

Radio frequencies designated for enhanced road safety in Europe - C-Roads position on the usage of the 5.9 GHz band

The C-Roads Platform brings together road authorities and operators currently covering 16 Member States (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Portugal, Slovenia, Spain, Sweden, The Netherlands and UK) as well as Norway, Switzerland and Australia. This C-Roads position paper is endorsed by the actual Core Member States of the C-Roads Platform, which are Austria, Belgium/Flanders, Czech Republic, France, Germany, Slovenia, The Netherlands and UK.

The objective of these European Member States is to realize the safe travel goal as expressed in the EU transport policy and reduce the amount of accidents via available ITS technologies that have been already tested and demonstrated on large scale. The aim of the C-Roads platform is to realize this road safety goal at a European level by aligning specifications for cooperative intelligent transport systems (C-ITS) to ensure European interoperability. A rapid and EU-wide deployment of harmonised C-ITS services is key to this objective. C-Roads Member States are focused at realizing flawless operation of C-ITS services cross border today and as such are contributing to the foundations for connected and automated driving.

The C-Roads platform and its contributing Member States are committed to the European strategy on C-ITS (COM(2016) 766), the European declaration of Amsterdam, and the European C-ITS deployment platform recommendations. Current deployments of C-ITS are based on available communication technologies: IEEE802.11p/ETSI ITS-G5 (in short: ITS-G5) as well as 3G and 4G cellular standards. In this combination, the short range communication technology ITS-G5 (as demonstrated in SCOOP and the C-ITS corridor) complements long range 3G/4G cellular communication (as demonstrated in NordicWay). This is shown in Figure 1.

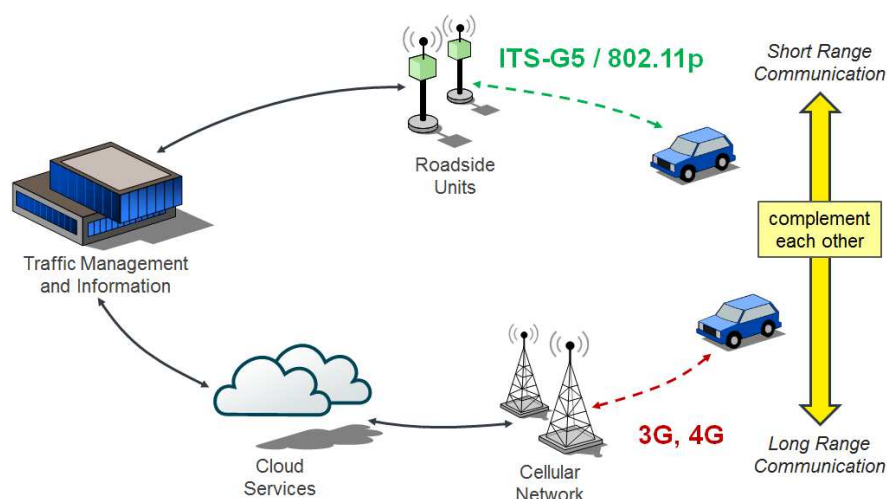


Figure 1: Short and long range communication complement each other

The C-Roads partners are investing 350 Mio. EUR into interoperable C-ITS services based on a hybrid communication technology mix – a combination of ITS-G5 short range communication and existing cellular 3G/4G networks for long range communication.

ITS Short Range Communication Technologies

In 2008 the European Commission (EC/2008/671) designated a specific frequency band of 30 MHz in the range of 5 875-5 905 MHz (in short 5.9 GHz frequency band) for safety-related ITS applications in Europe. Research on C-ITS started already in the 1980s. It was followed by the spectrum allocation in 2008 and the release of a complete set of tested ITS-G5 standards by 2013. Functional products became available on the market for on-board-vehicle as well as for road-side implementations.

As part of current standardisation work (LTE Release 14 and beyond), the telecommunications industry in 3GPP has started standardization on LTE-V2X (also known as 5G Sidelink), equally a technology for short range communication. Interoperability with ITS-G5 however remains an issue as an ITS-G5-only and an LTE-V2X-only equipped vehicle today apparently cannot communicate with each other.

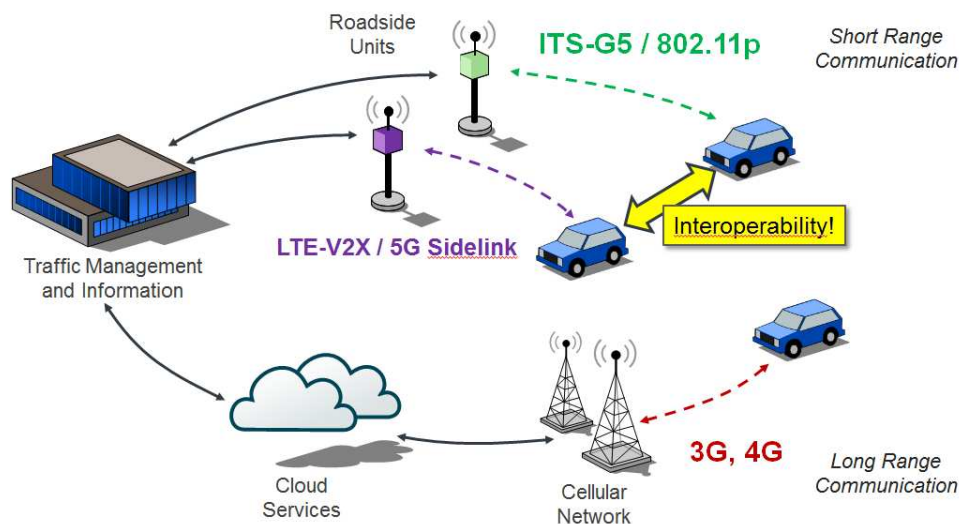


Figure 2: Danger of non-interoperability between ITS-G5 / 802.11p and LTE-V2X / 5G Sidelink

Therefore Member States, road authorities, and road operators contributing to the C-Roads platform emphasize:

- Interoperability is a must: It is unacceptable that people would die on European roads because vehicles cannot "speak" to each other or implemented roadside units due to non-interoperable communication systems (e.g. non-interoperability of ITS-G5 and LTE-V2X).
- Road authorities should not be forced to equip the roadside with two or more competing technologies (ITS-G5, LTE-V2X, or potential future technologies) serving the same use cases or providing the same content to road users.
- Furthermore, C-Roads Member States are committed to the "backwards compatibility" criteria in the technological evolution: New C-ITS equipment beyond Day-1 needs to support and safeguard already deployed C-ITS services.
- Additionally, the evolution of cellular communication standards towards 5G is expected to bring further improvements to long range cellular communication (e.g. coverage improvements and signalling efficiency), providing benefits to the hybrid communication approach and complementing short range connectivity.

- And road authorities need to have the choice how to provide connectivity via a hybrid communication approach, including all suitable communication networks to vehicles also in the future.

Radio Frequencies for ITS and 5G

In 2016 the European Commission published a communication “A European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility” (COM(2016) 766) stating “The Commission will maintain the designation of spectrum used by ITS-G5 for safety-related ITS services and support measures to protect this frequency band from harmful interference, both at the European and international level (UN International Telecommunications Union and European Conference of Postal and Telecommunications Administrations).”

Several C-Roads Member States already started the procurement and deployment of ITS-G5 / 802.11p based equipment and hence expect that the required capacity at the 5.9 GHz frequency bands will remain available for ITS-G5 / 802.11p without harmful interference. C-Roads Member States should not delay deployments of safety-related services, considering that every year 26.000 European citizens lose their lives and 135.000 are injured on European roads, whereas interference between current and future communication technologies for sure should not cause fatalities in automated vehicles using connectivity as a sensor.

While ITS frequency spectrum is allocated at 5.9 GHz, the option of using bandwidth available for mobile cellular communication and for the 5th generation of wireless systems (5G) may be beneficial for avoiding complex situations. New frequency bands at 3.4-3.8 GHz will be available for 5G and have been already identified as pioneer frequencies for 5G¹. The Figure 3 shows the frequency allocation in Austria as example, including new designations such as the European 5G pioneer bands (note that allocation may vary in other countries).

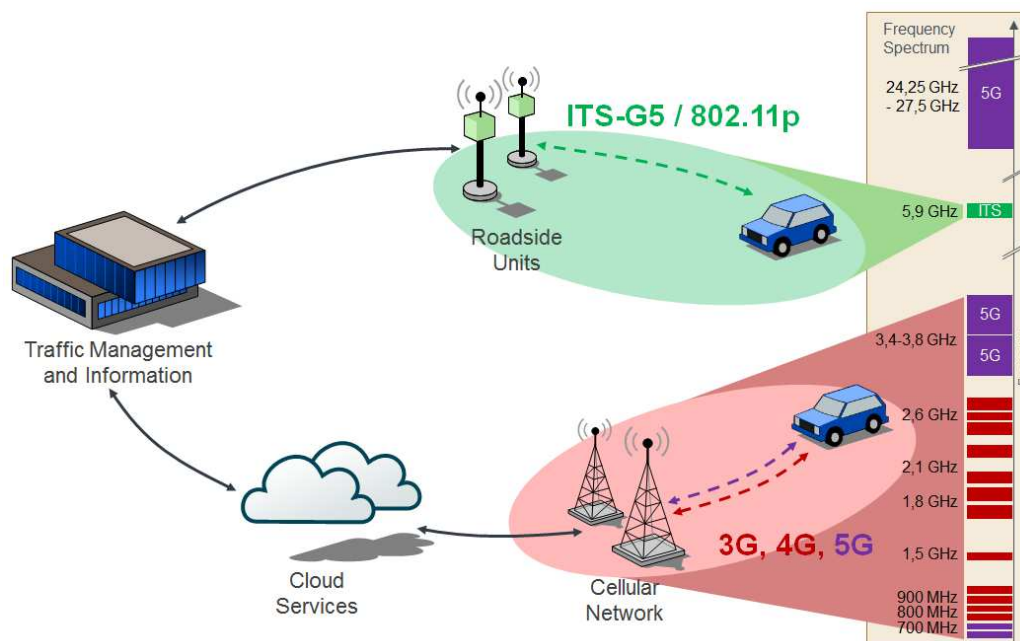


Figure 3: Current allocation of frequency bands available for C-ITS services (The 3.4-3.8 GHz frequency band has already been identified as pioneer frequency for 5G)

¹ Radio Spectrum Policy Group; Strategic roadmap towards 5G for Europe, RSPG16-032

It however is observed that despite a reservation for large harmonized frequency bands for 5G, the 5GAA suggests that LTE-V2X should operate in the ITS band at 5.9 GHz in parallel to the ITS-G5 technology², subject to further agreements. C Roads members wish to flag that operating LTE-V2X and ITS-G5 in the 5.9 GHz band and in the same geographic area without an agreed coexistence solution may result in mutually harmful co-channel interference. Whereas splitting the ITS band and fragmenting the 5.9 GHz spectrum may not providing a satisfying option as it contradicts spectrum neutrality. Member States respect spectrum neutrality as a principle.

C-Roads Member States expect C-ITS deployments to respects the current spectrum regulation. This includes the duty of ensuring non-interference with existing technologies. New technologies should avoid interfering with the proper operation of existing ITS-G5 equipment. It is therefore a clear position of C-Roads, that the use of LTE-V2X at 5.9 GHz requires prior investigations, and agreements within CEPT, to ensure non-interference with existing applications and services.

In the 5G Strategy of Germany³, V2X communication is named as one of the central applications for using one of the pioneer 5G frequency bands (3.4-3.8 GHz, not 5.9 GHz). LTE-V2X can as well operate in 5G frequency bands, since it is a 5G technology. ACEA highlights that the 3.4-3.8 GHz band is a good compromise between high and low carrier frequencies with regards to propagation characteristics and antenna size. Therefore, ACEA suggests to use ITS-G5 at 5.9 GHz and redundant usage of LTE-V2V at 3.4-3.8 GHz⁴. C-Roads Member States support this view and therefore suggest that:

- The 5.9GHz (ITS frequency) band is already being used for initial deployments of C-ITS services through ITS-G5 technology, therefore LTE-V2X technology should be used in the same band only in non-interfering manner.
- A solution may exist in operating LTE-V2X in allocated 5G frequency bands as LTE-V2X is being viewed as part future 5G technology.
- The evolution of cellular LTE/5G long-range communication is beneficial for connecting vehicles to infrastructures via cloud services and backend interfaces (vehicle-to-network). C-Roads Member States are interested in further developing such a hybrid approach, in which services are provided through a mix of complementing (communication-) technologies.

Cooperation and Ways Forward

The C-Roads Member States envision a growth of C-ITS services in the future and encourage the telecommunications industry as well as the automotive industry to further investigate communication options in due collaboration with road authorities, to realize future and attractive use cases complementing existing ones. This complementary approach should explore and not replicate possibilities – it should extend the diversity of spectrum use, not fragment it, and enhance reliability and robustness of services deployed. The hybrid approach is the basic principle of the C-Roads community.

Automotive industry and C-Roads members in June 2017 already established a cooperation for the roll-out in Europe of day one C-ITS services based on short range communication till 2019. This

² 5GAA Position Paper June 12, 2017. http://5gaa.org/pdfs/5GAA_News_neu.pdf

³ Die Bundesregierung: 5G-Strategie für Deutschland, July 12, 2017, [https://www.bmvi.de/SharedDocs/DE/Anlage/Presse/098-dobrindt-5g-strategie.pdf? blob=publicationFile](https://www.bmvi.de/SharedDocs/DE/Anlage/Presse/098-dobrindt-5g-strategie.pdf?blob=publicationFile)

⁴ ACEA Position Paper: Frequency bands for V2X, http://www.acea.be/uploads/publications/ACEA_Position_Paper_Frequency_bands_for_V2X.pdf

cooperation is to ensure interoperability of services building on ITS-G5 / 802.11p cross road operators / authorities & the automotive industry, cross borders and cross vehicle brands.

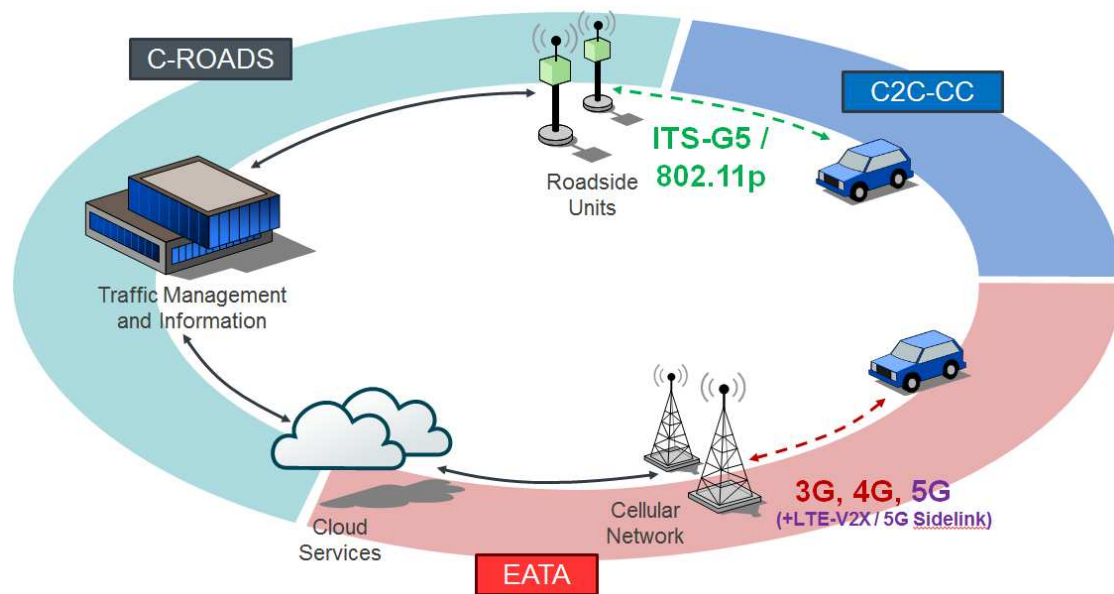


Figure 4: Cooperation model to cover the full value chain of C-ITS

The C-Roads platform sees a cooperation with the Car-to-car Communication Consortium (C2C-CC) as well as with EATA as the way forward: Hereby this cooperation can include cloud services with content from NRA's and service delivery by MNO's and OEM's to their customers. All three entities could provide a unique contribution to the deployment and further development of C-ITS, solving the open technological as well as business related questions, following the C-Roads hybrid technology approach.

Further information about the C-Roads Platform: www.c-roads.eu

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