5GAA TR S-180180

Technical Report

5G Automotive Association;
Working Group on Standards and Spectrum;
Initial C-V2X System Profile (ICSP)
– Amendments to C-ROADS Roadside System Profile

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Contents

Important note

The objective of this document is to provide changes that can be applied to the C-ROADS Roadside ITS-G5 System Profile (RSP) in order to make it applicable to C-V2X for the 'Day 1' use cases envisioned by the European Commission. To make full use of this document, the C-ROADS documents must be acquired separately and with permission from the C-ROADS project consortium. To the extent that portions of the C-ROADS documents are not suggested to be modified, replaced or deleted in creating implementations of the C-V2X implementations by this document, such documents may be otherwise considered normative references.

Because the C-ROADS project documentation is protected by copyrights, this document contains only incremental changes, referring to the corresponding items to be replaced or which are not applicable for C-V2X. The changes are based on version 5.5 of [C-ROADS RSP] and release 1.3.0 of [C2C-CC BSP] and [C2C-CC Feat]. Updates or new versions of the C-ROADS documentation should be reviewed and may lead to further suggested differences from the C-ROADS documents, and this document is not provided with any expectation that the suggestions in this document would meet the requirements of the C-ROADS.

It is assumed that the C-ROADS documents [C-ROADS Serv] and [C-ROADS Func] describing the C-ITS service and functional requirements, respectively, are already in a 'technology neutral' state and can be reused for C-V2X direct communication mode as is.

Foreword

This Technical Report has been produced by 5GAA.

The contents of the present document are subject to continuing work within the Working Groups (WG) and may change following formal WG approval. Should the WG modify the contents of the present document, it will be re-released by the WG with an identifying change of the consistent numbering that all WG meeting documents and files should follow (according to 5GAA Rules of Procedure):

x-nnzzzz

(1) This numbering system has six logical elements:

(a) x: A single letter corresponding to the Working Group:

where x =

T (Use Cases and Technical Requirements)

B (Business Models and Go-To-Market Strategies)

A (System Architecture and Solution Development)

S (Standards and Spectrum)

P (Evaluation, Testbed and Pilots)

E (Security and Privacy)

(b) nn: Two digits to indicate the year. i.e. 16,17,18, etc

(c) zzzz: Unique number of the document

(2) No provision is made for the use of revision numbers. Documents which are a revision of a previous version should indicate the document number of that previous version.

(3) The file name of documents shall be the document number. For example, document S-160357 will be contained in file S-160357.doc.

1 Introduction

<AM_RSP_001>

Several initiatives had been started to introduce C-V2X technology for different use cases into different international standards and industry organisations, which were traditionally focusing only on DSRC/ITS-G5. At the same time, some regulatory bodies are considering to mandate C-ITS technologies to foster deployment. For example, the Commission proposed a Delegated Act which was supposed to regulate the C-ITS deployment in Europe based on currently existing technologies. On 8th July 2019 the Council of the European Union adopted a decision to object against the proposal for Delegated Regulation on Cooperative Intelligent Transport Systems.

While C-V2X standards are already finalised for 3GPP Rel. 14 and 5GAA published White Paper on C-V2X Use Cases: Methodology, Examples and Service Level Requirements, there are still many options on how to configure and establish parameters for C-V2X systems. In order to provide a common standard interpretation, corresponding Basic System Profiles (BSP) are needed, which outline the basic system settings and environments.

In Europe, such BSPs have been developed by the Car-2-Car Communication Consortium (C2C-CC) and the EU-funded C-ROADS project, assuming ITS-G5 with IEEE 802.11p as radio access technology for V2V and V2I communication. Though many aspects of the existing BSPs could be reused, there are some modifications needed to be applicable for C-V2X. In addition, there would be extensions required to accommodate alternative communication links like V2P, V2N, and V2C.

The text of the rejected EU Delegated Act proposal included input from the proprietary from the proprietary C2C-CC and C-ROADS BSPs. Since this would limit the C-ITS deployment to ITS-G5 technologies, amendments considering the Basic System Profile for C-V2X would be needed in order to achieve technology neutrality.

2 Scope

<AM_RSP_002>

The scope of this document is the extent to which the C-ROADS roadside system profile [C-ROADS RSP] should be amended, focusing on the direct communication interface PC5 used in Mode 4 of the C-V2X system specified in [ETSI TS 136 300].

This document shall enable the use of the PC5 interface of C-V2X systems for ‘Day 1’ applications envisioned by the Commission which are expected to be used in initial deployments for C-ITS systems, acknowledging and reusing most of the prior work of C-ROADS to reach the highest degree of interoperability on the application level.

This document is written to allow standard evolutions by referencing specifications without version numbers, unless explicitly provided.

3 Conventions to be used

3.1 Model verb terminology

<AM_RSP_003> (replaces [C-ROADS RSP] Section 1.1)

In the present document shall, shall not, 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).

Words such as must and must not are NOT accepted in ETSI deliverables except when used in direct citation.

3.2 Item identification

<AM_RSP_004> (replaces [C-ROADS RSP] Section 1.3)

This document contains individual requirement items which are assigned with unambiguous references starting with 'AM_RSP_' as prefix. The unique identifier should be used as a reference for any comments/questions instead of sections or page numbers, which can be affected by formatting and other subsequent changes.

References to corresponding items of [C-ROADS RSP] are denoted with the prefix 'RS_RSP_' or the corresponding section number as needed. If an item shall be replaced, the unique identifier will be appended by a bracket term indicating the identifier it replaces, e.g. (replaces RS_RSP_123).

3.3 Provisions from referenced documents

<AM_RSP_005> (replaces [C-ROADS RSP] Section 1.2)

Normative requirements of referred standard documents which support the functionality of the C-V2X Basic System shall be applied, unless explicitly specified otherwise in this document.

Requirements specified in this document clarify and take precedence over requirements of referred documents which are in any way ambiguous or contradictory. This excludes obvious errors or misinterpretations, which would require a revision of this document.

4 References

The following documents contain provisions which, through references in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

The following sections amend **normative and informative references** given in [C-ROADS RSP].
Note that references given in [C-ROADS RSP] can be adopted without version numbers in order to account for technical evolutions.

4.1 Normative references

<AM_RSP_006>

[ETSI TS 103 613]	Intelligent Transport Systems (ITS); Access Layer Specification for Intelligent Transport Systems Using LTE Vehicle-to-Everything Communication in the 5.9 GHz Frequency Band
[ETSI TS 102 636-7-1]	ETSI TS 102 636-7-1: Intelligent Transport Systems (ITS); GeoNetworking; Part 7: Amendments for C-V2X; Sub-part 1: Amendments to EN 303 636-4-1 (Media-Independent Functionality)
[ETSI TS 102 636-7-2]	ETSI TS 102 636-7-2: Intelligent Transport Systems (ITS); GeoNetworking; Part 7: Amendments for C-V2X; Sub-part 1: Amendments to EN 303 636-5-1 (Basic Transport Protocol)
[ETSI TS 103 574]	ETSI TS 103 574: Intelligent Transport System (ITS); Congestion Control Mechanisms for C-V2X PC5 Interface; Access Layer Part

[ETSI TS 136 300]	ETSI TS 136 300; LTE, Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN), Overall Description (3GPP TS 36.300 Release 14)
[ETSI TS 136 101]	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)
[5GAA TR P-180065]	5GAA: General Aspects and Strategy to Assess System Performance, Interoperability, and Conformance, doc # TR P-180065-RevA

4.2 Informative references

<AM_RSP_007>

[C2C-CC BSP]	C2C-CC Basic System Profile, Release 1.3.0
[C2C-CC Feat]	C2C-CC Features, Release 1.3.0
[C2C-CC Trig]	C2C-CC Triggering Conditions and Data Quality on Adverse Weather, Dangerous Situation, Exchange of IRCs, Special Vehicle, Stationary Vehicle, and Traffic Jam, Release 1.3.0
[C2C-CC HSM]	C2C-CC Protection Profile V2X Hardware Security Module, Release 1.3.0
[C2C-CC Ref]	C2C-CC References, Release 1.3.0
[C-ROADS RSP]	C-ROADS Platform, Roadside ITS G5 System Profile, Version 5.5, June 13, 2018
[C-ROADS Serv]	C-ROADS Platform, Common C-ITS Service Definitions, Version 1.2, June 12, 2018
[C-ROADS Func]	C-ROADS Platform, C-ITS Infrastructure Functions and Specifications, June 12, 2018
[5GAA Uu CSP]	5G Automotive Association; Task Force: Profiles for Cellular Uu-based C-ITS; C-ITS Communication System Profile Using Cellular Uu Interface, Sep. 2018

5 Definitions and abbreviations

5.1 Definitions

For the purpose of the present document, definitions are adopted from [C-ROADS RSP] and amended by the following items.

<AM_RSP_008>

A C-V2X Basic System is a C-ITS roadside sub-system as outlined in [C-ROADS Serv] employing C-V2X technologies according to [ETSI TS 136 300], 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. For simplicity reason, C-V2X Basic System in the present document describes ‘C-V2X Basic System using the PC5 interface’, while the profile of C-V2X Basic System using the Uu Interface is out of the scope of this document and defined in [5GAA Uu CSP].

C-ITS Basic System is a technology neutral term which can encompass either an ITS-G5 system, based on IEEE 802.11p technology, or a C-V2X system based on 3GPP Rel. 14 or newer releases.

<AM_RSP_009>

For the purpose of adapting the requirements from [C-ROADS RSP], [C-ROADS Func], and [C-ROADS Serv] to a C-V2X Basic System, we replace all references to the terms ‘C2C-CC Basic System’ to a generic term ‘C-ITS Basic System’.

Furthermore, in order to keep technology neutrality, it is necessary to replace all occurrences of the term ‘ITS-G5’ by the term ‘C-ITS’. For the same purpose, the term ‘DCC’ is replaced by the generic term ‘congestion control’.

<AM_RSP_010>

If not otherwise stated in this document, the requirements [C-ROADS RSP], [C-ROADS Func], and [C-ROADS Serv] can be adapted for C-V2X systems as well.

3.2 Abbreviations

For the purposes of the present document, abbreviations and acronyms are adopted from [C-ROADS RSP] and amended by the following items.

<AM_RSP_011>

The following abbreviations should be added to those mentioned in [C-ROADS RSP]:

3GPP	3rd Generation Partnership Project
5GAA	5G Automotive Association
C-V2X	Cellular Vehicle-to-Everything
C-ROADS	EU-funded platform for C-ITS deployments
CBR	Channel Busy Ratio
CSP	C-V2X System Profile
ICSP	Initial C-V2X System Profile
PC5	3GPP direct communication interface (sidelink)
PPPP	ProSe Per Packet Priority
V2C	Vehicle-to-Cloud Communication
V2N	Vehicle-to-Network Communication
V2P	Vehicle-to-Pedestrian Communication
V2X	Vehicle-to-Everything Communication

6 Requirement specification

6.1 Applicable items

The following requirements shall be applied for a C-V2X Basic System and amend [C-ROADS RSP].

<AM_RSP_012> (replaces RS_RSP_008)

The C-V2X Basic System for roadside units shall transmit infrastructure messages (e.g. CAM, DENM, IVIM, SPATEM and MAPEM) and follow congestion control requirements when needed.

<AM_RSP_013>

The C-V2X Basic System shall be compliant with all relevant regulatory requirements.

<AM_RSP_014> (replaces [C-ROADS RSP] Section 3.2)

The access layer of a C-V2X Basic System shall comprise a message protocol stack, which includes Physical (PHY), Medium Access Control (MAC), Radio Link Control (RLC), and Packet Data Convergence Protocol (PDCP) layers, according to AM_RSP_015.

Spectrum usage in the 5 855 MHz to 5 925 MHz frequency band shall be applied according to AM_RSP_016.

A congestion control mechanism to mitigate interference in tolling zones and to accommodate high loading scenarios shall be applied according to AM_RSP_017 and AM_RSP_018, respectively.

<AM_RSP_015> (replaces [C-ROADS RSP] Section 3.2.3)

The C-V2X Basic System's access layer shall conform to [ETSI TS 103 613] and employ congestion control according to [ETSI TS 103 574].

<AM_RSP_016> (replaces RS_RSP_011)

A C-V2X Basic System shall use a sub-band dedicated to C-ITS and in line with [ETSI EN 302 571] for all messages.

<AM_RSP_017> (replaces RS_RSP_022)

When the C-V2X Basic System enters a protected communication zone, the C-V2X Basic System shall set its power $P_{regulatory,c}$ according to [ETSI TS 136 101] and apply the mitigation techniques as described in RS_BSP_458 or RS_BSP_459 of [C2C-CC BSP] without changing any other congestion control parameters. This requirement shall not be applied to messages with TC=0.

<AM_RSP_018> (replaces [C-ROADS RSP] Sections 3.2.5, 3.2.6, 3.2.7)

The congestion control mechanism of a C-V2X Basic System shall be compliant to [ETSI TS 103 574]. Herewith, the Network Design Limits (NDL) shall be kept in terms of parameter value ranges, design limits and regulatory requirements.

The C-V2X Basic System shall support the mapping of traffic classes to PPPP levels as defined below.

Table 1: Mapping between Traffic Class (TC) and PPPP

TC	PPPP	Intended Use
0	2	high priority DENMs
1	4	normal DENMs, IVIMs, SPATEMs and MAPEMs
2	5	CAMs
3	7	forwarded DENMs and other low-priority messages

<AM_RSP_019> (amends [C-ROADS RSP] Section 3.3)

For C-V2X Basic System, the network and transport layer shall comply with the specifications [ETSI TS 102 636 7-1] and [ETSI TS 102 636 7-2], covering media-independent functionality and basic transport protocols, respectively.

<AM_RSP_020> (amends RS_RSP_031)

Further relevant parameter settings for C-V2X Basic System shall be used as defined in [ETSI TS 102 636-7-1].

<AM_RSP_021> (replaces RS_RSP_035)

The Geonetworking (GN) parameter itsGnIfType shall be set to 'LTE-V2X' according to [ETSI TS 102 636 7-1].

<AM_RSP_022> (replaces RS_RSP_067)

The C-V2X Basic System shall allow coexistence with CEN-DSRC according to [ETSI EN 302 637-2], [ETSI EN 103 613] and AM_RSP_017.

6.2 Non-applicable items

The following items from [C-ROADS RSP] are not applicable to C-V2X Basic System or are covered by other items, as appropriate.

RS_RSP_010, RS_RSP_070, RS_RSP_013, RS_RSP_018, RS_RSP_019, RS_RSP_026, RS_RSP_027, RS_RSP_028, RS_RSP_029

Annex A: Change history

Date	T-Doc	Subject/Comment
2018-09-14	S-180180-RevA	Final version Rev 1.0 based on pA5
2018-09-27	S-180180	Corrigendum Rev 1.1