

Recognising the need to accelerate cross-industry efforts in that field, 5GAA initiated in 2022 a new Work Item VRU-PRO to increase our understanding of the implementations of VRU use cases based on recommendations highlighted in the original 5GAA VRU White Paper published in 2020.

Gathering best practices from 5GAA members' ongoing proofs of concept, demos and deployment activities, the Technical Report, published in the first quarter (Q1) of 2023, outlined how diverse approaches using V2X can increase safety for pedestrian, roadworkers, cyclists, e-bikes, mopeds, e-scooters, and other powered two-wheelers. As a follow-up activity, a new Work Item (VRU-DEMO) was launched to focus on 5GAA large-scale

interoperability demonstrations of VRU solutions and applications.

In parallel, the MEC4AUTO Work Item in Q1 2023 delivered two Technical Reports (MEC-TR) investigating system interoperability and cross-MNO MEC trials. Providing a deeper look at the Multi-Access Edge Computing (MEC) deployment architecture, related interoperability and testing issues, the reports also outlined the technical, regulatory, and business constraints around deployment of multi-MNO MEC scenarios under different conditions

and meeting Original Equipment Manufacturer (OEM) requirements.

These respective learnings fed into concrete plans to scale up deployment in different parts of the world and highlighted the need for 5GAA to work on a collective VRU interoperability project to promote the readiness of the technology to non-expert audiences such as media and policymakers. This resulted in the announcement of a series of 5GAA showcases parallel to the 5GAA 2023 Meeting Weeks.


School Zone VRU Safety Showcase, Seoul (KR)

At the Seoul face-to-face (F2F) meeting in May 2023, LGE showcased a pilot project called 'Smart ITS 2.0' to demonstrate their VRU protection solutions for pedestrians. Carried out between 2022 and 2023, the project focused on building and testing a customised

C-V2X smartphone app sending alerts generated by smart cameras and sent via Road-Side Units (RSU). Alerts were sent to pedestrians and vehicles alike. The results are promising: thanks to the pre-emptive alerts, LGE registered a 37% time reduction in accident risk

exposure for its users. A survey conducted with 114 respondents resulted in an 80% satisfaction rate with the service, with 82% stating that it is 'helpful' and 88% believing it is 'necessary' to reduce collision risk for pedestrians.
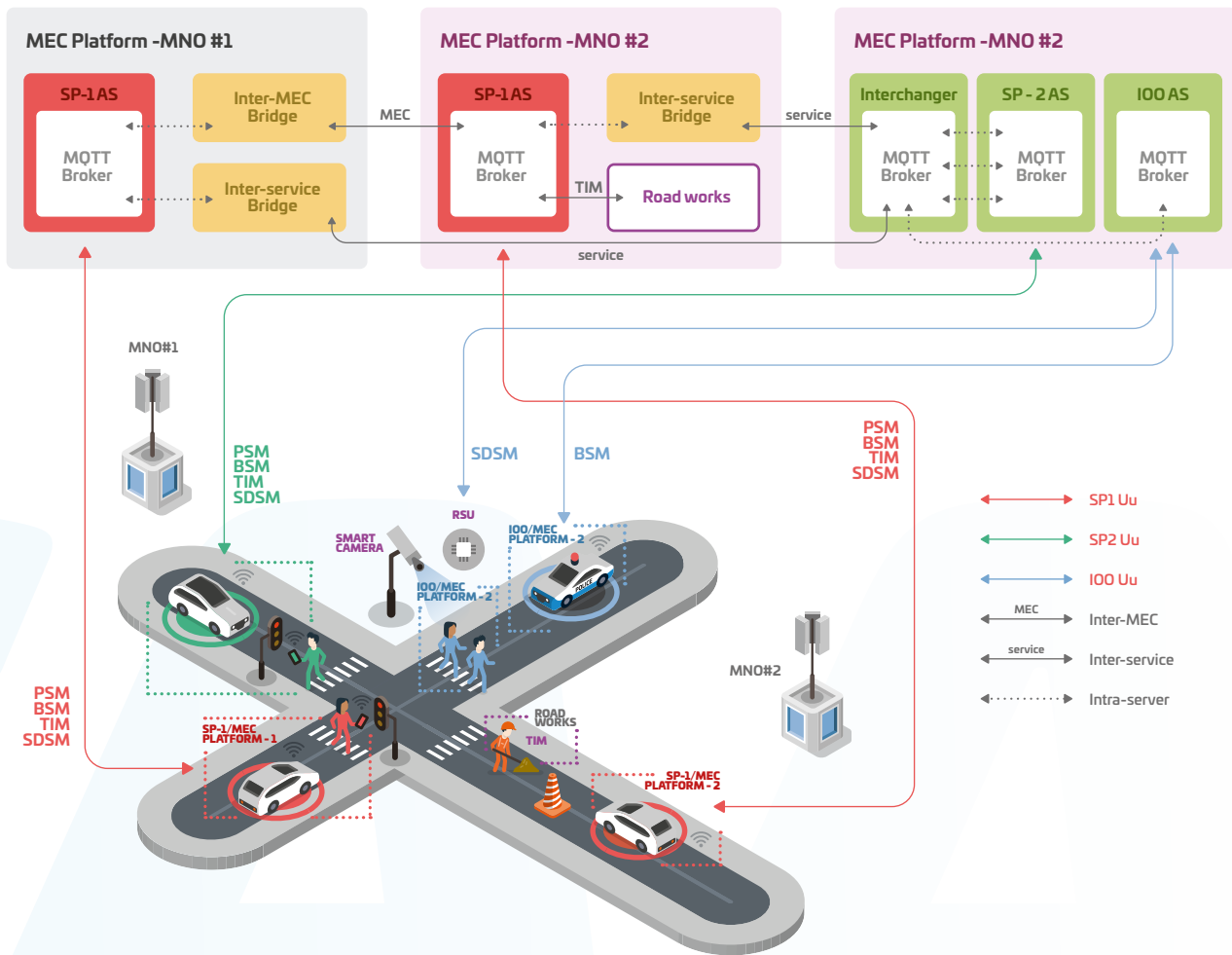
Day 1 Services and Interoperability of VRU Protection Showcase, Detroit (US)

Drawing inspiration from the results of LGE's VRU protection project, 5GAA members organised a demo in Q4 2023 in Detroit, Michigan of VRU deployment-readiness via network communication in an interoperable scenario, as close as possible to real-life conditions and involving two service providers (VRU apps) and two Mobile Network Operators' (MNO) MEC infrastructure.

The above figure shows one of the system architectures models used to demonstrate interoperability between MEC providers and VRU protection service providers. During the live demonstration at the MCity test facility, attendees had the opportunity to witness the result of the VRU-DEMO WI, as well as other ready-to-deploy C-V2X solutions. The focus was on the service interoperability of near-real-time safety-enhancing alerts and information-enhancing solutions in driving assistance. Curated showcases immersed participants in real-life scenarios, both on the track and on open roads, unveiling the impressive capabilities of mobile network communications.

Besides VRU protection, other use cases showcased included an approaching emergency vehicle, an upcoming active school zone, and an alert for a pedestrian crossing on the open road and under live conditions using cellular network communication. Additionally, indoor exhibitions allowed members to showcase their innovative products, such as digital twins replicating the demonstrations in a virtual scenario. The technologies were successfully demonstrated over two days in front of a large audience consisting of various US government and industry stakeholders, as well as the media. 5GAA conveyed the potential of C-V2X to significantly reduce road fatalities and create a smoother, safer driving experience for everyone, at the same time as the US Department of Transport (DOT) released its Draft National V2X Deployment Plan on 26 October, 2023.

�î Scan the QR code to watch the video.

Participating members

The Hague workshop conclusions and showcases

The first 2023 face-to-face (F2F) meeting took place in the Hague, Netherlands, where 5GAA organised a number of activities to engage with EU ecosystem stakeholders. The F2F meeting days were punctuated by live demonstrations of live CAM data sharing for traffic operations on open road, enabled by Monotch's TLEX infrastructure-to-vehicle smart mobility platform.

In the context of C-V2X mass-market deployments in the Benelux countries, 5GAA organised a workshop that gathered road operators, C-ITS service providers and industry experts from Netherlands and Belgium to present successes of mass-market deployments and their benefits for traffic management, traffic operators and public safety services. On the same day, the 5GAA leadership and more than 10 road operators from various EU countries sat together at a roundtable to define common use cases for the automotive industry and road operators towards a

converged update of the C-V2X Roadmap 2030, planned for publication in 2024.

Work Item Bridge: Bridging industry and public needs for a common approach to connected mobility
The BRIDGE WI carried the dialogue with European road operators throughout 2022-2023 to identify their priority use cases for traffic and road operations and assess network requirements to enable their deployment.

The WI resulted in two reports. The first presents the prioritised use cases and analyses how MNOs can support the V2X expectations of road operators (Road Operator Use Case Modelling and Analysis). The final technical report concludes that LTE connectivity can meet the requirements of the majority of road operators' prioritised use cases and proposes various strategies to optimise network performance for the communication service providers to support prioritised use cases.
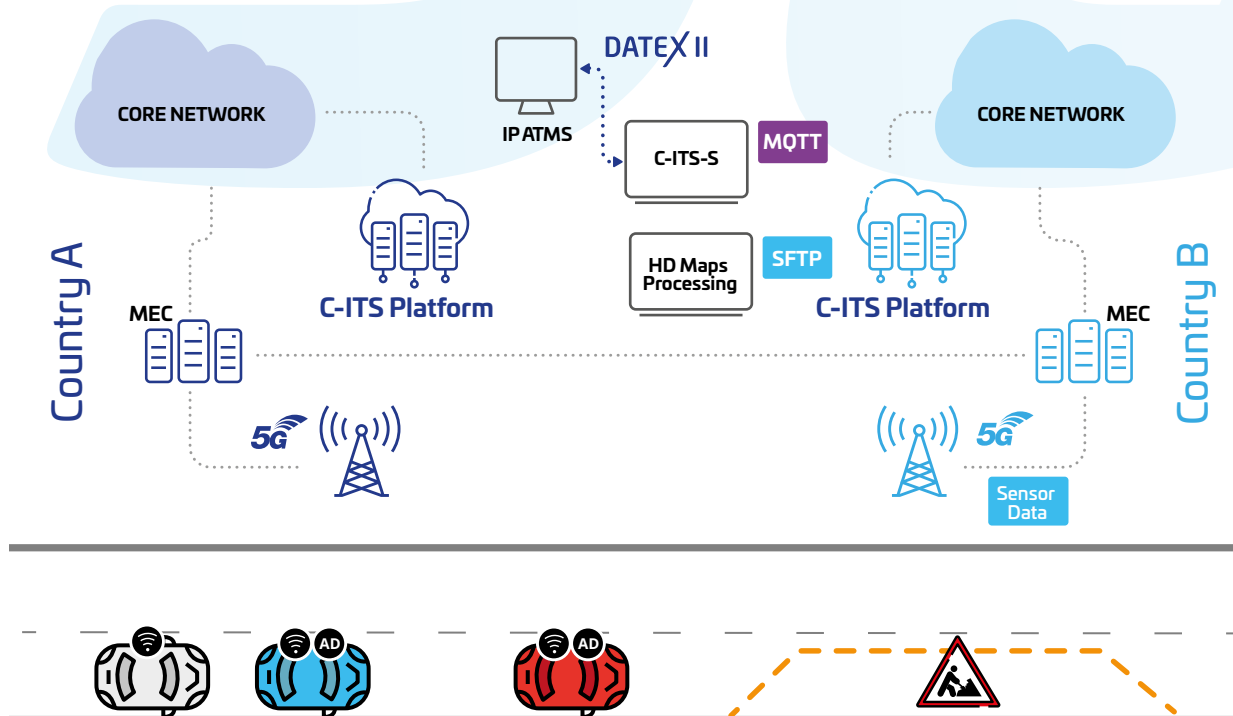
UCID sensor data sharing

As part of the 5GAA's Roadmap, multiple variants of use cases for sensor sharing have been identified as key milestones. While the Technical Reports on C-V2X Use Cases and Service Level Requirements (SLRs) describe these use cases in a technology-agnostic manner, the Technical Report on Use Case Implementations for Sensor Data Sharing[3] complements these descriptions with technology-dependent Use Case Implementation Descriptions (UCIDs) fulfilling the SLRs.

The sensor data sharing UCIDs covered in this technical report included data collection and sharing for HD maps, data sharing of dynamic objects, and non-analysed sensor data sharing. Every use case was provided with different implementation options, e.g. data sharing of dynamic objects via direct communication, or through a data provider using mobile network

communications.

Below is an example of a potential future realisation of the sensor data sharing use case via direct communication.

↘ Scan the QR code to read the publication.
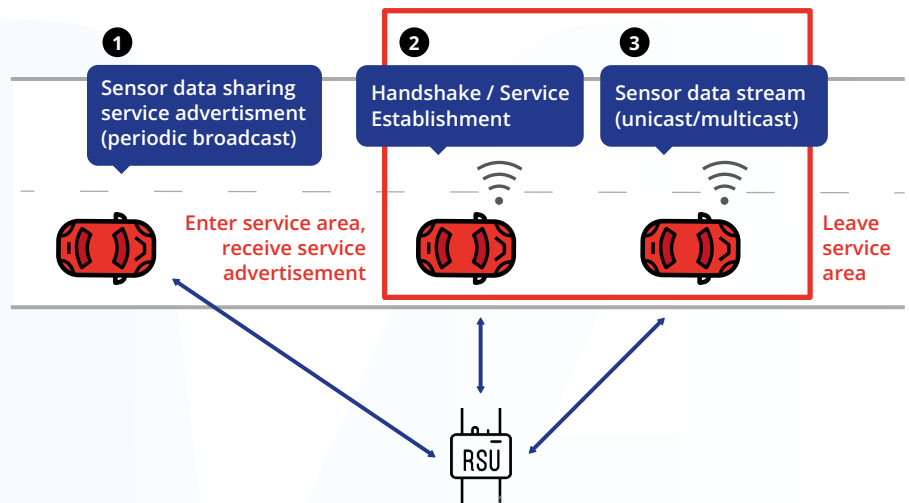
Connected Powered Two-Wheelers with CMC

The Work Item on Connected Powered Two-Wheelers (CPTW) was a joint effort between the 5GAA and its MoU partner, the Connected Motorcycle Consortium (CMC) on how to improve the safety of motorcyclists worldwide. The CMC brought the motorcycling perspective (e.g. motorcycle behaviour, crash statistics, etc.) that allowed 5GAA experts to better understand how specific use cases can be implemented using C-V2X. The cooperation led in

November 2023 to the publication of a Technical Report on C-V2X-enabled Use Cases for Powered Two-wheelers with a focus on safety aspects.

The report concluded that mobile network communications (Uu interface) can increase the safety of PTW riders by connecting them with other ITS stations (vehicles, infrastructure points, and ITS application servers). Direct communication will also play an important

role for PTWs, as recent enhancements in standards have introduced the discovery feature of PC5-enabled CPTWs, to detect and be detected in non-line-of-sight situations and unicast/multicast possibilities on top of the current broadcast options.

5GAA and CMC will continue to cooperate and investigate how to improve powered two-wheelers thanks to C-V2X.

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[3]. https://5gaa.org/content/uploads/2023/02/5gaa-t-220019-use-case-implementations-for-sensor-data-sharing.pdf

5G-V2X OEM industry statement

Building on the Board's agreed messaging on 5G-V2X (approved end 2022), 5GAA has underlined the need for action on the next steps of its strategy to make 5G-V2X a reality.

On 26 September, 5GAA published an Open Statement co-signed by Audi, BMW, Ford, JLR, Mercedes-Benz, Renault, Stellantis, and Volkswagen. The statement signals the industry's readiness to deploy 5G-V2X in Europe within the 2026-2029 timeframe, in line with 5GAA's Roadmap.

With this initiative, and recognising the need to strike a consensus, 5GAA and its members have charted a unified path forward for Europe in an open letter to policymakers, regulatory bodies, and industry players.

The 5GAA announcement echoed the published position of the French Automotive Industry representative body (Plateforme Automobile – PFA, representing also 5GAA members such as Renault, Stellantis, and Valeo) designating 5G-V2X as the technology of choice for V2X direct communication.
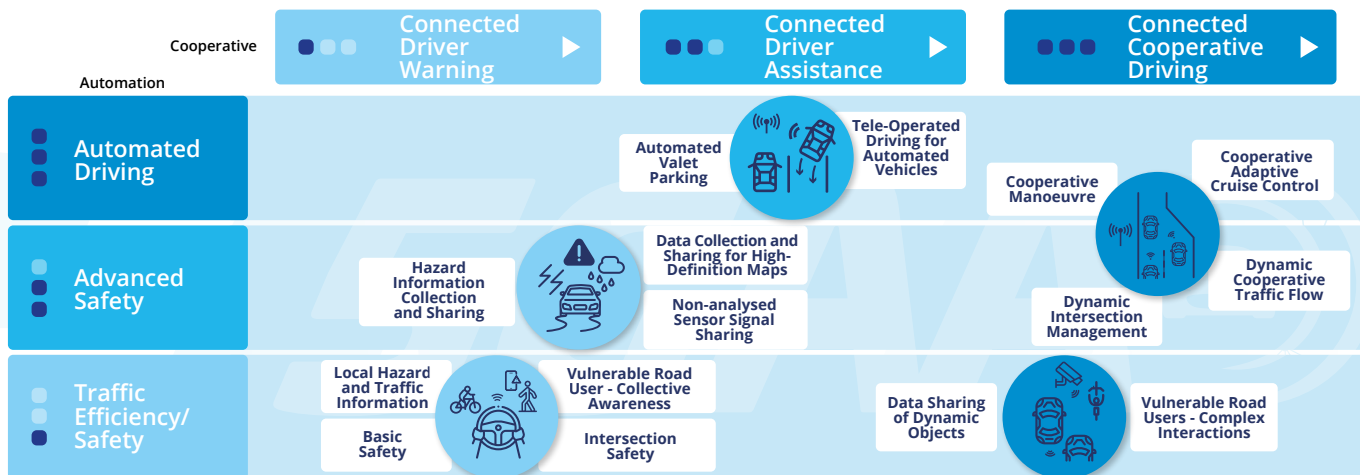
Ready to move forward with state-of-the-art technology, these major European carmakers and 5GAA members (representing jointly over 70% market share of the European fleet) demonstrate their commitment to bridging differences and working together towards the widespread adoption of 5G-V2X.

↘ Scan the QR code to read the statement.

Evolution of C-V2X use cases towards connected cooperative driving

	Connected Driver Warning ● ● ○ ▶	Connected Driver Assistance ● ● ○ ▶	Connected Cooperative Driving ● ● ● ▶
Cooperative Automation			

Automated Driving
- Automated Valet Parking
- Tele-Operated Driving for Automated Vehicles
- Cooperative Manoeuvre
- Cooperative Adaptive Cruise Control

Advanced Safety
- Hazard Information Collection and Sharing
- Data Collection and Sharing for High-Definition Maps
- Non-analysed Sensor Signal Sharing
- Dynamic Intersection Management
- Dynamic Cooperative Traffic Flow

Traffic Efficiency/Safety
- Local Hazard and Traffic Information
- Vulnerable Road User - Collective Awareness
- Basic Safety
- Intersection Safety
- Data Sharing of Dynamic Objects
- Vulnerable Road Users - Complex Interactions

Work Item on 5G-V2X-Direct

On a technical level, 5GAA launched several key activities in 2023 in preparation for 5G-V2X mass deployment.

This included an evaluation of 5G-V2X Direct technology, which had to be realistic enough to cope with automotive requirements, use cases, and system limitations (considering, at least, the first environment for implementation). The Work Item NR-V2X-EVAL White Paper evaluated the relationship between the services, messages, 5G (NR) V2X lower-layer parameters, and data traffic models according to these requirements. Simulation results show that the selected use cases are well supported with 5G-V2X Direct technology while open relevant performance topics related to radio aspects need further investigation and analysis.
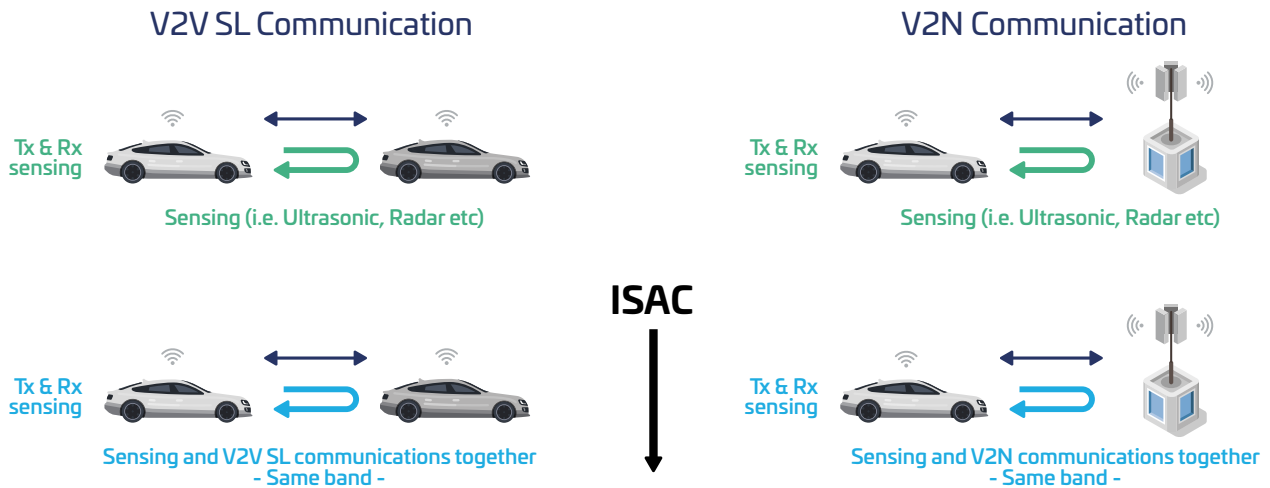
Another important milestone was achieved in 2023 as 5GAA launched the Work Item 5G-V2X-Profiles and hired an external contractor (Fraunhofer) to support the technical advancement of 5G-V2X Direct and feed into relevant SDOs. The Work Item focuses on defining a use case implementation profile, specifically on the triggering conditions and data quality requirements, as well as for advanced capabilities. 5G-V2X Direct profiling would follow a similar approach to LTE-V2X Direct, for which ETSI standardised a system profile that references 3GPP specifications and previous work done in C2C-CC and C-ROADS.

The primary concern for the 5G-V2X-Profiles is to include both basic and advanced safety applications, and the respective message types (e.g. CAMv2, DENMv2, VAM, CPM, etc.). Eventually, the profiles developed in 5GAA should be used by members as the basis for contributions to relevant SDOs in different regions (e.g. ETSI, SAE, C-SAE, etc.).

ISAC for automotive applications

V2V SL Communication

Tx & Rx sensing

Sensing (i.e. Ultrasonic, Radar etc)

Tx & Rx sensing

Sensing and V2V SL communications together
- Same band -

V2N Communication

Tx & Rx sensing

Sensing (i.e. Ultrasonic, Radar etc)

Tx & Rx sensing

Sensing and V2N communications together
- Same band -

ISAC

Beyond 5G evolution

Given that 5G is still in at an early stage of automotive deployment, 5GAA's focus remains on making it happen with currently available technology (LTE-V2X/5G-V2X). This does not preclude 5GAA from investigating short-term improvements that new technology can bring, e.g. precise positioning, non-terrestrial networks, etc.

5GAA's current work scope also entails investigating Beyond 5G (or 5G Advanced) potential, e.g. by identifying potential technology enablers for V2X services, improvements to existing use cases or devising new 'enabled' use cases, liaising with SDOs to align on requirements and expectations from the automotive perspective, etc.

In that regard, the 5GAA Work Item studying the trends and technologies for 5G evolution and beyond (WI-5GEB) published a White Paper, Evolution of Vehicular Communication Systems Beyond 5G, which presents a holistic analysis of 5G communication systems and beyond. The paper reviewed

the expectations of future vehicular communication systems from a requirement and ecosystem point of view, as well as essential features for ubiquitous connected and automated mobility systems, and it provided an overview of potential technology enablers for C-V2X services. Among other things, it highlighted Integrated Sensing and Communications (ISAC) as one of the critical topics. 5GAA is not only closely monitoring progress in the field but also taking a proactive role with a dedicated follow-up WI studying the integration of sensing and communications into one system as well as liaison with 3GPP.

5GAA also monitors the research work on 6G and ongoing R&D projects to better understand what functionalities and Key Performance Indicators (KPI) are to be expected. Another important consideration for 5GAA and the industry overall in the context of such technology evolution is the importance of ensuring service continuity across mobile network generations.

↘ Scan the QR code to read the publication.

Precise positioning

The realisation of fully automated driving depends on highly accurate and reliable positioning systems. In 2023, 5GAA concluded two important work items in relation to precise positioning.
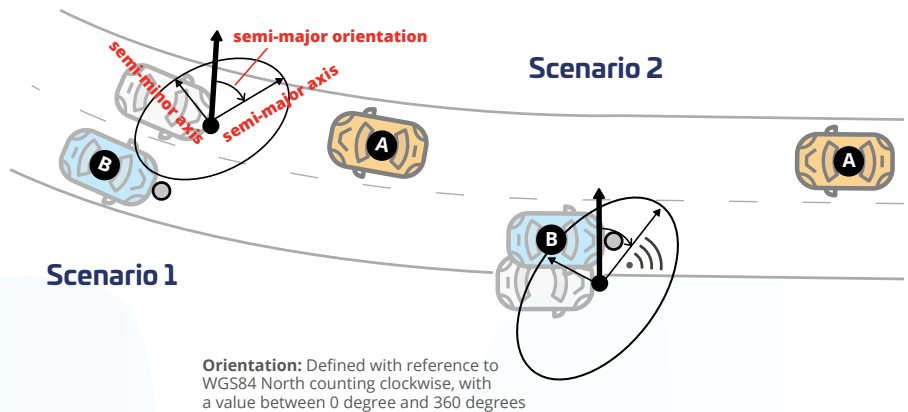
The Work Item Trustable Positioning Methodology for V2X (TPM4V2X) technical report investigated the issue of trustworthiness in relation to position information exchanged in the context of V2X communication (i.e. how much trust the ITS station can place in the received V2X message containing the positioning information).

To understand the problem of trust in the context of standardisation, the report provides an overview of the current standards related to positioning, including the integrity of the position and confidence levels, and it reviews the definitions and metrics used so far. It then analyses the gaps in the current/available V2X standards related to the confident use of such positioning information. Based on these key findings, 5GAA provided recommendations to key SDOs.

Work related to trustworthiness continues in 5GAA under WIs STICAD II and Trust4Auto, e.g. on test methodologies, extension to Day 2 scenarios. At a later stage, new activities should be envisaged to define specific methodologies and metrics for positioning trustworthiness related to the integrity concept.

The 5GAA Work Item Evaluation of Radio-Based Positioning Enhancements for Automotive Use Cases (EPos) provided an in-depth look at the evolving landscape of positioning techniques for safe driving, with a particular focus on automotive use cases.

One of the key takeaways is that the pursuit of precise positioning should be tailored to specific prerequisites. For example, safety-critical applications, such as VRU protection at an intersection require extremely high accuracy to prevent accidents and protect road users. On the other hand, less critical applications, such as infotainment systems, may have less stringent positioning requirements.

By leveraging these additional insights included in the technical report, stakeholders in the automotive industry can work together to further develop innovative positioning solutions that enhance safety, efficiency, and the user experience.

- ○ True position (corresponding to the reference point given in V2X standard
- ● Reported position
- ● Vehicle A receiving the information of vehicle B

Scenario 2

Scenario 1

semi-major orientation

semi-minor axis

semi-major axis

Orientation: Defined with reference to WGS84 North counting clockwise, with a value between 0 degree and 360 degrees

MEC publications

5GAA and its members released several publications in 2023 covering different topics in Multi-access Edge Computing (MEC) scenarios important to the V2X field.

One report, entitled Predictive Edge Analytics and Network Slicing Enabling Mobility-as-a-Service in Global MEC Scenarios, analyses how such analytics can be generated and delivered in distributed MEC deployments. Another report, Cybersecurity for Edge Computing, studies cybersecurity aspects related to MEC deployments in multi-MNO, multi-OEM, and multivendor environments. It considers security, privacy, and trust threats and assesses the suitability of available mitigation strategies for MEC scenarios.
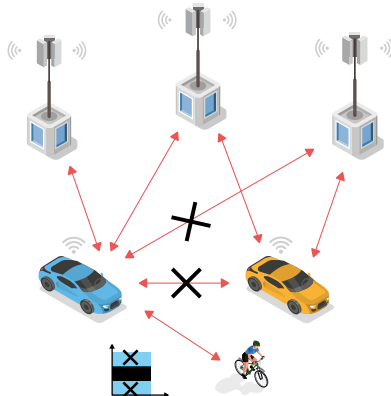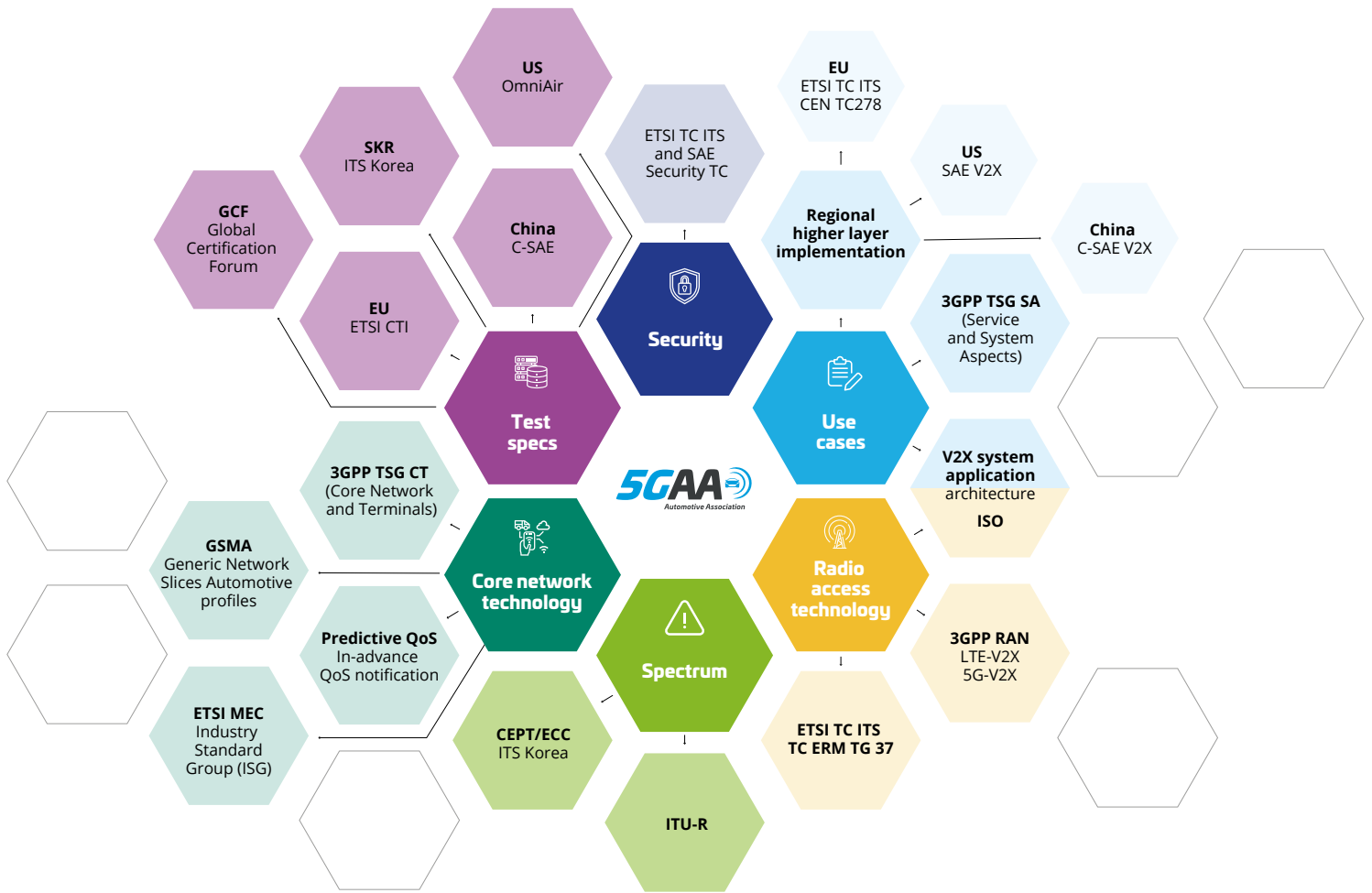
↘ **Positioning accurancy depends on available deployment, bandwidth, device capacity.**

↘ Scan the QR code to read the report.

↘ Scan the QR code to read the publication.

Contributing
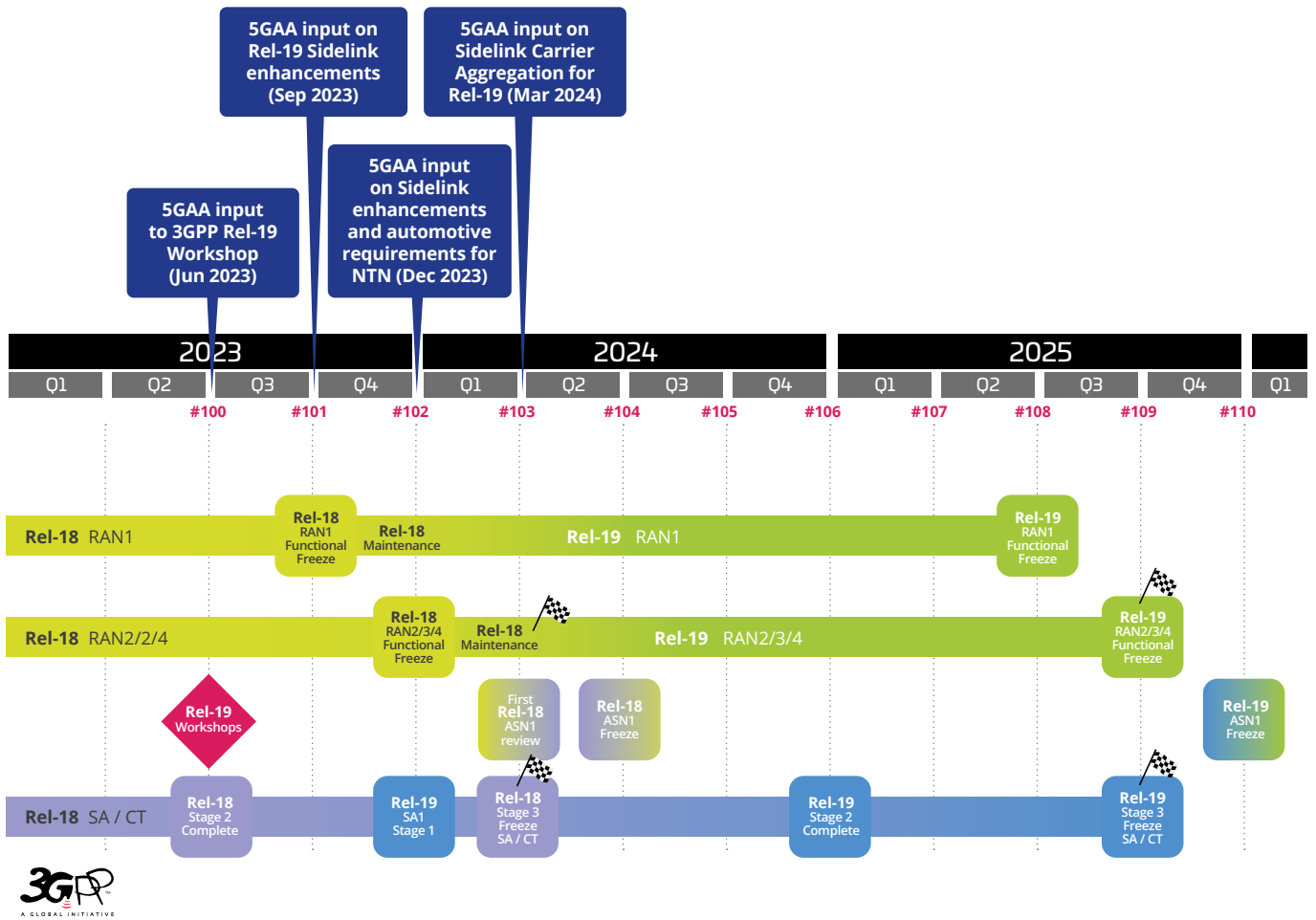## to standardisation

3GPP Release-19 priorities submission

As a global cross-industry association bringing together the automotive, technology, and telecommunications industries, 5GAA participates in 3GPP Release-19 (Rel-19) discussions by providing unique input as official Market Representation Partner (MRP). Ahead of the 5GAA F2F meeting in Seoul, all 5GAA members were invited to submit and rate proposals (in terms of priority and relevance) for input to the first 3GPP RAN Rel-19 Workshop. Following internal discussions in WG4 and Board approval, 5GAA then submitted its consolidated proposals

for new features and requirements, as well as a study item, as input to 3GPP RAN Rel-19 Workshop in June 2023. Following this, 5GAA provided several inputs to 3GPP RAN meetings on topics of interest for the automotive sector, such as satellite connectivity (i.e. Non-Terrestrial Networks, NTN), sidelink enhancements and integrated sensing and communications.

A key priority topic for 5GAA's membership relates to NTN Satellite Connectivity High-Level Requirements for automotive. For the 3GPP RAN

#102 meeting in December 2023, 5GAA provided 3GPP details on automotive vehicle-mounted NTN user equipment (UE) characteristics and additional parameters to be considered in the 3GPP definition of appropriate UE types as part of Rel-19 work.

Satellite connectivity is an increasingly important topic for automotive connectivity and 5GAA is eager to continue its support of 3GPP in ensuring that next-generation connectivity meets automotive requirements.

5GAA input on Rel-19 Sidelink enhancements (Sep 2023)

5GAA input on Sidelink Carrier Aggregation for Rel-19 (Mar 2024)

5GAA input to 3GPP Rel-19 Workshop (Jun 2023)

5GAA input on Sidelink enhancements and automotive requirements for NTN (Dec 2023)

2023	2024	2025	
Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1

#100 #101 #102 #103 #104 #105 #106 #107 #108 #109 #110

Rel-18 RAN1 — **Rel-18** RAN1 Functional Freeze — **Rel-18** Maintenance — **Rel-19** RAN1 — **Rel-19** RAN1 Functional Freeze

Rel-18 RAN2/2/4 — **Rel-18** RAN2/3/4 Functional Freeze — **Rel-18** Maintenance — **Rel-19** RAN2/3/4 — **Rel-19** RAN2/3/4 Functional Freeze

Rel-19 Workshops

First **Rel-18** ASN1 review — **Rel-18** ASN1 Freeze — **Rel-19** ASN1 Freeze

Rel-18 SA / CT — **Rel-18** Stage 2 Complete — **Rel-19** SA1 Stage 1 — **Rel-18** Stage 3 Freeze SA / CT — **Rel-19** Stage 2 Complete — **Rel-19** Stage 3 Freeze SA / CT

3GPP — A GLOBAL INITIATIVE

Regional standards (ETSI/SAE/C-SAE)

5GAA is actively monitoring and contributing whenever necessary to regional standardisation work. In Europe, this includes ETSI Rel-2 standards, in particular the ongoing adoption of access layer specifications for LTE-V2X and NR-V2X. 5GAA is also working on better understanding mitigation techniques to avoid interference between road tolling and ITS in the 5 GHz frequency range.

In 2023, 5GAA provided input to the China-SAE (C-SAE) Roadmap for the Convergence of Automation and Connectivity Based on C-V2X, highlighting the comprehensiveness of the plans in China for C-V2X deployment with different stages of vehicle-infrastructure-cloud deployment and connectivity levels. In its response, 5GAA members noted the challenge of connectivity coverage as the technology evolves from Warnings to Cooperative Advanced Driver Assistance Systems (C-ADAS) to Cooperative Automation Driving System (C-ADS), and they recommended matching the C-SAE levels of cooperation with specified SAE levels, which also match 5GAA Roadmap use cases.

5GAA also engaged with International Telecommunication Union Collaboration on ITS Communication Standards (ITU CITS) regarding the potential establishment of an Expert Group on Communications Technology for Automated Driving. The group might explore the communications technologies for vehicles, including those to be installed in all new vehicles to achieve the required volume of equipped vehicles necessary to enable reliable automated merging. This was in the context of the creation by the UNECE World Forum for Harmonisation of Vehicle Regulations (WP.29) of a Task Force on Vehicular Communications (TF VC) under the ITS Informal Group, which is expected to lead to more extensive regulations for automated driving.

External partnership: certification bodies

The collaboration between 5GAA and C-V2X certification bodies continued to focus primarily on three partner organisations: the Global Certification Forum (GCF), the OmniAir Consortium (US-based) and IMT2020 PG (China-based).

The GCF Connected Vehicle Work Stream (CVWS) enables compliance assessment for the connected vehicles industry by managing the development of relevant processes and certification criteria for a standalone certification programme covering connected vehicles. In 2023, 5GAA WG3 experts provided GCF inputs and feedback on test cases (conformance and interoperability) and on automotive product type categorisation.

Over the course of 2023, OmniAir was invited to present at 5GAA F2F Meetings in The Hague (NL) and Detroit (US). On these occasions, OmniAir provided an overview of their testing activities and results related to their yearly Plugfest event.

Moreover, in its pursuit of a harmonised framework for C-V2X certification schemes, 5GAA investigated the differences in test parameters between those used by OmniAir and those developed by 3GPP and used by GCF.

5GAA continued its close engagement with IMT2020, whose representatives were also able to join two F2Fs, both in person and virtually. IMT2020 provided valuable insight into the C-V2X testing ecosystem in China and explained the past and ongoing testing activities being conducted. For instance, in the city of Shenyang, IMT2020 held a C-V2X safety application demonstration showcasing cross-regional interoperability and service consistency. The findings included areas requiring improvements, such as interoperability across different service providers and the level of perception accuracy.

US Deployment Guidance

In 2023, 5GAA published guidance to serve as a straightforward reference for Day 1 LTE-V2X deployment in the United States. It is primarily targeted at IOOs to guide planning and installation of connected infrastructure, providing a tightly focused message set for Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) necessary to support Day 1 applications.

The guidance includes the SAE J3161 communication profiles and parameters so that vehicle OEMs and IOOs have a common channel access and set of rules for optimal use of the 20 MHz LTE-V2X radio spectrum (defined Channel 183). The goal is to ensure V2X communications provide the interoperability and data integrity to support the requisite performance of the various implementations utilising the Day 1 messages.

Led by 5GAA in the WI US_DPLOY, this technical report and guide is a result of cooperation with several 5GAA partners, including the Crash Avoidance Metrics Partners (CAMP), Utah Department of Transportation, the National Electrical Manufacturers Association (NEMA), IOOs OmniAir and ITS America, and University of Michigan researchers.

5GAA will continue supporting regional standardisation efforts with a view to greater international harmonisation.

↘ Scan the QR code to read the report.

Engaging with policymakers

European policy

The industry, including major European carmakers, is moving towards 5G-V2X, including direct communications, as the future reference technology for automotive direct connectivity and an essential enabler of automated driving. This commitment, along with the adoption of the ITS Directive, is expected to drive the deployment of and demand for connected cars in Europe. The 5GAA Visionary 2030 Roadmap anticipates mass deployment of 5G-V2X in commercial vehicle models between 2026 and 2029.

ITS Directive
In October 2023, The European Parliament approved the revision of the ITS Directive. This marked the end of almost two years of work for 5GAA and represented a clear success for the association's advocacy efforts, including provisions on key priorities such as technology neutrality, and supporting industry efforts towards large-scale deployment of intelligent transport systems across Europe.
5GAA has now turned its attention to the ITS Work Programme 2024-2028, with work scheduled to begin between the European Commission and the wider ITS ecosystem in March 2024. While the content of the Work

Programme is not yet public, 5GAA is already working closely with partners in both the public and private sector, and this work will remain a priority throughout 2024.

eCall
In April 2023, the Commission released two draft regulations to revise the eCall standards, following the European standardisation organisations (ETSI, CEN) adopting new eCall-related technical specifications based on packet-switched networks. The regulation aimed to include reference to the new NG eCall standards and technical specifications both in-vehicle and for Public-Safety Answering Points (PSAPs), as MNOs are planning the phase-out of 2G/3G.

5GAA successfully engaged its members to find cross-industry compromise and published a position paper requesting the Commission to address discrepancies within certain timelines and underlining the need to future-proof the regulation with explicit mention of technology evolution and associated best practices, among others. 5GAA reached

out to various policymakers within the Commission, addressing industry's priorities and concerns on the implementation of NG eCall.

5GAA continues to work on the topic of eCall, with ongoing discussion about coordination of testing activities for the implementation of NG eCall (foreseen to be mandated as of 2026/2027), as well as to find cross-industry compromise when it comes to the continuity of services for the legacy fleet, once 2G/3G will be phased out.

5G-V2X
Following up on the 5G-V2X OEM industry statement in September 2023, 5GAA focused on engaging with policymakers and other ecosystem stakeholders to address possible obstacles to 5G-V2X deployment. Among these, 5GAA advocates to the European Conference of Postal and Telecommunications Administrations (CEPT) to achieve a suitable 5.9 GHz band configuration for road ITS deployment in Europe (WI 5G-V2X EU) and coexistence with non-3GPP technologies.

US policy

In 2023, 5GAA increased its engagement in the US thanks to the appointment of John Kwant as 5GAA's Executive Director, Americas. This led to increased dialogue with public institutions and a stronger presence at US-based events.

5GAA participated in the US DOT industry consultation on a National V2X Deployment Plan and several V2X Communications Summits organised in April and October 2023. 5GAA highlighted the existing capabilities in the industry that can support several

public goals related to connected transportation: road safety, traffic efficiency, sustainable transportation, and social equity.

To enable further mass deployment, 5GAA published a technical report on deployment of Day 1 safety use cases, serving as a guide for the deployment and installation of connected infrastructure, and the association has provided expert input on a vision for a connected roadside digital infrastructure for optimised traffic operations.

5GAA continues to engage with US federal and state entities to enable deployment of C-V2X applications, which are expected to improve road safety and traffic operations. 5GAA works on ensuring deployment of C-V2X direct communications in the 5.9 GHz band by supporting waiver applicants with resources and expertise, and engages with the Federal Communications Commission (FCC) to ensure that ITS to be deployed in the upper 5.9 GHz band will operate free of harmful interference.

Asia Policy

South Korea

In May 2023, 5GAA Meeting Week and Conference in Seoul allowed members to gain insights into South Korea's technology roadmap, including 5G-V2X performance verification and data collection of VRU safety application in real-life road conditions.

In December 2023, the country decided to opt for C-V2X direct communications as its technology of choice, complementing C-V2X mobile network communications to offer a synergetic platform for connected mobility.
In addition to designating 20 MHz of the 5.9 GHz frequency band to C-V2X direct communications back in 2022, South Korean authorities have announced follow-up measures, including revising spectrum regulation, and updating technical standards.

The decision followed a comprehensive analysis of global technology trends, the needs of automotive and telecommunications industries, road operators, and public authorities as well as extensive testing, to which 5GAA and its members positively contributed.

This all aligns with 5GAA's vision for a connected future and is an influential example for other nations. South Korea's choice aligns with the growing global trend towards C-V2X as the preferred technology for widespread ITS deployment, promising societal, economic, and environmental benefits.

Japan

In Japan, 5GAA followed the latest developments of the Next Generation ITS Study Group on 5.9 GHz. After a public consultation, the Ministry of Internal Affairs and Communications adopted an interim report in August which proposed considering the upper 30 MHz in 5.9 GHz assignment for V2X direct communication. The report is expected to serve as a basis for a related Study Group to discuss the 5.9 GHz assignment plan, technical aspects, and migration plans, among other elements. Furthermore, 5GAA's Working Group for Japan (WG6-Japan) played a pivotal role by submitting comments on the FY2023 frequency reorganisation action plan.

The WG began collaborating with ITS Forum Japan to facilitate discussions and engagement with Japanese companies and organisations. Additionally, 5GAA partnered with ITS Forum to organise face-to-face meetings and workshops in Tokyo in Q1 2024.

China

In 2023, WG6 China initiated a new work item to provide an update to Technical Reports published in 2022 as regards the China V2X State of Play on policies and regulation, standardisation, and pilot and demonstration areas. The group provided regular updates to 5GAA members about ongoing developments in China such as the launch of three new National Pilot Areas (Xiangyang in Hubei Province, Deqing in Zhejiang Province, and Liuzhou in Guangxi Province).

Through 2023, MIIT announced the release of the "Guidelines for the Construction of the National Connected Vehicle Industry Standard System (Intelligent Connected Vehicles) (2023 version)". These guidelines aimed to leverage the normative role of standards in the construction of the ecosystem of the Connected Vehicles industry, adapt to the new trends, features, and demands of the development of intelligent connected vehicles in China, and accelerate the construction of a new intelligent connected vehicle standard system. It is an inheritance, extension, and improvement of the 2018 version.

5GAA has also closely monitored the developments surrounding the China Shifting Algorithm and its impact on V2X, tracking progress and delivering timely updates and insights to our members. This diligent monitoring has kept our members well-informed throughout the resolution process, successfully addressing the challenges associated with the China Shifting Algorithm).

In October of the same year, as part of his trip to China for the ITS World Congress, as well as to visit Chinese members, 5GAA's CTO Dr Maxime Flament attended the successful C-V2X Function Verification Demonstration. The demonstration was organised jointly by IMT 2020 (5G) PG C-V2X WG, C-SAE, CAICV and 10 OEMs, 3 terminal providers and a map provider. Cooperation with C-SAE to align our respective organisations' roadmaps for 2030 kicked-off in Q4 2023.

Communicating
internally and externally

Communication and positioning of 5GAA

Over the past seven years, 5GAA has raised awareness of the industry's need for C-V2X technology, positioning it as the optimal solution to navigate global challenges in mobility and connectivity.

We do this through a combination of organising internal events and demonstrations for members, participating in external events, and keeping both members and the rest of the world up to date on the association and the industry's progress on the deployment of C-V2X technology in the market.

Authoritative voice in ITS

ITS America Conference – Texas, US

5GAA invited the ITS stakeholder community and road infrastructure-owner operators to participate in an interactive session focused on the system benefits of C-V2X technology at the ITS America Conference, in April 2023. Participants discussed the emerging guidebook for Day 1 foundational deployments, including building consensus on expectations and how applications can be deployed in 5.9 GHz to save lives.

ITS European Congress – Lisbon, Portugal

Leveraging the presence of the connected mobility ecosystem at the ITS European Congress, 5GAA organised a roundtable bringing together 15 road operators representing Sweden, Portugal, Spain, Finland, Romania, Czechia, Germany, Belgium, UK, and The Netherlands. The discussion focused on the understanding of the various infrastructure models across the EU and laid the groundwork for follow-up conversations on future harmonisation.

ITS WC Congress – Suzhou, China

5GAA played an important role in the ITS World Congress 2023 held in Suzhou, China, by hosting a special interest session that delved into the intricacies of C-V2X technology. Moderated by 5GAA's Chief Technology Officer Maxime Flament, the session provided a comprehensive exploration of the technology's market readiness and its crucial role in ensuring safe mobility.

5GAA: A key partner for cross-industry discussions

European Space-enabled Connectivity Solutions for the Car of the Future Workshop – Munich, Germany

Early November, the German Space Agency at DLR, the European Space Agency, 5GAA, and the German ESA Business Applications Ambassador, with the support of BMW, organised a one-day workshop highlighting the role of satellite solutions in achieving a full-scale digital transformation of the automotive sector. The event was attended by more than 200 high-level participants from national and EU authorities to industry stakeholders and civil society representatives, and it re-confirmed the association's added value in bringing together various sectors towards one common goal – a fully connected mobility ecosystem.

Raising 5GAA's profile at events

A key feature of 5GAA's outreach includes attending and often actively participating in high-profile events representing our members' diverse industries, technologies, and interests. Major communications actions and profile-raising events in 2023 included:

➘ Ahead of the global tech event CES 2023, 5GAA developed a member brochure to spotlight our members' activities. This document provided a comprehensive overview of the diverse initiatives and contributions made by our members within the realm of connectivity. Beyond individual achievements, the brochure strategically underscored the substantial footprint of 5GAA at CES, emphasising our collective impact on the event.

➘ 5GAA attended the 2023 Mobile World Congress in Barcelona (MWC), the largest annual gathering in connectivity. Participating alongside high-level executives from leading global tech companies, government representatives, and emerging businesses shaping the connectivity landscape, 5GAA made a significant impact. At the event, the association set up an informative booth providing attendees insights into its activities and the advantages of being a 5GAA member.

➘ In 2023, 5GAA earned more recognition as an influential association in the field of 5G technology in the automotive industry by securing 38 global speaking slots, underlining its pivotal role in shaping the conversation around the intersection of telecommunications and automotive innovation.

➘ As the association continues to drive discussions and initiatives, it remains at the forefront of fostering collaboration and advancements in the dynamic landscape of 5G connectivity.

Notable meetings hosted

5GAA also organised or co-hosted several high-level activities and face-to-face meetings to delve into key challenges and opportunities in connected and automated mobility. Notable examples included:

⤵ A workshop dedicated to C-V2X Mass Market Deployment in Real-Life Traffic. The session focused on connected mobility for road management in The Netherlands and Flanders (BE), and the benefits of connected mobility services for end users.

⤵ A high-level conference – The Future of Connected Mobility in South Korea –brought institutional stakeholders together with industry representatives to discuss how connected mobility and ITS can advance road safety and automated driving in the Korean transport ecosystem.

GROWING 5GAA ONLINE PRESENCE
*AS OF 31 DECEMBER 2023

22,411
followers on Twitter and LinkedIn combined
(journalists, industry experts, broader ecosystem, and policymakers)

62,717
visits on 5GAA website

14
news items

18
publications

400K
organic impressions on social media

6
5GAA online events

Global media coverage

Interviews with leading 5GAA figures in major media outlets explored the intersection of connectivity and automotive innovation, showcasing the association's growing importance as the voice of connected mobility worldwide.

Indeed, 5GAA's CTO Maxime Flament shared insights on the future of C-V2X deployment in North America, emphasising the technological forces propelling the automotive industry forward, and safety enhancements for pedestrians and cyclists.

Gallery of media relations highlights

During MWC 2023, 5GAA organised a press tour to guide a dozen journalists around the exhibits and explore members' latest market innovations. The visits included prominent companies such as Qualcomm, Vodafone, Ericsson, Rhode & Schwarz, and more, showcasing the collaborative and innovative spirit of 5GAA within the dynamic connectivity ecosystem.

Internal communication

While external communications are key to building awareness of 5GAA and its achievement, effective internal communications are equally important to the success of the association. Seamless internal collaboration fosters a sense of unity and cultivates a shared vision among the members.

In 2023, 5GAA's communications team(s) continued to ensure that members' news and relevant industry developments were communicated in a timely and effective manner.
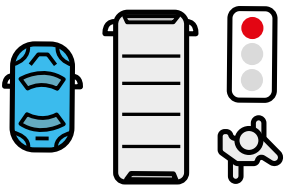
Newsletters

5GAA regularly sends out newsletters to all members, reporting on recent achievements as well as highlighting upcoming milestones or activities relevant to the association and its members.

In 2023, **six internal newsletters** were sent out to over **1,700 subscribers** – all representing 5GAA member companies.

Master icon and slide library

In 2023, 5GAA decided to look for new ways to better support its members. One project agreed was to create a shared library of icons relevant to connected mobility that all members can use for the sake of consistency in messages and simplifying sometimes technical topics. Additionally, the association managed and updated a master slide library that serves as a comprehensive point of reference for all 5GAA members.

- Icon library: This centralised set of visual resources, fully compliant with the association's brand guidelines, provides members with essential elements of the mobility landscape, including pedestrians, intersections, antennas and more.

- Slide library: An extensive slide deck, frequently updated to reflect the latest and accurate information – 5GAA mission and values, membership, technology evolution, regional developments, etc.

Community building sessions

5GAA also likes to treat the extended community or ecosystem of stakeholders in connected mobility as part of the family, especially on technological advances that require greater awareness as a condition for wider uptake. As such, the team organises an outreach and engagement through Community Building Sessions (CBS). In the 2023 the programme included **four such CBS events**/actions.

5GAA MEMBERS - DECEMBER 2023

AIRBUS · ALPS ALPINE · American Center for Mobility · AMERICAN TOWER · Anritsu · Anting · Shanghai International Automobile City · Apple · applied INFORMATION · AT&T · Audi

AUTOCRYPT · Autotalks · AVL · Baidu · Bell · BMW GROUP · BOSCH · BUREAU VERITAS · CAERI · Capgemini engineering

cavnue · China Mobile · China unicom · CISCO · Cohda Wireless · commsignia · Continental · continual · CTAG · DANLAW

Datang Telecom · DEKRA · DENSO · DESAY SV · Deutsche Messe · T (Deutsche Telekom) · EQUINIX · ERICSSON · ETTIFOS · FAW

ferrovial · FET · FEV · flex · Ford · Fraunhofer · FUTUREWEI Technologies · General Test · gm · here

HEXAGON NovAtel · HONDA · HUAWEI · HYUNDAI · HYUNDAI MOBIS · Infineon · intel · INTERDIGITAL · jember · JLR

KDDI · KEYSIGHT TECHNOLOGIES · LEAR CORPORATION · LG · LINKS · lmt · MARBEN · Mercedes-Benz · microsec · Microsoft

MITSUBISHI ELECTRIC · molex · monotch · MVG Microwave Vision Group · NIO · NISSAN MOTOR CORPORATION · NOKIA · NSI MI AMETEK · NTT docomo · OKI

orange · Panasonic · PIRELLI · QORVO · Qualcomm · QUECTEL · RANIX · Renault Group · RISE · ROGERS

ROHDE & SCHWARZ · ROLLING WIRELESS · SAESOL TECH · SAMSUNG · s·e·a · SGS · SiriusXM · SoftBank · SONY · SPORTON LAB.

STELLANTIS · stellar · SUMITOMO ELECTRIC · Swift NAVIGATION · SwRI · SYNTONY GNSS · Telstra · TATA COMMUNICATIONS · Telit Cinterion · TELUS

Tencent · TIM · TNO · TOPCON · TÜV Rheinland · u-blox · UNIO ENTERPRISE · UNIVERSITY OF MICHIGAN · Valeo · INSTITUT VEDECOM

verizon · vodafone · VW · VOLVO · ZF · ZTE

The 5G Automotive Association (5GAA) is a global, cross-industry organisation of companies from the automotive, technology, and telecommunications industries (ICT), working together to develop end-to-end solutions for future mobility and transportation services. Created in September 2016, 5GAA has rapidly expanded to include key players with a global footprint in the automotive, technology and telecommunications industries. This includes automotive manufacturers, tier-1 suppliers, chipset/communication system providers, mobile operators, and infrastructure vendors.