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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Executive Summary

The present document describes the spectrum requirements for the following communications of urban rail systems:

- primarily trackside/infrastructure-to-train communications; and
- optionally train-to-train communications.

Standardisation work is currently ongoing in the ESOs related to EC mandate M/486 EN "for programming and standardisation addressed to the European Standardisation Bodies in the field of Urban Rail" [i.12]. The rationale for this mandate from the European Commision is to reduce the greenhouse gas emissions, which come for a large portion from urban areas and urban transport. Urban rail is seen as one of the prominent solutions to offer the public other ways of transportation while supporting a modal shift from private car and increasing demand for public transport thanks to the economies of scale and to the administrative simplification.

In addition, since the European rail industry is a world leader, the technical harmonisation of urban rail would be beneficial not only from the environmental point of view but also from the competitiveness point of view.

The spectrum requirements cover the needs for:

1) fundamental time-critical CBTC and safety relevant applications with very low latency; and
2) non-safety relevant applications, applying mobile networking based on internet protocol as well as other protocols, extending the applicability of the communications equipment towards railway traffic management tasks and other applications.

Both of these types of applications might indirectly enhance the traffic safety and system operation.

CBTC is providing automatic train control with or without driver. To drive automatically a train, a Data Communication System is needed. When trains are moving the wireless system allows communication with a central system. The wireless system is used to transmit traction order or breaking order in a safe mode. If trains cannot transmit messages, they will not be authorized to move.

Each train sends its location 5 times a second and the central system sends an authorization to move for each train in the line. All the messages use the wireless DCS. This system allows to reduce the time between trains in automatic mode (85 s instead of 105 s with human drivers)

It is recommended to have contiguous and/or nearby frequency bands, in the upper 5 GHz frequency range designated for items 1 and 2. It is proposed:

- for item 1: to designate 20 MHz of spectrum for CBTC and safety relevant critical applications, preferably within the frequency range from 5,905 GHz to 5,925 GHz;
- for item 2: to designate 20 MHz of spectrum, i.e. 5,855 GHz to 5,875 GHz, for non-safety related urban rail applications (secure control, railway traffic management and video-surveillance).

It also requested to consider in a future review of the proposed ECC Decision the designation of 5,925 GHz to 5,945 GHz for future Urban Rail applications.

Spectrum usage as proposed in the present document is to be considered on a pan-European basis. In addition to the benefits expected from technical harmonization, the aim is to avoid coordination/protection zone issues at borders, and to facilitate any deployment in urban areas crossing borders.

Introduction

The present document has been developed to support the co-operation between ETSI and the Electronic Communications Committee (ECC) of the European Conference of Post and Telecommunications Administrations (CEPT).

Status of pre-approval draft

The present document was developed by TC RT in cooperation with the UITP Spectrum User Group. An earlier version underwent internal enquiry ERM(12)DEC058 by TC ERM. The comments received during that internal enquiry have been considered when preparing the current version. The present document contains final information.

1 Scope

The present document describes urban rail systems which may require a change of the present frequency designation/utilisation within CEPT.

It includes in particular:

- market information;
- technical information including expected sharing and compatibility issues;
- regulatory issues.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references,only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ECC/DEC/(08)01: ECC Decision of 14 March 2008 on the harmonised use of the 5875-5925 MHz frequency band for ITS, and subsequent amendments.

[i.2] ECC/DEC/(04)08 of 12 November 2004 on the harmonised use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs).

[i.3] IEEE 802.11p-2010: "IEEE Standard for Information technology-Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Wireless Access in Vehicular Environments (WAVE)".

[i.4] ETSI EN 302 665 V1.1.1 (2010-09): "Intelligent Transport Systems (ITS); Communications Architecture".

[i.5] ETSI EN 302 663: "Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".

[i.6] ISO 21215: "Intelligent Transport Systems -- CALM -Medium and long range, high speed, air interface parameters and protocols for broadcast, point-point, vehicle-vehicle, and vehicle-point communications in the ITS Sector -- Air interface using 5 GHz communications".

[i.7] ETSI EN 302 571: "Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

[i.8] MODURBAN, FP6 Project TIP4-2005-516380, MODCOMM Subproject, D39: "Data Communication System functional requirements".

NOTE: Modurban public documents are available at http://www.modurban.org/documents.php.

[i.9] MODURBAN, FP6 Project TIP4-2005-516380, MODCOMM Subproject, D40: "Data Communication System performance, reliability and maintainability requirements".

NOTE: Modurban public documents are available at http://www.modurban.org/documents.php.

[i.10] MODURBAN, FP6 Project TIP4-2005-516380, MODCOMM Subproject, D41: "Data Communication System Architecture".

NOTE: Modurban public documents are available at http://www.modurban.org/documents.php.

[i.11] CENELEC EN 50159: "Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems".

[i.12] EC Mandate M/486 EN: "Mandate for Programming and Standardisation addressed to the European Standardisation bodies in the field of urban rail".

NOTE: This mandate is available at http://www.etsi.org/about/our-role-in-europe/public-policy/ec-mandates.

[i.13] 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.

[i.14] MODSAFE European Commission Seventh Framework Programme MODSafe Modular Urban Transport Safety and Security Analysis Glossary Deliverable D.5.

NOTE: The MODSAFE Glossary is available at www.modsafe.eu.

[i.15] EN 14383-1:2006: CEN/TC 325 "Prevention of crime - Urban planning and building design - Part 1: Definition of specific terms".

[i.16] draft IEC 61375-2-6 Ed. 1.0: "Electronic railway equipment - Train Communication Network - Part 2-6: On-board to ground communication".

[i.17] CEPT/ERC Recommendation 70-03: "Relating to the Use of Short Range Devices (SRD)", Tromso 1997, Subsequent amendments 07 February 2014".

[i.18] Commission Decision of 5 August 2008 on the harmonised use of radio spectrum in the 5875-5905 MHz frequency band for safety-related applications of Intelligent Transport Systems (ITS) (2008/671/EC).

[i.19] ECC Recommendation (08)01: "Use of the band 5855-5875 MHz for Intelligent Transport Systems (ITS)".

[i.20] Commission Decision of 11 July 2005 on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs)(2005/513/EC).

[i.21] Commission Implementing Decision of 11 December 2013 amending Decision 2006/771 on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC (2013/752/EU).

[i.22] ERC Report 25, version February 2013: "The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz (ECA table)".

[i.23] Recommendation ITU-R M.1453-2: "Intelligent transport systems - dedicated short range communications at 5.8 GHz".

[i.24] Report Recommendation ITU-R M.2228: "Advanced intelligent transport systems (ITS) radiocommunications".

[i.25] Recommendation ITU-R F.699: "Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to about 70 GHz".

[i.26] CEPT/ERC Recommendation 74-01E (Siófok 98, Nice 99, Sesimbra 02, Hradec Kralove 05, Cardiff 11): "Unwanted emissions in the spurious domain".

[i.27] Agence Nationale de Fréquences, Commission de la Compatibilité Electromagnétique, 5 January 2010: "Rapport d"étude sur la compatibilité à 5.9 GHz entre les sytèmes RATP et les ITS".

[i.28] European Commission, Radio Spectrum Committee, document RSCOM13-32rev3: "Mandate to CEPT to study and identify harmonised compatibility and sharing conditions for Wireless Access Systems including Radio Local Area Networks in the bands 5350-5470 MHz and 5725-5925 MHz ("WAS/RLAN extension bands") for the provision of wireless broadbands services".

[i.29] CEPT/ECC document ECC(14)025 Annex 12: "Interim Report from CEPT to the European Commission in response to the Mandate To study and identify harmonised compatibility and sharing conditions for Wireless Access Systems including Radio Local Area Networks in the bands 5350-5470 MHz and 5725-5925 MHz ("WAS/RLAN extension bands") for the provision of wireless broadband services".

[i.30] ITU Radio Regulations, 2012.

[i.31] ETSI ES 202 663: "Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band".

[i.32] ETSI EN 302 502: "Broadband Radio Access Networks (BRAN); 5,8 GHz fixed broadband data transmitting systems; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

[i.33] ECC/REC(06)04: "Use of the band 5 725-5 875 MHz for Broadband Fixed Wireless Access (BFWA)".

[i.34] ETSI EN 300 440: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range".

[i.35] ETSI EN 302 372: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Equipment for Detection and Movement; Tanks Level Probing Radar (TLPR) operating in the frequency bands 5,8 GHz, 10 GHz, 25 GHz, 61 GHz and 77 GHz".

[i.36] ETSI EN 302 217: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas".

[i.37] ETSI EN 301 443: "Satellite Earth Stations and Systems (SES); Harmonized EN for Very Small Aperture Terminal (VSAT); Transmit-only, transmit-and-receive, receive-only satellite earth stations operating in the 4 GHz and 6 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive".

[i.38] ERC/REC 12-02: "Harmonised radio frequency channel arrangements for analogue and digital terrestrial fixed systems operating in the band 12.75 GHz to 13.25 GHz".

[i.39] ECC/DEC/(11)02: ECC Decision of 11 March 2011 on industrial Level Probing Radars (LPR) operating in frequency bands 6 - 8.5 GHz, 24.05 - 26.5 GHz, 57 - 64 GHz and 75 - 85 GHz.

[i.40] ETSI EN 302 729: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Level Probing Radar (LPR) equipment operating in the frequency ranges 6 GHz to 8,5 GHz, 24,05 GHz to 26,5 GHz, 57 GHz to 64 GHz, 75 GHz to 85 GHz".

[i.41] ETSI EN 302 065: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communications purposes; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

[i.42] ETSI EN 302 500: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra WideBand (UWB) technology; Location Tracking equipment operating in the frequency range from 6 GHz to 9 GHz".

[i.43] ERC/REC 14-02: "Radio-frequency channel arrangements for medium and high capacity analogue and high capacity digital radio-relay systems operating in the band 6425-7125 MHz".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Data Communication System (DCS): global communication architecture into which radiocommunication links are integrated

NOTE: The Data Communication System is specified in [i.8], [i.9] and [i.10].

on-board unit: antenna**,** radio frequency accessories, radio transmitter and receiver, usually installed in a train

physical security: part of security concerned with measures and concepts designed to:

1) safeguard personnel;
2) prevent unauthorized access to equipment, installations, material and documents; and
3) safeguard equipment, installations, material and documents against espionage, sabotage, damage and theft

NOTE 1: This definition is from the European project MODSAFE (www.modsafe.eu) Glossary Deliverable D.5 [i.14] which are based on definitions from EN 14383-1 [i.15].

NOTE 2: See also "Security".

safety: freedom from unacceptable levels of risks resulting from unintentional acts or circumstances [i.11]

NOTE: This definition is from [i.14].

security: freedom from unacceptable levels of risks resulting from intentional acts or circumstance

NOTE 1: This definition is from [i.14].

NOTE 2: See also "Physical security".

Track-Side Unit: antenna**,** radio frequency accessories, radio transmitter and receiver, usually fixed as part of the railway infrastructure:

- installed along the track, e.g. on a gantry or a tunnel ceiling above it or at poles beside it;
- single TSUs operating in a stand-alone fashion; or
- a group of TSUs connected together by an appropriate infrastructure, which may include an information network; or
- a single TSU connected to an information network.

trackside-to-train communications: downlink communications

NOTE: See also trackside-train communications.