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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

Modal verbs terminology

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Introduction

Several initiatives had been started to introduce vehicular communication technology for different use cases into different international standards and industry organizations, which were previously focusing only on ITS-G5. At the same time, some regulatory bodies are currently considering to mandate C-ITS technologies in order to foster its deployments.

While LTE-V2X standards are already finalized in 3GPP Rel. 14 and are expected to be deployed for "Day 1" use cases, there are still many options on how to configure and parameterize the LTE-V2X systems. In order to provide a common standard interpretation, there is a need for corresponding system profiles, which outline the basic system settings and environments.

In Europe, Basic System Profiles (BSPs) have been developed by the Car-2-Car Communication Consortium (C2C-CC) and the EU funded C-ROADS Platform project, assuming ITS-G5 with IEEE specifications as radio access technology for V2V and V2I communication. Though many aspects of the existing BSPs could be reused, there are some modifications needed in order to allow applicability for LTE-V2X, which are addressed in the present document.

The objective of the present document is to specify a profile for LTE-V2X by making references to the C2C-CC Basic System Profile (BSP) and the C-ROADS Roadside ITS-G5 System Profile (RSP) and specifying the differences, in order to use LTE-V2X for the envisioned "Day 1" use cases provided in these documents. In order for the present document to be useful for its intended purpose and to make full use of it, the C2C-CC and C_ROADS documents need to be acquired separately. Where portions of the C2C-CC and C-ROADS documents are not suggested to be modified, replaced or deleted in creating implementations of the LTE-V2X implementations by the present document, those portions are considered to apply to LTE-V2X.

Since the C2C-CC and C-ROADS documents are not under the control of ETSI, the present document contains only incremental changes that need to be applied, referring to the corresponding items that are to be replaced or not applicable for LTE-V2X. The considered changes are based on Release 1.5.0 of C2C-CC BSP [8] and C2C-CC Feat [9] as well as Release 1.6 of C-ROADS RSP [13] and C-ROADS MSP [14]. Initial work has been done in 5GAA PC5 BSP [i.1] and 5GAA PC5 RSP [i.2] based on earlier releases. The present document may be revised in the future to take into account later releases of C2C and C-ROADS deliverables.

C2C-CC documents C2C-CC Trig [10] describing C-ITS triggering conditions, as well as C-ROADS documents C-ROADS Serv [15] and C-ROADS Func [16] describing C-ITS service and functional requirements, respectively, are already applicable to LTE-V2X.

1 Scope

The scope of the present document is to identify a common set of standards and specify configuration parameter values and references required for the implementation of direct communication between ITS stations, to achieve interoperable deployment of ITS services via V2V and V2I links.

The scope is limited to communication aspects of ITS stations using the single access layer technology LTE-V2X PC5 mode 4. Additional requirements like triggering conditions, position accuracy, security, and functional safety aspects are out of scope of the present document.

Descriptions, definitions and rules for all layers (Applications, Facilities, Networking & Transport and Access) of the ETSI ITS station reference architecture are considered as needed.

2 References

2.1 Normative 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 https://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.

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

[1] ETSI EN 303 613: "Intelligent Transport Systems (ITS); LTE-V2X Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".

[2] ETSI EN 302 636-4-1: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality".

[3] ETSI EN 302 636-5-1: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol".

[4] ETSI TS 103 574: "Intelligent Transport Systems (ITS); Congestion Control Mechanisms for C-V2X PC5 interface; Access layer part".

[5] Void.

[6] ETSI TS 136 101: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 Release 14)".

[7] ETSI EN 302 571: "Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

[8] C2C-CC: "Basic System Profile", Release 1.5.0.

NOTE: Available at https://www.car-2-car.org/fileadmin/documents/Basic_System_Profile/Release_1.5.0/C2CCC_RS_2037_Profile.pdf.

[9] C2C-CC: "Features", Release 1.5.0.

NOTE: Available at https://www.car-2-car.org/fileadmin/documents/Basic_System_Profile/Release_1.5.0/C2CCC_RS_2036_Features.pdf.

[10] C2C-CC: "Triggering Conditions and Data Quality on Adverse Weather", Dangerous Situation, Exchange Of IRCs, Special Vehicle, Stationary Vehicle, and Traffic Jam, SPatMAP, Release 1.5.1.

NOTE: Available at https://www.car-2-car.org/fileadmin/documents/Basic_System_Profile/Release_1.5.1/C2CCC_RS_2002_AdverseWeather.pdf.

[11] C2C-CC: "Protection Profile V2X Hardware Security Module", Release 1.5.0.

NOTE: Available at https://www.car-2-car.org/fileadmin/documents/Basic_System_Profile/Release_1.5.0/C2CCC_PP_2056_HSM.pdf.

[12] C2C-CC: "References", Release 1.5.0.

NOTE: Available at https://www.car-2-car.org/fileadmin/documents/Basic_System_Profile/Release_1.5.0/C2CCC_RS_2052_References.pdf.

[13] C-ROADS, Roadside ITS G5 System Profile, Release 1.6, Version 6.2, Jun 25, 2019.

NOTE: Available at https://www.c-roads.eu/platform/about/news/News/entry/show/release-16-of-c-roads-harmonised-c-its-specifications.html.

[14] C-ROADS, Mobile Roadside ITS G5 System Profile, Release 1.6, Version 1.1, Oct 28, 2019.

NOTE: Available at https://www.c-roads.eu/platform/about/news/News/entry/show/release-16-of-c-roads-harmonised-c-its-specifications.html.

[15] C-ROADS, Common C-ITS Service Definitions, Release 1.6, Version 1.6, Feb 4, 2020.

NOTE: Available at https://www.c-roads.eu/platform/about/news/News/entry/show/release-16-of-c-roads-harmonised-c-its-specifications.html.

[16] C-ROADS, C-ITS Infrastructure Functions and Specifications, Release 1.6, Version 11.1, Dec 18, 2019.

NOTE: Available at https://www.c-roads.eu/platform/about/news/News/entry/show/release-16-of-c-roads-harmonised-c-its-specifications.html.

[17] C-ROADS Specification for interoperability of backend hybrid C-ITS communication, Release 1.6, Version 1.6, Dec 17, 2019.

NOTE: Available at https://www.c-roads.eu/platform/about/news/News/entry/show/release-16-of-c-roads-harmonised-c-its-specifications.html.

[18] ETSI TS 136 214: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements (3GPP TS 36.214 Release 14)".

[19] ETSI TS 136 321: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification (3GPP TS 36.321 Release 14)".

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.

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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] 5GAA TR S-180179: "5G Automotive Association; Working Group on Standards and Spectrum (WG4); Initial C-V2X System Profile (ICSP) - Amendments to C2C-CC Basic System Profile".

NOTE: Available at https://5gaa.org/wp-content/uploads/2020/02/5GAA_S-180179_TR_ICSP_Initial_C-V2X_System_Profile_v1.1.pdf.

[i.2] 5GAA TR S-180180: "5G Automotive Association; Working Group on Standards and Spectrum; Initial C-V2X System Profile (ICSP) - Amendments to C-ROADS Roadside System Profile".

NOTE: Available at https://5gaa.org/wp-content/uploads/2020/02/5GAA_S-180180_TR_ICSP_Initial_C-V2X_System_Profile_RSU_v1.1-1.pdf.

[i.3] C2C-CC: "Glossary", Release 1.5.0.

NOTE: Available at https://www.car-2-car.org/fileadmin/documents/Basic_System_Profile/Release_1.5.0/C2CCC_TR_2053_Glossary.pdf.

[i.4] ETSI TS 136 300: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (3GPP TS 36.300 Release 14)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in C2C-CC BSP [8], C-ROADS RSP [13], C-ROADS MSP [14] and the following apply:

C-ITS basic system: cooperative ITS system employing radio communication technologies to exchange messages between ITS stations

hybrid system: system combining direct communication over a PC5 interface and network communication over a Uu interface

LTE-V2X Basic System: C-ITS vehicle or roadside sub-system as outlined in C2C-CC Feat [9], C-ROADS Serv [15] and employing C-V2X technologies according to ETSI TS 136 300 [i.4] Release 14, where the PC5 link is used for direct communication instead of ITS-G5 and the Uu interface is used for V2X communication via cellular network infrastructure

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in C2C-CC Glossary [i.3] and the following apply:

3GPP	3rd Generation Partnership Project
5GAA	5G Automotive Association
AM	Item identifier prefix for amendments provided in the present document
BSP	Basic System Profile
C2C-CC	Car-2-Car Communication Consortium
CBR	Channel Busy Ratio
C-ROADS	EU funded platform for C-ITS deployments
C-V2X	Cellular Vehicle-to-Everything
DCC	Distributed Congestion Control for ITS-G5
GN	Geo Networking
HSM	Hardware Security Module
ICSP	Initial C-V2X System Profile
IEEE	Institute of Electrical and Electronics Engineers
ITS-G5	Short range V2X system using IEEE 802.11 access technology
LTE-V2X	Long Term Evolution C-V2X system

NOTE: Defined in ETSI EN 303 613 [1].

MAC	Medium Access Control
MSP	Mobile Roadside Unit System Profile
OBU	On-Board Unit (C-ITS vehicle sub-system)
PC5	3GPP direct communication interface (sidelink)
PDCP	Packet Data Convergence Protocol
PHY	Physical Layer
PPPP	ProSe Per Packet Priority
RLC	Radio Link Control
RSP	Roadside Unit System Profile
RSU	Roadside Unit (C-ITS roadside sub-system)
Uu	3GPP network communication interface
V2X	Vehicle-to-Everything Communication

4 General Requirements

4.1 Introduction

The present document contains individual requirement items which are assigned with unambiguous references starting with "AM_BSP_", and "AM_RSP_", and "AM_MSP_" as prefix for OBU and, RSU and Mobile-RSU requirements, respectively. The unique identifier is useful as a reference for any comments/questions instead of referring to sections or page numbers. This follows the same principles as was applied in previous work from C2C-CC and C-ROADS.

In the present document, references to corresponding items of C2C-CC BSP [8], C-ROADS RSP [13], and C-ROADS MSP [14] are denoted with the prefix "RS_BSP_", "RS_RSP_", and "RS_MSP_" respectively, or with the corresponding section number of the reference document as needed. Throughout the present document, if an item is replaced, the unique identifier is appended by a bracket term indicating the identifier it replaces, e.g. "(replaces RS_BSP_123)".

4.2 AM_BSP_010

If not otherwise stated in the present document, the requirements from C2C-CC BSP [8], C2C-CC Feat [9], C2C-CC Trig [10], C2C-CC HSM [11], C-ROADS RSP [13], C-ROADS MSP [14], C-ROADS Func [16], C-ROADS Hyb [17], and C-ROADS Serv [15] shall be adopted for LTE-V2X systems. Version numbers of references given in C2C-CC [12] shall not apply, i.e. latest versions shall apply.