Roadside ITS G5 System Profile

C-Roads Platform

Working Group 2 Technical Aspects

Taskforce 3 Infrastructure Communication

28/10/2019

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7.1	28/10/2019	Release 1.6 Alignment with BSP 1.4; addition of requirements for GNSS correction	D

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Scope

This system profile specifies a minimum set of standards and fills the missing gaps necessary for the realisation of an interoperable roadside ITS-Station as defined in the Communication Architecture EN 302 665 [12]. The profile only includes the interoperability requirements leaving open any additional requirements, it therefore does not describe the full functionality of the roadside ITS-Station.

The current version of this system profile enables the deployment of the “Day-1 services”, as selected by C-Roads for this release. It may also support other services but these other services may require extensions of this system profile in next releases.

An infrastructure roadside System shall at least realize the requirements as specified here to realize European interoperability with the aim to increase road traffic safety and at improving the overall traffic efficiency.

The current document considers requirements such as information quality, the efficient use of the spectrum in the 5.9 GHz range and the coexistence with the tolling frequency band 5.8 GHz.

It does not consider the communication between roadside and centre (R2C and C2R) or roadside and web service (R2W and W2R) as well as vehicle and vehicle (V2V) are out of scope.

Security related requirements are also out of scope for this document, as they are covered by a dedicated document.

Mobile R-ITS-S are also not covered in this document.

The infrastructure roadside system profile contributes to the realisation of the objective of the C-ROADS Platform to develop, share, and publish common communication profiles.

The current document covers the Intra-C-ITS information exchange between infrastructure and vehicles, and not for intra-sub-system interoperability.

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Acronyms

BSP	Basic System Profile
BTP	Basic Transport Protocol
C-ITS	Cooperative Intelligent Transport Systems
C2C-CC	Car2Car Communication Consortium
CA	Cooperative Awareness
CAM	Cooperative Awareness Message
5G-CCH	Control Chanel; Channel with 5900 MHz carrier centre frequency;
CRW	Collision Risk Warning
DCC	Decentralised Congestion Control
DENM	Decentralized Environmental Notification Message
DP	DCC profile
DPID	DCC profile identifier
DSRC	Dedicated Short Range Communications
GBC	Geo Broadcast
GN	Geo Networking
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HST	Header Sub-Type
HT	Header Type
ITS	Intelligent Transport Systems
ITS-G5	ITS-G5 is a European standard for ad-hoc short-range communication of vehicles among each other (V2V) and with Road ITS Stations (V2I). ITS-G5 refers to the approved amendment of the IEEE 802.11 (standard IEEE 802.11p). This technology (possibly others) uses the 5.9 GHz frequency band to support safety- and non-safety ITS applications. In this document ITS-G5 stands for IEEE802.11p/ETSI ITS-G5.
ITS-S	Intelligent Transport Systems Station
IVI	Infrastructure to Vehicle Information
IVIM	Infrastructure to Vehicle Information Message
IVS	In-Vehicle Signage
LLC	Logical Link Control
LT	Lifetime
MAP	Geometric information for the intersection
MAPEM	MAP (topology) Extended Message

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MHP	Maximum Hop limit
MS	Member State
NDL	Network Design Limits
NH	Next Hop
NTP	Network Time Protocol
HLN	Hazardous Location Notification
R-ITS-S	Roadside ITS Station (RSU or ITS-S R in the French Terminology); also called infrastructure roadside system in this document
RLT	Road Lane Topology
RSP	Roadside ITS-G5 System Profile (short also Roadside System Profile)
RWW	Roadworks Warning
s	Seconds
SCF	Store Carry Forward
SCH	Safety related channel with the carrier centre frequency of 5 880 MHz
SHB	Single-Hop Broadcast
SPAT	Signal Phase and Timing
SPATEM	Signal Phase and Timing Extended Message
TAI	Temps Atomique International, engl. International Atomic Time
TC	Traffic Class
TCC	Traffic Control Centre
TLM	Traffic Light Manoeuvre
time base	ITS-S time
V-ITS-S	Vehicle ITS station
WiFi	Technology for radio wireless local area networking of devices based on the IEEE 802.11 standards
WGS	World Geodetic System

N/A	Not Applicable
TBC	To Be Checked, with MS or associated partner

Glossary

ITS-S Application	Uses one or more FLSs with different parameters, depending on the situation, to provide an ITS service to the user. ETSI TR 102 638 [34] e.g. is RWW, IVS and CRW.

hat gelöscht: [34]

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Use case scenario	Denotes a more specific way to execute an ITS-S application, e.g. the stand-alone mode of Roadworks Warning in case of safety trailers failing to connect to the centre. As another example, in the C-ITS Corridor terminology, “TCC-triggered RWW” denotes a use case scenario to implement RWW application based on TCC data only.
Facilities Layer Service (FLS)	In this document, the term service is derived from the term ITS-S service as defined in ETSI EN 302 665 [12]. It describes a communication functionality offered by an ITS-S to an ITS-S application.

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Introduction

The European ITS-Station architecture, outlined in EN 302 665 [12], defines four ITS sub-systems; vehicle, roadside, personal, and central Standards are developed in a neutral and open way such that they include different options to allow diversion and future options to extend the standards later. To realize Interoperability among sub-systems many of these options need to be made specific. Profiles therefore describe the selected options and include additional specification when required to ensure the expected interoperability. Herein, the roadside sub-system profile is defined.

The Infrastructure Roadside Wi-Fi ITS-G5 System Profile, short called Roadside System Profile (RSP), defines a common base for the Wi-Fi ITS-G5 communication between roadside and vehicle. The communication directions derived from this are also known as I2V.

The profile provides descriptions, definitions and rules for all layers (Applications, Facilities, Networking & Transport and Access) of the ETSI ITS station reference architecture/ITS-S host. Management is included, but Security is out of scope. The understanding of the core infrastructure roadside system components is depicted in Table 1;

hat gelöscht: Table 1

Table 1 Infrastructure roadside system components

<table>
<tr><th>Layer</th><th colspan="2">Component</th><th>Tasks</th><th>Com-ponent</th></tr>
<tr><td>Applications</td><td colspan="2">Operational Specifications</td><td>Service definitions, and transmission principles, and triggering conditions</td><td rowspan="7">Management & Security</td></tr>
<tr><td rowspan="3">Facilities</td><td colspan="2">Positioning & Time (incl. minimum data quality requirements)</td><td>Relevance Checking (C2C-CC White Paper on Positioning and Timing [20])</td></tr>
<tr><td rowspan="2">Data and Message Content</td><td>CAM & DENM</td><td>Vehicle & infrastructure data provider (incl. minimum data quality requirements)</td></tr>
<tr><td>IVIM, SPATEM, MAPEM, etc.</td><td>Infrastructure data provider (incl. minimum data quality requirements)</td></tr>
<tr><td rowspan="3">Transport & Network</td><td>Transport</td><td>Basic transport protocol (BTP)</td><td>End-to-end, connection-less transport service</td></tr>
<tr><td rowspan="2">Network</td><td>Geo-Based Addressing</td><td>Future use</td></tr>
<tr><td>Geo-Routing Protocol</td><td>Future use</td></tr>
<tr><td>Access</td><td colspan="2">ETSI ITS-G5 European Profile Standard</td><td>Congestion Control</td></tr>
<tr><td colspan="4">IEEE 802.11p</td></tr>
</table>

hat gelöscht: [20]

This infrastructure system is a Roadside ITS sub-system enabling a set of “Day-1 services” (listed in Table 2 in section 2.1).

hat gelöscht: Table 2

Since the requirements of the ITS sub-systems are very similar, this Infrastructure Roadside ITS-G5 System Profile uses the C2C-CC BSP [2] as a basis from content- and structure point of view.

1 Provisions

1.1 Verbal forms of the expression of provisions

In this document, the following verbal forms are used to indicate requirements:

Shall / Shall not

Recommendations shall be indicated by the verbal forms:

Should / Should not

Permissions shall be indicated by the verbal forms:

May / May not

Possibility and capability shall be indicated by the verbal forms:

Can / Cannot

Inevitability used to describe behavior of systems beyond of the scope of this deliverable shall be indicated by:

Will / Will not

Facts shall be indicated by the verbal forms:

Is / Is not

1.2 Provisions from referenced documents

Unless otherwise specified in the present document, the normative requirements included in the referenced documents supporting the required functionality of the ITS system shall apply. The verbal forms for the definition of provisions of referenced documents are defined either inside the document or generally by the SDO (standardisation organisation) or the organisation providing them. For example, normative requirements in ETSI documents are indicated by the verbal form “shall”.

1.3 Notation used to identify requirements

This document uses the C2C-CC BSP [2] as a basis from content and structure point of view. Some requirements were directly copied, because they also apply on the roadside system. Those have the identifier of the referenced BSP requirement in braces after the RSP identifier, e.g. RS_RSP_001 (RS_BSP_193).

Other requirements have been adopted from the BSP. They are also marked by the RSP identifier with the key word “based on”, e.g. RS_RSP_005 (based on RS_BSP_205).

Requirements without any reference to a BSP requirement are new and only apply to the roadside system.

1.4 Standards evolution

The standards chosen as specifications in this deliverable are evolving standards. This document selects specific versions of the underlying existing standards for concrete implementation.

2 FEATURES OF THE ROADSIDE SYSTEM PROFILE (RSP)

2.1 Introduction

The standards profile distinguishes between two types of interoperability:

- Inter-sub-system interoperability (interoperability of different ITS subsystems), i.e. sub-systems implementing the standards profile can communicate/understand each other,
- Intra-sub-system interoperability (interoperability of components within one ITS subsystem), i.e., the sub-system consists of completely interchangeable components.

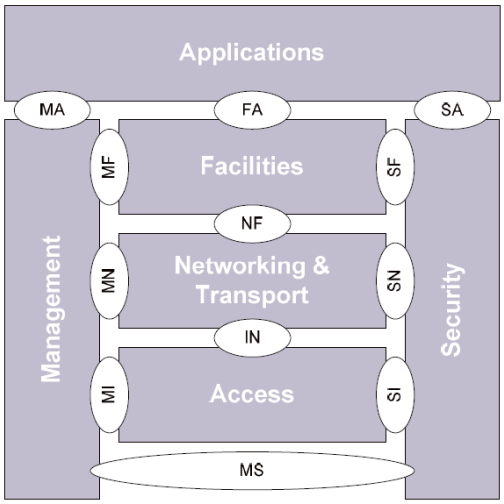
Each type of interoperability provides benefits for the system but comes with a certain effort to achieve this interoperability.

Inter-sub-system interoperability requires a precise definition of the external interfaces but can leave room for different implementations within the sub-system, which encourages innovation and competitive differentiation.

Intra-sub-system interoperability requires a much higher degree of standardisation within the sub-system and allows customers to select among the best suppliers for each individual component within the sub-system.

The infrastructure roadside system standard profile contributes to the realisation of the objective of the C-ROADS Platform to develop, share, and publish common communication profiles. This standard profile aims for inter-sub-system interoperability between infrastructure and vehicles, and not for intra-sub-system interoperability.

Figure 1 The ITS-Station layered architecture/ITS-S host (ETSI EN 302 665 [12])



2.2 Set of supported applications

The main purpose of the Roadside System Profile (RSP) document is to ensure interoperability between roadside ITS-Stations and vehicle ITS-Stations for safety and efficiency related functions. This document focuses on

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specifying the infrastructure roadside system on the roadside ITS-Station transmitting side. Moreover, this profile document shall be oriented towards ensuring the fulfilment of the requirements of the FLSs from the safety and efficiency domains as specified in Table 2.

hat gelöscht: Table 2

Table 2 'Day-1' Infrastructure-to-Vehicle ITS-S applications incl. mapping to FLSs

ITS-S Application	Facility Layer Service (FLS)
Roadworks Warning (RWW)	Decentralized Environmental Notification (DEN) Basic Service (DEN Basic FLS)
Hazardous Location Notifications (HLN)	
In-Vehicle Signage (IVS)	Infrastructure to Vehicle Information (IVI) Service (IVI FLS)
Intersection Safety	Traffic Light Maneuvers (TLM) Service & Road and Lane Topology (RLT) Service (TLM FLS and RLT FLS)
Coexistence (ITS-G5 – CEN-DSRC)	Cooperative Awareness (CA) Basic Service (CA Basic FLS)

Coexistence differentiates itself from the other ITS-S applications. It is used to ensure the stable operation of the roadside system and is therefore called a system ITS-S application. The other ITS-S applications are of functional nature.

2.3 Infrastructure roadside system requirements

2.3.1 Introduction

This section defines the interoperable characteristics of the infrastructure roadside system. The roadside system shall be supported by R-ITS-Ss that implement the infrastructure roadside system profile as identified in 2.3.

2.3.2 Positioning and timing

2.3.2.1 General

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A sR- selsc
NOTAnGN sg stR-) or dynamic (e.g. vehicle) the values are different and depend on the quality of the location referencing subsystem used. Values provided here have to bemub

Objective
In case an infrastructure roadside system (R-ITS-S) is in a static situation (fixed station) it is able to determine its own position with high accuracy. In this case the requirements as defined in the following paragraphs apply.
In case the R-ITS-S is placed on a moving vehicle the same accuracy and confidence shall apply as defined by the vehicle C2C-CC BSP [2] for messages generated by the ITS-S itself or messages based on information generated by the ITS-S itself. In other cases, the requirements as defined in the following paragraphs apply.
A sR- son

Requirement *RS_RSP_001 (based on RS_BSP_193)*

C-Lt2) nE

Requirement *RS_RSP_002 (based on RS_BSP_194)*

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2.3.2.2 Confidence validation

Requirement *RS_RSP_003*

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2.3.2.3 Position, Velocity and Heading confidence values

Requirement *RS_RSP_004 (based on RS_BSP_205)*

Fors s
The3d:

- horizontal (latitude, longitude) position confidence of 5 m

hat gelöscht: requirements specified in this subsection considers the assumptions and motivation introduced and …x plained in t…e C2C-CC white Paper “Positioning and Timing… [...]
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hat gelöscht: TS 102 894-2] follow this time format
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hat gelöscht: <#>¶ [...]
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hat gelöscht: system providing state information with [...]
hat gelöscht: TE: The position confidence depends o [...]
hat gelöscht: a stationary mounted R-ITS-S the [...]
hat gelöscht: confidence values shall be equal to or [...]

- altitude position confidence of 15 m

Th
NO5

2.3.2.4 Timing accuracy

Requirement *RS_RSP_006 (RS_BSP_207)*

ThestTstaTmsts 20 ms, but shall be less then 200 ms. TIt s s than 200 ms.
NO piaatts
NO s
NOTE 3: V-ITS-S will implement the maximum time difference of 20 ms

2.3.2.5 Confidence requirements dependent on ITS-S applications and use case scenarios

The position confidence depends on the ITS-S application and use case scenario. Some ITS-S applications are GNSS/trailer based others use map projections from the road operator system. Further information will be provided in future releases

2.3.3 System behaviour

Requirement *RS_RSP_007*

The

Requirement *RS_RSP_099*

Th R-ITS-S shall be able to receive DENM, CAM as defined in the C2C-CC BSP

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hat gelöscht: TE 1: A…precise timestamp is needed
hat gelöscht: TE 2: The information for
hat gelöscht: ¶
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hat gelöscht: <#>Definition RS_BSP_449¶
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3 LIST OF RELEVANT STANDARDS AND REFERENCE DOCUMENTS

This chapter lists the set of documents essential for specifying the infrastructure roadside system. Most of these documents are published (or under the publishing process) at ETSI, CEN, or ISO. The document C-ROADS C-ITS Infrastructure Functions and Specifications [4] is essential to achieve interoperability between the various implementations of the infrastructure roadside systems as it fills gaps currently not addressed by CEN and ETSI.

3.1 Access Layer

3.1.1 General

The access layer comprises of the two lowest layers in the protocol stack; physical (PHY) and data link layers, where the latter is further subdivided into medium access control (MAC) and logical link control (LLC). All of them are specified in ETSI EN 302 663 [11]. PHY and MAC are derived from IEEE 802.11-2016 [24] with the MIB parameter **dot11OCBActivated** set to true enabling a new capability namely "communicating outside the context of a basic service set (BSS)", i.e., IEEE 802.11-2016 [24]. ETSI EN 302 663 [11] mandates the use of IEEE 802.2 LLC with the mode of operation set to Type 1 – unacknowledged connectionless. Further, ETSI EN 302 663 [11] requires decentralised congestion control (DCC) methods to avoid unstable network behaviour and channel congestion. ETSI TS 102 792 [14] specifies amongst other things minimum duty cycles for different DCC profiles to ensure interoperability with CEN DSRC (European electronic toll collection at 5.8 GHz). ETSI EN 302 571 [21] specifies the frequency channels for radio equipment in the 5 855 MHz to 5 925 MHz frequency band. Further, it specifies output power for the different frequency channels and spectrum masks.

3.1.2 List of relevant documents

Table 3 Relevant documents for the access layer

Document	Title	Short Description
ETSI EN 302 571 [21]	Intelligent Transport Systems (ITS); Radio communications 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	Specification of frequency channels for 5 855 MHz to 5 925 MHz, with corresponding spectrum mask and output power.
ETSI EN 302 663 [11]	Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band	Specifies the whole access layer with PHY, MAC, and LLC, for 5 855 MHz to 5 925 MHz. Requirements on DCC [17] and co-existence with CEN DSRC.
ETSI TS 102 792 [14]	Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range.	specifies requirements to ensure coexistence between ITS stations using the frequency bands ITS-G5A/B/D and CEN DSRC using the TTT band.
ETSI TS 102 687 [17]	Decentralized Congestion Control Mechanisms for Intelligent Transport	Specifies the DCC operation responsible for maintaining network stability, throughput efficiency and

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	Systems operating in the 5 GHz range; Access layer part	fair resource allocation to ITS-S using ITS-G5 access technology.
IEEE 802.11	Wireless LAN	set of media access control and physical layer specifications for implementing wireless local area network (WLAN) communication in the 900 MHz and 2.4, 3.6, 5, and 60 GHz frequency bands.

3.1.3 ETSI EN 302 571

3.1.3.1 Infrastructure Profile Settings of ETSI EN 302 571

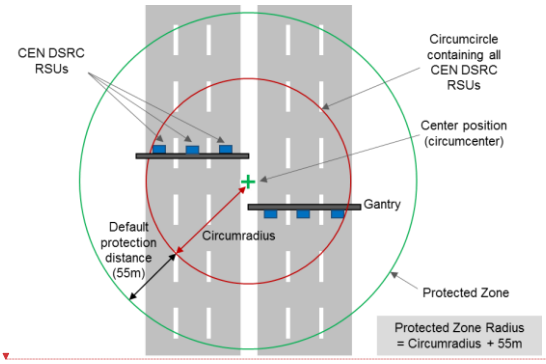
Requirement *RS_RSP_072 (RS_BSP_433)*

The roadside ITS-S access layer shall be compliant with the EN 302 571. In addition, optional enhanced receiver performance requirements as defined in Table 17-19 of IEEE 802.11-2016 [24] shall be used.

Requirement *RS_RSP_100*

A Protected Zone shall be defined as follows: If a tolling location only consists of a single CEN-DSRC RSU, then a Protection Zone with the default radius of 55m shall be defined, having the location of the CEN-DSRC RSU as centre position. In case there are multiple CEN-DSRC RSUs nearby, overlaps of Protected Zones should be avoided as much as possible through combined Protected Zones. A combined Protected Zone shall use the geographical centre (circumcentre) of all contained DSRC RSUs as a centre position; the radius shall be given by the circumradius + 55 m (See Figure 2). In any case, the maximum radius of 255 m shall not be exceeded.

NOTE: Due to the maximum radius of 255 m, overlaps can not always be avoided.



Control Channel

Requirement *RS_RSP_011 (RS_BSP_225)*

Roa 5G-CCH)

Security Channel

RF Output Power

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CAM

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hat gelöscht: it generates.¶
¶
Requirement RS_BSP_225 ¶
The C2C-CC Basic System shall use the control channel G5-CCH as specified in Table 3 in [EN 302 663] to send messages to support Cooperative Awareness Basic Service and the priority C-ITS services in [C2CCC tc Docs].¶

Requirement *RS_RSP_012 (based on RS_BSP_226)*

RF output power of the roadside equipment (e.g. R-ITS-S) depends on the relevance area for the specific message sent and shall be adjustable such that the communication performance specified to comply to the minimum communication performance as achieved but shall not exceed the maximum set in the ETSI EN 302 571 [21].

Requirement *RS_RSP_017*

The power spectral density shall not exceed 23 dBm/MHz.

3.1.4 ETSI EN 302 663

3.1.4.1 Infrastructure Profile Settings of ETSI EN 302 663

Requirement *RS_RSP_018 (based on RS_BSP_228)*

The roadside system shall use a transfer rate of 6Mbit/s (QPSK 1/2) for the transfer of messages in requirement RS_RSP_011 on CCH.

Requirement *RS_RSP_073 (based on RS_BSP_434)*

Roadside equipment's (e.g. R-ITS-S's) access layer shall be compliant with ETSI EN 302 663 [11].

Requirement *RS_RSP_074*

Roadside equipment (e.g. R-ITS-S) shall implement the DCC State Machine in such a way that the parameters in that table can be modified in later releases.

Table 4 lists the parameters that may be subject to change (i.e., through optimization) in future revisions of the DCC Mechanism.

Table 4 Parameters settings for Day One

Parameter	Meaning	Default
PTx	Transmission power	There is no default value set in this document. For each system the default TX power will depend on what is needed to fulfill the minimum communication range requirement
PToll	Transmission power across all states and DPs when in *toll communication mode* (see NOTE 3 in [25])	*PToll* = 10 dBm
Tup	Time of sustained channel load that triggers transition to a more restrictive state	*Tup* = 5 s Tup= NDL_timeUp in ETSI TS 102 687 [17]
Tdown	Time of sustained channel load that triggers transition to a less restrictive state	*Tdown* = 1 s Tdown = NDL_timeDown in ETSI TS 102 687 [17]

hat gelöscht: [21]
hat gelöscht: ¶
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hat gelöscht: ¶
¶
[[Editor's note: BSP v4.0: No mentions about it]
hat gelöscht: CCH.
hat gelöscht: ¶
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hat gelöscht: to
hat gelöscht: [11]
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hat gelöscht: RS_BSP_ ...
hat gelöscht: Table 4
hat gelöscht: ¶
¶
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[Rmax_active,k]; [Rmax_restrictive]; [CLmax]; [CLmin] …….etc¶
[Editor's note: BSP v4.0: No mentions about these parameters¶
¶
hat gelöscht: [25]
hat gelöscht:
hat gelöscht: [17]
hat gelöscht: [17]

TTX_MAX	Maximum transmission interval for all states	*TTX_MAX* = 460 ms
TTX_MIN	Minimum transmission interval for DP1-DP3 NOTE: minimum transmission interval for DP0 is 50 ms	TTX_MIN = 60 ms
RBurst	Maximum message rate of message bursts (additionaly to rate of DP1-DP3)	*RBurst* = 20 messages per second
TBurst	Time period over which message burst is measured TBurst seconds is allowed very TWaitBurst seconds.	TBurst = 1 second
TBurstPeriod	Time period in which one burst is allowed.	TBurstPeriod = 10 seconds
Rmax_relaxed	Maximum message rate in relaxed state	Rmax_relaxed=36,7messages/second
Rmax_active,k	Maximum message rate in active sub-states	The inverse of the transmission interval for each CL value. k=1..n
Rmax_restrictive	Maximum message rate in restrictive sub-states	See ETSI TS 102 687 [17]
CLmax	Transition threshold between active and restrictive states	CLmax = 59%
CLmin	Transition threshold between relaxed and active states	CLmin = 19%
CLactive_k k=1…n	Transition threshold between active states	CLactive_k , k= 1…n
tj , j=1..m	relaxed (sub-)states transmission interval values as per Table 8	m = 1, see ETSI TS 102 687 [17]
tk , k=1..n	active (sub-)states transmission interval values as per Table 8	n = 5, see ETSI TS 102 687 [17]
tl , l=1..q	restrictive (sub-)states transmission interval values as per Table 8	q = 1, see ETSI TS 102 687 [17]
n	Number of active sub-states	n=5
q	Number of restrictive (sub-)states	n=1

hat gelöscht: [17]

hat gelöscht: [17]

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hat gelöscht: [17]

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m	Number of relaxed (sub-)states	m=1
MCS	Modulation and Coding Scheme	6 Mbps QPSK ½ as per ETSI EN 302 571 [21] for all states and DP values in Table 8
α,β,γ	Channel Load smoothing parameters	Default values are α=β=0.5, γ=0 see section 1.3 of [25]
Sth, Np, Tm , Tp	Channel Load estimation parameters	Default values are Tm= 100 ms, Tp = 8 μs, Np= 12 500, and Sth = -85 dBm see section 1.3 of [25]

Requirement *RS_RSP_076 (based on RS_BSP_241)*

Roadside equipment (e.g. R-ITS-S) should manage its limited hardware and software resources at its disposal, and it may perform traffic shaping or selective forwarding following the best effort principle.

NOTE: Traffic shaping is especially relevant for relayed DENM messages sent on DP3, as it is anticipated that in some situations – such as severe traffic congestion or other extreme vehicular network scenarios – the DENM load might increase abruptly. In such cases, Roadside equipment (e.g. R-ITS-S) are explicitly allowed to forgo the forwarding of foreign DENM messages.

Requirement *RS_RSP_078 (based on RS_BSP_243)*

Roadside equipment (e.g. R-ITS-S) shall, at a minimum, be able to generate and transmit the number of messages as determined by the value of the highest CAM generation rate (i.e. 10 Hz) and, if detection algorithms are used, then increased by the minimum required DENM generation rate derived from those triggering conditions.

Requirement *RS_RSP_021*

Roadside equipment (e.g. R-ITS-S) shall support the broadcast mode as defined in ETSI EN 302 663 [11].

3.1.5 ETSI TS 102 792

3.1.5.1 Infrastructure Profile Settings of ETSI TS 102 792

Requirement *RS_RSP_022*

In case the R-ITS-S is located in close distance (at least inside the protection radius) of CEN DSRC based tolling equipment, this R-ITS-S shall apply mitigation techniques as defined in ETSI TS 102 792 [14].

Requirement *RS_RSP_024*

In case the R-ITS-S is used to indicate the presence of a tolling station, this R-ITS-S shall transmit CAMs including protection zones in line with the technique defined in ETSI TS 102 792 [14] and in line with the CA message format as specified in the ETSI EN 302 637-2 [9].

hat gelöscht: [21]

hat gelöscht: [25]

hat gelöscht: [25]

hat gelöscht: ¶
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hat gelöscht: ¶
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hat gelöscht: *(based on RS_BSP_398)*

hat gelöscht: [11]

hat gelöscht: ¶
¶
Requirement RS_BSP_398 ¶
The C2C-CC Basic System shall support the broadcast mode.¶
Note: This requirement is intended for future use cases.¶
¶

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hat gelöscht: [14]

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hat gelöscht: [14]

hat gelöscht: [9]

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Requirement *RS_RSP_025*

In case protection is wanted, roadside equipment (e.g. R-ITS-S) shall transmit CAM including protected zone information in such a way, that vehicles can receive it before entering the protected zone.

hat gelöscht: ¶
¶

3.1.6 ETSI TS 102 724

3.1.6.1 Infrastructure Profile Settings of ETSI TS 102 724

Requirement *RS_RSP_082 (based on RS_BSP_435)*

- Roadside equipment's (e.g. R-ITS-S's) access layer shall be compliant with ETSI TS 102 724 [13].

hat gelöscht: to
hat gelöscht: [13]
hat gelöscht: ¶

3.1.7 ETSI TS 102 687

3.1.7.1 Infrastructure Profile Settings

Requirement *RS_RSP_027 (RS_BSP_436)*

DCC techniques shall be applied according with ETSI TS 102 687 [17].

hat gelöscht: to
hat gelöscht: [17]
hat gelöscht: ¶
¶

3.2 Network and Transport Layer

3.2.1 General

The relevant standards are listed in Table 5 below. The specification of the Geo Networking protocol is split into two parts, media-independent and media-dependent. Purpose of the split was to allow for more than one access technology other than ITS-G5. However, so far, a specification for another access technology-specific extension other than ITS-G5 does not exist. Roadside equipment (e.g. R-ITS-S) does not include the features specified in the media dependent standard. Transport layer requirements are considered in this section.

hat gelöscht: Table 5

3.2.2 List of relevant documents

Table 5 Relevant documents for the network and transport layer

Document	Title	Short Description
ETSI EN 302 636-4-1 [7]	Vehicular Communication; Geonetworking; Part 4 Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality	Defines common media-independent functionality of Geo Networking
ETSI EN 302 636-5-1 [8]	Vehicular Communication; Geonetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocols	Defines the Basic Transport Protocol (what data is to be provided by higher layer to networking layer)
ETSI EN 302 931 [6]	Vehicular Communications;	Defines geographical areas so that different shapes can be

	Geographical Area Definition	used as destinations for the messages from higher layers.

3.2.3 ETSI EN 302 636-4-1 Geo Networking media-independent

3.2.3.1 Infrastructure Profile Settings of ETSI EN 302 636-4-1

Requirement *RS_RSP_030 (RS_BSP_437)*

GeoNetworking (GN) shall be applied as networking protocol according to ETSI EN 302 636-4-1 [7] by roadside equipment (e.g. R-ITS-S).

Requirement *RS_RSP_031 (RS_BSP_250)*

All default constants and parameters of the infrastructure roadside profile not defined or overwritten in the current document shall be set as specified in Annex H of ETSI EN 302 636-4-1 [7].

hat gelöscht: All default constants and parameters of the infrastructure roadside profile not defined or overwritten in the current document shall be set as specified in Annex G of

Requirement *RS_RSP_083 (RS_BSP_416)*

Packet repetition shall not be performed by GN in an R-ITS-S and the corresponding steps for repetition in the packet handling procedures described in clause 10.3 of ETSI EN 302 636-4-1 [7] (clause 9.3) shall not be executed. The 'maximum repetition time' parameter of the service primitive GN-DATA.request and the GN protocol constant itsGnMinPacketRepetitionInterval do not apply to an R-ITS-S.

hat gelöscht: Packet repetition shall not be performed by GN and the corresponding steps in the packet handling procedures in ETSI EN 302 636-4-1

hat gelöscht: (clause 9.3) shall not be executed. The parameter 'Maximum repetition time' of the service primitive GN-DATA.request is not applicable. Also, the GN protocol constant itsGnMinPacketRepetitionInterval is not applicable.

Requirement *RS_RSP_033 (based on RS_BSP_252)*

"Anonymous address" may be chosen for GN address configuration (itsGnLocalAddrConfMethod set to ANONYMOUS (2)) by roadside equipment (e.g. R-ITS-S).

Requirement *RS_RSP_035 (based on RS_BSP_414)*

GN shall be used with itsGnIfType set to ITS-G5 (1) by roadside equipment (e.g. R-ITS-S).

Requirement *RS_RSP_036*

itsGnMinPacketRepetitionInterval is not applicable, in case GN packet repetition is disabled.

Basic Header Fields

Requirement *RS_RSP_038 (based on RS_BSP_258)*

The LifeTime (LT) field of all SHB packets shall be set to 1 second.

Requirement *RS_RSP_039 (based on RS_BSP_259)*

The LifeTime (LT) field of all GBC packets shall be set to the minimum value of ValidityDuration and RepetitionInterval, but shall not exceed the itsGnMaxPacketLifetime parameter, specified in Annex H of ETSI EN 302 636-4-1 [7].

hat gelöscht: The LifeTime (LT) field of all GBC packets shall be set to the minimum of ValidityDuration and RepetitionInterval, but shall not exceed the itsGnMaxPacketLifetime parameter, specified in Annex G of ETSI EN 302 636-4-1

Common Header Fields

Requirement *RS_RSP_040 (based on RS_BSP_260)*

In case "Store-carry-forward" is enabled, the SCF bit in the Traffic Class (TC) field shall be set to 1.

NOTE: That way, packets can be buffered if no neighbours are available.

Requirement *RS_RSP_042 (RS_BSP_262)*

Roadside equipment (e.g. R-ITS-S) is not required to offload packets to another channel. Consequently, the channel offload bit of the TC (Traffic Class) field should be set to 0 for all message types.

Requirement *RS_RSP_044 (RS_BSP_264)*

Roadside equipment (e.g. R-ITS-S) shall set the itsGnIsMobile bit of the Flags field to 0. In case the RSU is not a static station (moving) the itsGnIsMobile bit of the Flags field should be set according to the BSP [2].

Multi-Hop support

Requirement *RS_RSP_046 (based on RS_BSP_266)*

The multi-hop operation mode shall be supported by the R-ITS-S by implementing the forwarding algorithm specified in the Annexes D, E.3 and F.3 of ETSI EN 302 636-4-1 [7].

NOTE: Multi-hop support is for R-ITS-S for incoming GN packets, with multi-hop request. Currently, the multi hop support by R-ITS-S is under discussion. It has to be tested if it is viable at low penetrations. The "network" of R-ITS-S is first and foremost built for I2V services, not as multi-hop network.

hat gelöscht: The multi-hop operation mode shall be supported by the R-ITS-S by implementing the forwarding algorithm specified in the Annex E.3 of ETSI EN 302 636-4-1

hat gelöscht: NOTE: Multi-hop support is for R-ITS-S for incoming GN packets, with multi-hop request. Currently, the multi hop support by R-ITS-S is under discussion. It has to be tested if it is viable at low penetrations. The "network" of R-ITS-S is first and foremost built for I2V services, not as multi-hop network.

Duplicate Packet Detection

Requirement *RS_RSP_048 (based on RS_BSP_268)*

Roadside equipment (e.g. R-ITS-S) shall use duplicate packet detection on the networking and transport layer. For the detection of duplicated packets, the algorithm specified in Annex A.2 of the EN 302 636-4-1 [7] shall be used.

hat gelöscht: Roadside equipment (e.g. R-ITS-S) shall use duplicate packet detection on the networking and transport layer. For the detection of duplicated packets, the algorithm specified in Annex A.2 and A.3 of the EN 302 636-4-1

Beaconing Support

Requirement *RS_RSP_049*

Roadside equipment (e.g. R-ITS-S) may only send beacons with the Position Accuracy Indicator (PAI) set to 1.

Ethertype

Requirement *RS_RSP_050 (based on RS_BSP_270)*

GeoNetworking Frames sent by roadside equipment (e.g. R-ITS-S) shall use the EtherType value 0x8947 as listed by the IEEE Registration Authority at http://standards.ieee.org/develop/regauth/ethertype/eth.txt.

3.2.4 ETSI EN 302 636-5-1 Basic Transport Protocol

3.2.4.1 Infrastructure Profile Settings of ETSI EN 302 636-5-1

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Requirement *RS_RSP_051 (RS_BSP_438)*

Roadside equipment (e.g. R-ITS-S) shall implement the Basic Transport Protocol EN 302 636-5-1 [8] and the following definitions in this section.

Requirement *RS_RSP_052 (based on RS_BSP_273)*

Roadside equipment (e.g. R-ITS-S) shall employ BTP-B headers. Consequently, the GeoNetworking common header shall use a value of 2 for the NH field.

Requirement *RS_RSP_053 (based on RS_BSP_274)*

Roadside equipment (e.g. R-ITS-S) shall set the destination port info field to the value 0.

Requirement *RS_RSP_054 (based on RS_BSP_275 & 276)*

Roadside equipment (e.g. R-ITS-S) shall set the destination port depending on the message set as specified in the ETSI TS 103 248 [22].

hat gelöscht: Roadside equipment (e.g. R-ITS-S) set the destination port depending on the message set as specified in the ETSI TS 103 248

3.2.5 ETSI EN 302 931 Geographical area definition

3.2.5.1 Infrastructure Profile Settings of ETSI EN 302 931

Requirement *RS_RSP_056 (based on RS_BSP_279)*

The roadside system shall at least support circular, rectangular and ellipsoidal geographical areas as defined in the EN 302 931 [6]. Each ITS-S application shall specify one of the above geographical area types indicated through the GeoNetworking header as specified in EN 302 636-4-1 [7].

hat gelöscht: The roadside system shall at least support circular, rectangular and ellipsoidal geographical areas as defined in the EN 302 931

hat gelöscht: Each ITS-S application shall specify one of the above geographical area types and indicated through the GeoNetworking header as specified in EN 302 636-4-1 …

Requirement *RS_RSP_057 (based on RS_BSP_280)*

Where roadside equipment (e.g. R-ITS-S) calculates the distance between two positions using Galileo or other GNSS coordinates (e.g. for PathDeltaPoints or in cases of circular relevance area), the great-circle or a more accurately performing method shall be used.

Thereby, care shall be taken to avoid large rounding errors on low-precision floating point systems; these can be avoided, e.g., with the haversine formula.

In case the relevance area is an ellipse or a rectangle, then the cartesian coordinates of the area centre and of the current position need to be calculated for assessing whether to hop the packet as specified in ETSI EN 302 931 [6]; for this purpose, it is recommended to use the Local Tangent Plane method, or another method delivering the same accuracy.

hat gelöscht: When roadside equipment (e.g. R-ITS-S) calculates the distance between two positions using GNSS coordinates (e.g. for PathDeltaPoints or in case of circular relevance area), it is recommended that the great-circle or orthodromic distance method is used. Thereby, care shall be taken to avoid large rounding errors on low-precision floating point systems; these can be avoided, e.g., with the haversine formula.¶
In case the relevance area is an ellipse or a rectangle, then the cartesian coordinates of the area centre and of the current position need to be calculated for assessing whether to hop the packet as specified in ETSI TS 102 894-2

hat gelöscht: [6]

hat gelöscht: [15]; for this purpose, it is recommended to use the Local Tangent Plane method, or another method delivering the same accuracy.

3.3 Facility Layer

3.3.1 List of relevant documents

The relevant standards for the facility layer are listed in Table 6 below.

hat gelöscht: Table 6

Table 6 Relevant documents for the facility layer

Document	Title	Short Description
ETSI EN 302 637-3 [10]	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3 Specifications of Decentralized Environmental Notification Basic Service	Defines event/triggered DEN message as second core message for many ITS-S applications
ETSI TS 102 894-2 [15]	Intelligent Transport Systems (ITS); Users and applications requirements; Applications and facilities layer common data dictionary	Definition and specifications on the common data container at the applications and facility layer. The common data container includes the definition, syntax and semantic specifications of all the data elements/data frames used in the applications and facilities layer messages
ETSI TS 103 301 [16]	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services	It provides specifications of infrastructure related ITS services to support communication between infrastructure ITS equipment and traffic participants using ITS equipment (e.g. vehicles, pedestrians).
C-ROADS C-ITS Infrastructure Functions and Specifications [4]	C-ITS Infrastructure Functions and Specifications	Functional and operational specifications of infrastructure day-1 ITS-S applications
VCS-A [1]	Vehicle Safety Communications – Applications; VSC-A; Final Report: Appendix B-2; Path History Reference Design and Test Results	Path History methods, constant and variables
ISO 8855 [28]	Road vehicles – Vehicle dynamics and road-holding ability - Vocabulary	Reference Coordinates System
EN 302 637-2 [9]	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	Defines CAM as core message for many ITS-S applications, plus sending rules

hat gelöscht: [15]

hat gelöscht: [4]

hat gelöscht: [9]

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3.3.2 ETSI EN 302 637-3 Decentralized Environmental Notification Basic Service

3.3.2.1 Infrastructure Profile Settings of ETSI EN 302 637-3

Requirement *RS_RSP_085 (based on RS_BSP_440)*

Roadside equipment's (e.g. R-ITS-S's) DEN basic FLS shall be compliant with ETSI EN 302 637-3 [10].

hat gelöscht: Roadside equipment's (e.g. R-ITS-S's) DEN basic FLS shall be compliant to ETSI EN 302 637-3 …

Requirement *RS_RSP_058 (RS_BSP_301)*

Roadside equipment (e.g. R-ITS-S) shall implement the DENM repetition as specified in the DEN basic FLS specification EN 302 637-3 [10].

Requirement *RS_RSP_069 (based on RS_BSP_305)*

The cases in which DENM Updates are triggered shall be specified on a ITS-S application specific basis in the corresponding triggering conditions in section 3.2 of C-ROADS C-ITS Infrastructure Functions and Specifications [4].

hat gelöscht: Furthermore, the cases in which DENM Updates are triggered shall be specified on a ITS-S application specific basis in the corresponding triggering conditions in section 3.2 of C-ROADS C-ITS Infrastructure Functions and Specifications

hat gelöscht: [4]

Requirement *RS_RSP_060 (RS_BSP_304)*

In the case roadside equipment (e.g. R-ITS-S) sends a DENM, the Traces shall be described as a list of geographical locations leading from the event position back to the first path point.

Requirement *RS_RSP_061 (RS_BSP_307)*

When a mobile R-ITS-S becomes stationary, the PathDeltaTime of the first PathPoint of the first DENM traces element shall be fixed to the maximum value specified in ETSI EN 302 637-3 [10]. Therefore, PathPoints do not "fall out" of the first DENM traces element. Applies only to trailer based ITS-S applications.

Requirement *RS_RSP_062 (RS_BSP_308)*

Additional PathHistory elements may be present in the DENM traces. However, unlike the first element, these shall describe alternative routes to the event location. These routes may or may not be available at the time of detecting the event.

Requirement *RS_RSP_063*

For roadside equipment (e.g. R-ITS-S) the Traffic Class value of a message is FLS or ITS-S application specific and therefore shall be specified in the related specification. The selected traffic class value shall comply to the message classifications as specified in TS 102 636-4-2 [26] with the exception that IVI messages related to variable speed limits are low priority DENM equivalents and therefore may have the same traffic class value.

The traffic class value for message sets shall be set as defined in Table 7.

hat gelöscht: Table 7

Table 7 Mapping of ITS-S applications to Traffic Class values

ITS-S applications	Message Sets	Traffic Class Values
Roadworks Warning (RWW)	DENM	1,3 (for multi hop DENM)
Hazardous Location Notifications (HLN)	DENM	There is a difference among national profiles, see parameter in

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		C-ROADS C-ITS Infrastructure Functions and Specifications [4]
Variable speed limits	IVIM	1
In-Vehicle Signage (IVS)	IVIM	3
Intersection Safety (IS)	SPATEM / MAPEM	3
Coexistence (ITS-G5 – CEN-DSRC)	CAM	2

hat gelöscht: [4]

3.3.3 ETSI TS 103 301 Facility layer protocols and communication requirements for infrastructure services

3.3.3.1 Infrastructure Profile Settings of ETSI TS 103 301

Requirement *RS_RSP_112*

The R-ITS-S shall implement the GNSS positioning correction service (GPC) service compliant to ETSI TS 103 301 [16] with the extensions and additional definitions specified in this document and in Functions and Specifications [4].

hat gelöscht: [16]

hat gelöscht: [XXX]

Requirement *RS_RSP_113*

The GPC service shall use RTCMEM to disseminate the GNSS correction data as defined in ETSI TS 103 301 [16].

hat gelöscht: [16]

Requirement *RS_RSP_114*

The RTCMEM messages shall contain one of the following RTCM messages with periodicity as defined below:

Message	Name	Rate	Size (bits)	Comments
RTCM 3.2 - 1005	Stationary RTK reference Station ARP	1 Hz	8*19 = 19 octets	
RTCM 3.2 - 1077	GPS MSM7	1 Hz	169+Nsat*(36 +81*Nsig) = 904 octets	Nsat= 16. Nsig = 5 Signals: L1 C/A, L2C, L5 (I and Q) and L1C
RTCM 3.2 - 1087	GLONASS MSM7	1 Hz	169+Nsat*(36 +81*Nsig)	Nsat= 16. Nsig = 5 signals
RTCM 3.2 - 1097	GALILEO MSM7	1 Hz	169+Nsat*(36 +81*Nsig)	Nsat= 16. Nsig = 5 signals
RTCM 3.2 - 1230	GLONASS L1 and L2 CodePhase Biases	1 Hz	32+16*N = 12 octets	

hat gelöscht:

Nsat refers to the number of GNSS Satellites;

Nsig refers to the number of different signals included in the transmitted message

N = Number of Code-Phase Biases (max 4)

Requirement *RS_RSP_115*

The msgs component of RTCMcorrections shall contain the following messages defined in RS_RSP_114 in a round robin fashion:

- RTCM 3.2 – 1005 and RTCM 3.2 – 1077
- RTCM 3.2 – 1005 and RTCM 3.2 – 1087 and RTCM 3.2 – 1230
- RTCM 3.2 – 1005 and RTCM 3.2 – 1097.

Requirement *RS_RSP_066 (based on RS_BSP_321)*

The roadside system shall use a coordinate system compliant with ISO 8855 [28], section 2.13.

NOTE: In detail this means that the X and Y axes are parallel to the ground plane, the Z axis is aligned vertically upwards, the Y axis points to the left of the vehicle's forward direction, and the X axis points towards the vehicle's forward driving direction.

Requirement *RS_RSP_101*

For the transmission of messages by roadside systems the facilities layer protocol and communication profile setting CPS_001 shall be used as specified by ETSI TS 103 301 [16].

3.3.4 ETSI EN 302 637-2 [9]

3.3.4.1 Infrastructure Profile Settings of ETSI EN 302 637-2 [9]

Requirement *RS_RSP_104*

The Protected Zone data provided in a CAM sent by an R-ITS-S shall not conflict with the Protected Zone information provided in the respective database. If the same zone is defined in the European Protected Zone database, the same ID shall be used as protectedZoneID. Otherwise, an ID greater than 67108863, which is not used in the database, shall be used.

Requirement *RS_RSP_105*

Roadside ITS Stations (R-ITS-S) intended to disseminate Protected Zone data shall transmit CAMs on a regular basis containing Protected Zone data according to the message format specified by ETSI EN 302 637-2 [9], CAM termination is not used.

NOTE 1: The data elements specific for the Coexistence ITS-S application are located in the highFrequencyContainer and the data frame rsuContainerHighFrequency.

NOTE 2: A CAM may as well contain other data elements not related to Coexistence.

Requirement *RS_RSP_106*

The antenna of a Roadside ITS Station (R-ITS-S) intended to disseminate Protected Zone data shall be placed such that Protection Zone CAM's can be received in time before entering the Protected Zone.

hat gelöscht: -

hat gelöscht: Q

hat gelöscht: XX3

hat gelöscht: to

hat gelöscht: NOTE: In detail this means that the X and Y axes are parallel to the ground plane, the Z axis is aligned vertically upwards, the Y axis points to the left of the vehicle's forward direction, and the X axis points towards vehicle's forward driving direction.

hat gelöscht: [9]

hat gelöscht: [9]

hat gelöscht: [9]

NOTE: The realisation of this requirement must consider the processing time the road user equipment requires to process the information received. According to the ETSI TS 101 539-1 [29] a time of 300 ms should be used as reference.

Requirement *RS_RSP_107*

Roadside ITS Stations (R-ITS-S) intended to disseminate Protected Zone data shall transmit CAMs containing Protected Zone data with a transmit rate that ensures that mobile ITS stations are able to identify the presence of Protected Zones in time.

EXAMPLE: Assuming a packet reception rate of 80% within 300m radius around an R-ITS-S, and a vehicle speed of 130 km/h, a CAM transmit rate of 1 Hz results in 13 expected CAM receptions by the vehicle ITS station.

Requirement *RS_RSP_108*

A Roadside ITS Station (R-ITS-S) intended to disseminate Protected Zone data shall be installed outside Protected Zones or configured in accordance to ETSI TS 102 792 [14]

hat gelöscht: [14]

Requirement *RS_RSP_067 (based on RS_BSP_439)*

If the Coexistence (ITS-G5 – CEN-DSRC) FLS is used, it shall be applied according to ETSI EN 302 637-2 [9] and as specified in ETSI TS 102 792 [14]

hat gelöscht: [9]

hat gelöscht: [14]

Requirement *RS_RSP_110*

ISO/TS 19321 is still referring to an older version 1.2.1 of the ETSI TS 102 894-2 Common Data Dictionary (CDD) for payload data. All ISO/TS 19321 based IVI ITS-S applications shall therefore be based on the updated version 1.3.1 of the CDD (ETSI TS 102 894-2 [15]) until the standard is updated accordingly.

hat gelöscht: [15]

NOTE: Requirement can be removed after ISO/TS 19321 is updated with a reference to the new version of the CDD.

Requirement *RS_RSP_091 (based on RS_BSP_290 & RS_BSP_216)*

The CA basic FLS shall be active as long as the roadside equipment (e.g. R-ITS-S) is in the safety-related context. As long as the CA basic FLS is active, CAMs shall be generated according to the generation rules defined in ETSI EN 302 637-2 [9]

hat gelöscht: [9]

NOTE: By default, a roadside equipment shall be considered to be within the safety-related context, as long as the roadside equipment is participating in public traffic under normal driving conditions.

Requirement *RS_RSP_092 (based on RS_BSP_291)*

A roadside equipment (e.g. R-ITS-S) shall transmit CAM messages as long as position information is available and within the clock accuracy defined in RS_RSP_004.

hat gelöscht: A roadside equipment (e.g. R-ITS-S) shall transmit CAM messages as long as position and time information are available and within the specified limits in RS_RSP_004 and RS_RSP_005.

Requirement *RS_RSP_094 (based on RS_BSP_293)*

The parameter T_GenCam_Dcc (see [EN 302 637-2]) shall be set to the value of the minimum time between 2 transmissions, Toff, as given by DCC mechanisms specified by ETSI TS 102 687. The values in Table A.2 of ETSI TS 102 687 shall be used if reactive DCC algorithm is implemented.

hat gelöscht: The parameter T_GenCam_Dcc (see ETSI EN 302 637-2 [9]) shall be set to the value of the transmission interval, TTX, as given by the DCC Mechanism (see Table 4).

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Requirement *RS_RSP_098 (based on RS_BSP_297)*

The adjustable N_GenCam parameter (see ETSI EN 302 637-2 [9]) specified in the CAM Generation Frequency Management shall be set to 0 for the roadside equipment (e.g. R-ITS-S), unless it is intended to disseminate Protected Zone data as defined in RS_RSP_105.

hat gelöscht: [9]

3.4 Management

3.4.1 List of relevant documents

Table 8 Relevant management standards

Document	Title	Short Description
ETSI TS 103 175 [3]	Intelligent Transport Systems (ITS);	Specify the functionality of the decentralized congestion control (DCC) entity residing in the management plane for the ITS-G5A, ITS-G5B, and ITS-G5D radio interfaces, collectively known as the 5 GHz ITS frequency band

3.4.2 ETSI TS 103 175

3.4.2.1 C-Roads Profile Settings of ETSI TS 103 175

Not all specified security services are required to be implemented. Additionally, for some services, the implementation is defined internally by the operator.

Requirement *RS_RSP_070*

A roadside system implementing ITS-G5 functionalities shall implement a management layer including a DCC_CROSS entity as specified in ETSI TS 103 175 [3].

3.5 Security

Requirement *RS_RSP_111*

A roadside system shall be compliant to ETSI TS 102 965 [30], ETSI TS 102 940 [31], ETSI TS 102 941 [32] and ETSI TS 103 097 [33].

4 References

All normative references within a standard referenced here are automatically included and will not be listed separately.
Only if a normative reference is out of date because a newer version of the reference standard is supported, the newer reference is listed and marked accordingly.

Table 9 Table of normative key references

#	Reference
[16]	ETSI TS 103 301 V1.2.1 (2018-08) - Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services
[17] [1]	ETSI TS 102 687 V1.2.1 (2018-04) - Intelligent Transport Systems (ITS); Decentralized Congestion Control Mechanisms for Intelligent Transport Systems operating in the 5 GHz range; Access layer part
[21] [2]	ETSI EN 302 571 V2.1.1 (2017-02) - 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
[30]	ETSI TS 102 965 v1.4.1 (????-??) - Intelligent Transport Systems (ITS); Application Object Identifier (ITS-AID); Registration
[31]	ETSI TS 102 940 v1.3.1 (2018-04) - Intelligent Transport Systems (ITS); Security; ITS communications security architecture and security management
[32]	ETSI TS 102 941 v1.3.1 (2019-02) - Intelligent Transport Systems (ITS); Security; Trust and Privacy Management
[33]	ETSI TS 103 097 v1.3.1 (2017-10) - Intelligent Transport Systems (ITS); Security; Security header and certificate formats
[2]	C2C-CC Basic System Standards Profile Version 1.4.0
[7]	ETSI EN 302 636-4-1 V1.3.1 (2017-08) Intelligent Transport Systems (ITS); Vehicular Communication; Geonetworking; Part 4 Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality
[8]	ETSI EN 302 636-5-1 V2.1.1 (2017-08) Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol

[1] Old reference in ETSI EN 302 663 [11]
[2] Old reference in ETSI EN 302 663 [11]

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[11]	ETSI EN 302 663 V1.3.0 (2019-05) Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band

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Table 10 Table of additional normative references

#	Reference
[1]	VSC-A Final Report, [Online]. Available: http://www.nhtsa.gov/DOT/NHTSA/NVS/Crash%20Avoidance/Technical%20Publications/2011/811492B.pdf.
[3]	ETSI TS 103 175 V1.1.1 (2015-06) - Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium
[4]	C-ROADS (2017-08) C-ITS Infrastructure Functions and Specifications, Release 1.0
[5]	Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC Text with EEA relevance
[6]	ETSI EN 302 931 V1.1.1: Vehicular Communications; Geographical Area Definition.
[9]	ETSI EN 302 637-2 V1.4.1 (2019-04) Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service
[10]	ETSI EN 302 637-3 v1.2.2 (2014-11) Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service
[12]	ETSI EN 302 665 V1.1.1 (2010-09) Intelligent Transport Systems (ITS); Communications Architecture
[13]	ETSI TS 102 724 V1.1.1: Intelligent Transport Systems (ITS); Harmonized Channel Specifications for Intelligent Transport Systems operating in the 5 GHz frequency band.
[14]	ETSI TS 102 792 V1.2.1 (2015-06) Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency rang.
[15]	ETSI TS 102 894-2 V1.3.1 (2018-08) - Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary
[18]	ISO/TS 19321:2015 (2015-04-15) - Intelligent transport systems - Cooperative ITS - Dictionary of in-vehicle information (IVI) data structures

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[19]	Road vehicles - Vehicle dynamics and road-holding ability - Vocabulary, ISO, 2011
[20]	C2C-CC (?), White Paper on Positioning and Timing
[22]	ETSI TS 103 248 V1.2.1 (2018-08) - Intelligent Transport Systems (ITS); GeoNetworking; Port Numbers for the Basic Transport Protocol (BTP)
[23]	C-ROADS (2018-06) - Draft report on European security mechanism, Version 0.99e
[24]	IEEE Std. 802.11-2016. 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
[25]	C2C-CC White Paper Decentralized Congestion Control (DCC) for Day One
[26]	ETSI TS 102 636-4-2 (2013-10) Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 2: Media-dependent functionalities for ITS-G5
[27]	ISO/TS 19091:2019 Intelligent transport systems -- Cooperative ITS -- Using V2I and I2V communications for applications related to signalized intersections
[28]	ISO 8855:2011 Road vehicles -- Vehicle dynamics and road-holding ability -- Vocabulary
[29]	ETSI TS 101 539-1 V1.1.1 (2013-08) - Intelligent Transport Systems (ITS); V2X Applications; Part 1: Road Hazard Signalling (RHS) application requirements specification
[34]	ETSI TR 102 638 V1.1.1 (2009-06) - Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions

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