

Conselho de Administração Executivo

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Assunto: Resposta à Consulta Pública lançada pela ANACOM em 01.03.2018 sobre disponibilização de espectro na faixa dos 700 MHz.

Caro Sr. Presidente Dr. João Cadete de Matos,

Na sequência da consulta pública lançada pela Autoridade Nacional de Comunicações (ANACOM) em 1/03/2018, relativa à futura disponibilização da faixa dos 700 MHz para serviços de comunicações eletrónicas terrestres, assim como das faixas 3,4-3,8 GHz, 24,5-27,5 GHz e banda L, a Infraestruturas de Portugal (IP), na sua qualidade de Gestor da Rede Ferroviária Nacional e de Gestor de Infraestruturas Rodoviárias, vem responder a esta consulta comentando e comunicando as suas necessidades de espectro radioelétrico necessárias ao cumprimento das suas obrigações de manter e implementar sistemas de controlo, gestão e operação do tráfego rodoferroviário de forma eficiente, segura e sustentável.

Encontramo-nos ao dispor para qualquer esclarecimento adicional ou reunião que considerem necessária.

Com os melhores cumprimentos,

Vanda Nogueira

A Vogal do Conselho de Administração Executivo

Vanda Nogueira

Vanda Nogueira



Resposta à Consulta Pública lançada pela ANACOM em 01.03.2018
“Disponibilização de espectro na faixa dos 700MHz.”

Enquadramento

Como ponto prévio à resposta, será útil referir os sistemas de comunicação móvel que a Infraestruturas de Portugal tem em operação, assim como outros a implementar futuramente, que necessitam de faixas de frequências atribuídas em regime de exclusividade nas suas áreas geográficas de implementação, tanto, para sistemas ferroviários, como, rodoviários, que suportam serviços e aplicações críticas de segurança, comando e controlo da circulação e gestão de tráfego.

Os sistemas e as faixas de frequências atribuídas e a designar são as referidas nos pontos seguintes:

1. Sistemas de comunicações para aplicação ferroviária

- i) Sistema analógico de comunicações Rádio Solo-Comboio (CP-N)
A IP tem ainda em operação na Rede Ferroviária Nacional, o sistema de comunicações analógico a funcionar na banda definida pela UIC (457,625 – 467,875 MHz), estando já a decorrer o processo de migração deste sistema para o de tecnologia GSM-R.
- ii) Sistema digital de comunicações Rádio Solo-Comboio (GSM-R)
Encontram-se disponibilizadas as faixas de frequência 876 – 880 MHz e 921 – 925 MHz, em conformidade com a Decisão ECC/DEC/(02)05.
- iii) Future Railways Mobile Communications System (FRMCS)
Tendo em consideração o fim de vida do Sistema GSM-R (estima-se que seja posterior a 2030), a UIC (Union Internationale des Chemin de Fer) decidiu em 2012 criar o projeto FRMCS para preparar as necessárias etapas conducentes à introdução do sucessor do atual GSM-R.
No que respeita ao desenvolvimento de estudos e dos respetivos processos de obtenção de faixa de frequências a atribuir a este sistema (a disponibilizar durante e no final do período de migração) estes não se encontram ainda concluídos. No caso de não vir a ser possível o uso da atual banda GSM-R (876-880/921-924), assim como da banda estendida ER-GSM (873-876/918-921), a faixa dos 700 MHz é uma possibilidade a considerar (**Anexo-1**, documento de trabalho do ETSI, “Railway vision on spectrum needs” de 20.04.2016 ref. NG2R(16)004020).

Com a finalidade de melhor compreensão das necessidades e expetativas da comunidade ferroviária na Europa, submetemos para vossa análise o documento anexo intitulado “With spectrum, boosting a Single European digital railway area” onde é expressa a posição conjunta de dois organismos que representam os Gestores de Infraestruturas Ferroviárias (*EIM-European Rail Infrastructure Managers*) e os Operadores Ferroviários Europeus (*CER-Community of European Railway and Infrastructure Managers*) relativamente à necessidade de espectro para comunicações móveis (**Anexo-2**).

2. Sistemas de comunicações para aplicação rodoviária

Tendo presente a “Diretiva ITS 2010/40/EU”, Lei nº32/2013, de 10 de maio, bem como a estratégia Europeia de implementação de sistemas inteligentes cooperativos de transporte (C-ITS), expressa na comunicação da Comissão Europeia “EC COM(2016) 766”, de 30/11/2016, que visam no essencial o incremento da segurança rodoviária e da eficiência de tráfego, será necessário disponibilizar faixas de frequências para garantir comunicações móveis *Vehicle-to-Vehicle* (V2V) e *Vehicle-to-Infrastructure* (V2I).

Considerando a posição expressa por diversos estados membros, que integram o “C-Roads Platform” (**Anexo-3**), no que respeita à alocação de espectro harmonizada temos:

- A necessidade de disponibilização e reserva da faixa de frequências 5,875 – 5,905 MHz (banda de 5,9 GHz), conforme decisão da Comissão Europeia “EC/2008/671” para uso da tecnologia ETSI ITS-G5;
- No que respeita à proteção desta banda contra interferências, fazemos notar que a caso venha a ser designada a banda dos 5,9 GHz para a tecnologia LTE-V2X terá de ser garantida a não interferência com os serviços e aplicações suportadas em tecnologia ITS-G5. Considerando que LTE-V2X é considerada como parte da tecnologia 5G, em alternativa faria sentido utilizar uma das faixas a alocar ao 5G (por ex. 3,4 – 3,8 GHz), eliminado o risco de interferência. Relativamente a este ponto anexamos documento no qual o “C-Roads Platform” manifesta o seu entendimento e posição sobre o problema.

Adicionalmente, o RSPG (Radio Spectrum Policy Group) recomenda a possibilidade de expandir a faixa designada para o ITS em duas bandas adicionais adjacentes de 20 MHz cada devendo essas faixas ser mantidas disponíveis por enquanto.

Resposta à Consulta Pública

Considerando o enquadramento anterior, transmite-se a posição da Infraestruturas de Portugal sobre cada uma das questões identificadas:

Questão 1 da Consulta – 700 MHz - core

1.1. Tem interesse na disponibilização da faixa core dos 700 MHz para serviços de Comunicações eletrónicas terrestres (SCET)? Justifique.

Resposta:

Como anteriormente referido no ponto 1iii) relativo ao FRMCS, as organizações ferroviárias na Europa procuram ativamente obter uma faixa adequada ao futuro sistema, manifestando o seu interesse nas faixas presentemente atribuídas às comunicações ferroviárias (R-GSM e ER-GSM).

Considerando no entanto que a atribuição desta faixa harmonizada na Europa dedicada ao FRMCS não se encontra garantida, a IP sugere como possível alternativa a disponibilização de uma subfaixa dentro da banda dos 700 MHz.

No que concerne ao sistema C-ITS, estando ao nível da Comissão Europeia a ser realizados esforços no sentido de harmonizar a definição do espectro de frequências afeto às comunicações veiculares de cariz rodoviário, Vehicle-to-Vehicle (V2V) e Vehicle-to-Infrastructure (V2I), deve ser acautelada a possibilidade de alocar frequências na faixa dos 700MHz.

1.2. Qual a data que considera adequada para a atribuição deste espectro, atento o prazo previsto na Decisão (UE) 2017/899? Justifique.

Resposta:

Tendo em consideração os programas de desenvolvimento do FRMCS e C-ITS esta faixa poderá ser necessária a partir de 2022.

1.3. Qual a dimensão dos blocos e a quantidade (mínima e/ou máxima) de espectro que considera adequada para uma exploração comercial? Justifique.

Resposta:

Decorrem ainda estudos relativos à definição da largura de espectro necessária às aplicações ferroviárias e rodoviárias.

Questão 2 (700 MHz - duplex gap e faixas de guarda)

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização desta faixa de frequências.

Questão 3 (1500 MHz – subfaixa dos 1452-1492 MHz)

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização desta faixa de frequências.

Questão 4 (1500 MHz – subfaixas dos 1427-1452 MHz e 1492-1518 MHz)

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização destas faixas de frequências.

Questão 5 (900 MHz, 1800 MHz e 2,6 GHz)

5.1. Tem interesse na disponibilização destas faixas para SCET? Justifique.

Resposta:

Relativamente à faixa dos 900 MHz, esta inclui as sub-faixas 876-800/921-925 MHz e 870-873/918-921 MHz que foram designadas para o sistema GSM-R (a segunda designada numa base nacional), conforme expresso na Decisão do ECC (ECC/DEC/(02)05).

Tendo em consideração os estudos desenvolvidos e promovidos pela UIC em estreita cooperação com o CEPT e o ETSI assim como a posição manifestada conjuntamente pelo EIM (European Rail Infrastructure Managers) e pelo CER (Community of European Railway and Infrastructure Managers) deverá ser ponderado o seguinte:

- i) Quanto à primeira das faixas (R-Band), esta terá que ser mantida alocada ao atual sistema GSM-R até ao fim da sua vida útil. Esta banda será gradualmente atribuída ao FRMCS de modo definitivo durante o processo de migração.*
- ii) No respeitante à segunda faixa (ER-Band), esta banda é essencial para permitir a implementação do FRMCS assim como possibilitar a migração do GSM-R para o seu sucessor. Em consequência será necessário acautelar a disponibilização desta faixa para uso das comunicações ferroviárias. No caso de esta banda vir a ser harmonizada a nível Europeu para o FRMCS, é expectável que a mesma possa ser necessária a partir de 2022.*

Espera-se que no primeiro trimestre de 2019 se encontre definida e aprovado nas instâncias comunitárias as bandas de frequências a dedicar ao FRMCS. Após isto a IP estará em condições de rever e atualizar as respostas à presente consulta pública.

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização das faixas 1800 e 2600 MHz.

5.2. Tem interesse na disponibilização simultânea destas faixas com a faixa core dos 700 MHz? Justifique.

Resposta:

Caso as bandas atualmente designadas na União Europeia para sistemas ferroviários, (R-Band e ER-Band - 873-880/918-925 MHz), possam vir a ser designadas para o futuro sistema FRMCS, não será necessário o uso da banda dos 700 MHz para aplicações ferroviárias.

5.3. Em caso afirmativo, qual a dimensão dos blocos a disponibilizar e a quantidade (mínima e/ou máxima) de espectro que considera ser necessário para uma exploração comercial? Justifique.

Resposta:

No pressuposto que o FRMCS virá a trabalhar nas bandas designadas nas Decisões ECC/DEC(02)05 e ECC/DEC(04)06 as quantidades mínimas a disponibilizar serão:

- i) Durante o período de migração do GSM-R para o FRMCS: 4 MHz (876-880/921-924 MHz) para o GSM-R e mais 3 MHz (873-876/918-921 MHz) para o FRMCS;*
- ii) Após conclusão da migração para o FRMCS: 7 MHz (873-880/918-925 MHz).*

Face à importância deste ponto, a Infraestruturas de Portugal aproveita a oportunidade para manifestar a sua posição alinhada com as dos restantes Gestores de Infraestruturas Ferroviárias e Operadores Ferroviários, relativamente à utilização da banda de frequências harmonizada a alocar ao FRMCS a nível Europeu:

- A atual banda de frequências harmonizada é hoje um recurso essencial para o caminho-de-ferro. Igualmente será necessário uma banda harmonizada a nível Europeu para o futuro sistema de comunicações de forma a garantir a interoperabilidade, segurança e uma operação sem interrupções, (pág. 2 do Anexo 2).*
- A faixa de 873-876 MHz / 918-921 MHz conjuntamente com a atual faixa GSM-R é a opção mais favorável para permitir a reutilização infraestrutura existente e permitir uma migração sustentável e continua para o FRMCS.*
- Os EIM e CER apoiam decididamente os esforços para a harmonização da banda 873-880 MHz / 918-925 MHz para o FRMCS. É imperativo garantir capacidades suficientes em termos de serviços e aplicações avançadas e interoperáveis para suportar o futuro de uma exploração ferroviária avançada.*
- É, na visão dos EIM (do qual a IP faz parte) e da CER, essencial possibilitar um processo de migração aceitável para os países Europeus que tem investido fortemente na infraestrutura GSM-R.*

Questão 6: (faixa dos 2,1 GHz - subfaixa 1900-1920 MHz)

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização destas faixas de frequências.

Title*: Railway vision on spectrum needs

from **Source*:** ERA / UIC FRMCS SWG
Contact: Thomas CHATELET, Dick MARTENS

Anexo 1

input for **Committee*:** RT NG2R

Contribution For*:	Decision	
	Discussion	X
	Information	

Submission date*: 2016-04-20

Meeting & Allocation: **RTNG2R#4** -
Relevant WI(s), or
deliverable(s):

ABSTRACT: *The purpose of this document is to provide a high-level vision on the spectrum needs for the European railway sector in the future, in the context of the preparation for a successor to the currently used GSM-R systems.*

It should be noted that this document is in its first version that would be later amended by ETSI NG2R WG, and further consolidated by all railway stakeholders.

1 Introduction

The purpose of this document is to provide a high-level vision on the spectrum needs for the European railway sector in the future, in the context of the preparation for a successor to the currently used GSM-R system.

GSM-R is a voice and data radio communication system for railway operation, mandated by the Control Command and Signalling Technical Specification for Interoperability (CCS TSI)¹, in the frame of the interoperability of the rail system within the Community Directive². GSM-R is the sole radio communication system that can be used for interoperable railway operation as per the current regulation.

The key driver for this spectrum vision is the forecast obsolescence of the 2G-based GSM-R technology (GSM-R Industry Group committed to support GSM-R until 2030). A GSM-R successor should be ready for deployment as of 2022 in order to leave a sufficient period for migration and phase-out of the GSM-R systems.

The requirements for the GSM-R successor system are being defined by the UIC in its Future Railways Mobile Communicating System (FRMCS) project, in close cooperation with ERA and the railway sector. Based on current and future functional needs, system architecture and radio spectrum requirements are being defined. A traffic analysis is ongoing to assess the bandwidth requirements for future railway applications.

¹ [COMMISSION DECISION \(EU\) 2015/14 of 5 January 2015 amending Decision 2012/88/EU on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system](#)

² [DIRECTIVE 2008/57/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 on the interoperability of the rail system within the Community](#)

Requirements to minimise the economic impact of the migration to a new system will also be taken into consideration (i.e. ERA studies on migration, cost benefit analysis performed for TSI update). GSM-R was designed as a railway specific system relying on the 2G system to benefit from economies of scale and wide product availability. However, the current market size is limited in terms of number of suppliers and the anticipated cost benefits were not achieved. This is mainly due to the specific railway features in the standards and to the specific radio spectrum. The successor system should consider the opportunity to significantly enlarge the market size and product ecosystem by following the main mobile telecommunications standards as is also anticipated by other users such as the Public Protection and Disaster Relief (PPDR) community.

In parallel, an ETSI System Reference Document (SRDoc) is under creation in the TC RT Working Group Next Generation Radio for Rail (NG2R). It considers spectrum needs, with the current working assumption that the successor will be based on dedicated radio spectrum providing coverage on the entire railway network, similar to the current service offered by GSM-R. This does not exclude national decisions to allow the use of shared or public radio systems in parts of the railway network.

2 Current GSM-R spectrum in Europe

Based on the 1999/569/EC Commission Decision of 28 July³ 1999 and ECC Decision (02)05⁴, all current GSM-R networks in Europe have the obligation to use the UIC band⁵ for the radio communications between on-board and trackside. GSM-R system benefits from an EU harmonized frequency band that has been implemented by all Member States. A key driver for this decision was the need for interoperability of the trans-European high-speed rail system (i.e. for European Railway Traffic Management System).

The UIC band is today used at its full capacity (19 frequencies), and in some specific cases shortage in capacity are seen: in very dense traffic conditions with ETCS Level 2 (European Train Control System), in large railway stations, and at the borders where not the entire set of frequencies is available due to coordination agreements. To cope with this situation ETSI is already considering some features to increase spectrum efficiency.

3 Re-using the UIC band

Re-use for the successor system of the current UIC band is regarded to be the most desirable spectrum option for a number of reasons.

First, it is an EU harmonized frequency band, allocated and available for the GSM-R networks in all EU Member States. Thus, there would be no need to identify and make available new spectrum. Continued usage of this band for the successor system would allow re-use of the existing radio site infrastructure (physical sites, masts, antennas, power, etc. – around 20.000 Base Stations in Europe), resulting in very significant investment savings.

Also for rolling stock, this would result in cost savings as the existing 900MHz antennas can be reused. Change to a different frequency band would most likely require replacement of antennas, leading to much longer periods where the rolling stock has to be taken out of service.

However, to make it possible to re-use the UIC band a number of aspects need to be resolved.

Current EU and national regulations only allows the usage of GSM-R technology in the UIC band. Therefore, in order to allow usage of 4G or 5G technology, this frequency band needs to be made technology neutral. This will require a coexistence analysis for the adjacent spectrum usages, to be developed and approved by CEPT/ECC.

³ [COMMISSION DECISION of 28 July 1999 on the basic parameters for the command-and-control and signalling subsystem relating to the trans-European high-speed rail system](#)

⁴ [ECC Decision \(02\)05 - The designation and availability of frequency bands for railway purposes in the 876-880 MHz and 921-925 MHz bands](#)

⁵ UIC band [876-880 / 921-925 MHz] / Extended UIC band [873-876 / 918-921 MHz]
ER-GSM band [873-915 / 918-960 MHz] / R-GSM band [876-915 / 921-960 MHz] / Extended GSM (E-GSM) band [880-915 / 925-960 MHz]
/ Primary GSM (P-GSM) band [890-915 / 935-960 MHz]

Likewise, would the successor system be based on a 3GPP 4G or 5G standards, the UIC frequency band would need to be introduced in those standards.

For the migration from the current GSM-R systems to the successor system, a migration period will be necessary, in which, at least on a subset of the railway tracks, simultaneous operation of both systems will be required for a number of years. This need arises from the fact that it may not be possible to guarantee that all (national and international) trains using a particular track will be equipped with dual mode (i.e. GSM-R plus the successor system) train radios. An ERA study is ongoing on the question whether or not it is actually possible - from radio coexistence, capacity and operational point of view - to have the coexistence of GSM-R and its successor at the same locations in the sole UIC band.

In case further analyses demonstrates that such simultaneous usage of both systems within the 4 MHz of the UIC band is not possible, it will be necessary to identify and make available other spectrum. In order to be cost-effective, such new spectrum needs to be below 1GHz. Options to be considered are the Extended-UIC band, the 700MHz band and possibly the 400MHz band. Other frequency bands below 1GHz that have an ITU land mobile destination are not available nor currently under discussion.

4 Using the Extended UIC band

In case it is not possible or sufficient to use the UIC band for the successor system, or during the migration period, the next best option would be to use the Extended UIC band. For this band, the same cost benefits would apply as described above for the UIC band.

This extension band has already been defined in ECC/DEC/(04)06⁶, which states “*that this ECC Decision also provides a possibility for a GSM-R extension into the bands 873-876 MHz and 918-921 MHz on a national basis*”. So far, a limited number of Member States have actually implemented this extended UIC band, even though GSM-R products supporting this band are available (7 countries have a provision for this in their national frequency plan: Germany, Hungary, Liechtenstein, Switzerland, Croatia, Czech Republic, Latvia).

However, the ECC Decision also states that the duplex frequency band 870-876/915-921 MHz is also designated for defence systems in ERC Report 25⁷. Furthermore, this frequency band is under discussion for usage by Short Range Device (SRD) and Radio Frequency Identification (RFID) equipment. Therefore, further study would seem required to determine if usage for railways would be the optimum usage of this frequency band. Sharing mechanisms could be considered.

In order to enable usage of this extended UIC band for the successor system it will be necessary to make it technology neutral, perform coexistence studies with adjacent spectrum usage, and introduction of this band into the 3GPP 4G / 5G standards.

5 Using the 700MHz band

In the situation where neither the UIC band nor the extended UIC band can be used for FRMCS, it becomes necessary to identify some alternatives.

The next alternative to consider is the 700MHz band (uplink 694 – 738MHz, downlink 758 – 791MHz). In current discussions on the usage of this land-mobile band, it is anticipated that a larger portion will be made available for public mobile networks, with possibly some part allocated to PPDR services.

A possible way forward would be to consider spectrum sharing between PPDR and railway communities, which as a concept seems to be very much in line with current trend at both Commission and Member State levels. In addition, this has been positively discussed at conceptual level between Railway and PPDR representatives.

⁶ [ECC Decision \(04\)06 - The availability of frequency bands for the introduction of Wide Band Digital Land Mobile PMR/PAMR in the 400 MHz and 800/900 MHz bands](#)

⁷ [THE EUROPEAN TABLE OF FREQUENCY ALLOCATIONS AND APPLICATIONS IN THE FREQUENCY RANGE 8.3 kHz to 3000 GHz \(ECA TABLE\)](#)

Taking in consideration the example of the French 700MHz allocations, sharing could be considered for a 5MHz (698-703 resp. 753-758MHz) and/or 3MHz (733-736 resp. 788-791MHz) part of this band (see Draft ECC Report 218⁸. For the 5MHz part, limitations have been defined on its usage intensity, leaving the 3MHz part as the best option for sharing. This 3MHz part then could be used as of the migration period from GSM-R to its successor.

For the longer term, the UIC frequency band could be brought into a pool of frequencies shared between railways and PPDR. The benefit of this would be that for both sets of users a much larger total system capacity becomes available then either could create using only its own spectrum. Such pooling could be achieved as of 2030, or sooner on a national basis, when GSM-R networks have been replaced by their successor system. This may also create an increased, common market for radio equipment, reducing the risk of niche markets.

6 Using the 400MHz band

In the situation where neither the UIC band nor the extended UIC band nor the 700MHz band can be used for the successor system, currently the last option under 1GHz would be to consider using the 400MHz band, in a sharing mode quite similar to the above-described 700MHz case. More specifically, this would be the 410-430MHz, or the 450-470MHz bands for uplink and downlink, in which several configurations of a broadband system could be applied.

Similar to the 700MHz case, this option would need further analyses. One additional aspect would be that the 400MHz band has different levels of usage across the Member States, with very high numbers of end users in several Member States. This would seem to complicate the migration of those users in order to free-up the desired spectrum.

7 Using other spectrum for non-critical applications

Currently the document on the railway requirements includes both critical and non-critical applications. At this moment, it is not yet clear if all those applications need to be supported by the successor system. It may be considered to offload non-critical applications to public networks. In this case, if different terminals would be required, a cost-benefit analysis would be relevant, to understand the impact on the railway vehicles supporting the use of public networks.

8 Summary

1. GSM-R is the only available radio communication system as per the regulation today to support railway operational and safety voice and data radio communications. It benefits from harmonised spectrum across CEPT countries.
2. GSM-R support is committed by industry until 2030. A successor to GSM-R is currently being defined. Deployment is anticipated from 2022.
3. Several options for a successor system are considered, based on requirements for future railway applications and a cost - benefit analysis of the alternatives.
4. From a spectrum perspective, also several options are considered:
 - a. Re-use of the 4MHz of the current UIC band;
 - b. Use in addition the 3MHz of the Extended UIC band;
 - c. Use other bands (700MHz, 400MHz) in sharing mode with e.g. PPDR;
 - d. Offloading non-critical applications to public networks.
5. Those options need to be assessed against various criteria:
 - a. Licence and Ownership model - dedicated versus shared (public operators or PPDR);
 - b. Capacity to serve current and future railway application needs;

⁸ [ECC Report 218 - Harmonised conditions and spectrum bands for the implementation of future European Broadband Public Protection and Disaster Relief \(BB-PPDR\) systems](#)

- c. Spectrum efficiency (including sharing scenarios);
 - d. Reuse of existing assets and other cost reductions related to market size and supplier competition;
 - e. Interoperability, requiring User Equipment to support all frequency bands available for railways in EU (dedicated, shared, public)
6. All the spectrum options considered require further development of Standards and spectrum regulation. EU regulation (CCS TSI) can only mandate a successor system with the support of CEPT/ECC and the Member States in their sovereign role for spectrum regulation.

Anexo 2



CER and EIM Position Paper

Brussels, 17 May 2017

With spectrum, boosting a Single European digital railway area

WITH SPECTRUM, BOOSTING A SINGLE EUROPEAN DIGITAL RAILWAY AREA

Summary of CER and EIM position

- Current harmonized spectrum is an essential asset for railways today and harmonized spectrum will also be needed for tomorrow to ensure safe and uninterrupted train operation.
- The 873 - 876 MHz / 918 – 921 MHz band, in addition to the current GSM-R band, is the most favorable option to reuse infrastructure investment and allow a smoother migration.
- CER and EIM strongly support the efforts for the harmonization within the 873 - 880 MHz / 918 – 925 MHz band for FRMCS. It is imperative to provide on the long run sufficient capabilities in terms of enhanced interoperable services and applications to manage the future of railway operations.
- It is, in the view of CER and EIM, essential to provide an acceptable migration path for those EU countries that have invested in GSM-R infrastructure.

The purpose of this document is to give to European and National Administrations the views of the railway operators (Infrastructure Managers and Railway Undertakings) on their needs for spectrum and the rationales of their request.

Background of rail request for spectrum

- Mobile communications play a key role in the railway sector and are used by safety critical (e.g. ETCS) and railway business applications. More specifically, the European railways rely on GSM-R as their mobile communication system, which nowadays utilises a uniform frequency band across Europe. This is laid down in EU railway regulations for interoperability (i.e. the TSIs).
- Dedicated railway communication radio networks are used throughout Europe to carry voice, data and signaling services, thus contributing to the transportation of about 400 billion passenger-kilometers¹ and 405 billion tonne-kilometers in Europe in a secure and safe way in a highly mobile environment.
- As the current standardized GSM-R system is to be phased out by suppliers by 2030, the migration towards the successor system will build a backbone for a digital Single European Railway Area. This will support the introduction of further innovations such as automatic train operation (ATO), saving energy and costs for the society and increasing punctuality.
- The coexistence between GSM-R and its successor must be guaranteed until the migration is completed in order to ensure the railway interoperability. Both GSM-R and its successor (FRMCS) need to be operated in parallel for a long period of time to ensure a seamless operational transition. Access to additional harmonized radio spectrum is therefore a key factor for the success of FRMCS.
- The roll-out of FRMCS is expected to be possible at latest in 2023.

CER and EIM have taken note of the recent recommendations of the Radio Spectrum Policy Group on spectrum for the next generation of railway communication systems, stating in particular that there is a wide range of options for the future of railway communications whose suitability may vary across Member States, while emphasizing that it will be important to ensure interoperability, and that a common solution would ease implementation. Based on this opinion, CER and EIM understand that this will be a challenge especially in view of defining a common European solution.

Railway needs for spectrum

1. Interoperability all over the EU

Interoperability is needed to support international train services. Until now, the interoperability of communication has been guaranteed by having a common system (GSM-R) that uses a harmonized frequency band.

Recalling that it is essential to ensure interoperability across member states and that a single solution would ease the implementation of the future radio communication system for railway, CER and EIM strongly support the efforts for **additional** harmonization of a uniform spectrum solution. Uniform frequency bands will allow easier spectrum management governance across Europe, but also more efficient issue resolution between countries by supporting best practice sharing and cooperation as the railway system is aimed to work in a common way across Europe.

¹ [The economic footprint of railway transport in Europe](#), CER, 2014

2. High performance for safety-critical applications

Railway mobile communication systems are used for safety critical applications, and require therefore a very high Quality of Service combined with a very high availability and reliability. For GSM-R, such a high Quality of Service has been achieved by operating a dedicated network, providing integral coverage of tracks with high availability/reliability (even in congested situations) including rural areas.

CER and EIM expect that for the future system (FRMCS), dedicated frequency bands along rail tracks will also be needed to guarantee this high Quality of Service for safety critical application along all the railway lines.

3. Seamless transition from GSM-R to FRMCS

The current GSM-R band will remain essential for the railway mission and must be maintained on the long term, as the GSM-R system will remain in service beyond 2030 and possibly remain active in some areas even further.

Ensuring a proper migration from GSM-R to FRMCS is an essential need for the railway sector since the business must continue during the migration. The roll-out of the new technology is expected to take several years and the start for the migration from GSM-R towards the new technology will vary from country to country.

4. Economies of scale

It is essential to make the best re-use of the site infrastructure of GSM-R when rolling out FRMCS. Using similar frequency bands for FRMCS and GSM-R (current GSM-R band and the extended GSM-R band) will save existing site infrastructure and also train borne equipment, and therefore limit the roll-out costs of FRMCS for member states.

It is also important to ensure that frequency bands used by FRMCS are supported by the 3GPP specifications to enhance the possibilities to use standardized products and open the market.

ANNEX: CER AND EIM VIEWS ON THE SPECTRUM OPTIONS IDENTIFIED BY RSPG FOR THE RAILWAY INDUSTRY

The views of CER and EIM on the different envisaged options for next-generation of railway communications systems is based on more than 15 years of experience of operation with GSM-R on about 114 000 km of railway tracks and about 64 000 GSM-R on-board in trains².

The different spectrum options for GSM-R are:

- Option 1: Leveraging the use of extension bands E-GSM-R (or part of it) to railway use in addition to the GSM-R band
- Option 2: Use of other dedicated bands for the railway industry
- Option 3: Use of public mobile networks for certain services
- Option 4: Sharing networks with other users (e.g. PPDR in the 700 MHz or 400 MHz band)

Recalling that it is essential to ensure interoperability across member states and that a single solution would ease this implementation, the railway sector strongly support the efforts for harmonization of a spectrum solution.

Option 1: using the GSM-R band and the extension (E-GSM-R) band (or a part thereof):

The railway sector supports the efforts for harmonization of a part or all of the extension-band in addition to the GSM-R band

- Availability of harmonized spectrum for current and future railway applications is essential for uninterrupted and safe train journeys. It is not possible to accommodate GSM-R and its replacement in the current frequency band (R-GSM band) simultaneously³.
- The current GSM-R band will remain essential for the railway mission and must be maintained on the long term, as GSM-R is likely remain in service beyond 2030 in some countries, and the band will host FRMCS-system after cessation of GSM-R.
- The band 873-876 MHz paired with 918-921 MHz has great advantages for the rail sector to enable the migration towards the new technology replacing GSM-R. It allows the re-use of existing site infrastructure and parts of train equipment, thus leading to significant cost reduction for the next generation communication system and thus for the society. Additionally, being adjacent to the R-GSM band, it opens up the possibility of a larger channel width for the future system once the GSM-R is phased out, supporting higher traffic requirements and innovative applications. The regulatory possibility in CEPT to allocate this band for rail already exists on a national basis, and is already implemented or considered in several countries. Harmonization of this band for rail, or part thereof, is the best option from European Railways.

² [Study on migration of railway radio communication system from GSM-R to other solutions, SYSTRA for ERA, 2016](#)

³ [Coexistence of GSM-R with other communication systems, LS Telecom for ERA, 2016](#)

Option 2: Use of other dedicated bands:

- Until now, the most suitable and economically-viable spectrum scenario for the seamless transition of GSM-R towards its successor in the EU is to use the 873-876 MHz (Uplink) and 918-921 MHz (Downlink) in addition to current GSM-R bands.
- The railway sector is open to discussion about different spectrum options and would like to recall its conclusions on this matter:
 - Using spectrum below 1GHz has great benefit for railways as more than 160 000 km of lines for its mission-critical applications need to be covered;
 - Several dedicated bands that vary between countries would be too complex and costly for the railway sector, given the interoperable nature of rolling stock units;
- The most favorable option for the European railway sector is a coordinated transition towards the next-generation railway communications system using a single harmonized-frequency solution.

Option 3: Current Public mobile networks and even 5G alone cannot be the unique answer for railways:

- The successor of GSM-R must combine integral coverage of tracks and high availability/reliability (even in congested situations), including in rural areas.
- Coverage of tracks by public networks will improve, but remain insufficient in the foreseeable future to cover railway essential and operational requirements especially in rural areas.
- There are currently no legal options that would allow MNO's to favor railway users and to preempt other users in case of congested situations, so as to ensure the availability needs of the railways especially in emergency situations.
- Nonetheless, public mobile networks are envisaged to support less-stringent railway applications, or act as a backup solution (however with a lower quality) in case of unavailability of railway radio network.
- The Public Mobile Operator Networks are therefore foreseen as a complementary option under certain circumstances (i.e. low-traffic regional lines, back-up solution), but are unlikely to cover the entire needs (specifically the mission critical needs) of the railways.

Option 4: Sharing with other Critical Communication Operators may be an option to consider on a national basis when interoperability is not concerned, but might be too complex to extend at a European scale:

- Sharing spectrum with PPDR or other Critical Communication Operators may be an option in some Member States where exclusive spectrum has been identified. It is complex, from an operational, organizational and legal standpoint, and no single solution exists for PPDR networks in Europe.
- Moreover, there exists no regulatory mechanism to enforce the sharing especially once spectrum has already been assigned to PPDR, nor to provide the legal assurance that rail mission critical operational requirements can be fulfilled.

Questão 7 (faixa dos 450 MHz)

7.1. Tem interesse na utilização do espectro identificado (453,0375-457,525 MHz / 463,0375-467,525 MHz) para redes/serviços acessíveis ao público (redes de comunicações públicas)? Justifique.

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização desta faixa de frequências.

No entanto dado que a IP tem ainda em exploração os sistema de comunicações rádio solo-comboio (RSC), em faixa adjacente (457,625-457,875/467,625-467,875 MHz), há que acautelar e proteger esta faixa de interferências nocivas sobre este sistema sob o risco de afetar a segurança e a operacionalidade da exploração ferroviária.

Questão 8 (3,6 GHz)

8.1. Tem interesse na disponibilização do espectro atualmente livre nesta faixa para SCET? Justifique.

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias dedicadas ao desenvolvimento do FRMCS, não está a ser considerada a utilização desta faixa de frequências.

No que concerne ao C-ITS, estando ao nível da Comissão Europeia a ser realizados esforços no sentido de harmonizar a definição do espetro de frequências afeto às comunicações veiculares de cariz rodoviário, Vehicle-to-Vehicle (V2V) e Vehicle-to-Infrastructure (V2I), deve ser acautelada a possibilidade de alocar frequências na faixa dos 3,4 a 3,8GHz.

Questão 9 (26 GHz)

9.1. Tem interesse na disponibilização da faixa dos 26 GHz para SCET? Justifique.

Resposta:

De acordo com os estudos em curso pelas instituições ferroviárias e rodoviárias dedicadas ao desenvolvimento do FRMCS e C-ITS não está a ser considerada a utilização desta faixa de frequências.

Questão 10 - (Questões transversais – procedimento e condições de atribuição e condições de utilização)

Resposta:

Tendo em consideração a natureza e finalidade dos sistemas de comunicações de exploração rodoferrviárias, bem como o que foi anteriormente exposto, considera-se que partes dos aspetos técnicos desta questão se encontram respondidos nas questões anteriores. Pela sua natureza comercial, outros aspetos desta questão não se aplicam à IP.

Anexos:

- Anexo 1. ETSI - "Railway vision on spectrum needs" - 20.04.2016 ref. NG2R(16)004020;
- Anexo 2. CER-EIM Position on spectrum - "With spectrum, boosting a Single European digital railway area".
- Anexo 3. "C-Roads Platform" Position paper on 5,9 GHz.

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.

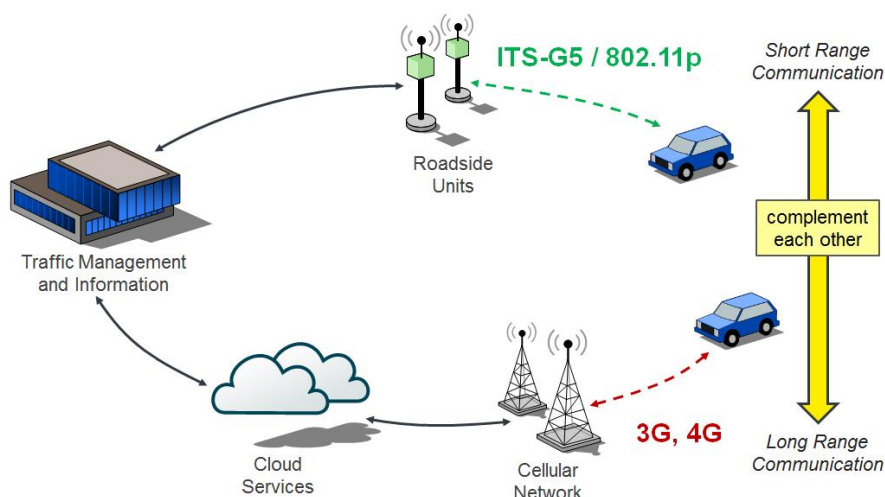


Figure 1: Short and long range communication complement each other

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.

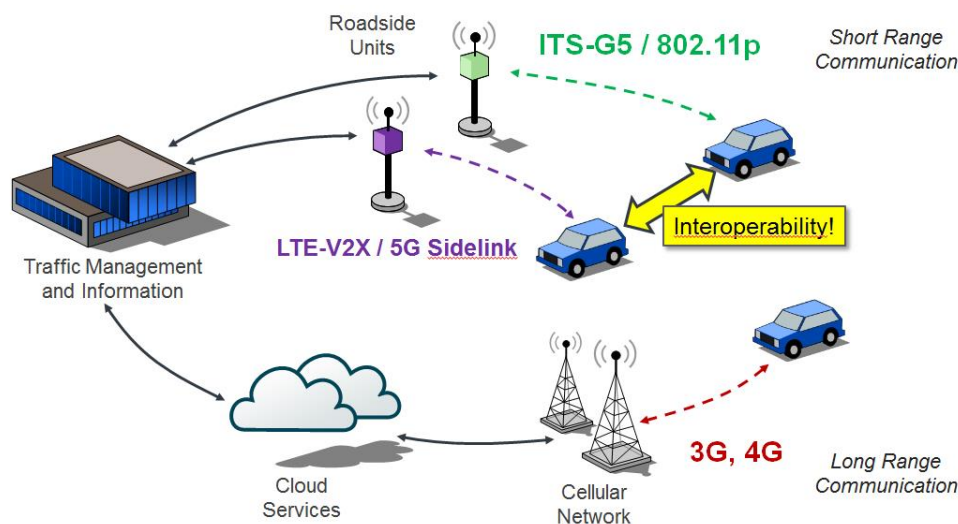


Figure 2: Danger of non-interoperability between ITS-G5 / 802.11p and LTE-V2X / 5G Sidelink

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 ¹ 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).

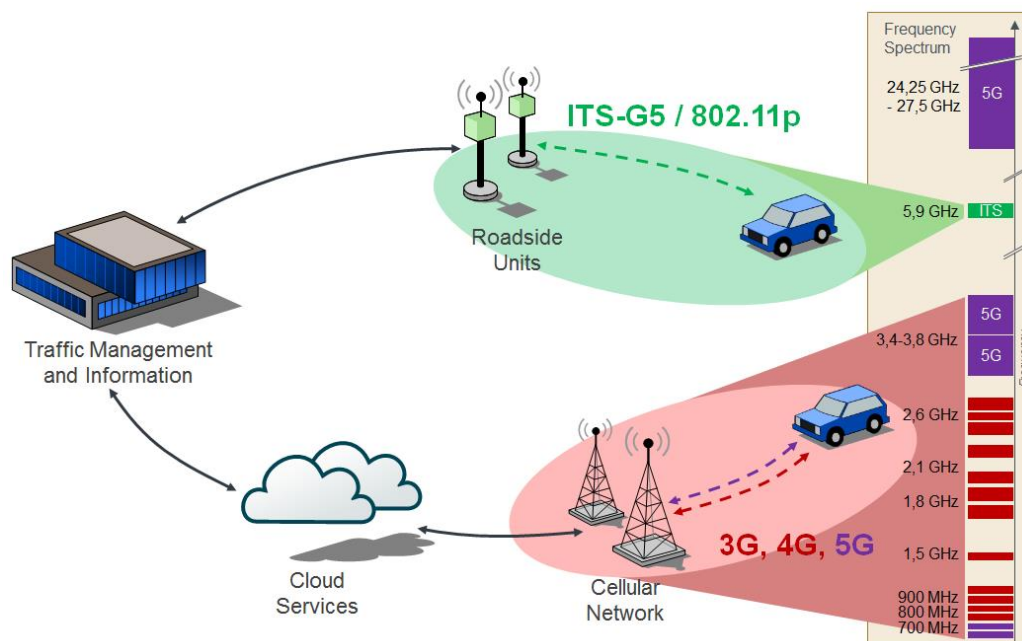


Figure 3: Current allocation of frequency bands available for C-ITS services (The 3.4-3.8 GHz frequency band has already been identified as pioneer frequency for 5G)

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). Similarly, OFCOM UK names V2X as a use case for 5G using high frequency cells at 3.4-3.8 GHz⁴. 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 GHz⁵. 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.

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

⁴ OFCOM UK, Update on 5G spectrum in the UK, Feb. 2017. https://www.ofcom.org.uk/data/assets/pdf_file/0021/97023/5G-update-08022017.pdf

⁵ ACEA Position Paper: Frequency bands for V2X, http://www.acea.be/uploads/publications/ACEA_Position_Paper_Frequency_bands_for_V2X.pdf

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 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.

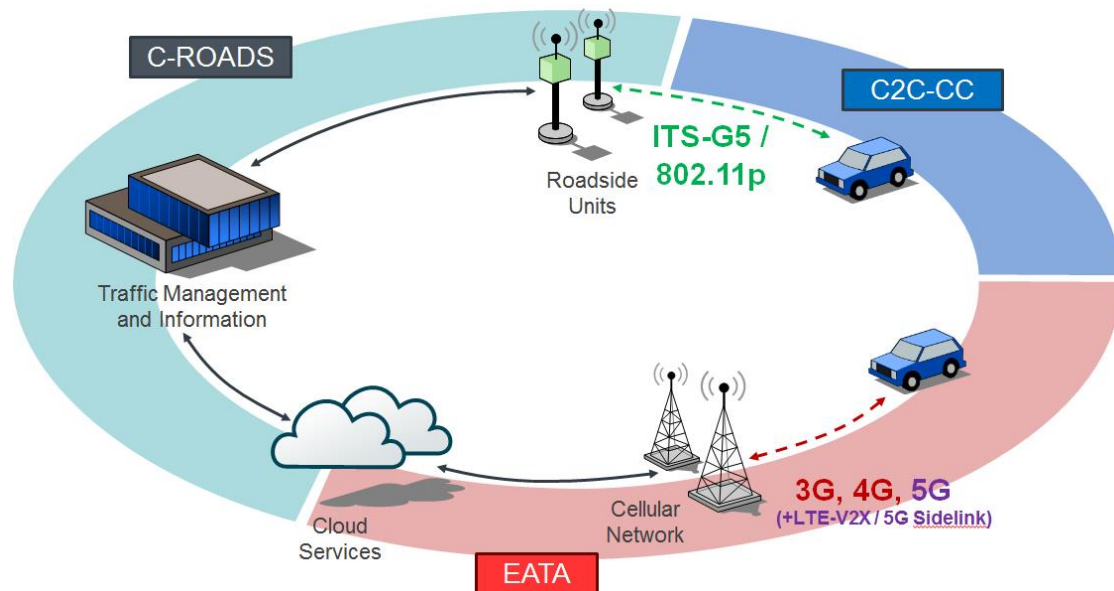


Figure 4: Cooperation model to cover the full value chain of C-ITS

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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