

5GAA response to the draft RSPG Opinion on a Radio Spectrum policy Programme

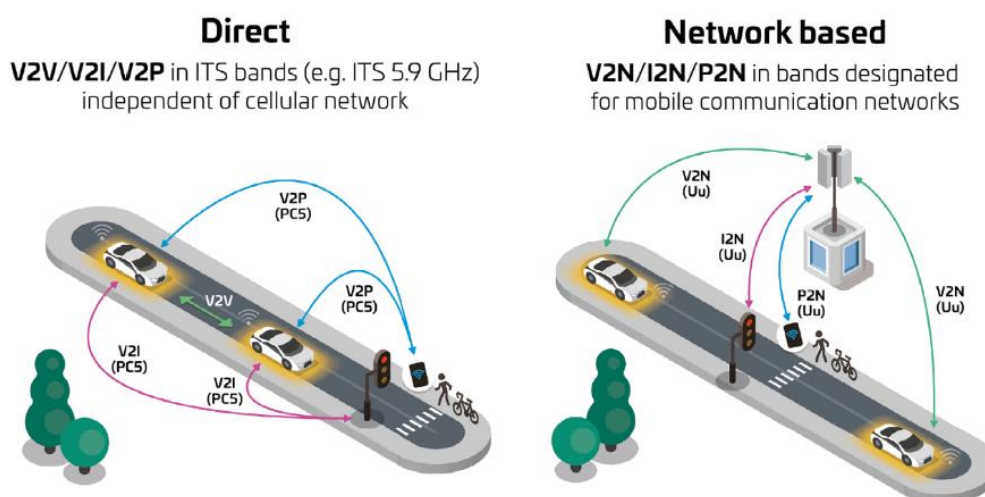
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5GAA welcomes the opportunity to comment on the draft RSPG Opinion on a Radio Spectrum Policy Programme. We first provide a brief introduction to C-V2X, and then address the specific points raised in the draft Opinion.

Cellular V2X (C-V2X)

In its roadmap¹ white paper published in 2020, 5GAA sets out a consolidated view of the automotive and telecommunications industries on the evolution of communication technologies, their application to automotive connectivity, and the deployment of advanced driving use cases up to 2030, which include advanced safety and automated driving.

In this roadmap, 5GAA identifies a number of promising advanced driving use cases, which can be supported by Cellular Vehicle-To-Everything (C-V2X) technologies² – LTE-V2X and 5G-V2X – for direct communications (between road users) and/or mobile network-based communications. These two modes of communications are illustrated below.



As explained in 5GAA's spectrum needs study³, the identified use cases can be classified as:

- "use cases which involve direct communications among road users or between road users and ITS roadside infrastructure (so-called V2V, V2I, V2P) as supported by the C-V2X (PC5) interface in the 5.9 GHz band harmonised globally for ITS, and

¹ 5GAA, "A Visionary Roadmap for Advanced Driving Use Cases, Connectivity Technologies, and Radio Spectrum Needs," September 2020.

² Cellular-V2X (C-V2X) is an umbrella term which encapsulates all 3GPP V2X technologies, including both direct (PC5) and mobile network communications (Uu). LTE-V2X relates to all 3GPP releases supporting LTE-V2X mobile network communications and LTE-V2X direct communications. LTE-V2X mobile network communications relate to 3GPP specifications, starting with Rel. 8 for LTE. LTE-V2X direct communications relate to 3GPP specifications, starting with Rel. 14. 5G-V2X relates to the combination of LTE-V2X and 5G radio access technology (NR). 5G-V2X mobile network communications is a combination of LTE-V2X mobile network communications and 5G radio access technology for mobile network communications (NR), which relate to 3GPP specifications, starting with Rel. 15. 5G-V2X direct communications is a combination of LTE-V2X direct communications and 5G radio access technology for direct communications, which relate to 3GPP specifications, starting with Rel. 16.

³ 5GAA, "Study of spectrum needs for safety related intelligent transportation systems – day 1 and advanced use cases," June 2020.

- use cases which involve network-based communications between road users and mobile network base stations (so-called V2N) as supported by the C-V2X (Uu) interface in bands designated and licensed for use by mobile communication networks,

where the term “road user” includes vehicles and pedestrians.”

Points raised in the draft Opinion

3.3. Transport

- Member States should ensure the availability of spectrum for public transport purposes and implement relevant EU Decisions for FRMCS and ITS urban rail supported by coherent European standardisation initiatives (including for example FRMCS receivers). Member States should support the development, where appropriate, of any additional spectrum measures such as cross border coordination or sharing with others usages or use of innovative 5G services, including commercial networks, if compatible with other non-spectrum EU regulations.

Source: RSPG Draft Opinion

5GAA strongly supports the European Commissions’ 5G Action Plan objective to achieve uninterrupted 5G coverage along main transport paths across Europe by 2025, as an essential enabler to connected and automated driving, to achieve a safer, smarter, and more sustainable mobility.

The availability of harmonised spectrum for ITS at 5.9 GHz for V2V/V2I/V2P communications, as well as sufficient amounts of low-band and mid-band spectrum for 5G mobile networks are essential elements for the achievement of this target.

On the 5.9 GHz band

5GAA recommends that Member States make available the frequency range 5915-5925 MHz for road ITS infrastructure-to-vehicle (I2V) connectivity, efficiently coordinated – where necessary – with urban rail ITS, as set out in the Commission Implementing Decision (EU) 2020/1426.

On the mobile network bands

In relation to cross border coordination of 5G mobile networks, 5GAA encourages Member States to take whatever action necessary to minimise the likelihood of inter-network interference which might result due to lack of synchronisation of uplink/downlink frame structures in neighbouring countries.

- European Commission and Member States should monitor ITS market developments and evolution of European standards and technology supporting ITS usage in order to maintain efficient usage of EU harmonised spectrum. Due to technology neutrality implemented in spectrum regulation, any support to a particular ITS road technology remains at the initiative from European Commission.

Source: RSPG Draft Opinion

ITS use cases and spectrum needs

In 2020, we expect that use cases such as Traffic Information and Local Hazard will be complemented with C-V2X direct communication and will lay the foundations for road safety and traffic efficiency. From 2022 onwards, advanced use cases such as Hazard Information Sharing for Automated Vehicles (AVs) and HD Map Sharing for AVs will gradually contribute to the building blocks required for automated driving.

Initial versions of certain advanced V2N use cases, such as Tele-Operated Driving and Automated Valet Parking, can already be implemented today by individual OEMs with LTE-V2X network-based communications and on-board sensors in controlled environments, such as on private campuses. By 2025/26, we expect that these use cases will be extended to operate in more complex environments and scenarios, such as on public roads and in parking garages, leveraging 5G-V2X.

Cooperative Manoeuvres (via direct communication) and Sensor Sharing to support cooperative perception – both basic functionalities for automated driving, e.g. Highway Pilot – are supported by 5G-V2X. We predict that all new AD vehicles will be equipped with 5G-V2X from 2026, in line with their mass production and entry to the market. Complex interactions between vehicles and VRUs via mobile phones – through both direct (PC5) and network-based (Uu) C-V2X communications – are foreseen to start by 2027.

It is to be noted that, in the foreseeable future, we will have a combination of connected and automated vehicles co-existing with normal vehicles that are not enabled by automated driving functions. Connectivity will support automation levels, but also bring benefits to mixed traffic situations, already enabling some use cases on the road to automation.

High-Definition Sensor Sharing, based on 5G-V2X will support the development of further automated driving levels in the future, with first pilots expected after 2026. Enhanced urban and highway pilots are expected to start in 2029 in dedicated areas allowing Dynamic Cooperative Traffic Flow and Dynamic Intersection Management.

According to our studies, additional spectrum for direct communications (including the entire 5850-5925 MHz band globally harmonised for ITS) and for mobile network-based communications (particularly below 1 GHz low-band frequencies and 1-7 GHz mid-band frequencies) will have to be made available for the implementation of many of the use cases identified in the roadmap. This is particularly the case for HD Map Sharing (Uu), Tele-Operated Driving (Uu), Cooperative Manoeuvres (PC5), Sensor Sharing (Uu/PC5), Dynamic Intersection Management (Uu+PC5), Dynamic Cooperative Traffic Flow (PC5), and Complex Interactions with VRUs (Uu+PC5).

Technology neutral spectrum regulations

5GAA supports the technological neutrality principle of European spectrum regulations, and considers this to be important to foster the deployment of the next generation of ITS services according to the technological evolution driven by the market.

Today (and even more so in the future), different V2X technologies co-exist in parallel with other technologies e.g., sensor-based safety systems. Therefore, the regulations should focus on achieving safety at system-level and not overregulate by requiring a specific technology implementation. Interoperability should not be a blanket-rule, but proportionally benchmarked at service-level (as opposed to radio-level). Requirements should be non-discriminatory to encourage business-driven decisions and innovation. Technical details such as standards, specifications, and communication system profiles can be adopted consensually by European standards developing organisations (SDOs).

As an example, 5GAA members are currently active at ETSI in defining measures to avoid mutual co-channel interference between different ITS technologies in the EU harmonised 5.9 GHz band. 5GAA members have been contributing to the definition of the framework for spectrum sharing described in ETSI Technical Report 103 667. The framework aims at minimizing the impact of mutual interference across road ITS technologies and, at the same time, to limit the impact on existing standards and products.

- European Commission and EU Member States should support
 - the development of connectivity on-board (cars, trains, aircraft) based on EU harmonised spectrum.
 - the development of autonomous vehicles based on ITS and other EU harmonised spectrum.

Source: RSPG Draft Opinion

On the matter of ITS and other EU harmonised spectrum, the 5GAA strongly recommends that national administrations make the entire globally harmonised 5855-5925 MHz band available for use by ITS communications between road users and between road users and roadside ITS infrastructure, as supported by the PC5 interface of C-V2X.

The 5GAA also places a high value on the importance of communications between road users and mobile network infrastructures in enabling future advanced driving use cases, as supported by the Uu interface of C-V2X. Accordingly, the 5GAA recommends that Member States ensure the availability of

sufficient spectrum for mobile communication networks in the so-called low-bands and mid-bands for the support of services, including ITS, in the coming decade in line with the Communication on European Digital Compass published on 9th of March 2021.

For further information on these recommendations, please see 5GAA's 2020 report on the spectrum needs of intelligent transport systems³.
