



**Intelligent Transport Systems (ITS);  
Vehicular Communications;  
Basic Set of Applications;  
Part 2: Specification of Cooperative  
Awareness Basic Service**

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# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Introduction .....	6
1 Scope .....	8
2 References .....	8
2.1 Normative references .....	8
2.2 Informative references.....	8
3 Definitions and abbreviations.....	9
3.1 Definitions.....	9
3.2 Abbreviations .....	10
4 CA basic service introduction .....	10
4.1 Background .....	10
4.2 Services provided by CA basic service .....	11
4.2.1 Sending CAMs.....	11
4.2.2 Receiving CAMs .....	11
5 CA basic service functional description .....	11
5.1 CA basic service in the ITS architecture .....	11
5.2 CA basic service functional architecture .....	12
5.3 Interfaces of the CA basic service .....	13
5.3.1 Interface to ITS applications.....	13
5.3.2 Interface to data provisioning facilities.....	13
5.3.3 Interface to the Networking & Transport Layer .....	13
5.3.3.1 Interface to the GeoNetworking/BTP stack .....	14
5.3.3.2 Interface to the IPv6 stack and the combined IPv6/GeoNetworking stack .....	15
5.3.4 Interface to the Management entity .....	16
5.3.5 Interface to the Security entity.....	16
6 CAM dissemination.....	16
6.1 CAM dissemination concept .....	16
6.1.1 CAM dissemination requirements .....	16
6.1.2 CA basic service activation and termination.....	16
6.1.3 CAM generation frequency management .....	16
6.1.4 CAM time requirement .....	17
6.1.4.1 CAM generation time.....	17
6.1.4.2 CAM Time stamp.....	18
6.2 CAM dissemination constraints .....	18
6.2.1 General Confidence Constraints .....	18
6.2.2 General security constraints.....	18
6.2.3 General priority constraints.....	18
7 CAM Format Specification .....	18
7.1 General Structure of a CAM PDU.....	18
7.1.1 ITS PDU header.....	19
7.1.2 Basic container.....	19
7.1.3 Vehicle ITS-S containers .....	19
7.2 CAM format and coding rules.....	20
7.2.1 Common data dictionary.....	20
7.2.2 CAM data presentation .....	20
7.2.3 Future CAM extension.....	20
<b>Annex A (normative): ASN.1 specification of CAM .....</b>	<b>21</b>
<b>Annex B (normative): Description for data elements and data frames.....</b>	<b>23</b>

B.1	header .....	23
B.2	cam .....	23
B.3	generationDeltaTime .....	23
B.4	camParameters .....	23
B.5	basicContainer .....	24
B.6	highFrequencyContainer .....	24
B.7	lowFrequencyContainer .....	24
B.8	specialVehicleContainer.....	24
B.9	basicVehicleContainerHighFrequency.....	24
B.10	basicVehicleContainerLowFrequency .....	24
B.11	publicTransportContainer.....	25
B.12	specialTransportContainer.....	25
B.13	dangerousGoodsContainer .....	25
B.14	roadWorksContainerBasic.....	25
B.15	rescueContainer .....	25
B.16	emergencyContainer.....	26
B.17	safetyCarContainer .....	26
B.18	stationType .....	26
B.19	referencePosition .....	26
B.20	performanceClass .....	27
B.21	heading .....	27
B.22	speed.....	27
B.23	vehicleRole.....	27
B.24	laneNumber .....	27
B.25	driveDirection.....	28
B.26	longitudinalAcceleration .....	28
B.27	accelerationControl .....	28
B.28	lateralAcceleration.....	28
B.29	verticalAcceleration.....	28
B.30	embarkationStatus .....	28
B.31	curvature.....	29
B.32	curvatureCalculationMode .....	29
B.33	yawRate .....	29
B.34	steeringWheelAngle .....	29
B.35	vehicleLength.....	30
B.36	vehicleWidth .....	30
B.37	exteriorLights .....	30
B.38	pathHistory .....	30

B.39	ptActivation.....	30
B.40	specialTransportType.....	31
B.41	dangerousGoodsBasic.....	31
B.42	roadworksSubCauseCode.....	31
B.43	closedLanes.....	31
B.44	trafficRule.....	31
B.45	speedLimit.....	32
B.45	lightBarSireneInUse.....	32
B.46	incidentIndication.....	32
B.47	emergencyPriority.....	32
<b>Annex C (informative): Protocol operation of the CA basic service.....</b>		<b>33</b>
C.1	Originating ITS-S operation.....	33
C.1.1	Protocol data setting rules.....	33
C.1.1.1	T_CheckCamGen.....	33
C.1.1.2	Originating ITS-S message table.....	33
C.1.2	General protocol operation.....	33
C.1.3	Exception handling.....	34
C.1.3.1	CAM construction exception.....	34
C.2	Receiving ITS-S operation.....	34
C.2.1	Protocol data setting rules.....	34
C.2.2	General protocol operation.....	34
C.2.3	Exception handling.....	35
C.2.3.1	CAM decoding exception.....	35
<b>Annex D (informative): Flow chart for CAM generation frequency management.....</b>		<b>36</b>
<b>Annex E (informative): Extended CAM generation.....</b>		<b>40</b>
History.....		41

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## Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Intelligent Transport System (ITS), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 2 of a multi-part deliverable covering Vehicular Communications; Basic Set of Applications, as identified below:

Part 1: "Functional Requirements";

**Part 2: "Specification of Cooperative Awareness Basic Service";**

Part 3: "Specification of Decentralized Environmental Notification Basic Service";

The specification of the CA basic service was initially developed by the European Car-to-Car Communication Consortium [i.2]. The service was evaluated by several initiatives such as the C2C-CC demonstration in 2008, ETSI Plugtests events and European projects including PRE-DRIVE C2X, DRIVE C2X, SafeSpot, CVIS, CoVeL, eCoMove, SCOR@F and simTD. These evaluation efforts have provided feedback to ETSI TC ITS.

The present document replaces TS 102 637-2 in whole. It includes improvements and enhancements of the CA basic service specifications in TS 102 637-2 according to the feedback provided by the various initiatives.

### Proposed national transposition dates

Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

## Introduction

Cooperative awareness within road traffic means that road users and roadside infrastructure are informed about each other's position, dynamics and attributes. Road users are all kind of road vehicles like cars, trucks, motorcycles, bicycles or even pedestrians and roadside infrastructure equipment are road signs, traffic lights or barriers and gates. The awareness of each other is the basis for several road safety and traffic efficiency applications with many use cases as described in [i.1]. It is achieved by regular exchange of information among vehicles (V2V, in general all kind of road users) and between vehicles and road side infrastructure (V2I and I2V) based on wireless networks, called V2X network and as such is part of Intelligent Transport Systems (ITS).

The information to be exchanged for cooperative awareness is packed up in the periodically transmitted Cooperative Awareness Message (CAM). The construction, management and processing of CAMs is done by the Cooperative Awareness basic service (CA basic service), which is part of the facilities layer within the ITS communication architecture [1] supporting several ITS applications.

The CA basic service is a mandatory facility for all kind of ITS-Stations (ITS-S), which take part in the road traffic (vehicle ITS-S, personal ITS-S, etc.). The present document focuses on the specifications for CAMs transmitted by all vehicle ITS-Ss participating in the V2X network. Nevertheless, the present document defines the CAM format with flexibility in order to be easily extendable for the support of other types of ITS-Ss or future ITS applications.

The requirements on the performance of the CA basic service, the content of the CAM and the quality of its data elements are derived from the Basic Set of Applications (BSA) as defined in [i.1] and in particular from the road safety applications as defined in [i.8], [i.9], and [i.10].

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# 1 Scope

The present document provides the specifications of the Cooperative Awareness basic service (CA basic service), which is in support of e.g. the BSA road safety application.

This includes definition of the syntax and semantics of the Cooperative Awareness Message (CAM) and detailed specifications on the message handling.

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# 2 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 reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://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.

## 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 (V1.1.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part2: Applications and facilities layer common data dictionary".
- [3] SAE J2735 (2009-11-19): "Dedicated Short Range Communications (DSRC) Message Set Dictionary".

NOTE: Available at: [http://standards.sae.org/j2735\\_200911/](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".

## 2.2 Informative references

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 TR 102 638 (V1.1.1) (2009-06): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions".
- [i.2] Car2Car Communication Consortium: "Car2Car Communication Consortium Manifesto", Version 1.1. (2007-08).

NOTE: Available at <http://www.car-to-car.org/>.

- [i.3] ETSI TR 102 863 (V1.1.1) (2011-06): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM); Rationale for and guidance on standardization".
- [i.4] ETSI EN 302 636-3: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network architecture".



- [i.5] ETSI EN 302 636-4-1 (V0.0.2): "Intelligent Transport System (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".
- [i.6] ETSI TS 102 894-1 (V1.0.2): Intelligent Transport System (ITS); Users & Applications requirements; "Facility layer structure, functional requirements and specifications".
- [i.7] ETSI EN 302 636-5-1 (V0.0.4): "Intelligent Transport System (ITS); Vehicular communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol".
- [i.8] ETSI TS 101 539-1 (V1.1.1): "Intelligent Transport Systems (ITS); V2X Application; Part 1: Road Hazard Signaling (RHS) application requirements specification".
- [i.9] ETSI TS 101 539-2 (V0.0.5): "Intelligent Transport Systems (ITS); V2X Application; Part 2: Intersection Collision Risk Warning (ICRW) Application Specification".
- [i.10] ETSI TS 101 539-3 (V0.0.5): "Intelligent Transport Systems (ITS); V2X Application; Part 3: Longitudinal Collision Risk Warning (LCRW) Application Specification".
- [i.11] ETSI TS 102 723-5: "Intelligent Transport Systems; OSI cross-layer topics; Part 5: Interface between management entity and facilities layer".
- [i.12] ETSI TS 102 723-9: "Intelligent Transport Systems; OSI cross-layer topics; Part 9: Interface between security entity and facilities layer".
- [i.13] ETSI TS 102 723-11: "Intelligent Transport Systems; OSI cross-layer topics; Part 11: Interface between networking & transport layer and facilities layer".
- [i.14] ETSI TS 102 890-3: "Intelligent Transport Systems (ITS); Facilities layer function; Facility Position and time management".
- [i.15] ISO EN 17419: "Intelligent Transport Systems -- Cooperative Systems -- Classification and management of ITS applications in a global context".
- [i.16] 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".
- [i.17] ETSI TS 103 097 (V1.1.1): "Intelligent Transport Systems (ITS); Security; Security header and certificate formats".

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 302 665 [1], EN 302 663 [5], LDM given in TR 102 863 [i.3] and DE and DF given in SAE J2735 [3] and the following apply:

**basic set of applications:** group of applications, supported by vehicular communication system

NOTE: The basic set of applications are defined in [i.1].

**CA basic service:** facility at the ITS-S facilities layer to generate, receive and process the CAM

**CAM:** ITS facilities layer PDU providing ITS-S status and attributes

**CAM protocol:** ITS facilities layer protocol that operates the CAM transmission and reception

## 3.2 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
DCC	Decentralized Congestion Control
DE	Data Element
DENM	Decentralized Environmental Notification Message
DF	Data Frame
GN	GeoNetworking
HMI	Human Machine Interface
I2V	Infrastructure-to-Vehicle
ID	Identifier
ITS	Intelligent Transportation 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
LDM	Local Dynamic Map
MIB	Management Information Base
N&T	Networking & Transport Layer
OSI	Open System Interconnection
PCI	Protocol Control Information
PDU	Packet Data Unit
PER	Packed Encoding Rules
POTI	Position and Time management
SAP	Service Access Point
SHB	Single-Hop Broadcasting
TAI	Temps Atomique International (International Atomic Time)
UTC	Coordinated Universal Time
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
V2X	V2V, V2I and/or I2V

---

## 4 CA basic service introduction

### 4.1 Background

Cooperative Awareness Messages (CAMs) are messages exchanged in the ITS network between ITS-Ss to create and maintain awareness of each other and to support cooperative performance in the road network. A CAM contains status and attribute information of the originating ITS-S. The content varies depending on the type of the ITS-S. For vehicle ITS-Ss the status information includes time, position, motion state, activated systems, etc. and the attribute information includes data about the dimension, vehicle type and role in the road traffic, etc. On reception of a CAM the receiving ITS-S is able to gain awareness of the presence, the type and the status of the originating ITS-S. The received information can be used by the receiving ITS-S to support several ITS applications. For example, by comparing the status of the originating ITS-S with its own status, a receiving ITS-S is able to estimate the collision risk with the originating ITS-S and if necessary may inform the driver of the vehicle via the HMI. Multiple ITS applications may rely on the CA basic service. It is assigned to domain application support facilities in [i.6].

Besides the support of applications the awareness of other ITS-S gained by the CA basic service may be used in the networking & transport layer for the position dependent dissemination of messages, e.g. DENM by GeoBroadcasting [i.5]. The generation and transmission of CAM is managed by the CA basic service by implementing the CAM protocol.

## 4.2 Services provided by CA basic service

The CA basic service is a facilities layer entity that operates the CAM protocol. It provides two services: sending and receiving of CAMs. The CA basic service uses the services provided by the protocol entities of the ITS networking & transport layer to disseminate the CAM.

### 4.2.1 Sending CAMs

The CAM sending 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. Generally a short time latency is expected for the CAM dissemination.

The dissemination of CAMs may vary depending on the applied communication system. In the ITS-G5A [5] network CAMs are sent by the originating ITS-S to all ITS-Ss within the direct communication range. This communication range may be influenced in the originating ITS-S by the transmission power.

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.

### 4.2.2 Receiving CAMs

Upon receiving a CAM the CA basic service makes the content of the CAM available to the ITS applications and/or to other facilities within the receiving ITS-S. In one possible implementation, the received CAM data are provided to the Local Dynamic Map (LDM) for further processing and provision to applications.

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## 5 CA basic service functional description

### 5.1 CA basic service in the ITS architecture

Sending CAMs as part of the CA basic service shall be present in all ITS-S, which take part in the road traffic (vehicle ITS-S, personal ITS-S, etc.).

The CA basic service is a facilities layer entity of the ITS-S architecture as defined in [1]. It may interface with other entities of the facilities layer and with the ITS application layer in order to collect relevant information for CAM generation and to forward the received CAM content for further processing. The CA basic service within the ITS-S architecture and the logical interfaces to other layers and potentially to entities within the facility layer are presented in Figure 1.

In a vehicle ITS-S entities for the collection of data may be the Vehicle Data Provider (VDP) and the Position and Time management (POTI) and for received data the Local Dynamic Map (LDM) as receiving terminal. The VDP is connected with the vehicle network and provides the vehicle status information. The POTI [i.14] provides the position of the ITS-S and time information. The LDM [i.11] is a database for the management of higher layer data in the ITS-S. It may be updated with received CAM data and ITS applications may retrieve information from the LDM for further processing.

The CA basic service interfaces through the NF-SAP with the networking & transport layer (N&T) for exchanging of CAM messages with other ITS-Ss, the SF-SAP with the Security entity to access security services for CAM transmission and CAM reception, the MF-SAP with the Management entity and the FA-SAP with the application layer if received CAM data are provided directly to the applications.

The functionalities of the CA basic service are defined in clause 5.2, the interfaces in Figure 2 are defined in clause 5.3.

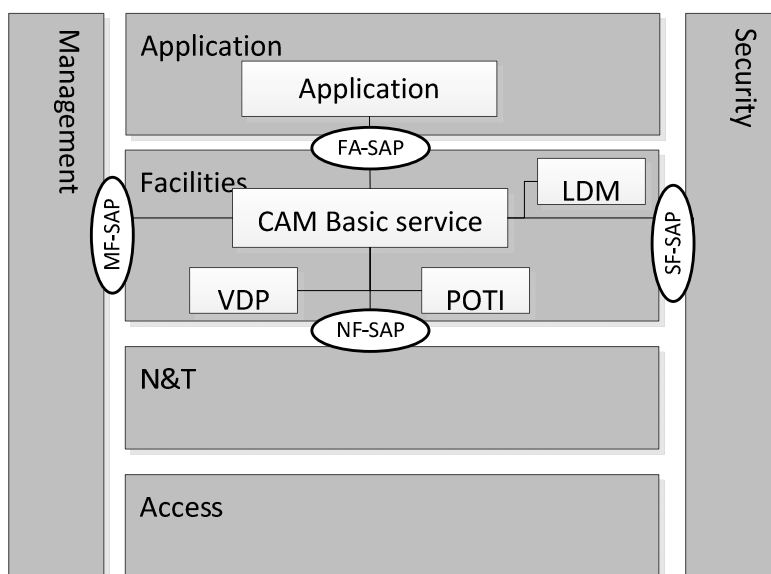


Figure 1: CA basic service within the ITS-S architecture

## 5.2 CA basic service functional architecture

The CA basic service is part of the Application Support domain of the Facilities Layer according to [i.6]. Figure 2 shows the functional block diagram with the functional blocks of the CA basic service and interfaces to other facilities and layers, which are detailed in the following. The interfaces to other entities and layers are defined in clause 5.3.

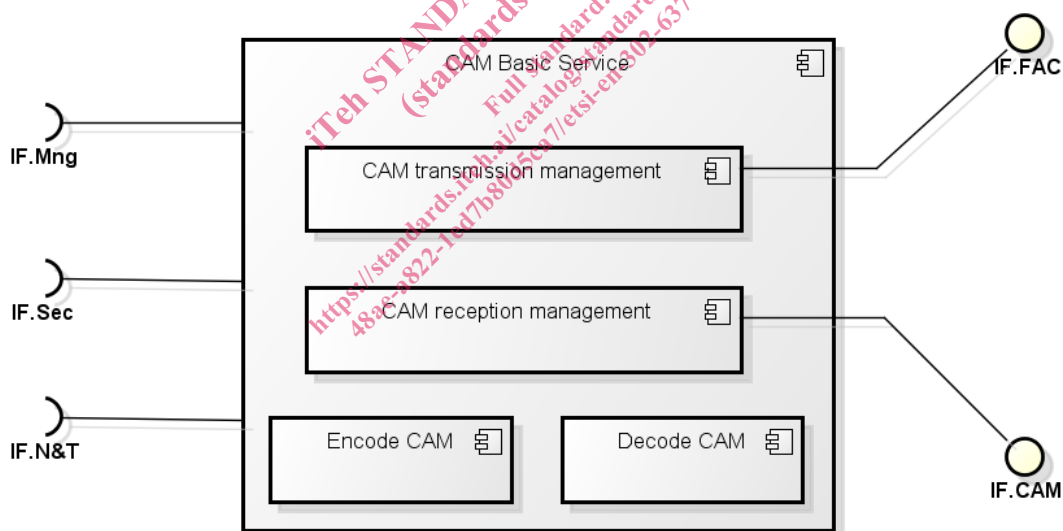


Figure 2: Functional block diagram of the CA basic service

For sending and receiving CAMs, the CA basic service shall provide the following sub-functions:

- Encode CAM:
 

This sub-function constructs the CAM according to the format specified in annex A. Always the latest available value of the in-vehicle data shall be included in CAM.
- Decode CAM:
 

This sub-function decodes the received CAMs.
- CAM transmission management: