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**Intelligent Transport Systems (ITS);
Vehicular Communications;
GeoNetworking;
Part 7: Amendments for LTE-V2X;
Sub-part 1: Amendments to ETSI EN 302 636-4-1
(Media-Independent Functionality)**

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

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

The present document is part 7, sub-part 1 of a multi-part deliverable covering Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking, as identified below:

ETSI EN 302 636-1: "Requirements";

ETSI EN 302 636-2: "Scenarios";

ETSI EN 302 636-3: "Network Architecture";

ETSI EN 302 636-4: "Geographical addressing and forwarding for point-to-point and point-to-multipoint communications";

ETSI EN 302 636-5: "Transport Protocols";

ETSI EN 302 636-6: "Internet Integration";

ETSI TS 102 636-7: "Amendments for LTE-V2X";

Sub-part 1: "Amendments to ETSI EN 302 636-4-1 (Media-Independent Functionality)";

Sub-part 2: "Amendments to ETSI EN 302 636-5-1 (Basic Transport Protocol)".

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Introduction

The Intelligent Transport System (ITS) Communication (ITSC) architecture defined in ETSI EN 302 665 [i.20] is intended to support a variety of existing and new access technologies and ITS applications. The ITS station reference architecture also follows the principles of the Open Systems Interconnection (OSI) model [i.19], in which layering provides modularity and the flexibility to support different protocols at various layers. However, several protocols that have been defined in accordance with the ITSC architecture include cross-layer dependencies on other protocols also intended for use within an ITS station. Recently, a new access layer technology for ITS communication, commonly referred to as LTE-V2X, has been specified by the 3rd Generation Partnership Project (3GPP) [i.17] and [i.18]. It has since been determined that the GeoNetworking Media-Independent Functionality specified in ETSI EN 302 636-4-1 (V1.3.1) [1] includes dependencies on the access layer technology, and thus amendments to GeoNetworking Media-Independent Functionality are needed to enable operation in an ITS station that utilizes the LTE-V2X access layer technology.

The present document specifies amendments to the GeoNetworking Media-Independent Functionality specification as needed to support LTE-V2X as an underlying access layer technology of an ITS station. It is possible that a future revision of ETSI EN 302 636-4-1 [1] could incorporate amendments based on the present document. Upon completion of such revisions to ETSI EN 302 636-4-1 [1], consideration might be given as to whether the present document could be subsequently withdrawn.

1 Scope

The present document specifies amendments to ETSI EN 302 636-4-1 (V1.3.1) [1] to extend the GeoNetworking protocol for communication of packets among ITS stations that utilize LTE-V2X as the access layer technology.

The present document is no longer maintained. Contents were moved to ETSI TS 102 636-4-3 [i.2] and ETSI EN 302 636-4-1 [1] was changed accordingly.

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 302 636-4-1 (V1.3.1): "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".

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

- [i.1] ETSI EN 302 663: "Intelligent Transport Systems (ITS); ITS-G5 Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".
- [i.2] ETSI TS 102 636-4-3: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 3: Media-dependent functionalities for LTE-V2X".
- [i.3] Void.
- [i.4] ISO/IEC 8802-2: "Information technology -- Telecommunications and information exchange between systems -- Local and metropolitan area networks -- Specific requirements; Part 2: Logical Link Control".
- [i.5] Void.
- [i.6] Void.
- [i.7] Void.
- [i.8] Void.

- [i.9] Void.
- [i.10] ETSI TS 103 613 (V1.1.1): "Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems using LTE Vehicle to everything communication in the 5,9 GHz frequency band".
- [i.11] ETSI TS 136 321: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification (3GPP TS 36.321 Release 14)".
- [i.12] ETSI TS 102 636-4-2: "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".
- [i.13] ETSI TS 136 322: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Link Control (RLC) protocol specification (3GPP TS 36.322 Release 14)".
- [i.14] ETSI TS 136 323: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) specification (3GPP TS 36.323 Release 14)".
- [i.15] ETSI TS 124 334: "Universal Mobile Telecommunications System (UMTS); LTE; Proximity-services (ProSe) User Equipment (UE) to ProSe function protocol aspects; Stage 3 (3GPP TS 24.334 Release 14)".
- [i.16] ETSI TS 124 386: "LTE; User Equipment (UE) to V2X control function; protocol aspects; Stage 3 (3GPP TS 24.386 Release 14)".
- [i.17] 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)".
- [i.18] ETSI TS 123 285: "Universal Mobile Telecommunications System (UMTS); LTE; Architecture enhancements for V2X services (3GPP TS 23.285 Release 14)".
- [i.19] ISO/IEC 7498-1: "Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model".
- [i.20] ETSI EN 302 665: "Intelligent Transport Systems (ITS); Communications Architecture".
- [i.21] ETSI EN 302 636-3: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network Architecture".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 302 665 [i.20], ETSI EN 302 636-3 [i.21] and ETSI EN 302 636-4-1 [1] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 302 665 [i.20], ETSI EN 302 636-3 [i.21], ETSI EN 302 636-4-1 [1] and the following apply:

FCS	Frame Check Sequence
GN	GeoNetworking
LL	Logical Link

LLC	Logical Link Control
LTE	Long Term Evolution
MAC	Medium Access Control
MIB	Management Information Base
PDCP	Packet Data Convergence Protocol
ProSe	Proximity-Services
RLC	Radio Link Control
SDU	Service Data Unit
SNAP	SubNetwork Access Protocol
T-SDU	Transport Service Data Unit
UE	User Equipment
V2X	Vehicle-to-Everything

4 Specification compliance

In order to support LTE-V2X as an underlying access layer technology of an ITS station, ETSI EN 302 636-4-1 (V1.3.1) [1] shall apply with the amendments as specified in the present document.

5 GeoNetworking media-independent specification amendments

5.1 Fields of the GeoNetworking address

Description of *MID* field of the GeoNetworking address in clause 6.3 of ETSI EN 302 636-4-1 (V1.3.1) [1] shall be extended as prescribed in this clause to specify setting of the field in the case of communication over LTE-V2X. The corresponding amendments are summarized in table 1.

The *MID* field corresponds to the access layer address. In case of ITS-G5 MAC layer as specified in ETSI EN 302 663 [i.1], the 48-bit MAC layer address shall be used. In the case of LTE-V2X MAC layer as specified in the MAC protocol specification, ETSI TS 136 321 [i.11], the 24-bit *Destination Layer 2 ID* shall be used for Octets 2-4 of the *MID* field and Octets 5-7 shall be set to zero.

Table 1: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], clause 6.3 as incorporated into the present document

Extension of specification of the <i>MID</i> field of the GeoNetworking address	
Original	<i>"The MID field corresponds to the access layer address. In case of ITS-G5 MAC layer as specified in ETSI EN 302 663 [i.1], the 48-bit MAC layer address shall be used."</i>
Amended	The <i>MID</i> field corresponds to the access layer address. In case of ITS-G5 MAC layer as specified in ETSI EN 302 663 [i.1], the 48-bit MAC layer address shall be used. In the case of LTE-V2X MAC layer as specified in the MAC protocol specification, ETSI TS 136 321 [i.11], the 24-bit <i>Destination Layer 2 ID</i> shall be used for Octets 2-4 of the <i>MID</i> field and Octets 5-7 shall be set to zero.

5.2 Overall packet structure

5.2.1 Overall packet structure for ITS-G5 access layer technology

The content of ETSI EN 302 636-4-1 (V1.3.1) [1] clause 9.2.2 and figure 6 of clause 9.4 include details that are specific to using GeoNetworking protocol communication of packets among ITS stations that utilize ITS-G5 [i.1] as the access layer technology, but are not clearly identified as such. For clarity, the content of ETSI EN 302 636-4-1 (V1.3.1) [1] clause 9.2.2 and figure 6 of clause 9.4 are incorporated into this clause (i.e. clause 5.2.1, the title of which clarifies applicability of the content only to ITS-G5) with amendments as summarized in table 2.

A GeoNetworking packet is part of the overall frame/packet structure depicted in figure 1 (without security) and figure 2 (with security), respectively:

- The *MAC header* is the header of the MAC protocol of the ITS-G5 access layer technology. The MAC protocol may add additional protocol elements, such as a trailer for the MAC FCS as in ITS-G5 (ETSI EN 302 663 [i.1]).

NOTE 1: The *MAC header* is not specified by the present document. However, the GeoNetworking protocol sets the MAC address, or more generally the link layer address, in order to define and identify the next hop of a GeoNetworking packet.

- The *LLC header* is the header of 802.2 LLC/SNAP specified in ISO/IEC 8802-2 [i.4] with the Ethernet Type field 0x8947 indicating GeoNetworking as the LLC transport protocol.
- The *GeoNetworking header* is the header of the GeoNetworking packet as defined in ETSI EN 302 636-4-1 [1] and the present document and extended for media-dependent GeoNetworking functionality, such as for ITS-G5 specified in ETSI TS 102 636-4-2 [i.12].
- The optional payload represents the user data that are created by upper protocol entities, i.e. the T-SDU or GN6-SDU. It is passed to the GeoNetworking protocol for transmission.

NOTE 2: The general packet structure is shown as seen by the MAC protocol of the ITS-G5 access layer technology.

NOTE 3: Some GeoNetworking packets do not carry a payload, such as Beacon.

MAC Header	LLC Header	GeoNetworking Header	Payload (optional)
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Figure 1: GeoNetworking packet structure over ITS-G5 (without security)

MAC Header	LLC Header	GeoNetworking Basic Header	GeoNetworking Secured Packet with GeoNetworking Common Header, Optional Extended Header and Optional Payload
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Figure 2: GeoNetworking packet structure over ITS-G5 (with security)

Table 2: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], clause 9.2.2 and figure 6 of clause 9.4 as incorporated into the present document

Replacement of phrase identifying applicable technology throughout clause	
Original	"ITS access technology"
Amended	ITS-G5 access layer technology
Original	"ITS Access Layer"
Amended	ITS-G5 access layer technology
Clarification of figure titles	
Original	"Figure 4: GeoNetworking packet structure (without security)"
Amended	Figure 1: GeoNetworking packet structure over ITS-G5 (without security)
Original	"Figure 6: GeoNetworking packet structure (with security)"
Amended	Figure 2: GeoNetworking packet structure over ITS-G5 (with security)
Clarification of reference for GeoNetworking header	
Original	"as defined in the present document and extended for media-dependent GeoNetworking functionality, such as for ITS-G5 specified in ETSI TS 102 636-4-2 [5]"
Amended	as defined in ETSI EN 302 636-4-1 [1] and the present document and extended for media-dependent GeoNetworking functionality, such as for ITS-G5 specified in ETSI TS 102 636-4-2 [i.12]
Change of figure numbering	
Original	"figure 4"
Amended	figure 1
Original	"figure 6"
Amended	figure 2

5.2.2 Overall packet structure for LTE-V2X access layer technology

A GeoNetworking packet is part of the overall frame/packet structure depicted in figure 3 (without security) and figure 4 (with security), respectively:

- The *MAC header* is the header of the MAC protocol of the LTE-V2X access layer technology, as specified in the MAC protocol specification, ETSI TS 136 321 [i.11].

NOTE 1: The *MAC header* is not specified by the present document. However, the GeoNetworking protocol sets the MAC address, or more generally the link layer address, in order to define and identify the next hop of a GeoNetworking packet.

- The *RLC header* is specified in the Radio Link Control (RLC) protocol specification, ETSI TS 136 322 [i.13].
- The *PDCP header* is specified in the Packet Data Convergence Protocol (PDCP) specification, ETSI TS 136 323 [i.14]. The *SDU Type* field of the *PDCP header* is set to 011 (i.e. Non-IP).
- The *Non-IP Type header* is specified in the Proximity-services (ProSe) User Equipment (UE) to ProSe function protocol aspects specification ETSI TS 124 334 [i.15], with settings as specified in the User Equipment (UE) to V2X control function; protocol aspects specification, ETSI TS 124 386 [i.16]. The *Non-IP Type* field of the *Non-IP header* indicates the *V2X message family* and is set to 3 (i.e. ETSI-ITS).
- The *GeoNetworking header* is the header of the GeoNetworking packet as defined in ETSI EN 302 636-4-1 [1] and the present document and extended as needed for media-dependent GeoNetworking functionality.
- The optional payload represents the user data that are created by upper protocol entities, i.e. the T-SDU or GN6-SDU. It is passed to the GeoNetworking protocol for transmission.

NOTE 2: The general packet structure is shown as seen by the MAC protocol of the LTE-V2X access layer technology.

NOTE 3: Some GeoNetworking packets do not carry a payload, such as Beacon.

MAC Header	RLC Header	PDCP Header	Non-IP Type Header	GeoNetworking Header	Payload (optional)
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Figure 3: GeoNetworking packet structure over LTE-V2X (without security)

MAC Header	RLC Header	PDCP Header	Non-IP Type Header	GeoNetworking Basic Header	GeoNetworking Secured Packet with GeoNetworking Common Header, Optional Extended Header and Optional Payload
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Figure 4: GeoNetworking packet structure over LTE-V2X (with security)

5.3 Encoding of the *TC* field in the *Common Header*

The description of the *TC ID* field in table 10 of ETSI EN 302 636-4-1 (V1.3.1) [1] clause 9.7.5 shall be updated as shown in table 3 to reflect the existence of multiple access layer technologies. The corresponding amendments are summarized in table 4.

Table 3: *TC* field in the GeoNetworking *Common Header*

Field #	Field name	Octet/bit position		Type	Unit	Description
		First	Last			
3	<i>TC ID</i>	Bit 2	Bit 7	6-bit unsigned integer	n/a	TC ID as specified in the media-dependent part of GeoNetworking corresponding to the interface over which the packet will be transmitted, e.g. in ETSI TS 102 636-4-2 [i.12] for ITS-G5 and ETSI TS 103 613 [i.10] for LTE-V2X. Length: 6 bits

Table 4: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], clause 9.7.5 as incorporated into the present document

Update of TC ID field description	
Original	"TC ID as specified in the media-dependent part of GeoNetworking, e.g. in ETSI TS 102 636-4-2 [5] for ITS-G5"
Amended	TC ID as specified in the media-dependent part of GeoNetworking corresponding to the interface over which the packet will be transmitted, e.g. in ETSI TS 102 636-4-2 [i.12] for ITS-G5 and ETSI TS 103 613 [i.10] for LTE-V2X.

5.4 Packet handling

The packet handling procedures of ETSI EN 302 636-4-1 (V1.3.1) [1], clause 10 shall be extended as prescribed in this clause to include support for LTE-V2X as the underlying access layer technology. The corresponding amendments are summarized in table 5.

In clauses 10.3.6.2 (two occurrences), 10.3.7.1.2, 10.3.7.3, 10.3.8.2, 10.3.8.3, 10.3.9.2, 10.3.9.3, 10.3.10.2, 10.3.11.2, 10.3.11.3 and 10.3.12.3 of ETSI EN 302 636-4-1 [1], where a packet handling step indicates to "execute media-dependent procedures" the list of possible sub-steps shall be extended with an option corresponding to the use of the LTE-V2X access layer technology. The two updated variants of such steps are:

- n) execute media-dependent procedures; if the GN protocol constant `itsGnIfType` is set to:
 - a) UNSPECIFIED then omit this operation;
 - b) ITS-G5 then execute the operations as specified in ETSI TS 102 636-4-2 [i.12];
 - c) LTE-V2X then execute the operations corresponding to the use of LTE-V2X as the underlying access layer technology, which are beyond the scope of the present document (e.g. see ETSI TS 103 613 [i.10]);

and;

- m) execute media-dependent procedures; if the *Communication profile* parameter of the service primitive *GN-DATA.request* is set to:
 - a) UNSPECIFIED then omit this operation;
 - b) ITS-G5 then execute the operations as specified in ETSI TS 102 636-4-2 [i.12];
 - c) LTE-V2X then execute the operations corresponding to the use of LTE-V2X as the underlying access layer technology, which are beyond the scope of the present document (e.g. see ETSI TS 103 613 [i.10]).

For the steps as prescribed herein, *n* and *m* are variables used to represent the number of any step in ETSI EN 302 636-4-1 (V1.3.1) [1] clause 10 that indicates to "execute media-dependent procedures".

Table 5: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], clause 10 as incorporated into the present document

Extension of media-dependent procedures for packet handling	
Original	"a) UNSPECIFIED then omit this operation; b) ITS-G5 then execute the operations as specified in ETSI TS 102 636-4-2 [5];"
Amended	a) UNSPECIFIED then omit this operation; b) ITS-G5 then execute the operations as specified in ETSI TS 102 636-4-2 [i.12]; c) LTE-V2X then execute the operations corresponding to the use of LTE-V2X as the underlying access layer technology, which are beyond the scope of the present document (e.g. see ETSI TS 103 613 [i.10]);

5.5 GeoNetworking protocol constants

The `itsGnIfType` GeoNetworking protocol constant in table H.1 of annex H of ETSI EN 302 636-4-1 (V1.3.1) [1] shall be updated as shown in table 6 to define a value indicating LTE-V2X. The corresponding amendments are summarized in table 7.

Table 6: Updated GeoNetworking protocol constants

Item	GeoNetworking protocol constant	Default/initial value	Comment
5	<code>itsGnIfType</code>	Unspecified (0) ITS-G5 (1) LTE-V2X (2)	Indicates type of interface

Table 7: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], annex H as incorporated into the present document

Addition of <code>itsGnIfType</code> value indicating LTE-V2X	
Original	"Unspecified (0) ITS-G5 (1)"
Amended	Unspecified (0) ITS-G5 (1) LTE-V2X (2)

5.6 ASN.1 encoding of the GeoNetworking MIB

The ASN.1 module in annex I of ETSI EN 302 636-4-1 (V1.3.1) [1] should be updated to reflect the value indicating LTE-V2X defined in clause 5.5 of the present document. The corresponding amendments are summarized in table 8.

The code for `itsGnIfType` should be extended to include the value defined for LTE-V2X as follows:

```
itsGnIfType OBJECT-TYPE
  SYNTAX      INTEGER{
                unspecified(0),
                its-g5(1),
                lte-v2x(2)
              }
  MAX-ACCESS  read-only
  STATUS      current
  DESCRIPTION
    "ITS interface type."
 ::= { itsGnConfig 5 }
```

NOTE: In a complete MIB, it is expected that additional changes, such as updates to the `MODULE-IDENTITY`, would also be made.

Table 8: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], annex I as incorporated into the present document

Addition of <i>itsGnIfType</i> value indicating LTE-V2X	
Original	<pre> <i>itsGnIfType</i> OBJECT-TYPE SYNTAX INTEGER{ unspecified(0), its-g5(1) } MAX-ACCESS read-only STATUS current DESCRIPTION "ITS interface type." ::= { <i>itsGnConfig</i> 5 }</pre>
Amended	<pre> <i>itsGnIfType</i> OBJECT-TYPE SYNTAX INTEGER{ unspecified(0), its-g5(1), lte-v2x(2) } MAX-ACCESS read-only STATUS current DESCRIPTION "ITS interface type." ::= { <i>itsGnConfig</i> 5 }</pre>

5.7 GeoNetworking data services

The description of the *GN-DATA.request* service primitive in clause J.2 of ETSI EN 302 636-4-1 (V1.3.1) [1] is updated in this clause for support of LTE-V2X as the access layer technology and the *Communication profile* is clarified to include LTE-V2X as an example. The corresponding amendments are summarized in table 9.

The service primitive *GN-DATA.request* is used by the ITS transport protocol entity to request sending a GeoNetworking packet. Upon reception of the service primitive *GN-DATA.request*, the GeoNetworking protocol delivers the GeoNetworking packet to LL protocol entity via the *IN_SAP*.

The *Communication profile* parameter determines the LL protocol entity (e.g. unspecified, ITS-G5 or LTE-V2X).

Table 9: Summary of amendments to content from ETSI EN 302 636-4-1 (V1.3.1) [1], clause J.2 as incorporated into the present document

Generalization of protocol stack	
Original	"Upon reception of the service primitive <i>GN-DATA.request</i> , the GeoNetworking protocol delivers the GeoNetworking packet to the LLC protocol entity via the <i>IN_SAP</i> ."
Amended	Upon reception of the service primitive <i>GN-DATA.request</i> , the GeoNetworking protocol delivers the GeoNetworking packet to the LL protocol entity via the <i>IN_SAP</i> .
Clarification of <i>Communication profile</i> example	
Original	"The <i>Communication profile</i> parameter determines the LL protocol entity (e.g. unspecified, ITS-G5)."
Amended	The <i>Communication profile</i> parameter determines the LL protocol entity (e.g. unspecified, ITS-G5 or LTE-V2X).

History

Document history		
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V1.1.2	April 2022	Publication