



Intelligent Transport Systems (ITS); Feasibility study on the use of UWB; Release 2

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**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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Introduction

Based on the new spectrum regulation framework (ECC Decision (06)04 [i.1]) in Europe the use of UWB technologies in the band 6 GHz to 8,5 GHz ITS has been simplified and the potential applications have been extended. Further extensions of the available spectrum are under investigation in CEPT [i.4]. Material sensing application using UWB which are deployable in vehicular environments are permitted under the ECC Decision (07)01 [i.2].

ECC Decision (06)04 [i.1] may be reviewed (as per its considering mm)) based on the outcome of the World Radio Conferences and/or on the actual UWB deployment, in particular if the deployment of UWB technology can present a significant risk of interference to radio services deployed in the band 6 GHz to 8,5 GHz. It is important to ensure that future ITS applications based on the present document match the assumptions used in ECC Report 327 [i.5] used to develop such ECC decision (e.g. densities of UWB devices, activity factors, etc.) and avoid risk of interference to other services.

The present document analyses the required extension of the ETSI ITS protocol and architecture for inclusion of UWB technologies into the overall C-ITS system.

For these analyses the present document uses example use cases such as:

- VRU detection and clustering
- Tolling based on secure ranging
- Precise cooperative positioning
- Highly automated parking applications

In the present document, some of the use cases are described and a potential way to integrate UWB technology in support of these use cases into the ITS standards framework is considered.

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1 Scope

The present document studies the feasibility of using Ultra Wide Band (UWB) technology in ITS.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative 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.

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

The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

- [i.1] [CEPT ECC/DEC/\(06\)04](#): "The harmonised use, exemption from individual licensing and free circulation of devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz", 24 March 2006 amended 18 November 2022.
- [i.2] [ECC/DEC/\(07\)01](#): "The harmonised use, exemption from individual licensing and free circulation of Material Sensing Devices using Ultra-Wideband (UWB) technology", 30 March 2007.
- [i.3] [Commission Implementing Decision \(EU\) 2024/1467](#) of 27 May 2024 amending Implementing Decision (EU) 2019/785 on the harmonisation of radio spectrum for equipment using ultra-wideband technology in the Union.
- [i.4] ETSI TR 103 750 (V1.1.1): "System Reference document (SRdoc); Short Range Devices (SRD) using Ultra Wide Band (UWB); Technical characteristics for UWB operation in the frequency band between 8,5 GHz to 10,6 GHz".
- [i.5] [ECC Report 327](#): "Technical studies for the update of the Ultra Wide Band (UWB) regulatory framework in the band 6.0 GHz to 8.5 GHz", 1 October 2021.
- [i.6] IEEE Std 802.15.4a™-2015: "IEEE Standard for Low-Rate Wireless".
- [i.7] IEEE Std 802.15.4z™-2020: "IEEE Standard for Low-Rate Wireless Networks--Amendment 1: Enhanced Ultra-Wideband (UWB) Physical Layers (PHYs) and Associated Ranging Techniques".
- [i.8] ETSI TR 103 579 (V1.1.1): Intelligent Transport Systems (ITS); Pre-Standardization Study on payment applications in Cooperative ITS using V2I communication.
- [i.9] [ERC Report 25](#): "The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz (ECA table)".
- [i.10] [ECC CEPT SE24_79](#): "UWB extension".
- [i.11] European Commission: "[Road safety statistics 2022 in more detail](#)".
- [i.12] Bettina Erdem, regulatory affairs V2X: "[Importance of Collective Perception, V2X spectrum needs, expectation on Euro NCAP](#)".
- [i.13] Microwaves&RF®: "[Revolutionizing Vehicle Safety: The Role of UWB in Modern Automobiles](#)", Qorvo, 2024.

- [i.14] ETSI TS 103 300-2 (V2.2.1): "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 2: Functional Architecture and Requirements definition; Release 2".
- [i.15] [ETSI EN 302 065-1 \(V2.1.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Requirements for Generic UWB applications".
- [i.16] [ETSI EN 302 065-2 \(V2.1.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 2: Requirements for UWB location tracking".
- [i.17] [ETSI EN 302 065-3 \(V2.1.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 3: Requirements for UWB devices for ground based vehicular applications".
- [i.18] [ETSI EN 302 065-4 \(V1.1.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 4: Material Sensing devices using UWB technology below 10,6 GHz".
- [i.19] [ETSI EN 302 065-4-4 \(V1.1.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard for access to radio spectrum; Part 4: Material Sensing devices; Sub-part 4: Exterior material sensing applications for ground based vehicles".
- [i.20] [ETSI EN 302 065-4-1 \(V2.2.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard for access to radio spectrum; Part 4: Material Sensing devices; Sub-part 1: Building material analysis operating within 30 MHz to 10,6 GHz".
- [i.21] [ETSI EN 302 065-5 \(V1.1.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU; Part 5: Devices using UWB technology onboard aircraft".
- [i.22] [ETSI EN 302 065-3-1 \(V3.2.1\)](#): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard for access to radio spectrum; Part 3: UWB devices installed in motor and railway vehicles; Sub-part 1: Requirements for UWB devices for vehicular access systems within 3,8 GHz to 4,2 GHz or 6 GHz to 8,5 GHz".
- [i.23] [ETSI EN 303 883-1 \(V2.1.1\)](#): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 1: Measurement techniques for transmitter requirements".
- [i.24] [ETSI EN 303 883-2 \(V2.1.1\)](#): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 2: Measurement techniques for receiver requirements".
- [i.25] Pirch H.-J., Leong F.: "[Introduction to Impulse Radio UWB Seamless Access Systems](#)".
- [i.26] Inpixon: "[Ultra-Wideband RTLS, Positioning, & Sensor Technology](#)".
- [i.27] Leoni Elia, et al.: "Validating Vehicular Localization Indoor using UWB: Challenges and Solutions". 2023 9th International Workshop on Advances in Sensors and Interfaces (IWASI). IEEE™, 2023, pp. 27-32.
- [i.28] San Martín J., et al.: "Precise positioning of autonomous vehicles combining UWB ranging estimations with on-board sensors". Electronics, 2020, 9(8), 1238.
- [i.29] u-blox: "[Exploring hybrid positioning solutions to enable future autonomous vehicles](#)".
- [i.30] Piavanini Marco, et al.: "Experimental Validation of Vehicle Positioning with Ultra-Wide Band Roadside Infrastructure." 2023 IEEE™ International Workshop on Metrology for Industry 4.0 & IoT (MetroInd4. 0&IoT). IEEE™, 2023, pp. 171-176.
- [i.31] FiRa Consortium: "[The Present and Future of UWB](#)".
- [i.32] European commission: "[General Safety Regulation protecting vehicle occupants and vulnerable road users](#)".
- [i.33] [ETSI TS 103 900 \(V2.1.1\)](#): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Cooperative Awareness Service; Release 2".

- [i.34] [ETSI TR 103 300-1 \(V2.3.1\)](#): "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 1: Use Cases definition; Release 2".
- [i.35] [ETSI TS 103 300-2 \(V2.3.1\)](#): "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 2: Functional Architecture and Requirements definition; Release 2".
- [i.36] [ETSI TS 103 300-3 \(V2.2.1\)](#): "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 3: Specification of VRU awareness basic service; Release 2".
- [i.37] Genovese A.: "[Awareness Messages for Vulnerable Road Users](#)", Politecnico di Torino, December 2023.
- [i.38] Xhoxhi E., Schiegg F.A.: "A First Study on the Spectrum Needs for Release 2 V2X Services", IEEE™ VTC-23 Fall.
- [i.39] CAR 2 CAR Communication Consortium: "[Survey on ITS-G5 CAM statistics CAR 2 CAR Communication Consortium](#)".
- [i.40] Renzel T., Stolz M., Watzenig D.: "Looking into the Path Future: Extending CAMs for Cooperative Event Handling", IEEE 92nd Vehicular Technology Conference, 11/2020.
- [i.41] Yonhap News: "['Next-Generation Intelligent Transportation System' Introduced in Sejong City to Ensure Safety on School Commutes](#)".
- [i.42] [ETSI TR 103 667 \(V1.1.1\)](#): "Intelligent Transport Systems (ITS); Study on Spectrum Sharing between ITS-G5 and LTE-V2X technologies in the 5 855 MHz-5 925 MHz band".
- [i.43] Lisa Ward, Jörg Köpp: "Exploring the Future of UWB Comprehensive insights into IEEE 802.15.4ab", R&S White Paper, 2025.
- [i.44] IEEE P802.15.4ab™/D03: "IEEE Draft Standard for Low-Rate Wireless Network Amendment 1: Enhanced Ultra Wide-Band (UWB) Physical Layers (PHYs) and Associated Medium Access and Control (MAC) sublayer Enhancements", September 2025.
- [i.45] ETSI TR 103 902 (V2.1.1): "Intelligent Transport Systems (ITS); ITS Framework; Terms, Symbols and Abbreviations; Release 2".
- [i.46] draft ETSI EN 302 065-1-1: "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard for access to radio spectrum; Part 1: Generic UWB devices; Sub-part 1: Communication devices within 3,1 GHz to 4,8 GHz using LDC mitigation or within the 6 to 8,5 GHz".

NOTE: Under development at the time of publication of the present document.

- [i.47] draft ETSI EN 302 065-2-1: "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised standard for access to radio spectrum; Part 2: Ultra Wide Band location tracking devices; Sub-part 1: Requirements for devices within 6 GHz to 8,5 GHz".

NOTE: Under development at the time of publication of the present document.

- [i.48] draft ETSI EN 302 065-2-2: "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised standard for access to radio spectrum; Part 2: Ultra Wide Band location tracking devices; Sub-part 2: Requirements for devices in the frequency band between 3,1 GHz to 4,8 GHz utilizing LDC mitigation technique".

NOTE: Under development at the time of publication of the present document.

- [i.49] draft ETSI EN 302 065-2-3: "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised standard for access to radio spectrum; Part 2: Ultra Wide Band location tracking devices; Sub-part 3: Requirements for fixed infrastructure UWB based localization systems in the frequency band between 3,1 GHz to 4,8 GHz deploying Detect-And-Avoid (DAA) mitigation technique".

NOTE: Under development at the time of publication of the present document.