**What needs to be changed is**

1. Rephrase abbreviation of ITS-G5A or add another one (but in the Abbreviations section, it is just referring to a the ITS band)
2. The references with an asterisk need to be considered in their amended form.
3. Add references to ETSI/3GPP specs.
4. Modify sections 4.3, 5.3.3, 5.3.5, 5.3.4, 6.1.3 as shown below
5. Add a new section 5.3.5a
6. Move the [5] and [xx] references to informative references, as it is not proper to normatively refer to access layer specifications in a facility layer standard.

BEGIN CHANGES

*Modify the Normative References section 2.1 as follows:*

## 2.1 Normative references

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

[1]\* ETSI EN 302 665 (V1.1.1): "Intelligent Transport Systems (ITS); Communications Architecture".

[2] ETSI TS 102 894-2 (V1.2.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary".

[3] SAE J2735 (2009-11-19): "Dedicated Short Range Communications (DSRC) Message Set Dictionary". Available at: http://standards.sae.org/j2735\_200911/.

[4] Recommendation ITU-T X.691/ISO/IEC 8825-2 (1997-12): "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".

[5]\* ETSI EN 302 663 (V1.2.1): "Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".

[xx] ETSI TS 136 300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

<…>

Modify the Abbreviations section 3.3 as follows:

## 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API Application Programming Interface

ASN.1 Abstract Syntax Notation 1

BSA Basic Set of Applications

BTP Basic Transport Protocol

CA Cooperative Awareness

CAM Cooperative Awareness Message

CCH Control Channel

C-V2X Access layer for Cellular V2X technology specified by 3GPP

DCC Decentralized Congestion Control

DE Data Element

DENM Decentralized Environmental Notification Message

DF Data Frame

FA-SAP Facilities/Applications Service Access Point

GN GeoNetworking

HF High Frequency

HMI Human Machine Interface

I2V Infrastructure-to-Vehicle

ID Identifier

ISO International Standards Organisation

ITS Intelligent Transport Systems

~~ITS-G5A~~ ITS Frequency band 5,875 GHz to 5,905 GHz dedicated for safety related applications

ITS-S ITS station

ITS-ST ITS Station Time

<…>

Modify section 4.3 as follows.

## 4.3 Sending CAMs

The sending of CAMs comprises the generation and transmission of CAMs. In the course of CAM generation, the originating ITS-S composes the CAM, which is then delivered to the ITS networking & transport layer for dissemination. The dissemination of CAMs may vary depending on the applied communication system. In the ITS-G5A network, defined in ETSI EN 302 663 [5],CAMs are sent by the originating ITS-S to all ITS-Ss within the direct communication range. This communication range may, inter alia, be influenced in the originating ITS-S by changing the transmit power. In the C-V2X network, CAMs are sent by the originating ITS-S to all ITS-Ss within the direct communication range or they are sent via the network

CAMs are generated periodically with a frequency controlled by the CA basic service in the originating ITS-S. The generation frequency is determined taking into account the change of own ITS-Ss status, e.g. change of position or speed as well as the radio channel load as determined by ~~DCC~~ the congestion control.

*Modify the section 5.3.3 as follows*

5.3.3 Interface to the Networking & Transport Layer

The CA basic service exchanges information with ITS Networking & Transport Layer via the interface IF.N&T
(Figure 2). A specification of the interface IF.N&T as NF-SAP (Figure 1) is provided in ETSI TS 102 723-11 [i.13].

At the originating ITS-S, the CA basic service shall provide the CAM embedded in a Facility-layer Service Data Unit (FL-SDU) together with protocol control information (PCI), e.g. according to ETSI EN 302 636-5-1 [i.7], to the ITS Networking & Transport Layer. At the receiving ITS-S, the ITS networking & transport layer will pass the received CAM to the CA basic service, if available.

~~NOTE: Central ITS-Ss (e.g. traffic control centre) exist, which do not have any CA basic service, see
ETSI EN 302 665 [1].~~

*<no further text changes>*

Modify the title of section 5.3.5 as follows

5.3.5 Interface to the Management entity for ITS-G5

*<no text changes>*

*Add a new section 5.3.5a*

5.3.5a Interface to the Management entity for C-V2X

The CA basic service may exchange priority parameters with management entity of the ITS-as in [congestion control for the C-V2X access layer]. In an originating ITS-S the CA basic service gets information regarding the channel status and packet transmission statistics.

Modify title of section 6.1.3 as follows

6.1.3 CAM generation frequency management for vehicle ITS-Ss applicable to ITS-G5 access layer

Add a new section 6.1.3a as follows

6.1.3a CAM generation frequency management for vehicle ITS-Ss applicable to C-V2X access layer

The CAM generation frequency is managed by the CA basic service; it defines the time interval between two consecutive CAM generations. Considering the requirements as specified in ETSI TS 101 539-1 [i.8],

ETSI TS 101 539-2 [i.9] or ETSI TS 101 539-3 [i.10] the upper and lower limits of the transmission interval are set as follows:

* The CAM generation interval shall not be inferior to *T\_GenCamMin* = 100 ms. This corresponds to the CAM generation rate of 10 Hz.
* The CAM generation interval shall not be superior to *T\_GenCamMax* = 1 000 ms. This corresponds to theCAM generation rate of 1 Hz.

Within these limits the CAM generation shall be triggered depending on the originating ITS-S dynamics and the channel congestion status. In case the dynamics of the originating ITS-S lead to a reduced CAM generation interval, this interval should be maintained for a number of consecutive CAMs. The conditions for triggering the CAM generation shall be checked repeatedly every *T\_CheckCamGen. T\_CheckCamGen* shall be equal to or less than

*T\_GenCamMin*.

The parameter *T\_GenCam* represents the currently valid upper limit of the CAM generation interval. The default value of *T\_GenCam* shall be *T\_GenCamMax*. *T\_GenCam* shall be set to the time elapsed since the last CAM generation, if aCAM is triggered due to condition 1). After triggering the number of *N\_GenCam* consecutive CAMs due to condition 2), *T\_GenCam* shall be set to T\_GenCamMax. The value of the parameter *N\_GenCam* can be dynamically adjusted according to some environmental conditions. The default and maximum value of *N\_GenCam* shall be 3.

EXAMPLE: *N\_GenCam* can be increased when approaching an intersection in order to increase the probability of CAM reception.

In detail the CAM generation trigger conditions shall be as follows:

1) One of the following ITS-S dynamics related conditions is given:

* the absolute difference between the current heading of the originating ITS-S and the heading included in the CAM previously transmitted by the originating ITS-S exceeds 4°;
* the distance between the current position of the originating ITS-S and the position included in the CAM previously transmitted by the originating ITS-S exceeds 4 m;
* the absolute difference between the current speed of the originating ITS-S and the speed included in the CAM previously transmitted by the originating ITS-S exceeds 0,5 m/s.

2) The time elapsed since the last CAM generation is equal to or greater than *T\_GenCam.*

If one of the above two conditions is satisfied, a CAM shall be generated immediately.

When a CAM needs to be generated, the CA basic service shall construct the mandatory containers as specified in clause 7.1. The mandatory containers mainly include the high dynamic information of the originating ITS-S, as

*{CAM.cam.basicContainer}* and *{CAM.cam.camParameters.highFrequencyContainer}* as specified in annex A.

Optionally, a CAM may include optional data. The optional data mainly include the status of the originating ITS-S which is less dynamic, as *{CAM.cam.camParameters.lowFrequencyContainer}* and specific information as included for a specific type of originating ITS-S, as *{CAM.cam.camParameters.specialVehicleContainer}* as specified in annex A.

The low frequency container shall be included in the first CAM generation since the CA basic service activation. After that the low frequency container of CAM shall be included if time elapsed since the generation of the last CAM with the low frequency container generation is equal to or greater than 500 ms.

For special vehicles, the special-vehicle container shall be included in the first CAM generation since the CA basic service activation. After that, a special vehicle container shall be included if the time elapsed since the generation of the last CAM with a special vehicle container is equal to or greater than 500 ms.

Modify section 5.3.4 by replacing the highlighted text in the Table with C\_V2X counterparts:”C-V2X” and respectively “ETSI TS 102 636-4-1 – aligned version“

5.3.4 Interfaces protocol stacks of the Networking & Transport Layer

5.3.4.1 Interface to the GeoNetworking/BTP stack

A CAM may rely on the services provided by the GeoNetworking/BTP stack. If this stack is used, the GN packet transport type Single-Hop Broadcasting (SHB) shall be used. In this scenario, only nodes in direct communication range may receive the CAM.

PCI being passed from CA basic service to the GeoNetworking/BTP stack shall comply with Table 1 and Table 2.

Table 2: PCI from CA basic service to GeoNetworking/BTP
at the originating ITS-S

| Category | Data | Data requirement | Mandatory/Conditional |
| --- | --- | --- | --- |
| Data passed from the CA basic service to GeoNetworking/BTP | BTP type | BTP header type B (ETSI EN 302 636-5-1 [i.7], clause 7.2.2) | ConditionalThe data shall be passed if the value is not provided by the ITS-S configuration, e.g. defined in a Management Information Base (MIB) or if the value is different from the default value as set in the MIB. |
|  | Destination port | As specified in ETSI EN 302 636-5-1 [i.7](see note) | ConditionalThe data shall be passed if the value is not provided by the ITS-S configuration, e.g. defined in a Management Information Base (MIB) or if the value is different from the default value as set in the MIB. |
| Destination port info | As specified in ETSI EN 302 636-5-1 [i.7] | ConditionalThe data shall be passed if the value is not provided by the ITS-S configuration, e.g. defined in a Management Information Base (MIB) or if the value is different from the default value as set in the MIB.  |
| GN Packet transport type | GeoNetworking SHB | ConditionalThe data shall be passed if the value is not provided by the ITS-S configuration, e.g. defined in a Management Information Base (MIB) or if the value is different from the default value as set in the MIB. |
| GN Communication profile | ITS-G5 | ConditionalThe data shall be passed if the value is not provided by the ITS-S configuration, e.g. defined in a Management Information Base (MIB) or if the value is different from the default value as set in the MIB. |
| GN Security profile | SECURED or UNSECURED | ConditionalThe data shall be passed if the value is not provided by the ITS-S configuration, e.g. defined in a Management Information Base (MIB) or if the value is different from the default value as set in the MIB. |
| GN Traffic Class | As defined in ETSI EN 302 636-4-1 [i.5] | Mandatory |
| GN Maximum packet lifetime | Shall not exceed 1 000 ms | Mandatory  |
| Length | Length of the CAM | Mandatory |
| NOTE: When a global registration authority for ITS application as specified in ISO EN 17419 [i.15] is operational, the BTP destination port registered with this authority shall be used. |

Modify section 5.3.4.2 as follows:

5.3.4.2 Interface to the TCP/IPv6 or UDP/IPv6 stack and the combined IPv6/GeoNetworking stack

A CAM may use the TCP/IPv6 or UDP/IPv6 stack or the combined IPv6/GeoNetworking stack for CAM dissemination as specified in ETSI TS 102 636-3 [i.4].

PCI being passed from CA basic service to the TCP/IPv6 or UDP/IPv6 stack shall comply with Table 1 and Table 3.

| Category | Data | Data requirement | Mandatory/Conditional |
| --- | --- | --- | --- |
| Data passed from the CA basic service to transport layer | Transport layer protocol type | TCP or UDP |  |
|  | Source port |  |  |
| Destination port |  |  |
| Destination IP address |  |  |
| Length | Length of the CAM |  |

NOTE: When the CAM dissemination makes use of the combined IPv6/GeoNetworking stack, the interface between the CA basic service and the combined IPv6/GeoNetworking stack may be identical to the interface between the CA basic service and IPv6 stack. ~~The transmission of CAM over the IPv6 stack is out of scope of the present document.~~

END CHANGES