Interim Report

Interim Report from CEPT to the European Commission in response to the EC Mandate to CEPT to study the extension of the Intelligent Transport Systems (ITS) safety-related band at 5.9 GHz

**02 March 2018**

# Executive summary

This Interim Report has been developed within the European Conference of Postal and Telecommunications Administrations (CEPT) in the framework of the EC Mandate to study the extension of the Intelligent Transport Systems (ITS) safety-related band at 5.9 GHz (see Annex 1).

CEPT was mandated to study the possibility of:

* Extending the upper edge of the EC harmonised safety-related ITS band (5875-5905 MHz) by 20 MHz up to 5925 MHz.
* In addition to road transport, allowing other means of transport such as Urban Rail[[1]](#footnote-1) using Communication Based Train Control (CBTC) in the EC harmonised safety-related ITS band.

The status of the CEPT work undertaken in response to the tasks of the Mandate (see Annex 1) is presented in the relevant sections of this report. The working assumption is a general authorisation regime for both road ITS and Urban Rail (CBTC).

CEPT ECC confirms that currently the work is progressing according the time schedule of the mandate.

CEPT ECC’s answer to the EC Mandate is supported by the work being done in ETSI on technical solutions for sharing spectrum between Road ITS technologies (ITS-G5 and LTE-V2X) and Urban Rail (CBTC) ITS technologies in the same frequency band.

Considerations for ITS applications operating in 5855-5875 MHz are outside of the scope of the EC Mandate to study the extension of the Intelligent Transport Systems (ITS) safety-related band at 5.9 GHz and will be handled in the CEPT Report in response to the permanent mandate to CEPT on SRD – 7th Update.

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# Introduction

ECC considered the tasks as described in the EC Mandate in order to respond to the mandate according to the time schedule of the mandate.

This interim report is providing an overview of the current on-going ECC activities on:

* technology neutrality for Road ITS and Urban Rail (CBTC) ITS and its consequences;
* safety-related requirements for Road ITS and Urban Rail (CBTC) ITS;
* preliminary elements on coexistence scenarios and mitigation techniques.

In its Opinion on Intelligent Transport Systems, the RSPG considers that "*There is no evidence that spectrum availability is currently a constraint on the development of ITS, and there is no immediate need to take regulatory action in this regard*.” However, given the momentum of policy and standardisation development for ITS, RSPG recommends “*that the options for ITS to expand to share spectrum for safety-related ITS in the 20 MHz above the existing designation and, for non-safety ITS, in the 20 MHz below, should be kept available for the time being*".

Interoperability[[2]](#footnote-2) between ITS-G5 devices and LTE-V2X devices is currently not possible, meaning that they cannot exchange data and share information and knowledge with each other.

So far no need has been identified for the exchange of data and for sharing of information and knowledge between Road ITS and Urban Rail (CBTC) ITS communications.

CEPT ECC’s answer to the EC Mandate is supported by the work being done in ETSI on technical solutions for sharing spectrum between Road ITS technologies (ITS-G5 and LTE-V2X) and Urban Rail (CBTC) ITS technologies in the same frequency band.

A transition period could be needed before new technical solutions facilitating sharing between Road ITS technologies as well as between Road ITS and Urban Rail (CBTC) ITS technologies would be available. In such a case, this should be set out in the regulatory framework.

The spectrum regulation should provide a technology-neutral approach for spectrum access which should be open to innovation and future developments which cannot be foreseen as of today.

# General principles and concept for future regulatory framework

In line with the EU principle of technology neutrality in spectrum regulation, the existing Decision 2008/671/EC already allows the use of any technology that falls within the definition of ITS in compliance with the applicable harmonised standard ETSI EN 302 571 (or equivalent).

Technology neutrality in spectrum regulation for Road and Urban Rail (CBTC) ITS and its consequences:

* The spectrum regulatory approach should be as technology-neutral as possible and should not impose the use of one technology. This does however not preclude the definitions of minimum technical requirements for shared spectrum access.
* Mitigation techniques developed through ETSI standardisation should be accompanied by technical conditions for spectrum access and relevant harmonised standards, in a technology-neutral approach.
* Uncompromised safety services for all users in case of multiple technologies implementation.
* Efficient spectrum use (an overarching principle of Union's Radio Spectrum Policy, also encompassed in the provisions of the Radio Equipment Directive 2014/53/EU). Backward spectrum compatibility implies that all technologies are at least capable to coexist in the same frequency band.
* There should be no segmentation and segregation of the band 5875-5925 MHz. The principle of equal access to shared spectrum should be applied in the spectrum regulation. No specific safety related ITS technology or use should be excluded from parts of the spectrum in the band 5875-5925 MHz. This means that technologies are allowed to use the spectrum regulation for safety related ITS in 5875-5925 MHz when they support a sufficiently polite spectrum access and/or interference mitigation which allows sharing of the spectrum in principle.
* In line with spectrum access requirements, Urban Rail (CBTC) ITS should be able to use any up-to-date technology.

Further requirements:

* Existing Road ITS and Urban Rail (CBTC) ITS implementations need to be taken into account to avoid deployment issues with the new ITS spectrum regulation. Technical solutions already deployed should stay available for maintenance and evolution. This concerns existing Road ITS in 5875-5905 MHz as defined under the current regulation as well as existing Urban Rail (CBTC) ITS systems in 5905-5925 MHz provided under national regulatory conditions. The continued rollout of these systems should not be unduly hindered by a change of the spectrum regulatory environment. This may imply the provision of sufficiently long transition periods.
* Under a general authorisation regime, once placed into service, it is difficult to envisage modifications to Road ITS devices to fix a potential coexistence issue between Road ITS and Urban Rail (CBTC) ITS.
* It is observed that there is no existing Road ITS implementation above 5905 MHz. In addition, the Urban Rail (CBTC) community favours the frequencies above 5905 MHz due to existing roll-outs as requested in the ETSI system reference document TR 103 111.
* Tramways not segregated from road or pedestrian traffic shall be considered as part of Road ITS.

# ITS Technologies

## Road ITS

Current radio technologies for Road ITS in the 5.9 GHz band are ITS-G5 and LTE-V2X. LTE-V2X uses in the 5.9 GHz band only the PC5 air interface. ITS-G5 is based on IEEE 802.11/11p specifications. The term C-V2X is interchangeable with LTE-V2X.

Within CEPT, in the 5.9 GHz range, the spectrum for ITS services is split into channels with a bandwidth of 10 MHz each. The 10 MHz are to be understood as a maximum channel bandwidth, it could also be less than 10 MHz.

### 3GPP LTE-V2X

3GPP has specified a 10 MHz and a 20 MHz air interface for the PC5 air interface in the 5.9 GHz band. However, the relevance of the 20 MHz air interface for Europe has not been expressed.

Only the PC5 interface is currently foreseen in 5855-5925 MHz in the 3GPP specification approach. No Uu interface in 3GPP band 47 (5855-5925 MHz) is indicated. However, relevant information about the PC5 mode in 5.9 GHz could be conveyed in other combined bands (MFCN bands) where the Uu air interface is in operation.

References to LTE-V2X specifications:

* 3GPP TR 22.885, Study on LTE support for Vehicle to Everything (V2X) services, V14.0.0;
* 3GPP TR 36.885, Study on LTE-based V2X Services; (Release 14), V14.0.0.

### ITS-G5

The existing studies in CEPT on 5.9 GHz ITS were all based on ITS-G5 and can be found mainly in ECC Reports 101 and 228. There is a set of specifications which were created under the standardisation mandate M/453 for ITS-G5.

### Safety-related requirements for Road ITS

Safety related Road ITS applications require low-latency for vehicle-to-vehicle communications and also for communications with roadside infrastructure. The overall communication channel loading and decentralized communication traffic congestion control must be such to ensure that safety related messages have a very high predictability to be received by other ITS stations. Future safety related ITS application (e.g. truck platooning) have increased requirements and will support more and more automated driving possibilities, compared with the existing initial driver alert applications in ITS.

## URBAN RAIL (CBTC) ITS

Working assumptions had been defined and set out in the [liaison statement to ETSI](https://cept.org/Documents/wg-fm/34863/fm-17-067-annex-36_ls-to-etsi-on-urban-rail-adopted) from WGFM#87 in February 2017. They are still valid with regard to shared spectrum use. Hence, Urban Rail (CBTC) should be considered as a subset of ITS. Activities within CEPT had already been started based on the [SRdoc TR 103 111](http://www.etsi.org/deliver/etsi_tr/103100_103199/103111/01.01.01_60/tr_103111v010101p.pdf) from ETSI on Urban Rail CBTC. A new draft ECC Report has already been under development within the SRD/MG before the reception of the Mandate and followed an earlier analysis of Urban Rail Systems in CEPT/ECC WGFM / SRD/MG as well as development of [ETSI TR 103 442](http://www.etsi.org/deliver/etsi_tr/103400_103499/103442/01.02.01_60/tr_103442v010201p.pdf) on the shared use of spectrum between Communication Based Train Control (CBTC) ITS and Road ITS applications. However, ETSI TR 103 442 can only be considered as an interim report on the way towards spectrum sharing solutions between Road ITS and Urban Rail (CBTC) ITS.

CBTC is a train-to-trackside radiocommunication system, with a potential evolution to train-to-train radiocommunications. Existing CBTC systems normally use 5MHz channels instead of 10MHz.

### Technologies

Current radio technologies for Urban Rail (CBTC) ITS are:

* DSSS/TDMA;
* full or modified IEEE 802.11 technology, OFDM based;
* 3GPP TD-LTE (used in China at 1.8 GHz, not implemented in Europe yet)

### Safety-related requirements for Urban Rail (CBTC) ITS

CBTC is providing automatic train control with and without driver. When trains are moving, the wireless system allows communication with a central system. The wireless system is used to transmit traction order or braking order in a safe mode. If trains cannot transmit messages, they will not be authorised to move. The critical aspect of the radio system for Urban Rail (CBTC) ITS implementations is its availability. CBTC therefore includes redundancy in the communications and has low latency requirements.

The Urban Rail CBTC ITS system has to be sufficiently robust, i.e. suitable choice of system parameters in line with the safety-related requirements, especially for use above the ground. This aspect will also be reviewed during the work under the mandate.

The precise safety-related requirements for both Road ITS (including future Road ITS applications) and Urban Rail (CBTC) ITS will be compared during the work under the mandate and in particular be investigated how these requirements can be matched in a shared spectrum environment. CEPT will create in parallel to the work under the mandate a new ECC Report with focus on the Urban Rail (CBTC) ITS and Road ITS spectrum sharing solutions, within the same timeframe.

# Preliminary additional coexistence scenarios considered under this Mandate

Whatever the technology used is, Road and Urban Rail (CBTC) ITS shall not cause harmful interference to other services as long as they are compliant with the harmonised standard EN 302 571.

Based on ECC Reports 101 and 228 (studies performed on ITS-G5), the following items are being verified by taking into account the need for reliable safety related operation in the 5875 - 5925 MHz band:

* for LTE-V2X, whether the assumptions and conclusions made in ECC Reports 101 and 228 are valid. This included considerations about TPC, duty cycling and overall transmission activity, coexistence with TTT road tolling;
* for Urban Rail CBTC, whether the assumptions and conclusions made in ECC Reports 101 and 228 are valid;
* whether the conclusions of ECC Report 101, stating that between 5875 MHz and 5925 MHz ITS will not suffer from excessive interference resulting from systems/services other than ITS, are also valid for Road ITS based on LTE-V2X (PC5 air interface) and for Urban Rail CBTC;
* coexistence of Smart Tachograph as a new TTT application, different in its usage scenario from road tolling, with ITS.

These items are considered in CEPT/ECC WGSE within the timeframe of the mandate. Additional items may be identified in the course of work.

It should be noted that the coexistence of Smart Tachograph below 5815 MHz with Road ITS and Urban Rail (CBTC) ITS is seen as more related to the 7th update (e.g. a possible proposal for harmonisation of the Smart Tachograph application as well as for ITS in 5855-5875 MHz would be in the CEPT Report in response to the 7th Update for SRD).

The following additional items are also seen as related to the 7th update of the EC Decision for SRD:

* Impact of Radiolocation below 5850 MHz on LTE-V2X in the non-safety band 5855-5875 MHz;
* Impact of FWA in 5725-5875 MHz on LTE-V2X in the non-safety band 5855-5875 MHz and in the adjacent safety band 5875-5925 MHz.

# Preliminary Elements for Coexistence between ITS applications and technologies

There is a common understanding that ECC and ETSI will need to work closely together during the development of the response to the Mandate, based on the existing process, especially with regard to the various technologies which are under discussion in ETSI, i.e. ITS-G5, LTE-V2X and technologies to support Urban Rail (CBTC) ITS solutions. The aim is to define a common framework to share the 5875-5925 MHz band amongst ITS applications (road, urban rail).

CEPT will in particular welcome feedback on the progress of the work developed by ETSI, which aims at providing a detailed and agreed technical standard allowing practical implementation of ITS applications (road, urban rail) in the 5875-5925 MHz band.

CEPT has invited ETSI to provide information, concerning the spectrum sharing of LTE-V2X and ITS-G5, about commonalities and differences of the spectrum access mechanisms and their capabilities for sharing; for those in use or intended for use by the various technologies (ITS-G5, LTE-V2X, technologies to support CBTC) and whether this implies that specific actions are necessary to ensure compatibility between them.

## Between Road ITS technologies

CEPT invited ETSI to provide support to the work to be carried out within the framework of the EC Mandate on ITS.

No solution for co-channel operations is expected between ITS-G5 and LTE-V2X based on currently available specifications. The sharing solutions for ITS-G5 and LTE-V2X in the band 5855-5925 MHz should be addressed in the standardisation.

## Between Urban Rail (CBTC) ITS technologies

This is not an issue since only one technology is usually in operation along a railway line and, if not, the CBTC operator may decide to segregate technologies by using different channels.

The main benefit of a European spectrum harmonisation for Urban Rail (CBTC) ITS is to achieve a bigger market in Europe by using a stable and available European harmonised spectrum regulatory approach. Urban/suburban deployment does not necessarily need the harmonisation of frequencies for operational reasons and does not require cross-border/cross-network interoperability specifications in Europe.

## Between Road ITS and Urban Rail (CBTC) ITS

CEPT invited ETSI to provide support to the work to be carried out within the frame of the EC Mandate on ITS.

The work is ongoing within ETSI (JTFIR – Joint Task Force ITS-RT). Based on the solution specified by ETSI, CEPT will define in the revised ECC Decision (08)01 the minimum technical requirements for shared spectrum access. The European Commission may then reflect them in the amendment to EC Decision 2008/671/EC.

# Preliminary consideration on the need for inclusion in the EC Decision (and ECC Decision)

Considering that the 5.9 GHz ITS band is likely to be used by different technologies for safety-related systems each having their own merit, and observing the principle of technology neutrality, it is needed to expand the 5875-5905 MHz band by 20 MHz upwards and amend article 2(1) of Decision 2008/671/EC in order to expand the definition of ITS beyond road transportation.

This also includes consideration of intertwining and working together of ETSI standards and the need to ensure coherence between the regulatory frameworks set out in the EC and ECC Decision.

1. MANDATE TO CEPT



1. This type of communication encompasses urban and suburban usages which shall be taken into due consideration when conducting relevant studies. [↑](#footnote-ref-1)
2. See Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport (published in OJEU L207, 6 August 2010), especially Article 4 [↑](#footnote-ref-2)