

Cooperative intelligent transport systems (C-ITS)

Guidelines on the usage of standards

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Summary

This document provides up-to-date information on global standardization and deployment in the domain of Intelligent Transport Systems (ITS), with a focus on Cooperative Intelligent Transport Systems (C-ITS). It serves as a guide for C-ITS system designers and for C-ITS deployment.

Especially, it complements the series of Technical Reports TR 21186 from CEN and ISO.

This document may be updated without notice to reflect latest developments in standardization and deployment.

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1 Cooperative C-ITS - An introduction

"Cooperative Intelligent Transport Systems" (C-ITS) is a subset of standards for "Intelligent Transport Systems" (ITS).

ITS aims on improving surface transportation in respect of

- **safety**
e.g.: crash avoidance, obstacle detection, emergency call, dangerous goods;
- **efficiency**
e.g. navigation, green wave, priority, lane access control, contextual speed limits, car sharing;
- **comfort**
e.g. telematics, parking, electric vehicle charging, infotainment;
- sustainability,

by applying information and communication technologies (ICT).

ITS specifications are in general developed to address a specific ITS service domain such as public transport, road safety, freight and logistics, public emergency, electronic fee collection.

To support interoperability, C-ITS specifications are developed to exchange and share information ITS applications of a given application domain, and even between application domains.

C-ITS services are based on the exchange of data between vehicles of any category (cars, trucks, buses, emergency and specialized vehicles, ...), the roadside and urban infrastructure (traffic lights, road tolls, variable message signs, ...), control and services centres in the cloud (traffic control centre, service providers, map providers, ...), and other road users (pedestrians, cyclists, ...).

Some ITS services require cooperation by vehicles with their surrounding environment (other vehicles, other road users, roadside and urban infrastructure, ...) while other ITS services require connectivity to remote service platforms (road traffic control centres, map providers, service providers, fleet managers, equipment manufacturers, ...).

To support

- a large variety of C-ITS services with diverging requirements, and
- efficient sharing of information maintained by individual service applications,

it is necessary to combine multiple access technologies and communication protocols with distinct performance characteristics (communication range, available bandwidth, end-to-end transmission delay, quality of service, security, ...).

Combining multiple access technologies and communication protocols requires a common approach to the way communications and data are managed in a secure way. A functional architecture ("the ITS station architecture") is thus specified to manage security, communications and data related to C-ITS services.

The ITS station architecture is specified in ISO 21217 ^[39], see Figure 1, and details of functional building blocks of the ITS station architecture are specified in a set of related standards.

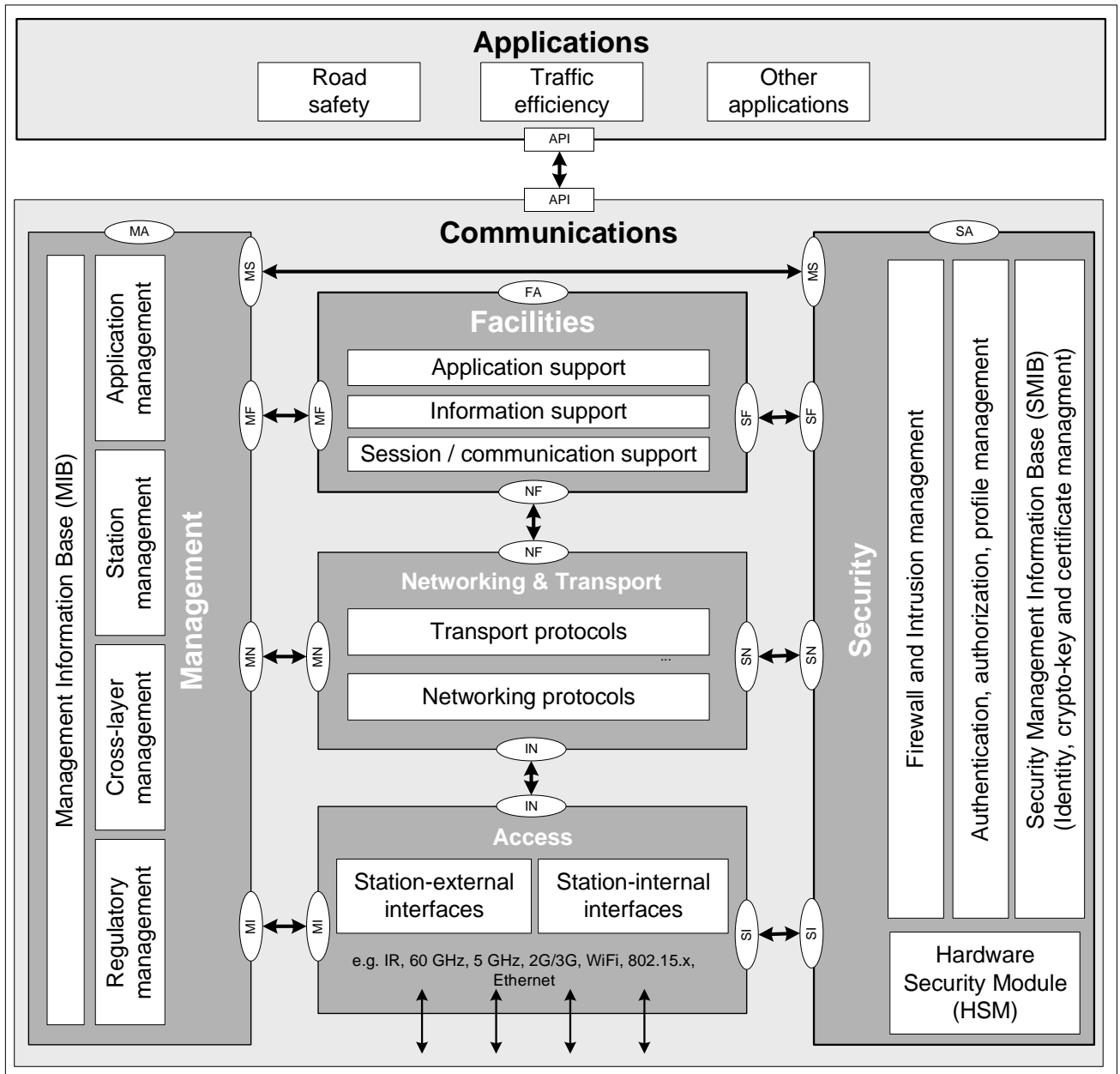


Figure 1 — ITS station architecture with some details (from ISO 21217 [39])

Similar to the ISO Open Systems Interconnection (OSI) 7-layer architecture, the ITS station architecture is designed into three independent communication layers (namely the ITS station access layer, the ITS station networking & transport layer, and the ITS station facilities layer) on top of which the ITS Applications entity is located. Additional cross-layer entities in charge of the management activities (management of ITS station units, communications and security) are supporting communications and applications.

An implementation of this ITS station architecture is referred to as "ITS Station Unit) (ITS-SUs); see ISO 21217 [39]. The functionalities available in an ITS station unit can be implemented in one or multiple physical units referred to as "ITS Station Communication Units" (ITS-SCUs); even such that the various ITS-SCUs of one ITS-SU are split over a large geographical area, e.g. along a motorway with several 10kms length.

ITS-SUs compliant with ISO 21217 [39] can be deployed in various environments, including vehicles of any kind (vehicle ITS station), on the roadside infrastructure (roadside ITS station), in the cloud (central ITS station) or in nomadic devices (personal ITS station), as illustrated in Figure 2.

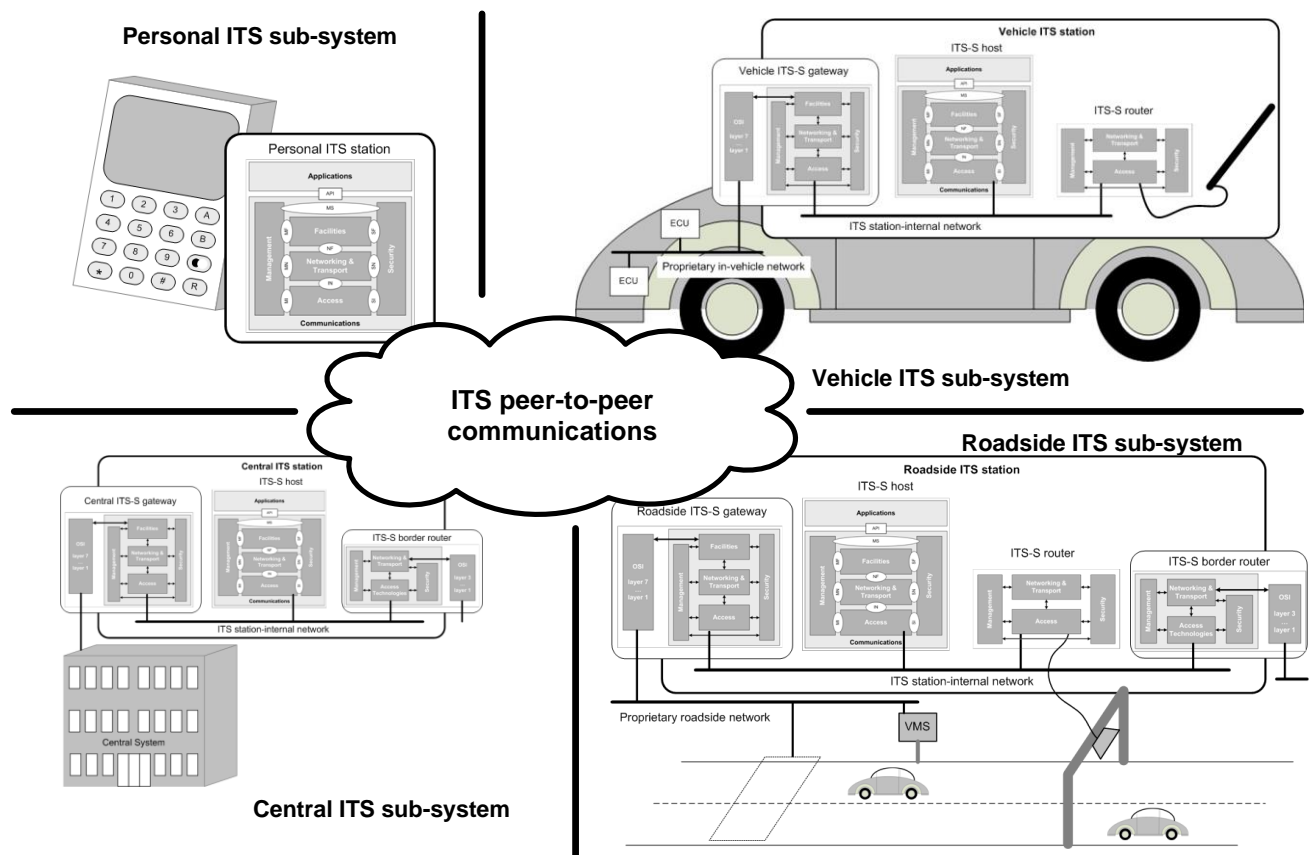


Figure 2 — Peer-to-peer communications between ITS station units

As C-ITS deals with safety of human life and property, ITS station units are designed for supporting secure provision of the C-ITS services and secure allocation of resources with prioritized access. Security means cover the two essential operational modes

- a) authentication of the sender of a broadcast message used for information dissemination, and
- b) secure session establishment and maintenance,

and station-internal controlled access to data and station functionalities, e.g. authentication (who is allowed to do what, or who is allowed to access which data and how <read / write / delete>?) and prioritization (who is served first?).

NOTE ISO 21217 [39] introduced the reference name "Bounded Secured Managed Entity" (BSME) of the ITS station unit to indicate these and further security features.

NOTE There can be station units for ITS in general, and particularly for C-ITS, that are not conformant with ISO 21217 [39] and the set of related standards from ISO in a strict sense. However, in order to ensure secure communications with ITS-SUs, as a minimum, security means are applied that are conformant with respective security standards.

Due to the diverging requirements from the multiplicity of already known and continuously emerging ITS applications, multiple communication technologies that are fundamentally different can be supported in a specific ITS station unit. Supporting multiple access technologies and

communication protocols, also referred to as “hybrid communications”, is a design principle of the ITS station architecture. The ITS station architecture is thus specified with no pre-defined mandatory communication technologies. It can support any type of existing and forthcoming technology to the conditions that

- 1) it respects the same design principles;
- 2) its integration into the ITS station architecture is specified in a support standard, and
- 3) preserves backward compatibility with existing standards.

Presently, specifications have been developed to support a number of access technologies, e.g.:

- all kinds of cellular access technologies (e.g. specified at 3GPP with profile standards from other SDOs tailoring them to the ITS station reference architecture);
- satellite communications;
- other technologies such as infrared, millimetre wave (ultra wideband communications), vehicular WiFi (ITS-G5/US-DSRC/ITS-M5: all profiles of IEEE 802.11 OCB), optical light communications,

and several flavours of communication protocol suites:

- GeoNetworking / Basic Transport Protocol from ETSI,
- FNTF from ISO,
- WSMP from IEEE
- the suite of IPv6 protocols from IETF with supporting specifications from ISO.

The ITS station architecture actually combines

- a) localized communications,

i.e. communications to nearby stations without involving networking from a source station through nodes of a network to a final destination station – also referred to as “ad-hoc communications” and

- b) networked communications.

NOTE Whilst networked communications, e.g. cellular communications and access to Internet, can apply the principle of “Technology Neutrality” (allowing simultaneous usage of a mix of incompatible technologies), localized communication between ITS station units has to be based on a specific access technology per service (or service domain) in order to enable interoperability.

EXAMPLE ITS-M5 (ISO 21215 ^[38]) with FNTF (ISO 29281-1 ^[56]) is an example of a protocol stack for localized communications. Cellular network access to Internet (ISO 17515-1 ^[17]) with IPv6 (ISO 21210 ^[34]) is an example of a protocol stack for networked communications.

Unlike many legacy applications, the choice of the access technology and communication protocol can be made transparent to the applications, i.e. ITS applications are technology-agnostic. This is achieved through a number of functionalities across the ITS station architecture in support of hybrid communications, and is illustrated in Figure 3.

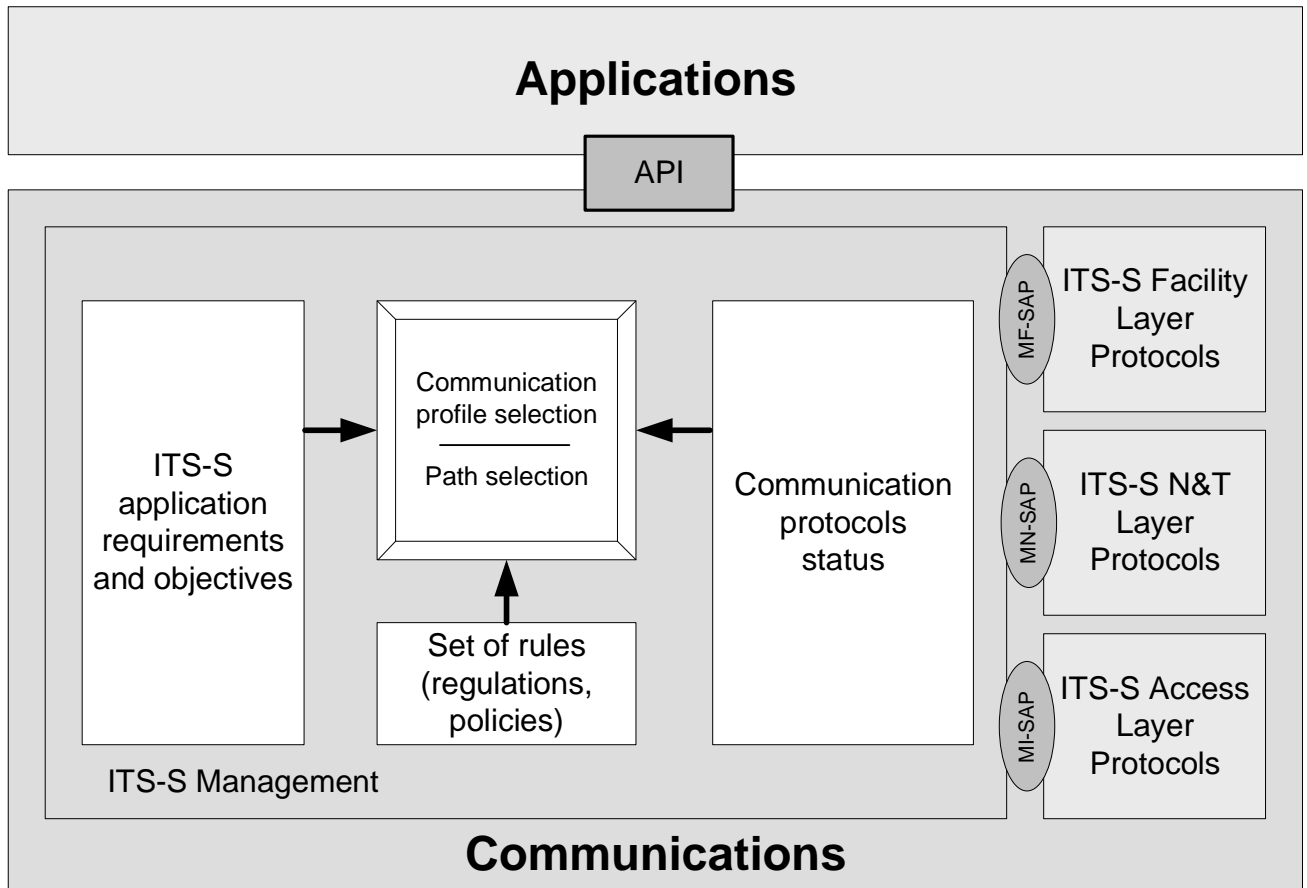


Figure 3 — Path and flow management for technology-agnostic ITS applications

Before transmitting data, applications provide their communication requirements (level of priority, amount of data to be transmitted, expected level of security, expected end-to-end transmission delay, ...) to the management entity of the ITS station unit for each type of communication flow. In the meantime, the management entity maintains various information (local regulation enforcing the use of a specific communication profile, existing capabilities of the ITS station unit and their status, characteristics and load of available radio technologies, current load of the ITS station unit, ...). Based on the communication requirement and the current view of the management, the uppermost relevant communication profile is selected and ITS station resources are securely committed for identified communication flow.

Standardization activities

C-ITS standards are developed by "Technical Committees" (TCs) of "Standard Development Organizations" (SDOs) dedicated to ITS, e.g.

- a) TC 204 within the International Organization for Standardization (ISO),
- b) TC 278 within the European Committee for Standardization (CEN) and
- c) TC ITS within the European Telecommunications Standards Institute (ETSI).

Particularly relevant standardization activities are conducted within

- ISO/TC 204/WG 1 on architectural issues and globally unique identifiers,

- ISO/TC 204/WG 16 on access technologies, communication protocols, and probe data,
- ISO/TC 204/WG 17 on personal devices,
- ISO/TC 204/WG 18 on cooperative ITS (applications and protocols),
- CEN/TC 278/WG 16 on cooperative ITS (joint WG with ISO/TC 204/WG 18),
- CEN/TC 278/WG 17 on mobility integration and urban ITS (joint WG with ISO/TC 204/WG 19),
- ETSI TC ITS on localized broadcast communications using ITS-G5.

While all of these groups are developing around the same ITS station architecture, each group has a specific focus.

- ISO TC 204 and CEN TC 278 are usually more focused to high level definition, technology-agnostic and generically applicable functionalities (vehicles, roadside infrastructure, personal devices and control centres), whereas
- ETSI is focused on vehicle-centric technologies and services using ITS-G5 and its associated set of protocols.

Supported access technologies and communication protocols are mostly developed within ISO/TC 204/WG 16 and ETSI TC ITS WG3 and WG4. Generic facilities (generic messaging, PVT, global LDM, ...) and infrastructure-centric messaging (SPaT / MAP / IVI, ...) are developed in ISO/TC 204/WG 18 jointly with CEN/TC 278/WG 16. ETSI TC ITS WG1 is developing vehicle-centric localized messages (CAM, DENM, ...) and other vehicle-centric facilities (vehicle-LDM, POTI).

ISO/TC 204, CEN/TC 278 and ETSI TC ITS are also developing standards using building blocks developed by other organizations. For instance,

- security functionalities developed by IEEE 1609 and IETF are adopted to exchange certificates and sign messages;
- Internet Protocols developed by IETF are adopted for end-to-end communications over hybrid communications and
- access technologies developed by IEEE and 3GPP are integrated as access technologies of the ITS station architecture.

Pilot deployments of C-ITS services

ISO, CEN and ETSI specifications related to C-ITS have been developed with the strong support of the European Commission since 2006, following its ITS Directive *on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport* [122], and its 6th and 7th framework research programmes (FP6 / FP7). From 2006 to 2012, the standardization activities at ISO was fuelled by collaborative projects (CVIS [126], SafeSpot, Coopers, COMeSafety, SeVeCom, Anemone, GeoNet, FOTsis, DriveC2X and ITSSv6) which provided work force and developed proof of concepts and prototypes, in particular CVIS. From 2010 to 2013 the standardization activities were further supported by the Standardization Mandate M/453 [123] given to CEN/TC 278 and ETSI TC ITS to develop C-ITS standards in support of the ITS Directive. A subsequent support was given by the Standardization Mandate M/546 [125] on Urban ITS given to CEN/TC 278.

In the meantime, various national efforts have also been initiated, for instance SCOREF in France and CONVERGE ^[127] in Germany.

The ITS station architecture serves as a reference for numerous C-ITS services developed around the world, and more particularly in Europe. Early deployments of C-ITS services complying with the ITS station architecture have been initiated in Europe under the framework of the C-ROADS and InterCor initiatives supported by the European Commission. National pilot deployments are underway all across Europe (SCOOP in France, NordicWay in Scandinavia, the C-ITS corridor project between The Netherlands, Germany, and Austria) and in other regions such as Austroads in Australia and New Zealand, and in Israel. These early deployment projects are typically focused on road safety and traffic efficiency services that rely on the exchange of data between vehicles and the roadside infrastructure. Such data exchange is performed through both localized communications and networked communications.

In these European deployments, localized communications, also known as V2X, are performed using the ITS-G5 access technology within the 5.9 GHz frequency band, a WiFi profile designed for vehicular communications, whereas networked communication are typically made through a cellular technology (e.g. LTE). Other technologies can of course be used in the future (e.g. 5G, infrared, ...) as long as they comply with the ITS station architecture and related standards defining technology building blocks.

Early deployments have evidenced the need to deploy C-ITS services using a diversity of access technologies, for instance either ITS-G5 or LTE, or a combination of both. For instance, the French pilot deployment (SCOOP) is using ITS-G5 between vehicle and roadside ITS stations to inform about immediate dangers (CAM, DENM) and LTE is used by patrol vehicles to provide information to road control centres. In Scandinavia, the scarce population has driven NordicWay to deploy roadside ITS stations only at critical locations and to rely on LTE to deliver environmental information (DENM) from road control centres to vehicles.

Further on, at the early stage of deployment of C-ITS services, the density of vehicle ITS stations equipped with ITS-G5 capabilities is scarce, whereas roadside ITS stations are only deployed in critical areas. Similarly, many areas anywhere in the world do not have the benefit of sufficient cellular network coverage. While some time critical road safety C-ITS services are best served by localized communications (e.g. notification of immediate danger requiring emergency breaking), there are not always vehicles equipped with the ITS-G5 technology or roadside equipment in the vicinity able to relay the notification immediately to nearby vehicles. In such a situation, using networked communications (e.g. cellular) to provide the information to road control centres, and then from them back to vehicles in a specific area prevents the successive occurrence of road accidents.

All these experiences, gained through early deployments, demonstrate that it is not possible to provide the same level of services to all vehicles in all locations. The type of service and the performance of the service depends on national decisions, the local road environment, the density of population, the density of vehicles equipped, cellular coverage, and numerous other factors. In addition, and importantly, the roadside infrastructure equipment and vehicles have a life expectancy that far exceeds the innovation cycle of new radio and communication technologies, therefore equipment at the roadside and in vehicles is likely to have to accommodate new communications technologies during its lifetime.

Enhanced functionalities in the ITS station architecture

Flexible and future-proof management of data and messages is a pre-requisite for success of C-ITS. New messages – even if efficiently defined in ASN.1 and encoded with Unaligned Packed Encoding Rules - can be made available during run-time of C-ITS simply by providing message

configuration information. This allows for faster introduction of new or modified services and increases communications efficiency. An approach to achieve this is known under the title "Global Transport Data Management" (GTDM) framework with specifications provided in TS 21184 [29].

Many C-ITS services depend on accurate information on the kinematics status, e.g. location and speed of a station at a given time, of the ITS station units. Thus, a general "Position-Velocity-Time" (PVT) service, as specified in TS 21176 [27], is a pre-requisite for successful deployment of such services. The basic estimation technology used for the PVT service is the technology known under the name of "Global Navigation Satellite System" (GNSS), namely GALILEO from the European Union, GPS from the United States of America, GLONAS from the Russian Federation. However, in addition to this basic technology, a large variety of complementary technologies are known to improve accuracy and reliability of the PTV service.

Hybrid communication support in the ITS station architecture

The ITS station architecture specified in ISO 21217 [39] and its functionalities in support for hybrid communications provides an answer to these concerns and enables a future-proof and sustainable deployment of C-ITS services.

Due to the diverging requirements from the multiplicity of already known and continuously emerging ITS applications, different communication technologies are to be supported in a specific ITS station unit. This need was envisioned from the start of the development of the ITS station architecture ISO 21217 [39] back to 2002 when ISO/TC 204/WG 16 was founded. As the diversity of ITS applications (ranged into three categories: "road safety", "traffic efficiency" and "comfort") with diverging communication requirements cannot be met by a single type of access technology and communication protocol, the ITS station architecture was designed to combine multiple access technologies and access protocols.

A first proof of concept of this approach was demonstrated as part of the EU funded CVIS project [126]. In 2015, this need was labelled with the term "Hybrid Communication" in the reports of the German CONVERGE project [127]. As of 2019, the need for hybrid communication solutions is expressed in pilot deployment of C-ITS services, particularly in the context of C-Roads in Europe.

Hybrid communications can basically be defined as the composition of multiple access technologies and protocols with different characteristics combined to provide complementary or redundant communication channels. This can arise in multiple situations:

- When localized communications, i.e. communication to nearby stations without involving support of an infrastructure network, is combined with networked communications, i.e. communications using support of an infrastructure network, for instance when the V2X communication stack from ETSI is combined with TCP/IP;
- When technology-agnostic applications are developed and deployed in a communication system equipped with multiple access technologies with dynamic determination of the most appropriate communication profile;
- When safety critical communications, e.g. for platooning, requires physically independent redundant communication channels such that at least one of these channels provides the necessary information.

Context in this document

The whole set of standards for deployment of C-ITS is quite difficult to understand by developers of equipment and software, especially ITS application software, and thus guidelines explaining a beneficial choice of standards (C-ITS release), the purpose and interaction of standardized

features, beneficial implementation approaches, and guidance in developing ITS applications are a prerequisite for a fair and open market allowing early deployment of interoperable and future-proof solutions.

This Brochure aims on improving understanding of standardization in C-ITS, and by this complements the CEN/ISO Technical Reports TR 21186 and TR 17427 (each with multiple parts), of which each part is dedicated to a specific purpose.

2 Standardization at SDOs

2.1 General

Standardisation in general is the process of generating specifications by a recognized authority, i.e. an SDO, applying the principle of consensus finding in the working groups of an SDO prior to formal approval by voting according to the rules of the SDOs.

Generating specifications outside of SDOs typically is a faster process of generation specifications than the process of standardisation, as the principle of consensus building amongst a group of stakeholders with typically at least slightly diverging interests and business models does not need to be applied. Consequently, standardisation is a somehow slow process that can result in compromises and standards composed of options, such that these standards cannot be used as "blueprints" for the development and production of interoperable equipment.

Regulatory requirements complement standards and specifications, and have to be considered for deployment of equipment and operation of services in the given regulatory domain.

2.2 Goals of standardisation

The purpose of standardisation, in general, is to enable or facilitate services of the respective standardisation domain, i.e. C-ITS services provided by ITS applications for the ITS service domains. Particularly, the purpose of standardisation is manifold, aiming on e.g.:

- technical interoperability at observable communications interfaces, covering e.g. mechanical, electrical, and logical requirements;
- portability of applications, enabling e.g. online download of applications from station management centres and execution of them on different technical platforms;
- syntactical and semantical interoperability in terms of data and messages;
- minimum functionality from the users point of view;
- minimum performance to ensure reliable execution of use-cases;
- facilitation of implementations;
- reliable protected operations in terms of privacy and (cyber) security;
- provision of commonly agreed terms and definitions, i.e. a common language;
- commonly agreed modes of operation, i.e. work methods;
- a global market;
- prevention of vendor-lock-in;

— evidence of compliance.

An introduction to C-ITS services is provided in ^[31].

2.3 Releases

In order to reach the standardisation goals listed in 2.2, standards are grouped in so-called "Releases" together with information on profiles and parameters. Profiles identify selected mandatory requirements, and parameter information identifies applicable values such that interoperability between equipment provided by different vendors is ensured.

Releases use dated references to standards. A release supports one or several use cases or services.

Clause 3 presents a non-exhaustive snap-shot of SDO deliverables that are considered to be of certain relevance for ITS, especially for C-ITS but also for the Urban ITS paradigm.

CEN/TR 21186-1 ^[31] explains an approach towards C-ITS releases and provides examples of releases.

2.4 SDOs

2.4.1 Overview

Major standard development organisations (SDOs) working on an international or regional level in the domain of C-ITS are illustrated in Figure 4.



Figure 4 — Major SDOs currently being active in C-ITS

Secondary SDOs are working on general purpose specifications that are usually referenced in ITS standards.

For deployment of ITS, regional legislation is to be considered, e.g. in Europe

- Decisions of the European Commission;
- Recommendations and Decisions from CEPT's ECC / ERC;
- Delegated Acts of the European Commission.

2.4.2 Major advocates of ITS

The main internationally active advocate of ITS is the Technical Committee TC204 "Intelligent Transport Systems" of the International Standards Organisation (ISO), producing standards related to many service domains of ITS. More than 10 ITS service domains are identified so far in ISO/TC 204. ISO/TC 204 was founded in 1993. Currently the work programme of ISO/TC 204 is being updated.

ISO/TC 204 is organised in Working Groups (WG), and cooperates partly with CEN/TC 278 under the Vienna Agreement (VA), see Figure 5. The VA is the tool for getting identical standards in CEN and ISO. Joint working groups typically develop standards under the VA; however, the VA can be applied also without having a joint working group. CEN/TC 278 was founded in 1992 with the original title of "Road Transport Traffic Telematics"; the title was harmonised at a later stage with ISO/TC 204.

The missing WG numbers in Figure 5 are due to the fact that some of the initial working groups in CEN/TC 278 and ISO/TC 204 either are dormant, or merged with others, or already closed.

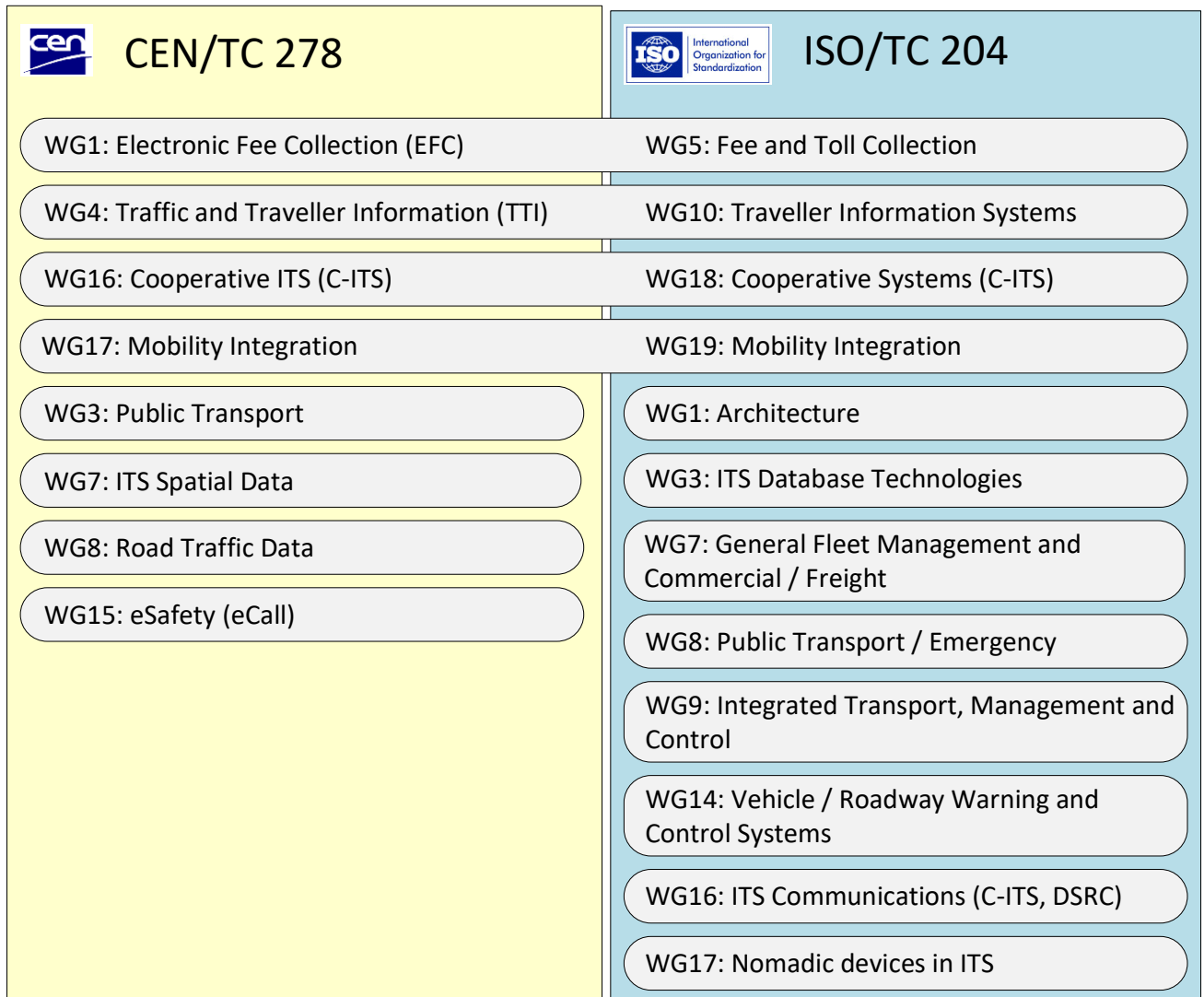


Figure 5 — Working groups and joint working groups in ISO/TC 204 and CEN/TC 278

2.4.3 Further advocates active in C-ITS

Most relevant for C-ITS, in addition to CEN/TC 278 and ISO/TC 204, are

- IEEE with its working groups on 802.11 and 1609, and
- SAE America with the activities on data and message specifications, e.g. SAE J2735 [118] and J2945/1 [119].

Further relevant is

- ETSI with its TC ITS being dedicated to C-ITS focusing on vehicle-centric communications and road safety, and its TC ERM working on frequency regulatory issues (Harmonised European Norms).

ETSI TC ITS was founded as the result of an initiative from the ETSI chair and board to become involved in ITS standardisation. It was formed in cooperation with CEN/TC 278 in respect of determining its remit and scope. ETSI TC ITS had its constitutional meeting in December 2007. From this time on, European car makers were involved in standardization, and significantly influence operations in TC ITS. ETSI TC ITS is organized in five working groups:

- WG1: Facilities and applications
- WG2: Architecture and cross-layer issues
- WG3: Networking
- WG4: Access technologies
- WG5: Security.

As the European Union's mandate M/456 on C-ITS from 6th October 2009 ^[123] was accepted by CEN/TC 278 and by ETSI TC ITS, CEN and ETSI had to formally cooperate and harmonize their contributions, e.g. with ETSI having a focus on its traditional experience on communications, and CEN having a focus on its traditional experience on services and applications. However, as a matter of fact, ETSI developed data and message specifications and ITS applications in its WG1, and CEN / ISO continued developing also communications standards.

ITU has some activities on ITS in general.

2.4.4 Secondary SDOs

Further SDOs, i.e. secondary SDOs with respect of ITS standardisation, are providing general purpose specifications that are applicable for C-ITS and referenced in C-ITS standards, e.g.:

- the Internet Engineering Task Force (IETF): developing Request for Comments (RFCs) providing specifications related to the Internet Protocol;
- the National Institute of Standards and Technology (NIST) of the United States of America: providing Federal Information Processing Standards (FIPSS) on cyber security.

2.5 Standardisation areas

Standardization activities can be grouped in standardization areas as presented in CEN/TR 21186-1 ^[31]. This grouping follows largely the ITS station architecture specified in ISO 21217 ^[39] and illustrated in Figure 6.

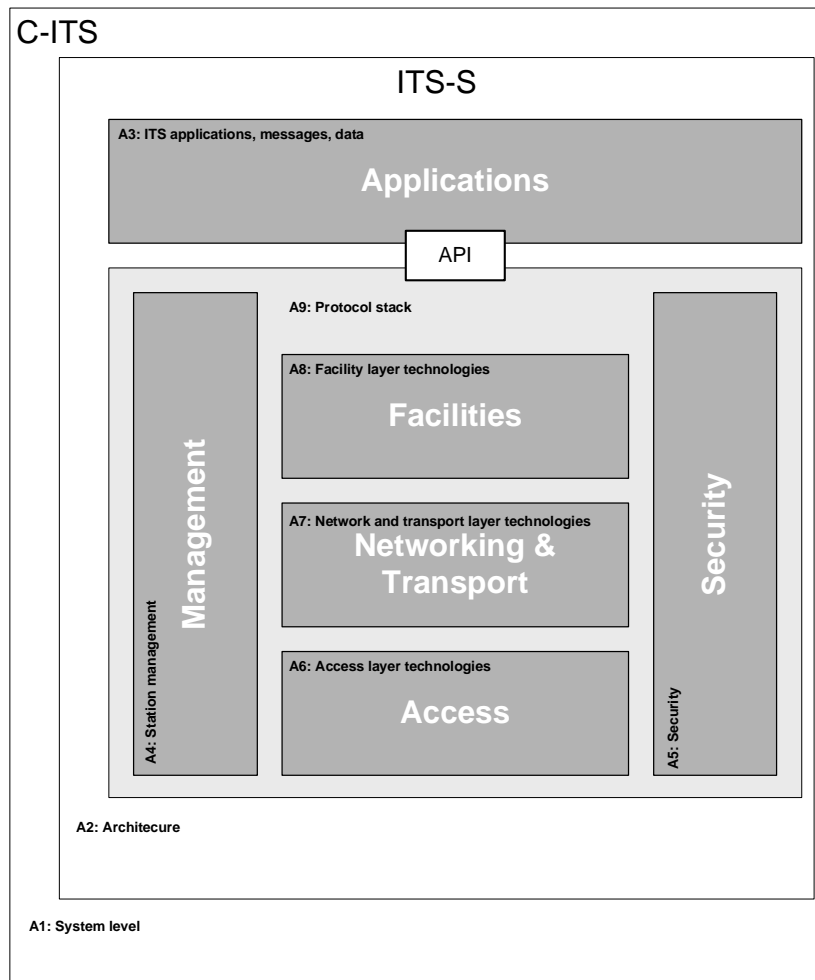


Figure 6 — Simplified ITS station architecture (ISO 21217 [39])

The following standardisation areas are identified and explained in CEN/TR 21186-1 [31]:

- A-1: System level issues
- A-2: Station architecture
- A-3: ITS applications, messages, data
- A-4: Station management
- A-5: Security
- A-6: Access layer technologies
- A-7: Network and transport layer technologies
- A-8: Facility layer technologies
- A-9: Protocol stack

Within each standardization area, possible subjects of an SDO deliverable are distinguished by means of categories of SDO deliverables; see 2.6.

2.6 Categories of SDO deliverables

The following standards categories, applicable for the various standardisation areas presented in 2.5, are identified and explained in CEN/TR 21186-1 ^[31]:

- C-1: Preparatory investigations
- C-2: Functional requirements
- C-3: Use cases
- C-4: Data and messages
- C-5: Protocols
- C-6: Profiles
- C-7: Testing
- C-8: Regulations
- C-9: Registries
- C-10: Tutorials and guidelines
- C-11: Reports
- C-12: Research
- C-13: Process

NOTE SDO deliverables can provide specifications related to various categories.

3 Selected standards for C-ITS

3.1 General

This clause provides a short description of standards that are considered to be relevant for future C-ITS Releases; see ^[31]. It is to be noted that C-ITS Releases dedicated to a specific region can be specified. A grouping is performed according to the standardisation areas defined in 2.5. A classification is indicated according to standard categories defined in 2.6.

The Bibliography clause of this Brochure contains informative references to additional deliverables from SDOs.

3.2 Overall high-level system architecture and related entities

NOTE Standards described in this sub-clause relate to the standardisation area "System architecture" introduced in 2.5.

3.2.1 EN 17419 - Globally unique identification

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 17419 ^[10]	2	None	CEN ISO	Published	A-1	Several

<p>Description:</p> <p>Describes and specifies globally unique addresses and identifiers (ITS-S object identifiers) which are both internal and external to ITS stations and are used for ITS station management.</p> <p>Describes how ITS-S object identifiers and related technical parameters are used for classification, registration and management of ITS applications and ITS application classes.</p> <p>Describes how ITS-S object identifiers are used in the ITS communication protocol stack.</p> <p>Introduces an organizational framework for registration and management of ITS-S objects.</p> <p>Is based on the architecture of an ITS station specified in ISO 21217 ^[39] as a Bounded Secured Managed Domain (BSMD).</p> <p>Specifies an ASN.1 module for the identifiers, addresses, and registry records identified in this document.</p> <p>Specifies an ASN.1 module for a C-ITS data dictionary containing general purpose ASN.1 type definitions.</p>
<p>Comments:</p> <p>The actual ASN.1 files</p> <ul style="list-style-type: none"> — 17419.1.asn — 17419.2.asn <p>are freely available for download via a hyperlink at https://standards.iso.org/iso/17419/ed-1/en.</p>
<p>Testing:</p> <p>Conformance testing is not applicable.</p>

3.2.2 TS 102 940 - Security architecture

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 940 ^[98]	1.3.1		ETSI	Published	A-1	C-2
<p>Description:</p> <p>Specifies a security architecture for Intelligent Transport System (ITS) communications. Based upon the security services defined in ETSI TS 102 731 ^[94], it identifies the functional entities required to support security in an ITS environment and the relationships that exist between the entities themselves and the elements of the ITS reference architecture defined in ETSI EN 302 665 ^[79] / ISO 21217 ^[39].</p> <p>Identifies the roles and locations of a range of security services for the protection of transmitted information and the management of essential security parameters. These include identifier and certificate management, PKI processes and interfaces as well as basic policies and guidelines for trust establishment.</p>						
<p>Comments:</p>						
<p>Testing:</p> <p>Unknown</p>						

3.2.3 ISO 17427-1 – Roles and responsibilities

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 17427-1 ^[14]	1	None	ISO	Published	A-1	C-13
<p>Description:</p> <p>Contains a detailed description of the (actor invariant) ‘Roles and Responsibilities’ required to deploy and operate Cooperative-ITS (C-ITS). The organization / organization of actors / roles described in this document are designed to be appropriate for any fully operational system that uses the C-ITS concepts and techniques in order to achieve</p>						

its service provision. The 'Organizational' or 'Enterprise' Viewpoint as defined in ISO/IEC 10746 Open Distributed Processing is applied.

Comments:

It seems to be that, to date, this business process standard is not actually applied anywhere.

Testing:

Conformance testing is not applicable.

3.3 Station architecture

NOTE Standards described in this sub-clause relate to the standardisation area "Station architecture" introduced in 2.5.

3.3.1 ISO 21217 – Station and communication architecture

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21217 ^[39]	2	None	ISO	Published	A-2	C-2
<p>Description:</p> <p>Describes the communications reference architecture of nodes called "ITS station units" designed for deployment in intelligent transport systems (ITS) communication networks.</p> <p>Describes the various communication modes for peer-to-peer communications over various networks between ITS communication nodes. These nodes can be ITS station units as described in ISO 21217 or any other reachable nodes.</p> <p>Specifies the minimum set of normative requirements for a physical instantiation of the ITS station based on the principles of a bounded secured managed domain.</p>						
<p>Comments:</p> <p>Edition 2 (2014) includes EN 302 665 ^[79].</p> <p>Under revision in 2020 to align with latest developments in C-ITS standardization.</p>						
<p>Testing:</p> <p>Conformance testing is not applicable.</p>						

3.3.2 ISO 20026 – C-ITS test architecture

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO/TS 20026 ^[25]	1	None	ISO	Published	A-2	C-7
<p>Description:</p> <p>Specifies an extension of the ETSI C-ITS test architecture EG 202 798 for conformance testing of protocols and applications in ITS station units.</p> <p>Specifies usage of the ITS station-internal management communication protocol (IICP) ISO 24102-4 ^[47] for the purpose of connecting an ITS test system to an implementation under test (IUT) residing in a system under test (SUT).</p>						
<p>Comments:</p> <p>This standard complements ETSI EG 202 798 ^[69].</p>						
<p>Related base standards:</p> <p>Those implemented in an ITS-SU conformant with ISO 24102-4.</p>						

3.3.3 EG 202 798 - Framework for conformance and interoperability testing

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EG 202 798 [69]	1.1.1	None	ETSI	Published	A-2	C-7
Description: Support ITS projects on the development of test specifications for ITS base standards from ETSI, ISO, CEN and other ""Standard Developing Organisations"" (SDOs) by providing: An ITS testing framework for conformance testing. An ITS testing framework for interoperability testing. The testing framework provides guidance for development of conformance and interoperability test strategies, test systems and the resulting test specifications for ITS.						
Comments:						
Related base standards: Those implemented in an ITS-SU.						

3.4 ITS applications, message sets, messages, data

NOTE Standards described in this sub-clause relate to the standardisation area "ITS applications, messages, data" introduced in 2.5.

3.4.1 TR 102 638 - Basic set of applications

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TR 102 638 [82]	1.1.1	None	ETSI	Published	A-3	C-10
Description: Describes a Basic Set of Applications (BSA) to be specified by Intelligent Transport Systems (ITS) in Release 1 of the ETSI ITS standards set. Defines BSA mainly focusing on V2V, V2I and I2V communications in the V2X dedicated frequency band. Introduces a V2X facilities layer model allowing the identification of the functional elements belonging to the facilities layer.						
Comments:						
Testing: Conformance testing is not applicable.						

3.4.2 TS 102 637-1 - Functional requirements for BSA

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 637-1 [91]	1.1.1	None	ETSI	Published	A-3	C-2
Description: Provides the functional requirements for the applications and their use cases as defined in TR 102 638 [82].						

Comments:
Testing: Conformance testing is not applicable.

3.4.3 ISO 22837 – Reference architecture for probe vehicle systems and data

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 22837 ^[42]	1	None	ISO	Published	A-3	C-10
<p>Description:</p> <p>Specifies reference architecture for probe vehicle systems and probe data, which provides a general structure for probe vehicle systems within which a wide range of actual probe vehicle systems can be built whose physical characteristics can differ.</p> <p>Specifies basic data framework for probe data elements and probe data, which defines probe data elements and probe messages.</p> <p>Specifies core data element definitions, which are basic descriptive elements intended to appear in every probe message, i.e. the location and the time at which the probe data was sensed.</p> <p>Specifies initial set of probe data elements, which are commonly used in typical probe data enabled application domains, such as traffic, weather, and safety.</p> <p>Provides example probe messages, which define how probe data elements are combined to convey information to probe processing centres.</p>						
Comments:						
Testing: Conformance testing is not applicable.						

3.4.4 ISO 25114 – Framework for probe data reporting management

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 25114 ^[55]	1	None	ISO	Published	A-3	C-2, C-4
<p>Description:</p> <p>Provides a common framework for defining probe data reporting management (PDRM) messages to facilitate the specification and design of probe vehicle systems.</p> <p>Provides definitions of PDRM messages.</p> <p>Specifies reference architecture for probe vehicle systems and probe data which incorporates PDRM, based on the reference architecture for ISO 22837 ^[42], and basic data framework for PDRM instructions, which defines specifically necessary conditions for PDRM instructions, and notations of these instructions (in XML).</p>						
Comments:						
Testing: Conformance testing is not applicable.						

3.4.5 ISO 29284 - Event based probe vehicle data

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 29284 ^[59]	1	None	ISO	Published	A-3	C-2, C-4
Description: Specifies reference architecture for event-based probe vehicles which encompasses event-based probe data and standard probe data elements (ISO 22837:2009 ^[42]). Specifies basic data framework of event-based probe data reporting, based on ISO 22837:2009 ^[42] . Defines an initial set of event-based probe data elements.						
Comments:						
Testing: Conformance testing is not applicable.						

3.4.6 TS 101 539-1 - Road Hazard Signalling (RHS)

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 101 539-1 ^[83]	1.1.1	None	ETSI	Published	A-3	C-2
Description: Provides the specification of the ITS application Road Hazard Signalling (RHS) service based on the cooperative awareness (CA) basic service and the decentralized environmental notification (DEN) basic service. This includes functional and operational requirements of the RHS application. For the originating side of the RHS application the operational conditions related to the hazard detection and the triggering of the DENM are specified. Considers performance requirements for the generation and transmission of CAMs and DENMs, which enable different levels of RHS, and collision avoidance and collision mitigation applications.						
Comments:						
Testing: Unknown						

3.4.7 TS 101 539-2 - Intersection collision risk warning

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 101 539-2 ^[84]	1.1.1	None	ETSI	Under development	A-3	C-2
Description: Aims to provide a description of the Intersection Collision Risk Warning application, and specifications of the necessary parameters and conditions to operate the application using CAM and DENM.						
Comments:						

Testing:
Unknown

3.4.8 TS 101 539-3 - Longitudinal collision risk warning

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 101 539-3 [85]	1.1.1	None	ETSI	Published	A-3	C-2
Description: Provides a description of the Longitudinal Collision Risk Warning (LCRW) application requirements. Provides the specification of the necessary parameters and conditions to operate the application using CAM and DENM. Provides the specifications of functional requirements and operational requirements of the LCRW application.						
Comments:						
Testing: Unknown						

3.4.9 ISO 14816 - Numbering and data structure for AVI

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 14816 [4]	1	None	ISO	Published	A-3	C-2, C-4
Description: Establishes a common framework data structure for unambiguous identification in RTTT / ITS systems.						
Comments:						
Testing: Conformance testing is not applicable.						

3.4.10 TS 102 894-2 - ETSI common data dictionary

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 894-2 [97]	1.2.1	None	ETSI	Published	A-3	C-4
Description: Defines a repository of a set of data elements and data element sets, denoted as data frames, that are commonly used in the ITS applications and facilities layer messages. Each data element is defined with a set of attributes, enabling the identification of the data element in question in a number of perspectives, e.g. descriptive name, ASN.1 definition, data definition, minimum data granularity requirement, etc. Focus is on the data elements being used by the Cooperative Awareness basic service as outlined in ETSI EN 302 637-2 [76] and by the Decentralized Environmental Notification basic service as outlined in ETSI EN 302 637-3 [77].						
Comments: This data dictionary contains the definition of the "ETSI common message header" that encapsulating all messages conveyed over the GeoNetworking protocol. This header provides redundant information on the message type which is already provided in the BTP port numbers; by this it violates the OSI layered model. Further on it contains a station identifier which might be subject to privacy issues; usage of this station identifier is unknown.						

Testing:
Conformance testing is not applicable.

3.4.11 ISO 14906 - Vehicle-related data

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 14906:2018/FDAmD 1 ^[6]	3	None	ISO	Published	A-3	C-2, C-4
<p>Description:</p> <p>Specifies the application interface in the context of electronic fee collection (EFC) systems using the dedicated short-range communication (DSRC), including EFC application information that can also be used for C-ITS applications and services.</p>						
<p>Comments:</p> <p>Clause 8.4 specifies the semantics of vehicle-related data, whilst Annex A presents the associated syntax notation one (ASN.1) type and value definitions.</p> <p>The actual ASN.1 files</p> <ul style="list-style-type: none"> — ISO14906(2020)EfcDsrcApplicationv8.asn; and — ISO14906(2020)EfcDsrcGenericv9.asn <p>are freely available for download via a hyperlink at www.itsstandards.eu/index.php/efc#EFCstandards and also at https://standards.iso.org/iso/14906/ed-3/amd/1/en.</p> <p>Annex E presents a mapping table between the data elements in ISO 14906 and the vehicle registration elements as defined in defined by European Council Directive 1999/37 ^[120] and the European Commission Directive 2003/127 ^[121] amending Council Directive 1999/37/EC on the registration documents for vehicles.</p>						
<p>Testing:</p> <p>The EN 15876 series ^[129] defines related conformance tests.</p>						

3.4.12 EN 16157-1 - DATEX II context and framework

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 16157-1 ^[60]	1	None	CEN	Published	A-3	C-2
<p>Description:</p> <p>Specifies the DATEX II Version 3.0 framework of all parts of this European Standard, the context of use and the modelling approach taken and used throughout these European Standard.</p>						
<p>Comments:</p> <p>CEN is revising the whole suite of TS standards for DATEX II version 2.x into DATEX II version 3.0. The new version 3.0 is not backward compatible with any version 2.x.</p>						
<p>Testing:</p> <p>Unknown</p>						

3.4.13 EN 16157-7 DATEX II common data elements

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 16157-7 [63]	1	Predecessor TS	CEN	Published	A-3	C-4
Description: Specifies common informational structures, relationships, roles, attributes and associated data types required for publishing information within the DATEX II framework.						
Comments: This is the first edition defining DATEX II Version 3.0.						
Testing: Conformance testing is not applicable.						

3.5 Station management

NOTE Standards described in this sub-clause relate to the standardisation area "Station management" introduced in 2.5.

3.5.1 ISO 17423 - Application requirements and objectives

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 17423 [11]	2	None	ISO	Published	A-4	C-5
Description: Specifies communication service parameters presented by ITS station application processes to the ITS-S management in support of automatic selection of ITS-S communication profiles in an ITS station unit. Specifies related procedures for the static and dynamic ITS-S communication profile selection processes at a high functional level. Provides an illustration of objectives used to estimate an optimum ITS-S communication profile.						
Comments: This standard complements ISO 24102-6 [48] on path and flow management. These two standards are the core management standards for hybrid communications. The actual ASN.1 file — 17423.asn is freely available for download via a hyperlink at https://standards.iso.org/iso/17423/ed-1/en .						
Testing: PICS included in an Annex. TSS&TP and ATS not available.						

3.5.2 ISO 24102-6 – Path and flow management

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 24102-6 [48]	1	None	ISO	Published	A-4	C-5
Description: Specifies parameters and procedures for the ITS station management entity to manage data flows and routing paths associated with available communication resources in an ITS station, and to map data flows to routing paths.						

Comments:

This standard complements ISO 17423 ^[11] on application requirements for communications. These two standards are the core management standards for management of hybrid communications.

There is an attempt to split ISO 24102-6 into several parts of ISO 24102.

The actual ASN.1 file

— 24102-6.asn

is freely available for download via a hyperlink at <https://standards.iso.org/iso/24102/-6/ed-1/en>.

Testing:

Not available.

3.5.3 ISO 24102-1 - Local station management

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 24102-1 ^[44]	2	None	ISO	Published	A-4	C-5

Description:

Provides specifications for local management of ITS station units conformant with the ITS station reference architecture specified in ISO 21217 ^[39].

Comments:

This standard is a toolbox including pointers to external management standards.

The actual ASN.1 file

— 24102-1.asn

is freely available for download via a hyperlink at <https://standards.iso.org/iso/24102/-1/ed-2/en>.

Testing:

PICS included in an Annex. TSS&TP in ETSI TS 102 797-2 V1.2.1 ^[134] - to be revised, and ATS in ETSI TS 102 797-3 V1.2.1 ^[135] - to be revised.

3.5.4 ISO 24102-2 - Remote station management

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 24102-2 ^[45]	2	None	ISO	Published	A-4	C-5

Description:

Provides specifications for remote station management of ITS station communication units conformant with the ITS station reference architecture specified in ISO 21217 ^[39].

Comments:

This standard provides basic requirements for remote station management whilst enabling - to a large extent - private implementations.

The actual ASN.1 file

— 24102-2.asn

is freely available for download via a hyperlink at <https://standards.iso.org/iso/24102/-2/ed-2/en>.

Testing:

PICS included in an Annex. TSS&TP and ATS not available.

3.5.5 ISO 24102-4 - Station-internal management communication

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 24102-4 [47]	2	None	ISO	Published	A-4	C-5
<p>Description:</p> <p>Provides specifications for secure ITS station-internal management communications.</p>						
<p>Comments:</p> <p>This standard is only applicable for ITS-SCUs being part of an ITS-SU consisting of several such physical units. In addition, this standard is also used for conformance testing, see TS 20026 [25].</p> <p>The actual ASN.1 file</p> <p>— 24102-4.asn</p> <p>is freely available for download via a hyperlink at https://standards.iso.org/iso/24102/-4/ed-2/en.</p>						
<p>Testing:</p> <p>PICS included in an Annex. TSS&TP in ETSI TS 102 797-2 V1.2.1 [134] - to be revised, and ATS in ETSI TS 102 797-3 V1.2.1 [135] - to be revised.</p>						

3.5.6 ISO 24102-7 - ITS-S capabilities

Under development; see [49].

3.5.7 ISO 24102-8 - ITS-S application processes

Under development; see [50].

3.5.8 ISO 24102-9 - ITS-S managed entities

Under development; see [51].

3.5.9 ISO 24102-3 - Service access points

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 24102-3 [46]	1	None	ISO	Published	A-4	C-5
<p>Description:</p> <p>Specifies the management service access points, i.e. the service access points of the interfaces between the ITS-S management entity and</p> <ul style="list-style-type: none"> the ITS-S access layer (MI-SAP), the ITS-S networking & transport layer (MN-SAP), the ITS-S facilities layer (MF-SAP); <p>the interfaces between the ITS-S security entity and</p> <ul style="list-style-type: none"> the ITS-S access layer, the ITS-S networking & transport layer, the ITS-S facilities layer; <p>the interface between the ITS-S management entity and the ITS-S security entity (MS-SAP),</p> <p>the interfaces between the ITS-S application entity and</p> <ul style="list-style-type: none"> the ITS-S management entity (MA-SAP), and the ITS-S security entity (SA-SAP). 						
<p>Comments:</p> <p>SAPs are not testable. Note that the ASN.1 specifications of this standard (service primitive specifications) become observable and thus testable in protocol data units specified in ISO 24102-4 [47].</p> <p>The actual ASN.1 files</p> <ul style="list-style-type: none"> — 24102-3-FASAPfunctions.asn — 24102-3-MA-CMD.asn — 24102-3-MA-REQ.asn — 24102-3-MF-CMD.asn — 24102-3-MF-REQ.asn — 24102-3-MI-CMD.asn — 24102-3-MI-REQ.asn — 24102-3-MN-CMD.asn — 24102-3-MN-REQ.asn — 24102-3-MS-CMD.asn 						

- 24102-3-MS-REQ.asn
- 24102-3-MSAPS.asn
- 24102-3-SF-CMD.asn
- 24102-3-SF-REQ.asn

are freely available for download via a hyperlink at <https://standards.iso.org/iso/24102/-3/ed-2/en>.

Testing:

Conformance testing is not applicable.

3.5.10 TS 102 687- Access layer decentralized congestion control mechanisms

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 687 [92]	1.2.1	None	ETSI	Published	A-4	C-5
Description: Specifies the access layer part of the decentralized congestion control mechanism for communications at 5,9 GHz.						
Comments: Bandwidth limitation is an issue in the 10 MHz wide channels at 5,9 GHz. Thus, specific channel congestion control mechanisms are necessary, and multi-hop forwarding with GeoNetworking is not feasible. See also ETSI TS 103 157 [103]. Referenced informatively in ISO 24102-1 [44].						
Testing: Test suite in ETSI TS 102 917-1 [154], TS 102 917-2 [155], TS 102 917-3 [156].						

3.5.11 TS 102 792 – DSRC mitigation techniques

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 792 [95]	1.2.1	None	ETSI	Published	A-4	C-5
Description: Specifies requirements to ensure coexistence between ITS stations using the frequency bands ITS-G5 A/B/D and CEN DSRC using the TTT band (5,8 GHz).						
Comments: Only applicable if CEN DSRC at 5,8 GHz [64], [65], [66] is used in the operational area of C-ITS operating in the 5 GHz band. Referenced normatively in ISO 24102-1 [44].						
Testing: Test suite in ETSI TS 102 916-1 [151], TS 102 916-2 [152], TS 102 916-1 [153].						

3.5.12 TS 103 157 - Cross layer DCC management

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 103 157 [103]	1.1.1	None	ETSI	Published	A-4	C-5

<p>Description:</p> <p>Specifies 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:</p> <p>the necessary support functions of DCC that needs to be in the management plane, i.e. cross-layer DCC operations;</p> <p>the required interface parameters between the DCC management entity and the DCC entities in the facilities, the networking & transport and the access layers;</p> <p>the testing procedures and corresponding test cases.</p>
<p>Comments:</p> <p>ISO 24102-1 ^[44] informatively refers to the ETSI DCC</p>
<p>Testing:</p> <p>Test suite in ETSI TS 102 917-1 ^[154], TS 102 917-2 ^[155], TS 102 917-3 ^[156].</p>

3.6 Security

NOTE Standards described in this sub-clause relate to the standardisation area "Security" introduced in 2.5.

3.6.1 TS 102 731 - Security services and architecture

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 731 ^[94]	1.1.1	None	ETSI	Published	A-5	C-2
<p>Description:</p> <p>Specifies mechanisms at the stage 2 level defined by ETS 300 387 for secure and privacy-preserving communication in ITS environments. It describes facilities for credential and identity management, privacy and anonymity, integrity protection, authentication and authorization.</p>						
<p>Comments:</p>						
<p>Testing:</p> <p>Conformance testing is not applicable.</p>						

3.6.2 TS 102 941 - Trust and privacy management

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 941 ^[99]	1.3.1	None	ETSI	Published	A-5	C-5
<p>Description:</p> <p>Specifies the trust and privacy management for Intelligent Transport System (ITS) communications. Based upon the security services defined in TS 102 731 ^[94] and the security architecture define in TS 102 940, it identifies the trust establishment and privacy management required to support security in an ITS environment and the relationships that exist between the entities themselves and the elements of the ITS reference architecture defined in EN 302 665 ^[79] / ISO 21217 ^[39].</p> <p>Identifies and specifies security services for the establishment and maintenance of identities and cryptographic keys in an Intelligent Transport System (ITS). Its purpose is to provide the functions upon which systems of trust and privacy can be built within an ITS.</p>						

Comments: Under revision for considering hybrid communications.
Testing: Unknown

3.6.3 TS 102 942 – Access control

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 942 [100]	1.1.1	None	ETSI	Published	A-5	C-5
Description: Specifies authentication and authorization services to avoid unauthorized access to ITS services. Specifies measures to ensure the required level of security and privacy for ITS message communication.						
Comments:						
Testing: Unknown						

3.6.4 TS 102 943 - Confidentiality services

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 943 [101]	1.1.1	None	ETSI	Published	A-5	C-5
Description: Specifies services to ensure that the confidentiality of information sent to and from an ITS station can be maintained at a level that is acceptable to the users of the station.						
Comments:						
Testing: Unknown						

3.6.5 TS 103 097 - Security header and certificate formats

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 103 097 [102]	1.3.1		ETSI	Published	A-5	C-5
Description: Specifies the secure data structure including header and certificate formats for Intelligent Transport Systems.						
Comments: The document is based on the specifications in IEEE Std. 1609.2™-2016: " <i>IEEE Standard for Wireless Access in Vehicular Environments — Security Services for Applications and Management Messages</i> ", as amended by IEEE Std. 1609.2a™-2017: " <i>Standard for Wireless Access In Vehicular Environments — Security Services for Applications and Management Messages Amendment 1</i> " [108].						
Testing: Test suite provided in ETSI TS 103 096-1 [159], TS 103 096-2 [160], TS 103 096-3 [161].						

3.6.6 IEEE Std. 1609.2 - Security services for applications and management messages

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
IEEE Std. 1609.2 ^[108]	2016 with amendment 2017	None	IEEE	Published	A-5	C-5
Description: Defines secure message formats and processing for use by Wireless Access in Vehicular Environments (WAVE) devices, including methods to secure WAVE management messages and methods to secure application messages. Describes administrative functions necessary to support the core security functions.						
Comments: This edition is being complemented by IEEE 1609.2b.						
Testing: Unknown						

3.6.7 ISO 21177 - Secure sessions with ITS station units

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21177 ^[28]	1	None	ISO	Published	A-5	C-5
Description: Contains specifications for a set of ITS station security services required to ensure the authenticity of the source and integrity of information exchanged between trusted devices, i.e. devices operated as bounded secured managed entities specified in ISO 21217 ^[39] and external entities such as sensor and control networks. These services include authentication and secure session establishment which are required to exchange information in a trusted and secure manner. Such secured services are essential for many ITS applications and services including time-critical safety applications, automated driving, remote management of ITS stations (ISO 24102-2 ^[45]), and roadside / infrastructure related services.						
Comments: This is also applicable for accessing sensor and control networks, e.g. probe data in vehicles via the CAN bus. The actual ASN.1 files — access-control.asn; and — adaptor-layer.asn are freely available for download via a hyperlink at https://standards.iso.org/iso/ts/21177/ed-1/en . Complements to and minor modifications of ISO 21177 are proposed in TR 21186-3 ^[33] .						
Testing: Not available						

3.7 Access technologies

NOTE Standards described in this sub-clause relate to the standardisation area "Access layer technologies" introduced in 2.5.

3.7.1 ISO 21215 – ITS-M5

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21215 ^[38]	2	None	ISO	Published	A-6	C-6
<p>Description:</p> <p>Provides specifications of a communication interface (CI) named "ITS-M5" with reference to IEEE 802.11 ^[112]. Specifies the additions to and deviations from IEEE Std 802.11™-2016 ^[112] required to make ITS-M5 CIs compatible with the ITS station and communication architecture specified in ISO 21217 ^[39]. Supports frequency regulation in all regions, with explicit reference to European frequency regulation (EN 301 893 ^[70], EN 302 571 ^[71]). Supports both OCB mode and ordinary WiFi mode.</p>						
<p>Comments:</p> <p>Covers fully ETSI EN 302 663 V1.2.1 ^[78] with the difference, that EN 302 663 V1.2.1 still uses LPD instead of EPD – although EPS is required in the 2016 edition of the referenced base standard IEEE 802.11, whilst ISO 21215 uses EPD - as US DSRC (WAVE) does. Candidate to replace ETSI EN 302 663, and by this enhance the supported functionality.</p> <p>Includes European usage as specified in the context of EN 302 663.</p> <p>The actual ASN.1 file</p> <ul style="list-style-type: none"> — 21215.asn <p>is freely available for download via a hyperlink at https://standards.iso.org/iso/21215/ed-2/en.</p>						
<p>Testing:</p> <p>PICS included in Annex. TSS&TP and ATS not available.</p>						

3.7.2 ISO 21218 - Access technology support

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21218 ^[40]	2	None	ISO	In publication	A-6	C-5
<p>Description:</p> <p>Specifies general technical details related to the access layer of the ITS station reference architecture specified in ISO 21217 ^[39] including</p> <ul style="list-style-type: none"> — the service access point (SAP) of a communication interface (CI) as provided by the communication adaptation layer (CAL) for communication, named IN-SAP, and related service primitives and service primitive functions; — the SAP provided by the CI management adaptation entity (MAE) for management of the communication interface, named MI-SAP, and related service primitives by reference to ISO 24102-3 ^[46], and service primitive functions. 						
<p>Comments:</p> <p>This is one of the core standards for hybrid communications. Provides a common communications SAP for all kinds of access technologies, including cellular networks.</p> <p>The actual ASN.1 file</p> <ul style="list-style-type: none"> — ISO21218_edition3_ITSllsapVersion2.asn <p>is freely available for download via a hyperlink at https://standards.iso.org/iso/21218/ed-3/en.</p>						

Testing:
PICS included in Annex. TSS&TP and ATS not available.

3.7.3 EN 302 663 - ITS-G5

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 663 [78]	1.2.1	None	ETSI	Published	A-6	C-6
Description: Specifies a profile of IEEE 802.11 [112] OCB @ 5,9 GHz for Europe						
Comments: The functionality of this ETSI standard is fully covered by ISO 21215 [38], including the correct protocol discrimination (EPD), whilst EN 302 663 V1.2.1 still uses LPD which is deprecated by IEEE.						
Testing: Unknown						

3.7.4 TS 102 724 - Harmonized channels in the 5 GHz frequency band

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 724 [93]	1.1.1	None	ETSI	Published	A-6	C-6
Description: Specifies details of the channel usage in the ITS G5A and ITS G5B bands including multichannel operation support.						
Comments: This functionality is also supported by ISO 21215 [38]						
Testing: Unknown						

3.7.5 IEEE Std. 802.11 - Wireless LAN

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
IEEE Std. 802.11 [112]	2016	None	IEEE	Published	A-6	C-6
Description: Provides one medium access control (MAC) and several physical layer (PHY) specifications for wireless connectivity for fixed, portable, and moving stations (STAs) within a local area.						
Comments: Included in ISO 21215 [38] by reference.						
Testing: Unknown						

3.7.6 EN 301 893 – RLAN essential requirements of article 3.2 of Directive 2014/53/EU

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 301 893 [70]	2.1.1	None	ETSI	Published	A-6	C-7, C-8
<p>Description:</p> <p>Specifies technical characteristics and methods of measurements for 5 GHz wireless access systems (WAS) including RLAN equipment. Describes spectrum access requirements to facilitate spectrum sharing with other equipment. This radio equipment is capable of operating in all or parts of the frequency bands:</p> <ul style="list-style-type: none"> — Transmit 5 150 MHz to 5 350 MHz — Receive 5 150 MHz to 5 350 MHz — Transmit 5 470 MHz to 5 725 MHz — Receive 5 470 MHz to 5 725 MHz <p>Covers the essential requirements of article 3.2 of Directive 2014/53/EU.</p>						
<p>Comments:</p> <p>This standard can be used in combination with ISO 22418 ^[41] (service announcement), applying ISO 21215 ^[38] (OCB mode) with the service announcer being the entity performing the required DFS.</p>						
<p>Testing:</p> <p>Conformance testing is not applicable.</p>						

3.7.7 EN 302 571 – C-ITS essential requirements of article 3.2 of Directive 2014/53/EU

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 571 [71]	2.1.1	None	ETSI	Published	A-6	C-7, C-8
<p>Description:</p> <p>Specifies technical characteristics and methods of measurement for radio transmitters and receivers operating in the frequency range 5 855 MHz to 5 925 MHz. The spectrum usage conditions are set out in ECC Decision (08)01 for the frequency range 5 875 MHz to 5 925 MHz (with 5 905 MHz to 5 925 MHz considered as a future ITS extension) and in ECC Recommendation (08)01 for the frequency range 5 855 MHz to 5 875 MHz. The Commission Decision 2008/671/EC mandates a harmonised use of the frequency band 5 875 MHz to 5 905 MHz dedicated to safety-related applications of ITS throughout the member states of the European Union.</p> <p>5 GHz ITS frequency band segmentation:</p> <ul style="list-style-type: none"> — 5 855 MHz to 5 875 MHz ITS non-safety applications ECC Recommendation (08)01; — 5 875 MHz to 5 905 MHz ITS road safety Commission Decision 2008/671/EC, ECC Decision (08)01; — 5 905 MHz to 5 925 MHz Future ITS applications ECC Decision (08)01. <p>Covers the essential requirements of article 3.2 of Directive 2014/53/EU. Interference mitigation techniques in the present document are provided to protect road tolling applications using CEN DSRC or HDR DSRC."</p>						
<p>Comments:</p> <p>Cited in the Official Journal of the European Union</p>						
<p>Testing:</p> <p>Conformance testing is not applicable.</p>						

3.7.8 ISO 17515-1 – LTE access to Internet

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 17515-1 [17]	2015	None	ISO	Published	A-6	C-6
Description: Specifies general usage of LTE in an ITS-SU conformant with ISO 21217 [39] and ISO 21218 for access to Internet.						
Comments: Essential technical specifications for LTE Internet access are provided by 3GPP. This is a "placeholder" for any kind of cellular access to the Internet. For this type of communications, the concept of "neutrality of technologies" applies.						
Testing: not available						

3.8 Networking and transport technologies

NOTE Standards described in this sub-clause relate to the standardisation area "Network and transport layer technologies" introduced in 2.5.

3.8.1 ISO 29281-1 – Fast networking & transport protocol (FNTF)

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 29281-1 [56]	2	None	ISO	Under publication	A-7	C-5
Description: Specifies the "Fast Networking & Transport Protocol" (FNTF) for efficient localized communications distinguishing networking related features and transport related features. FNTF is extendible in the future without breaking binary backward compatibility. Specifies <ul style="list-style-type: none"> — message formats and related basic protocol procedures by reference to ISO TS 16460:2016 [8], and — further requirements for operation of FNTF in the context of an ITS station specified in ISO 21217 [39]. 						
Comments: Provides broadcast interoperability mode with IEEE 1609.3 [109] WSMP. The actual ASN.1 file <ul style="list-style-type: none"> — ISO29281-1_2018_ITSfntp.asn is freely available for download via a hyperlink at https://standards.iso.org/iso/29281/-1/ed-2/en .						
Testing: PICS contained in an Annex. TSS&TP in ETSI TS 102 985-2 V1.2.1 [157] - to be revised, and ATS in ETSI TS 102 985-3 V1.2.1 [158] - to be revised.						

3.8.2 ISO 21210 – IPv6 networking for ITS

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21210 ^[34]	1 plus Amd 1	None	ISO	Published	A-7	C-5
<p>Description:</p> <p>Specifies networking protocol functionalities related to IPv6 networking between two or more ITS stations communicating over the global Internet communication network.</p>						
<p>Comments:</p> <p>ISO 21210 will be complemented and split into a multi-part document with the new title " Intelligent transport systems - IPv6 networking " and with four parts:</p> <p>Part 1: Common terms, definitions and requirements</p> <p>Part 2: Addressing and forwarding</p> <p>Part 3: Mobility management</p> <p>Part 4: ITS station management adaptation entity</p> <p>The actual ASN.1 file</p> <p>— ISO 21210_2012A1_ITSpv6.asn</p> <p>is freely available for download via a hyperlink at https://standards.iso.org/iso/21210/.</p>						
<p>Testing:</p> <p>Not available</p>						

3.8.3 EN 302 636-4-1 – GeoNetworking – media-independent functionality

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 636-4-1 ^[73]	1.3.1	None	ETSI	Published	A-7	C-5
<p>Description:</p> <p>Specifies the media-independent functionality of the GeoNetworking protocol.</p>						
<p>Comments:</p> <p>It is agreed that the multi-hop forwarding, for which GeoNetworking was designed, is not applicable in the 10 MHz wide channels at 5,9 GHz. Single hop localized communications can be achieved more efficiently by applying the ISO 29281-1 ^[56] FNTF messaging protocol, which has the broadcast interoperability mode with IEEE 1609.3 WSMP.</p> <p>However GeoNetworking single-hop mode is already supported by all vendors of ITS-SUs. GeoNetworking thus is the recommended protocol for early deployment. Thus coexistence with ISO 29281-1 and a migration towards ISO 29281-1 are recommended.</p> <p>It is to be noted that a TS version of this standard co-exists; it is not obvious whether the EN or the TS version is closer to the implementation reality.</p>						
<p>Testing:</p> <p>Test suite available in the ETSI series TS 102 871-1 ^[148], TS 102 871-2 ^[149], TS 102 871-3 ^[150].</p>						

3.8.4 TS 302 636-4-2 – GeoNetworking – media-dependent functionality for ITS-G5

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 102 636-4-2 ^[90]	1.1.3	None	ETSI	Published	A-7	C-5
Description: Specifies the media-dependent functionalities for GeoNetworking over ITS-G5 as a network protocol for ad hoc routing in vehicular environments						
Comments: See comment on EN 302 636-4-1 in 3.8.3.						
Testing: Test suite available in the ETSI series TS 102 871-1 ^[148] , TS 102 871-2 ^[149] , TS 102 871-3 ^[150] .						

3.8.5 EN 302 636-5-1 – Basic transport protocol for GeoNetworking

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 636-5-1 ^[74]	2.2.1	None	ETSI	Published	A-7	C-5
Description: Specifies the Basic Transport Protocol (BTP) for the transport of packets among ITS stations. It resides on top of the GeoNetworking protocol specified in ETSI EN 302 636-4-1 and ETSI TS 102 636-4-2 and below the ITS-S facilities layer. It provides an end-to-end, connection-less and unreliable transport service.						
Comments: See comment on ETSI EN 302 636-4-1 in 3.8.3. It is to be noted that a TS version of this standard co-exists; it is not obvious whether the EN or the TS version is closer to the implementation reality. This standard is only needed in combination with EN 302 636-4-x.						
Testing: Test suite available in the ETSI series TS 102 870-1 ^[145] , TS 102 870-2 ^[146] , TS 102 870-3 ^[147] .						

3.8.6 EN 302 636-6-1 – IPv6 over GeoNetworking

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 636-6-1 ^[75]	1.2.1	None	ETSI	Published	A-7	C-5
Description: Specifies the transmission of IPv6 packets over the ETSI GeoNetworking protocol as defined in ETSI EN 302 636-4-1 via a protocol adaptation sub-layer referred to as the GN6ASL (GeoNetworking to IPv6 Adaptation Sub-Layer). The scope of the present document is limited to the GN6ASL.						
Comments: See comment on ETSI EN 302 636-4-1. It is to be noted that a TS version of this standard co-exists; it is not obvious whether the EN or the TS version is closer to the implementation reality. This standard is only needed in combination with EN 302 636-4-x.						
Testing: Test suite available in the ETSI series TS 102 859-1 ^[136] , TS 102 859-2 ^[137] , TS 102 859-3 ^[138] .						

3.8.7 EN 302 931 - Geometrical shapes

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 931 [81]	1.1.1		ETSI	Published	A-7	C-4
Description: Specifies geometrical shapes to be used as geographical area definitions						
Comments: This is used in GeoNetworking.						
Testing: Conformance testing is not applicable.						

3.8.8 TS 103 248 - Port numbers for BTP

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 103 248 [105]	1.1.1	None	ETSI	Published	A-7	C-9
Description: Defines port number values for the Basic Transport Protocol as specified in ETSI EN 302 636-5-1.						
Comments: As this port number space is dedicated to the GeoNetworking protocol, it is not applicable for other messaging protocols, e.g. FNTTP specified in ISO 29281-1 [56] or WSMP specified in IEEE 1609.3						
Testing: Conformance testing is not applicable.						

3.8.9 ISO 16460 - Harmonized messaging format

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 16460 [8]	1	None	ISO	Published	A-7	C-4, C-5
Description: Specifies <ul style="list-style-type: none"> — the Localized Message (LM) format: an NPDU of a networking and transport layer protocol that does not support routing of a packet through a network; — the related basic requirements for procedures. Specifications are partly done by normative references to IEEE 1609.3 [109]. Further protocol details are specified in ISO 29281-1 [56].						
Comments: Harmonized message formats used in ISO 29281-1 and IEEE Std. 1609.3. Specifies also harmonized messages for service announcement; see 3.9.3. The actual ASN.1 files <ul style="list-style-type: none"> — TS16460_2016_ITSee.asn; and 						

— TS16460_2016_ITSlm.asn; and

are freely available for download via a hyperlink at <https://standards.iso.org/iso/ts/16460/TS%2016460%20ASN.1%20repository>.

Currently under revision.

Testing:

Will be tested in the context of the target protocol, e.g. ISO 29281-1.

3.9 Station facilities

NOTE Standards described in this sub-clause relate to the standardisation area A-8 "Facility layer technologies" introduced in 2.5.

3.9.1 ISO 19091 – Intersection management SPaT / MAP / SRM / SSM

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 19091 ^[21]	1	None	ISO	Published	A-8	C-4
Description: Defines message, data structures, and data elements in support of exchanges between the roadside equipment (traffic lights) and vehicles. Creates profiles of SAE J2735.						
Comments: The actual ASN.1 file — ISO-TS-19091-addgrp-C-2018.asn is freely available for download via a hyperlink at https://standards.iso.org/iso/ts/19091/ed-2/en .						
Testing: PICS to be developed in CEN ISO TS 20598 ^[132] . TSS&TP and ATS not available. There is a test suite dedicated to the SAE version of TS 19091 provided in the ETSI series TS 103 191-x ^{[162], [163], [164]} .						

3.9.2 ISO 19321 – In-vehicle information

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 19321 ^[24]	1	None	ISO	Published	A-8	C-4
Description: Specifies in-vehicle information (IVI) data structures that are required by different ITS services (for example, refer to ISO TS 17425 and ISO TS 17426) for exchanging information between ITS Stations.						
Comments: The actual ASN.1 file — ISO19321(2019)IVIV2.asn is freely available for download via a hyperlink at https://standards.iso.org/iso/ts/19321/ed-2/en .						
Testing: PICS to be developed in CEN ISO TS 20597 ^[131] . TSS&TP and ATS not available.						

3.9.3 ISO 16460 – Harmonized messages for service announcement

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 16460 ^[8]	1	None	ISO	Published	A-8	C-4, C-5
<p>Description:</p> <p>Specifies</p> <ul style="list-style-type: none"> — the Service Advertisement Message (SAM): an APDU to be transported in for example, an LM specified in ISO 29281-1 ^[56]; — the Service Response Message (SRM): an APDU acknowledging a SAM that offered a service based on an ITS application class to be transported in for example, an LM; — the related basic requirements for procedures. Specifications are partly done by normative references to IEEE 1609.3 ^[109]. <p>Further protocol details are specified in ISO 22418 ^[41].</p>						
<p>Comments:</p> <p>Harmonized message formats used in ISO 22418 ^[41] and IEEE Std. 1609.3 ^[109]. Specifies also the harmonized messaging format; see 3.8.9. The actual ASN.1 files</p> <ul style="list-style-type: none"> — TS16460_2016_ITSee.asn; and — TS16460_2016_ITSSa.asn <p>are freely available for download via a hyperlink at https://standards.iso.org/iso/ts/16460/TS%2016460%20ASN.1%20repository.</p> <p>Currently under revision.</p>						
<p>Testing:</p> <p>Will be tested in the context of the target protocol, e.g. ISO 22418.</p>						

3.9.4 ISO 17429 – Generic facilities CPH, CSH, FSH

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 17429 ^[15]	1	None	ISO	Published	A-8	C-4, C-5
<p>Description:</p> <p>Specifies generic mechanisms enabling the exchange of information between ITS stations for applications related to Intelligent Transport Systems. It complies with the ITS station reference architecture (ISO 21217 ^[39]) and defines the following ITS station facilities layer functionalities:</p> <ul style="list-style-type: none"> — Communication Profile Handler (CPH); — Facilities Services Handler (FSH); — Content Subscription Handler (CSH). 						
<p>Comments:</p> <p>Will be split into a multi-part document with the new title " Cooperative intelligent transport systems (C-ITS) — ITS station facility services" and with three parts:</p> <p>Part 1: Communication profile handler Part 2: Facility services handler Part 3: Content subscription handler</p>						

Testing:
PICS to be developed in CEN ISO TS 20594 ^[130]. TSS&TP and ATS not available.

3.9.5 ISO 18750 - Local dynamic map

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 18750 ^[19]	2	None	ISO	Published	A-8	C-4, C-5
<p>Description:</p> <p>Describes the functionality of a "Local Dynamic Map" (LDM) in the context of the "Bounded Secured Managed Domain" (BSMD);</p> <p>Specifies</p> <ul style="list-style-type: none"> — general characteristics of LDM Data Objects (LDM-DOs); — service access point functions; — procedures in an LDM; — mechanisms supporting several LDMs in a single ITS station unit. 						
<p>Comments:</p> <p>This testable standard fully covers the functionality of ETSI EN 302 895 ^[80], which is not testable.</p> <p>The actual ASN.1 file</p> <ul style="list-style-type: none"> — 18750.asn <p>is freely available for download via a hyperlink at https://standards.iso.org/iso/18750/ed-1/en.</p>						
<p>Testing:</p> <p>PICS contained in an Annex. TSS&TP and ATS to be developed.</p>						

3.9.6 ISO 21176 – Position, velocity, time in an ITS-SU

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21176 ^[27]	1	None	ISO	Published	A-8	C-4
<p>Description:</p> <p>Specifies a generic PVT (absolute Position, Velocity and Time) service within the ITS station facilities layer (ISO 21217 ^[39]) and its interface to e.g.</p> <ul style="list-style-type: none"> — the LDM service specified in ISO 18750 ^[19], — ITS-S application processes specified in ISO 21217 ^[39], and — the generic facilities service handler (FSH) functionality of the ITS station facilities layer specified in ISO 17429 ^[15]. 						
<p>Comments:</p> <p>Provides flexibility for various formats of PVT data. Explicitly refers to the format specifications in ETSI TS 102 894-2 ^[97].</p> <p>Developed by CEN/TC 278 PT 1605 - currently in parallel CEN Formal Vote / ISO DTS ballot.</p>						
<p>Testing:</p> <p>Not available</p>						

3.9.7 ISO 22418 – Fast service announcement protocol

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 22418 ^[41]	2	None	ISO	Published	A-8	C-5
<p>Description:</p> <p>Specifies the "Fast Service Advertisement Protocol" (FSAP) in support of locally advertised ITS services uniquely identified by an ITS application identifier (ITS-AID).</p> <p>Specifies message formats and related basic protocol procedures by reference to ISO 16460 ^[8], and further related protocol requirements for operation of FSAP in the context of an ITS station specified in ISO 21217 ^[39].</p>						
<p>Comments:</p> <p>Provides interoperability mode with IEEE Std 1609.3 ^[109] WSA.</p> <p>The actual ASN.1 file</p> <p>— 22418.asn</p> <p>will become freely available for download via a hyperlink at https://standards.iso.org/iso/22418/ed-2/en.</p>						
<p>Testing:</p> <p>PICS contained in an Annex. TSS&TP and ATS to be developed.</p>						

3.9.8 EN 302 637-2 - Cooperative awareness message

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 637-2 ^[76]	1.4.1	None	ETSI	Published	A-8	C-2, C-4, C-5
<p>Description:</p> <p>Provides the specifications of the Cooperative Awareness basic service (CA basic service), which is in support of the BSA road safety application.</p> <p>Specifies the syntax and semantics of the Cooperative Awareness Message (CAM) and the CAM protocol handling.</p>						
<p>Comments:</p> <p>There are discussions at ETSI to revise this standard in order to make CAM better fit to cellular network communications. That would break backward compatibility.</p>						
<p>Testing:</p> <p>Test suite available in ETSI series of TS 102 868-1 ^[139], TS 102 868-2 ^[140], TS 102 868-3 ^[141].</p>						

3.9.9 EN 302 637-3 – Decentralized environmental notification message

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 302 637-3 ^[77]	1.3.1	None	ETSI	Published	A-8	C-2, C-4, C-5
<p>Description:</p> <p>Provides specification of the DEN basic service, which is in support of the RHW application.</p> <p>Specifies the syntax and semantics of the "Decentralized Environmental Notification Message" (DENM) and the DENM protocol handling.</p>						
<p>Comments:</p> <p>There are discussions at ETSI to revise this standard in order to make DENM better fit to cellular network communications. That would break backward compatibility.</p>						

Testing:

Test suite available in ETSI series of TS 102 869-1 [142], TS 102 869-2 [143], TS 102 869-3 [144].

3.9.10 ISO 21184 – Global transport data management framework

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ISO 21184 [29]	1	None	ISO	Published	A-8	C-5
<p>Description:</p> <p>Specifies the "Global Transport Data Management" (GTDM) framework to support data exchange between applications and correct interpretation of data.</p> <p>Defines standardized data classes in a Global Transport Data Format (GTDF), and means to manage them.</p> <p>Data exchange between ITS stations is based on messages and content composed of pre-configured information including conditional handling. Each message uses a global unique identifier and the associated data element. The format of the data element is specified by the global unique identifier pointing to configuration information including instructions for correct interpretation of the data element.</p> <p>Application and role-based access control to GTDF resources are specified in conformance with IEEE 1609.2 certificates.</p> <p>Specifies GTDM as an ITS-S capability conformant with ISO 24102-6, which is an optional feature.</p> <p>The GT access control (GTAC) data model specifies permission to protocol services and data parameter access based on assigned roles.</p> <p>The GT function monitor (GTFM) data model specifies function bricks and data concatenated to a monitoring logic by the GTFM configuration data.</p> <p>The Open Telematics Platform/Open Vehicular Secure Platform as introduced by the European commission (see OVERSEE[10]) can be implemented as an ITS Station Unit.</p>						
<p>Comments:</p> <p>Developed by CEN/TC 278 PT 1605 - currently in preparation at ISO/CS for parallel CEN Formal Vote / ISO DTS ballot.</p>						
<p>Testing:</p> <p>Not available</p>						

3.9.11 ETSI TS 102 894-1 – Facilities layer structure and functional requirements

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ETSI TS 102 894-1 [96]	1.1.1		ETSI	Published	A-8	C-2
<p>Description:</p> <p>Defines the functional architecture for the facilities layer of the ITS station and provides functional requirements and specifications for main identified facilities in support of the BSA specified in ETSI TR 102 638 [82].</p>						
<p>Comments:</p>						
<p>Testing:</p> <p>Conformance testing is not applicable.</p>						

3.9.12 ETSI TS 103 301 – Facilities layer requirements for infrastructure services

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
ETSI TS 103 301 ^[106]	1.2.1		ETSI	Published	A-8	C-2
Description: Provides specifications of infrastructure related ITS services to support communication between infrastructure ITS equipment and traffic participants using ITS equipment (e.g. vehicles, pedestrians). It defines services in the Facilities layer for communication between the infrastructure and traffic participants. The specifications cover the protocol handling for infrastructure-related messages as well as requirements to lower layer protocols and to the security entity.						
Comments:						
Testing:						

3.9.13 TS 17425 - In-vehicle presentation of external road and traffic related data

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 17425 ^[12]	1	None	ISO	Published	A-8	C-4, C-5
Description: Specifies the In-Vehicle Signage service and application that delivers In-Vehicle Signage information to ITS stations (vehicle ITS stations or personal ITS stations devices) concerning road and traffic conditions, qualified by road authorities/operators, in a consistent way with road authority's/operator's requirements, in the manner that is coherent with the information that would be displayed on a road sign or variable message sign (VMS).						
Comments: Overlaps with CEN ISO TS 19091 ^[21] .						
Testing: Unknown						

3.9.14 TS 17426 - Contextual speeds

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 17426 ^[13]	1	None	ISO	Published	A-8	C-2, C-4, C-5
Description: Specifies the Contextual Speed Information Service, namely the general requirements regarding the provision of the Contextual Speed Information Service, the data flow supporting the service, and the presentation of the service result.						
Comments:						
Testing: PICS specification ISO 21189 ^[133] .						

3.9.15 EN 16157-2 – DATEX II location referencing

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 16157-2 [61]	1	Predecessor TS	CEN	Published	A-8	C-4
Description: Specifies the informational structures, relationships, roles, attributes and associated data types, for the implementation of the location referencing systems used in association with the different publications defined in the Datex II framework.						
Comments: This is the first edition defining DATEX II Version 3.0.						
Testing: Conformance testing is not applicable.						

3.9.16 EN 16157-3 – DATEX II situation publication

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
EN 16157-3 [62]	1	Predecessor TS	CEN	Published	A-8	C-4
Description: Specifies the informational structures, relationships, roles, attributes and associated data types required for publishing situation traffic and travel information within the DATEX II framework.						
Comments: This is the first edition defining DATEX II Version 3.0.						
Testing: Conformance testing is not applicable.						

3.10 Protocol stack

NOTE Standards described in this sub-clause relate to the standardisation area A-9 "Protocol stack" introduced in 2.5.

3.10.1 CEN 17496 – Communication profiles

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
CEN/TS 17496 [68]	1	None	ISO	Published	A-9	C-5
Description: Contains specifications of communication profiles based on standardized communication protocols to interconnect ITS station units. Globally unique identifiers of communication profiles are used e.g. in ISO 22418 [41].						
Comments: Developed by CEN/TC 278 PT 1605 - currently in CEN Formal Vote. Vienna Agreement cancelled by CEN; almost identical TS at ISO published with slightly different title: ISO/TS 21185:2019 <i>Intelligent transport systems — Communication profiles for secure connections between trusted devices</i> [30].						

Testing:
Not available

3.10.2 TS 17182 - eCall in an ITS-SU

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
TS 17182 [67]	1	None	CEN	Published	A-9	C-5
Description: Defines the high-level application protocols, procedures and processes required to provide the eCall service via an ISO 21217 [39] conformant "ITS station unit".						
Comments: Uses ISO 22418 [41].						
Testing: Not available						

3.10.3 SAE J2945/1 - On-board system requirements for V2V safety communications

Reference:	Latest edition:	Other editions:	SDO:	Status:	Standard area	Standard category
SAE J2945/1 [119]	2016	None	SAE	Published	A-9	C-2, C-4, C-5, C-6,
Description: Specifies the system requirements for an on-board vehicle-to-vehicle (V2V) safety communications system for light vehicles, including standards profiles, functional requirements, and performance requirements. The system is capable of transmitting and receiving the Society of Automotive Engineers (SAE) J2735-defined Basic Safety Message (BSM) [118] over a Dedicated Short Range Communications (DSRC) wireless communications link as defined in the Institute of Electrical and Electronics Engineers (IEEE) 1609 suite [107, 108, 109, 110] and IEEE 802.11 [112] standards.						
Comments: This is not just applicable for C-ITS in the USA, but also referenced in the European Union.						
Testing: Unknown						

4 Example release for C-ITS

4.1 General

TR 21186-1 [31] introduces a concept of releases for C-ITS and presents an example of a "C-ITS Release 2". This clause presents details of the standards listed in this C-ITS Release 2, including indication of "Purposes" defined in TR 21186-1.

4.2 A-1: System level issues

Standard Reference	Purposes	Profile / Parameterisation	Comments
EN 17419:2018, "Globally unique identification", see 3.2.1	P1, P6	n.a.	none

Standard Reference	Purposes	Profile / Parameterisation	Comments
ETSI TS 102 940 V1.3.1, "Security architecture" see 3.2.2.	P6		This security architecture is for localised communications with broadcast information dissemination.

4.3 A-2: Station architecture

Standard Reference	Purposes	Profile / Parameterisation	Comments
ISO 21217:2014, "ITS station and communication architecture", see 3.3.1.	P2, P6	n.a.	ISO 21217:2014 is a super-set of ETSI EN 302 665
ISO 20026:2017, "C-ITS test architecture", see 3.3.2.	P7	n.a.	Only applicable for implementations conformant with ISO 24102-4, see 3.5.5. This standard complements ETSI EG 202 798
ETSI EG 202 798 V1.1.1, "Framework for conformance and interoperability testing", see 3.3.3	P7	n.a.	??

4.4 A-3: ITS applications, messages, data

Standard Reference	Purposes	Profile / Parameterisation	Comments
ETSI TS 102 637-1 V1.1.1, "Functional requirements for BSA", see 3.4.2	P2	Support for those ITS services that are implemented in an ITS-SU	
TS 101 539-1 - Road Hazard Signalling (RHS), see 3.4.6. TS 101 539-2 - Intersection collision risk warning, see 3.4.7. TS 101 539-3 - Longitudinal collision risk warning, see 3.4.8.	P2		
ISO 14816:2005, "Numbering and data structure for AVI", see 3.4.9	P1, P6		

Standard Reference	Purposes	Profile / Parameterisation	Comments
ETSI TS 102 894-2 V1.3.1, "Common data dictionary", see 3.4.10.	P1, P6		
ISO 22837:2009 "Reference architecture for probe vehicle systems and data ", see 3.4.3.	P1		
ISO 25114:2010, "Framework for probe data reporting management", see 3.4.4.	P1		
ISO 29284:2012, "Event based probe vehicle data", see 3.4.5.	P1. P4		

4.5 A-4: Station management

Standard Reference	Purposes	Profile / Parameterisation	Comments
EN 17423:2018, "Application requirements and objectives", see 3.5.1.	P4, P5	n.a.	Essential for hybrid communications. Presentation of communication needs per flow of an ITS-S application process. Complements ISO 24102-6, see 3.5.2.
ISO 24102-6:2018, "Path and flow management", see 3.5.2.	P4, P5	n.a.	Essential for hybrid communications. Real-time identification of communication path per flow of an ITS-S application process. Complements EN 1723, see 3.5.1.
ISO 24102-1:2018, "Local station management", see 3.5.3.	P2, P3, P6	Dependent on intended region of usage of an ITS-SU, and dependent on implementation options, some management features are not applicable as identified in the standard.	

Standard Reference	Purposes	Profile / Parameterisation	Comments
ISO 24102-2:2018, " <i>Remote station management</i> ", see 3.5.4.	P2, P6	n.a.	This enabling standard explicitly allows for different implementations as it uses the system concept of an ITS-SCU configuration management centre specified in EN 17419, see 3.2.1. Interoperability is only applicable between an ITS-SU and its related ITS-SCU configuration management centres.
ISO 24102-4:2018, " <i>Station-internal management communications</i> ", see 3.5.5.	P1, P2, P5, P6	Only applicable for ITS-SUs consisting of several ITS-SCUs.	This standard provides also the functionality to access an implementation under test as specified in ISO/TS 20026, see 3.3.2.
ETSI TS 103 157 V1.1.1, " <i>Cross layer DCC management</i> ", see 3.5.12.	P3	n.a.	None
ETSI TS 102 687 V1.2.1, " <i>Access layer decentralised congestion control mechanisms</i> ", see 3.5.10.	P3	n.a.	None
ETSI TS 102 792 V1.2.1, " <i>DSRC mitigation techniques</i> ", see 3.5.11	P3	only applicable in regions where the semi-passive transponder technology CEN DSRC at 5,8 GHz is used.	Interference mitigation is also specified in ISO 24102-1, see 3.5.3.

4.6 A-5: Security

Standard Reference	Purposes	Profile / Parameterisation	Comments
ETSI TS 102 731 V1.1.1 " <i>Security services and architecture</i> ", see 3.6.1.	P1, P2, P6	n.a.	For securing broadcast information dissemination
ETSI TS 102 941 V1.3.1, " <i>Trust and privacy management</i> ", see 3.6.2.	P1, P2, P6	n.a.	None
ETSI TS 102 942 V1.1.1, " <i>Access control</i> ", see 3.6.3.	P2, P4	n.a.	None

Standard Reference	Purposes	Profile / Parameterisation	Comments
ETSI TS 102 943 V1.1.1, "Confidentiality services", see 3.6.4.	P2, P4	n.a.	None
ETSI TS 103 097 V1.3.1, "Security header and certificate formats", see 3.6.5.	P1	n.a.	For securing broadcast information dissemination
CEN/TS 21177:2019, "Secure sessions with ITS station units", see 3.6.7.	P1, P2, P6	n.a.	For securing sessions

4.7 A-6: Access layer technologies

Standard Reference	Purposes	Profile / Parameterisation	Comments
ISO 21215:2018, "ITS-M5", see 3.7.1.	P1		This covers the requirements set up in ETSI EN 302 663 [78], see 3.7.3.
ISO 21218:2018, "Access technology support", see 3.7.2.	P2, P5	n.a.	In support of hybrid communications
ETSI TS 102 724 V1.1.1, "Harmonized channels in the 5 GHz frequency band", see 3.7.4.	P1	n.a.	European approach to use the 5GHz ITS bands
ISO 17515-1:2015, "LTE for Internet access", see 0.	P2	n.a.	Any other cellular network technology for accessing the Internet with similar or better performance is also allowed.

4.8 A-7: Network and transport layer technologies

Standard Reference	Purposes	Profile / Parameterisation	Comments
ISO 29281-1:2018, "FNTP"; see 3.8.1.	P1, P2	Carrying messages that are not designed for GeoNetworking, e.g. FSAP.	Essential for hybrid communications – <u>localised</u> communications. Interoperability mode with WSMP for broadcast dissemination of information.

Standard Reference	Purposes	Profile / Parameterisation	Comments
ISO 21210:2012 with Amd 1:2017, " <i>IPv6 networking</i> "; see 3.8.2.	P1, P2	n.a.	Essential for hybrid communications – <u>networked</u> communications
ETSI EN 302 636-4-1 V1.4.1, " <i>GeoNetworking – media-independent functionality</i> "; see 3.8.3.	P1, P2	Only single-hop mode at the 10 MHz wide bands at 5,9 GHz. Carrying day-1 messages related to BSA such as CAM, DENM.	Essential for hybrid communications – <u>localised</u> communications related to BSA. Not recommended for single-hop communications due to the large unused overhead in the GN-header
ETSI TS 102 636-4-2 V1.3.1, " <i>GeoNetworking – media-dependent functionality of ITS-G5</i> "; see 3.8.4.	P1, P2	Only single-hop mode at the 10 MHz wide bands at 5,9 GHz.	Essential for hybrid communications – localised communications carrying day-1 messages such as CAM, DENM, Not recommended for single-hop communications due to the large unused overhead in the GN-header
ETSI EN 302 636-5-1 V2.2.1, " <i>Basic transport protocol for GeoNetworking</i> "; see 3.8.5	P1	Only in combination with GeoNetworking.	Valid well-known port numbers are presented in ETSI TS 103 248; see 3.8.8.

4.9 A-8: Facility layer technologies

Standard Reference	Purposes	Profile / Parameterisation	Comments
CEN/TS 17425: 2016, " <i>In-vehicle presentation of external road and traffic related data</i> ", see 3.9.13.	P1, P2, P6	n.a.	Functional overlap with CEN/TS 19321, see 3.9.2.
CEN/TS 17426:2016, " <i>Contextual speeds</i> ", see 3.9.14.	P1, P2, P6	n.a.	None
CEN/TS 17429:2017, " <i>Generic facilities CPH, CSH, FSH</i> ", see 3.9.4	P1, P2	n.a.	None

Standard Reference	Purposes	Profile / Parameterisation	Comments
EN 18750:2018, "LDM", see 3.9.5.	P2, P4	n.a.	None
CEN/TS 21176:2020, "PVT service", see 3.9.6.	P2, P4	n.a.	None
EN 22418:2019 "FSAP", see 3.9.7.	P1, P2, P4	n.a.	None
CEN/TS 21184:2020, "Global transport data management (GTDM) framework", see 3.9.10.	P1, P2, P4	n.a.	None
CEN/TS 19321:2015, "IVI", see 3.9.2.	P1	n.a.	None
CEN/TS 19091:2017, "Intersection management SPaT / MAP", see 3.9.1.	P1	n.a.	None
ETSI EN 302 637-2 V1.4.1, "CAM", see 3.9.8.	P1, P2	n.a.	None
ETSI EN 302 637-3 V1.3.1, "DENM", see 3.9.9.	P1, P2	n.a.	None

4.10 A-9: Protocol stack

Standard Reference	Purposes	Profile / Parameterisation	Comments
CEN/TS 17496:2020, "Communication profiles", see 3.10.1.	P1, P4, P8	n.a.	Real-time usage of communication profile identifiers is specified for FSAP (ISO 29281-1)
SAE J2945/1:2016, "On-board system requirements for V2X safety communications", see 3.10.3.	P1, P2, P4a	unknown	None

5 Acronyms, symbols, terms, and definitions in C-ITS

5.1 Terms and definitions

Below an informative non-comprehensive list of terms and definitions that are used in C-ITS together with information on where the original definition (undated reference) is made. Focus is on terms and definitions related to architectural specifications and protocols, rather than application specifications.

NOTE There is an approach at ISO/TC 204 to improve terminology in general, including fixes of unfortunate and duplicate conflicting definitions. An approach towards a common vocabulary in ITS is presented in ISO/TS 14812 [2].

NOTE Terms and definitions can also be found in ETSI's "Terms and Definitions Database Interactive" (TEDDI) at <https://webapp.etsi.org/Teddi/>, and on the ISO Online Browsing Portal at <https://www.iso.org/obp/ui/#home>.

Table 1 — Terms and definitions used in C-ITS

Term	Definition	Reference
(V)CI identifier	unique identifier of a (virtual) CI	ISO 21218
Access Control PDU	PDU generated by the Security Subsystem for purposes of establishing the authorisation status of a peer ITS-S application process	ISO/TS 21177
Access Control Policy	data source governing what access to resources is permissible by peer Applications	ISO/TS 21177
access technology	technology employed in a communication interface to access a specific medium	ISO 21217
anchor node	logical node contained in an ITS-S path which, when instantiated, has a locator known by the source node	ISO 24102-6
application data unit	data unit exchanged between ITS-S application processes	ISO 21217
authorization	prescription that a particular behaviour shall not be prevented NOTE Unlike a permission, an authorization is an empowerment. NOTE From [ITU-T X.911 (10/2001)]	ISO 17419
care-of address	'IPv6 address' associated with a mobile node while attached on a 'foreign IPv6 link'	ISO 21210
CI priority manager	logical entity in a CI that is managing priority queues	ISO 21218
C-ITS release	a release in support of C-ITS services, i.e. publication of information - identified by a name, a date, a version number - on a consistent set of (profiles of) dated specifications and standards including necessary parameterisation by an authority for a specific usage in support of deployment of equipment and services for C-ITS	ISO/TR 21186-1
communication adaptation layer	set of protocols and functions to adapt access technologies to the ITS-S networking and transport layer	ISO 21217
communication interface	instantiation of a specific access technology and ITS-S access layer protocol --> definition should be changed to "instantiation of a specific ITS-S access technology and ITS-S access layer protocol" --> definition of "ITS-S access layer protocol" to be added in ISO 21217	ISO 21217
communication path	directed sequence of nodes connected by links, starting at a source node and ending at one or more destination nodes	ISO 21217

Term	Definition	Reference
Cryptomaterial	cryptographic keys and associated material, either a secret key for a symmetric algorithm, or a private key for an asymmetric algorithm, and the associated public key or certificate	ISO/TS 21177
Cryptomaterial Handle	reference to Cryptomaterial allowing that Cryptomaterial to be used in cryptographic operations, i.e. sign, verify, encrypt, decrypt	ISO/TS 21177
data integrity	property that data has not altered or destroyed in an unauthorized manner [SOURCE: ISO 24534-5]	ISO 18750
destination node	communication end point of an ITS-S path Note 1 to entry: In multicast operation, there can be many distinct destination nodes.	ISO 24102-6
egress IPv6 interface	interface of an MR attached to the 'home IPv6 link' if the 'IPv6 mobile router' is at home, or attached to a 'foreign IPv6 link' if the 'IPv6 mobile router' is in a foreign network [SOURCE: RFC 3753]	ISO 21210
EtherType	2-octet unsigned Integer number with allowed values $\geq 1\ 536$ (0x06.00), assigned by the IEEE Registration Authority and used in data link layer frames, which identifies the protocol in the ITS networking & transport layer able to parse and process the ITS-NTPDU contained in the data link layer frame	ISO 21215
external IPv6 interface	'IPv6 interface' of an 'ITS-S IPv6 router' in an ITS station used to connect to another ITS station or the Internet	ISO 21210
FA interface	interface between the ITS-S facilities layer and the ITS-S applications entity	ISO 21217
foreign IPv6 link	'IPv6 link' other than the mobile node's 'home IPv6 link'	ISO 21210
global IPv6 address	'IPv6 address' corresponding to 'Global Unicast Addresses' as specified in RFC 4291	ISO 21210
home address	'IPv6 address' assigned to a mobile node, used as the permanent address of the mobile node NOTE The term 'home address' is defined in RFC 3753. This 'IPv6 address' is within the mobile node's 'home IPv6 link'. Standard IP routing mechanisms deliver packets destined for a mobile node's 'home address' to its 'home IPv6 link'.	ISO 21210
home IPv6 link	'IPv6 link' on which a mobile node's 'home IPv6 prefix' is defined	ISO 21210
home IPv6 prefix	'IPv6 prefix' corresponding to a mobile node's 'home address'	ISO 21210
home ITS-S IPv6 LAN	'ITS-S IPv6 LAN' providing Internet reachability functions to 'mobile ITS-S IPv6 LANs'	ISO 21210

Term	Definition	Reference
hybrid communications	composition of multiple access technologies and communication protocols combined to provide complementary or redundant communication channels	ISO 21217
hybrid communication support	feature of an ITS station used to combine multiple access technologies and protocols	ISO 21217
hybrid ITS service	ITS service that relies on hybrid communications	ISO 21217
IN interface	interface between the ITS-S access layer and the ITS-S networking and transport layer	ISO 21217
ingress IPv6 interface	interface of an MR attached to an 'IPv6 link' inside the 'IPv6 mobile network' [SOURCE: RFC 3753]	ISO 21210
International Atomic Time	time since 00:00:00 UTC, 1 January, 2004, identical with UTC except that no leap seconds need to be added	ISO 18750
in-vehicle network	generic term for a network in a vehicle which is not an ITS station-internal network	ISO 21217
IPv6 Access Network	'IP network that includes one or more Access Network Routers' [SOURCE: RFC 3753]	ISO 21210
IPv6 access router	'Access Network Router residing on the edge of an Access Network and connected to one or more Access Points' NOTE This definition of "access router" is taken from RFC 3753. An 'IPv6 Access Router' offers IP connectivity to Mobile Nodes, acting as a default IPv6 router to the mobile nodes it is currently serving. The 'IPv6 Access Router' may include intelligence beyond a simple forwarding service offered by ordinary IPv6 routers.	ISO 21210
IPv6 address	IPv6-layer identifier for an interface or a set of interfaces NOTE IPv6 addresses are assigned to network interfaces, not to nodes. [SOURCE: RFC 2460]	ISO 21210
IPv6 home agent	'IPv6 router' on a mobile node's 'home IPv6 link' with which the mobile node (MN) has registered its current Care-of Address. NOTE This definition of 'home agent' is taken from RFC 3753. While the mobile node is away from home, the home agent intercepts packets on the 'home IPv6 link' destined to the mobile node's Home Address (HoA), encapsulates them, and tunnels them to the mobile node's registered Care-of Address (CoA).	ISO 21210
IPv6 host	any 'IPv6 node' that is not a 'IPv6 router'	ISO 21210

Term	Definition	Reference
IPv6 interface	<p>node's attachment to an 'IPv6 link'</p> <p>NOTE Each interface is configured with at least one link-local address and possibly other types of IPv6 addresses (global unicast, multicast).</p> <p>[SOURCE: RFC 2460]</p>	ISO 21210
IPv6 link	<p>communication facility or medium over which nodes can communicate at the link layer, i.e. the layer immediately below IPv6</p> <p>NOTE A link is the layer immediately below IP. In a layered network stack model, the Link Layer (Layer 2) is normally below the Network (IP) Layer (Layer 3), and above the Physical Layer. Examples are Ethernet (simple or bridged; PPP links; X.25, Frame Relay, or ATM networks; and IP (or higher) layer 'tunnels', such as tunnels over IPv4 or IPv6 itself.</p> <p>[SOURCE: RFC 2460]</p>	ISO 21210
IPv6 mobile network	<p>entire network, moving as a unit, which dynamically changes its point of attachment to the Internet and thus its reachability in the topology</p> <p>NOTE This definition of 'mobile network' is taken from RFC 3753.</p>	ISO 21210
IPv6 mobile router	<p>'IPv6 router' capable of changing its point of attachment to the network, moving from one 'IPv6 link' to another</p> <p>'IPv6 link'</p> <p>NOTE The mobile IPv6 router is capable of forwarding packets between two or more interfaces, and possibly running a dynamic routing protocol modifying the state by which it does packet forwarding. A mobile IPv6 router acting as a gateway between an entire IPv6 mobile network and the rest of the Internet has one or more egress interface(s) and one or more ingress interface(s). Packets forwarded upstream to the rest of the Internet are transmitted through an egress interface; packets forwarded downstream to the IPv6 mobile network are transmitted through an ingress interface (RFC 3753).</p>	ISO 21210
IPv6 node	<p>device that implements IPv6</p> <p>[SOURCE: RFC 2460]</p>	ISO 21210
IPv6 prefix	<p>bit string that consists of some number of initial bits of an 'IPv6 address'</p> <p>NOTE The prefix of length 64 (/64) of an IPv6 'Global Unicast Address' (RFC 3587) identifies a specific IPv6 subnet and its position in the Internet hierarchy</p> <p>[SOURCE: RFC 3753]</p>	ISO 21210
IPv6 router	<p>'IPv6 node' that forwards IPv6 packets not explicitly IPv6 addressed to itself</p> <p>[SOURCE: RFC 2460]</p>	ISO 21210

Term	Definition	Reference
IPv6 subnet	logical group of connected network nodes NOTE Nodes in an 'IPv6 subnet' share a common network prefix. [SOURCE: RFC 3753]	ISO 21210
ITS application	instantiation of an ITS service that involves an association of two or more complementary ITS-S application processes	ISO 21217
ITS application class	ITS application with mutually exclusive characteristics designed for operation in different contexts NOTE Introduced in ISO 15628 and ISO 22418	ISO 17419
ITS application identifier	globally unique, registered number identifying an ITS application object	ISO 17419
ITS application object	ITS application and ITS application class identified by a globally unique ITS application identifier (ITS-AID)	ISO 17419
ITS message	message designed for an ITS-related purpose	ISO 17419
ITS message set	set of messages designed for an ITS-related purpose --> definition should be changed to "set of uniquely identified ITS messages"	ISO 21217
ITS message set identifier	globally unique, registered number identifying an ITS message set	ISO 17419
ITS protocol stack identifier	globally unique, registered number identifying a non-parameterized communications protocol stack	ISO 17419
ITS registration authority	entity authorized to register ITS-S object identifiers	ISO 17419
ITS service	functionality provided to users of intelligent transport systems designed e.g. to increase safety, sustainability, efficiency, or comfort	ISO 21217
ITS station	functional entity comprised of an ITS-S facilities layer, ITS-S networking and transport layer, ITS-S access layer, ITS-S management entity, ITS-S security entity, and ITS-S applications entity providing ITS services Note 1 to entry: From an abstract point of view, the term "ITS station" refers to a set of functionalities. The term is often used to refer to an instantiation of these functionalities in a physical unit. Often, the appropriate interpretation is obvious from the context. The proper name of the physical instantiation of an ITS-S is ITS station unit (ITS-SU).	ISO 21217
ITS station unit	implementation of an ITS-S	ISO 21217
ITS trusted authority	entity authorized to issue ITS-S object security credentials	ISO 17419
ITS-S access layer	protocol layer in the ITS-S reference architecture containing the OSI physical and data link layer protocols for ITS communications	ISO 21217

Term	Definition	Reference
ITS-S access layer protocol data unit	protocol data unit exchanged between peer ITS-S access layers	ISO 21217
ITS-S access layer service data unit	service data unit exchanged between ITS-S access layer and ITS-S networking and transport layer	ISO 21217
ITS-S access router	ITS-S border router with additional functionality that provides other ITS communication nodes a point of attachment to an external network	ISO 21217
ITS-S access technology	access technology dedicated to operation in an ITS-S	ISO 21217
ITS-S anchor segment	segment of an ITS-S path that starts at an ITS-S ingress anchor node and ends up at an ITS-S egress anchor node	ISO 24102-6
ITS-S application	ITS-S application process residing in the ITS-S application entity	ISO 21217
ITS-S application process	instantiation of an ITS service that involves an association of two or more complementary ITS-S application processes [SOURCE: ISO 21217:2014, 3.9 — modified: Note 1 to entry was deleted.]	ISO 17423
ITS-S application process	element in an ITS station that performs information processing for a particular application and uses ITS-S services to transmit and receive information	ISO 21217
ITS-S application process provisioner	functionality in an ITS-SU offering ITS-S application processes for download and installation to other ITS-SUs --> definition to be checked – seems to be wrong	ISO 17419
ITS-S application process provisioner	functionality in an ITS-SU offering ITS-S application processes for download to other ITS-SUs [SOURCE: ISO 17419:2018, 3.14]	ISO 17423
ITS-S application process RX/TX interface	sink or source of an ITS-S application process	ISO 17423
ITS-S border router	ITS-S router with additional functionality that provides connectivity to other ITS communication nodes over external networks	ISO 21217
ITS-S capability	uniquely addressable protocol or functionality that is part of an ITS-S Managed Service Entity Note 1 to entry: Examples of ITS-S capabilities in the ITS station facilities layer are generic ITS-S facilities layer services specified in ISO/TS 17429 (Communication Profile Handler, Facilities Services Handler, Content Subscription Handler), the position and time service defined in ISO/TS 21176 , the security service defined in ISO/TS 21177 ; examples of ITS-S capabilities in the ITS-S networking and transport layer are IPv6 functionalities defined in ISO 21210 (IPv6 neighbour discovery, IPv6 forwarding, IPv6 mobility support, ...), the fast service announcement protocol defined in ISO 22418 , etc.	ISO 21217

Term	Definition	Reference
ITS-S communication profile	parameterized ITS-S communication protocol stack	ISO 21217
ITS-S communication profile identifier	globally unique, registered reference number identifying an ITS-S communication profile	ISO 21217
ITS-S communication protocol	protocol used in a communication protocol stack of an ITS-S	ISO 21217
ITS-S communication protocol stack	consistent set of ITS-S communication protocols enabling communications between an ITS-SCU and other nodes which may be identified by a registered globally unique reference number	ISO 21217
ITS-S communication protocol stack identifier	globally unique, registered reference number identifying a non-parameterized communications protocol stack	ISO 21217
ITS-S communication unit	physical unit in an ITS-SU containing a part or all of the functionality of an ITS-S Note 1 to entry: In case an ITS-SU consists of a single physical unit, the ITS-SU and the ITS-SCU are identical. In case an ITS-SU consists of more than one ITS-SCU, then these ITS-SCUs are interconnected via the ITS station-internal network of the ITS-SU.	ISO 21217
ITS-S data container	sequence of type-length-value (TLV) encoded data objects	ISO/TS 17429
ITS-S data header	header of the "ITS-S generic data container format" uniquely identifying the data contained in the ITS-S data containers by means of data dictionary identifiers unique in the ITS domain and the number of data objects from the data dictionary in the container	ISO/TS 17429
ITS-S egress anchor node	second (last) anchor node contained in an ITS-S path	ISO 24102-6
ITS-S facilities header	header used to form an "ITS-S facilities layer protocol data unit"	ISO/TS 17429
ITS-S facilities layer	layer in the ITS-S reference architecture containing OSI layers 5, 6, and 7 that connects applications to the ITS-S networking and transport layer	ISO 21217
ITS-S facilities layer protocol data unit	protocol data unit exchanged between peer ITS-S facility layers	ISO 21217
ITS-S facilities layer service data unit	service data unit exchanged between ITS-S facilities layer and ITS-S application entity	ISO 21217
ITS-S facilities service	ITS-S capability of the ITS-S facilities layer providing a service that may be applied to ADUs at the request of the source ITS-S-AP Note 1 to entry: Examples of ITS-S facilities services are "time stamping", "geo-stamping".	ISO 21217
ITS-S facility application	ITS-S application process residing in the ITS-S facilities layer	ISO 21217

Term	Definition	Reference
ITS-S facility layer service	process residing in the ITS-S facilities layer acting as source or destination of FNTP NPDUs	ISO 29281-1
ITS-S flow	identifiable sequence of packets of a given ITS-S flow type transmitted between a source node and a destination node	ISO 21217
ITS-S flow identifier	identifier, being unique within an ITS station unit, that identifies an ITS-S flow	ISO 24102-6
ITS-S flow type	set of characteristics describing a data flow Note 1 to entry: Flow types could be pre-assigned, well known and recorded with some authority registry or defined by the applications following a number of conventions	ISO 21217
ITS-S flow type identifier	identifier being unique within the ITS station that identifies an ITS-S flow type	ISO 24102-6
ITS-S gateway	ITS-S node used to interconnect two different OSI protocol stacks at layers 5 through 7 Note 1 to entry: An ITS-S gateway may convert between different protocols.	ISO 21217
ITS-S generic data container format	format of an ADU exchanged between an "ITS-S application process" and a Content Subscription Handler (CSH) or between two peer CSHs containing an "ITS-S data header" and followed by a number of "ITS-S data containers"	ISO/TS 17429
ITS-S host	ITS-S node comprised of ITS-S functionalities other than the functionalities of an ITS-S router, ITS-S border router, ITS-S mobile router, or an ITS-S gateway	ISO 21217
ITS-S ingress anchor node	first anchor node contained in an ITS-S path	ISO 24102-6
ITS-S internal router	ITS-S router that connects two or more ITS station-internal networks	ISO 21217
ITS-S IPv6 access router	'IPv6 router' implementing communication functions of an ITS station and offering access to 'mobile ITS-S IPv6 LANs'	ISO 21210
ITS-S IPv6 border router	IPv6 router implementing communication functions of an ITS station and connecting 'ITS-S IPv6 LANs' to the Internet and other networks	ISO 21210
ITS-S IPv6 home agent	'IPv6 home agent' implementing communication functions of an ITS station and maintaining access to 'mobile ITS-S IPv6 LANs'	ISO 21210
ITS-S IPv6 host	'IPv6 host' implementing non-routing capabilities of an ITS station	ISO 21210

Term	Definition	Reference
ITS-S IPv6 LAN	<p>IPv6 LAN composed of one or more IPv6 subnets comprising one or more ITS station(s) and 0 or more legacy IPv6 node(s) deployed in an ITS sub-system</p> <p>NOTE An 'ITS-S IPv6 router' with no 'ITS-S IPv6 LAN interface' is considered as a simple case of an 'ITS-S IPv6 LAN' comprising only one 'IPv6 node'. Considering only 'ITS-S IPv6 LANs' simplifies this International Standard and ensures compatibility among ITS sub-systems equipped to meet different design choices.</p>	ISO 21210
ITS-S IPv6 LAN interface	<p>ITS-S IPv6 LAN interface</p> <p>'IPv6 interface' of an 'IPv6 node' in an ITS station used to connect to the 'ITS-S IPv6 LAN'</p> <p>NOTE All 'IPv6 interfaces' are either 'external IPv6 interfaces' or 'ITS-S IPv6 LAN interfaces'.</p>	ISO 21210
ITS-S IPv6 LAN node	<p>node on an 'ITS-S IPv6 LAN'</p> <p>NOTE Any 'ITS-S IPv6 node' or 'legacy IPv6 node'.</p>	ISO 21210
ITS-S IPv6 mobile router	<p>'IPv6 router' implementing communication functions of an ITS station and deployed in a 'mobile ITS-S IPv6 LAN'</p>	ISO 21210
ITS-S IPv6 node	<p>'IPv6 node' ('IPv6 host' or 'IPv6 router') implementing functions of an ITS station</p> <p>NOTE The ITS station comprises a communication function and application functions. These functions may be split into physically separated nodes communicating over an LAN.</p>	ISO 21210
ITS-S IPv6 router	<p>'IPv6 router' implementing routing capabilities of an ITS station</p>	ISO 21210
ITS-S IPv6 router serving an ITS-S IPv6 LAN	<p>'ITS-S IPv6 router' that is connecting an 'ITS IPv6 LAN' to other 'ITS IPv6 LANs' or the global Internet</p>	ISO 21210
ITS-S managed service entity	<p>uniquely addressable entity in an ITS-S layer comprised of a set of related ITS-S capabilities</p> <p>Note 1 to entry: Examples of ITS-S managed service entities are: a communication module in the ITS-S access technologies layer (M5, cellular, etc.), a protocol suite in the ITS-S networking and transport layer (IPv6, FNETP, GeoNetworking, 6LoWPAN, etc.), the generic facilities MSE at the ITS-S facilities layer.</p>	ISO 21217
ITS-S management application	<p>ITS-S application process residing in the ITS-S management entity</p>	ISO 21217
ITS-S mobile router	<p>ITS-S border router with additional functionality that allows a change of point of attachment to an external network while maintaining session continuity</p>	ISO 21217
ITS-S networking and transport layer	<p>layer in the ITS-S reference architecture containing OSI layers 3 and 4 that connects the ITS-S facilities layer to the ITS-S access layer</p>	ISO 21217

Term	Definition	Reference
ITS-S networking and transport layer protocol data unit	protocol data unit exchanged between peer ITS-S networking and transport layers	ISO 21217
ITS-S networking and transport layer service data unit	service data unit exchanged between ITS-S networking and transport layer and ITS-S facilities layer	ISO 21217
ITS-S node	node comprised of a set of functionalities in an ITS station unit that is connected to the ITS station-internal network or comprises an entire ITS station unit	ISO 21217
ITS-S object	entity used in ITS related to ITS-S management that may require a globally unique identifier NOTE Examples of ITS-S objects include ITS-SU, ITS-SCU, ITS application object, ITS message set, ITS-S communication protocol, ITS flow type	ISO 17419
ITS-S object identifier	an identifier of an ITS-S object	ISO 17419
ITS-S object owner	entity responsible for the specification (design), maintenance and registration of an ITS-S object	ISO 17419
ITS-S path	directed sequence of nodes connected by links starting at a source node, traversing a communication interface of the source ITS-S, an ITS-S ingress anchor node and an ITS-S egress anchor node, ending at a destination node	ISO 21217
ITS-S path	directed sequence of nodes connected by links starting at a source node, traversing a communication interface of the source ITS-S, an ITS-S ingress anchor node and an ITS-S egress anchor node, ending at a destination node Note 1 to entry: In some circumstances, the ITS-S ingress anchor node and the ITS-S egress anchor nodes might be collapsed with the destination node (i.e. the roles of the ITS-S ingress anchor node and the ITS-S egress anchor node are played by the destination node). Note 2 to entry: For bidirectional communications, two such ITS-S paths exist, i.e. one starting at each communication end point. Note further that there could be multiple ITS-S paths between a source and its destination.	ISO 24102-6
ITS-S path identifier	identifier of a given ITS-S path being unique within an ITS station	ISO 24102-6
ITS-S router	ITS-S node comprised of routing functionalities of an ITS station unit used to connect two networks and to forward packets not explicitly addressed to itself	ISO 21217
ITS-S security application	ITS-S application process residing in the ITS-S security entity	ISO 21217
ITS-S service	communication functionality of an ITS-S that provides the capability to connect to other nodes	ISO 21217

Term	Definition	Reference
ITS-S unit	implementation of an ITS station NOTE From ISO 21217:2014	ISO 17419
ITS-SCU configuration management centre	entity that retains information about capabilities of ITS-SCUs, status of objects in ITS-SCUs, and supports management and update of this information	ISO 17419
LDM Area of Interest	location requirement used in the filter process of queries and automatic notifications	ISO 18750
LDM Area of Maintenance	information on the operational location area of an LDM used by LDM maintenance Note 1 to entry: ETSI EN 302 895 restricts the LDM Area of Maintenance to "geographical area specified by the LDM for LDM maintenance".	ISO 18750
LDM Data Dictionary	dictionary of LDM Data Object Types	ISO 18750
LDM Data Object	location-referenced and time-referenced representation of a real object that is self-explanatory without any further context information	ISO 18750
LDM Data Object ID	identifier of an LDM Data Object which is unique in an LDM	ISO 18750
LDM Data Object Type	identifier of the type of information contained in an LDM Data Record	ISO 18750
LDM Permissions	information on how a specific ITS-S application process may use an LDM	ISO 18750
LDM Time of Interest	time requirement used in the filter process of queries and automatic notifications	ISO 18750
legacy IPv6 node	'IPv6 node' in accordance with RFC 4294 (IPv6 node requirements) and functions without additional IPv6 networking capabilities	ISO 21210
Link-ID	identifier of a link given by the address of a VCI	ISO 21218
link-local IPv6 address	'IPv6 address' corresponding to a 'link-local IPv6 unicast address' as specified in RFC 4291	ISO 21210
Local Dynamic Map	entity consisting of LDM Data Objects, services and interfaces for manipulating these LDM Data Objects	ISO 18750
localized communications	communications with nearby stations without involving support of an infrastructure network	ISO 21217
location reference	uniquely identifiable description of position or area in the real world	ISO 18750
Location Validity	information indicating a location at which an LDM Data Object is valid	ISO 18750
locator	identifier of the topological location of a node in a communication network Note 1 to entry: A locator of an ITS station is the identifier of an ITS-S ingress anchor node (an ITS station has as many locators as there are ITS-S ingress anchor nodes to which it is attached).	ISO 24102-6

Term	Definition	Reference
MA interface	interface between the ITS-S management entity and ITS-S applications	ISO 21217
medium	physical entity that supports the transmission of signals carrying information between ITS communication nodes, e.g. a set of wires supporting Ethernet signals or the space between two antennas that supports electromagnetic, optical, or acoustical transmissions	ISO 21217
medium	physical properties of a CI used to transmit a modulated signal, e.g. wireless or on a wire Note 1 to entry: Medium is also referred to as access technology.	ISO 21218
metadata	data about data Note 1 to entry: The term "metadata" is ambiguous as it is used for fundamentally different concepts. Structural metadata is information related to the design and specification of data structures; it is also referred to as "data about the containers of data". Descriptive metadata is information on instances of data, i.e. the data content; it is also referred to as "data about data content".	ISO 18750
MF interface	interface between the ITS-S management entity and the ITS-S facilities layer	ISO 21217
MI interface	interface between the ITS-S management entity and the ITS-S access layer	ISO 21217
MN interface	interface between the ITS-S management entity and the ITS-S networking and transport layer	ISO 21217
mobile edge multihoming	possibility for a mobile node ('IPv6 host' or 'IPv6 router' serving an 'IPv6 mobile network') to connect simultaneously to the Internet through multiple points of attachment, either using multiple communication media or using multiple interfaces of the same communication medium, or through multiple 'IPv6 mobile routers' serving the same 'IPv6 mobile network' NOTE Mobile edge multihoming mechanisms are known as MonAmi6 support within the IETF as a reference to the former MonAmi6 Working Group where these mechanisms were first defined before being taken over by the MeXT Working Group. For a comprehensive understanding of the mobile edge multihoming issues, it is recommended that the user read RFC 4980.	ISO 21210
mobile ITS-S IPv6 LAN	'ITS-S IPv6 LAN' having the capability of changing its point of attachment to the ITS domain or the Internet	ISO 21210
mobile ITS-S IPv6 LAN node	'IPv6 node' on a 'mobile ITS-S IPv6 LAN'	ISO 21210
MS interface	interface between the ITS-S management entity and the ITS-S security entity	ISO 21217
networked communications	communications using support of an infrastructure network	ISO 21217

Term	Definition	Reference
network mobility support	network function allowing an entire mobile 'IPv6 subnet' or 'IPv6 mobile network' to change its point of attachment to the Internet and, thus, its reachability in the topology, without interrupting IP packet delivery to or from this 'IPv6 mobile network' NOTE This terminology associated with this support function is defined in RFC 3753 and RFC 4885.	ISO 21210
NF interface	interface between the ITS-S networking and transport layer and the ITS-S facilities layer	ISO 21217
permission	rule that a particular behaviour is allowed to occur NOTE From ITU-T X.911	ISO 17419
policy	set of rules related to a particular purpose, expressed as an obligation, an authorization, a permission or a prohibition NOTE From ITU-T X.911	ISO 17419
prohibition	prescription that a particular behaviour shall not occur NOTE From ITU-T X.911	ISO 17419
PVT information	any piece of information provided by the PVT service, e.g. position, time or velocity	ISO/TS 21176
PVT service	station-internal service providing PVT information	ISO/TS 21176
registered ITS-S flow	ITS-S flow that has been allocated an ITS-S FlowID	ISO 24102-6
registration	assignment of an unambiguous name to an object in a way which makes the assignment available to interested parties NOTE From ITU-T X.911	ISO 17419
registration authority	entity such as an organization, a standard or an automated facility that performs registration of one or more types of objects NOTE From ITU-T X.911	ISO 17419
regulation (document)	written instrument containing rules having the force of law	ISO 17419
regulation (process)	process of the promulgation, monitoring, and enforcement of rules defined in 'regulation (document)', established by primary and/or delegated legislation	ISO 17419
regulator	agency responsible for exercising autonomous authority over some area of human activity	ISO 17419
regulatory information	set of regulatory requirements for radio wave emission	ISO 24102-1
Remote Management Client	TS station communication unit in which remote ITS station management is performed by a remote management server	ISO 24102-2

Term	Definition	Reference
Remote Management Server	entity performing remote ITS station management in an ITS station communication unit	ISO 24102-2
SA interface	interface between the ITS-S security entity and ITS-S applications	ISO 21217
Secure Session	functional entity providing confidentiality, integrity, authentication, guaranteed in-order delivery, and replay protection on the datagrams that are passed over it	ISO/TS 21177
Secure Session Service	functional entity responsible for establishing secure communications sessions with its peer instances	ISO/TS 21177
Security Adaptor Layer	functional entity providing multiplexing and demultiplexing functionality for data and session control commands	ISO/TS 21177
SF interface	interface between the ITS-S security entity and the ITS-S facilities layer	ISO 21217
SI interface	interface between the ITS-S security entity and the ITS-S access layer	ISO 21217
SN interface	interface between the ITS-S security entity and the ITS-S networking and transport layer	ISO 21217
source node	communication end point that creates packets for transmission to peer entities	ISO 24102-6
temps atomique international	time since 00:00:00 UTC, 1 January, 2004, identical with UTC except that no leap seconds need to be added	ISO 21218
Time of Creation	time when an LDM Data Record was created and updated	ISO 18750
Time of Deletion	time when an LDM Data Record may be deleted and will no longer be considered by the LDM search functionality	ISO 18750
Time of Generation	time when the content of the LDM Data Object information field was created Note 1 to entry: This is different to the time, when the LDM Data Object was written into an LDM.	ISO 18750
Time Validity	information indicating a time interval during which an LDM Data Object is valid	ISO 18750
tunnel	forwarding path between two nodes on which the payload consists of encapsulated packets	ISO 21210
violation	behaviour contrary to a rule NOTE From ITU-T X.911	ISO 17419
virtual communication interface	logical entity in a CI that is associated with a peer station	ISO 21218

5.2 Symbols and acronyms

Below an informative list of symbols and abbreviated terms that are used in C-ITS, together with information on where the original definition is made. Focus is on terms and definitions related to architectural specifications and protocols, rather than application specifications.

NOTE Abbreviations can also be found in ETSI's "TErms and Definitions Database Interactive" (TEDDI) at <https://webapp.etsi.org/Teddi/>, and on the ISO Online Browsing Portal at <https://www.iso.org/obp/ui/#home>.

Table 2 — Symbols and abbreviated terms used in C-ITS

Acronym / symbol	Definition	Reference
ABS	Anti-lock Breaking System	TS 101 539-3
ADU	Application Data Unit	ISO 21217
AEB	Automatic Emergency Braking	EN 302 637-3
AEI	Automatic Equipment Identification	ISO 18185-4
AERIS	Applications for the Environment: Real-Time Information Synthesis	ISO/TS 19091
AES	Advanced Encryption Standard	IEEE Std 1609.2™
API	Application Programming Interface	ISO 21217
APN	Access point name	ISO 21218
AR	IPv6 access router	ISO 21210
ARCP	Application Requirements for selection of Communication Profiles	ISO 17419
ASD	Aftermarket Safety Device	ISO/TS 19091
ATIS	Advanced Traveller Information System	ISO/TS 19091
AVI	Automatic Vehicle Identification	ISO 17687
BC-VCI	VCI for transmission to the broadcast MAC address	ISO 21218
BOPC	Back Office Processing Centre (also known as Traffic Management Centre)	ISO/TS 19091
BR	IPv6 border router	ISO 21210
BRAN	Broadband radio access network	ISO 21215
BSA	Basic Set of Applications	EN 302 637-2
BSM	Basic Safety Message	SAE J2735™
BSMD	Bounded Secured Managed Domain	ISO 21217

Acronym / symbol	Definition	Reference
BSME	Bounded Secured Managed Entity	ISO 21217
BSS	Basic service set	IEEE Std 802.11™
BST	Beacon Service Table	ISO 17419
BTP	Basic Transport Protocol	EN 302 636-5-1
C-ITS-SU	central ITS-SU	ISO 21217
CA	certificate authority	IEEE Std 1609.2™
CAL	Communication Adaptation Layer	ISO 21217
CALM	Communications Access for Land Mobiles	ISO 21217
CAM	Cooperative Awareness Message	EN 302 637-2
CBF	Contention-Based Forwarding	EN 302 636-4-1
CCM	counter mode with cipher block chaining message authentication code	IEEE Std 1609.2™
CGA	Cryptographically Generated Addresses	EN 302 636-6-1
CI	Communication Interface	ISO 21217
CIC	Communication interface class	ISO 21218
CIID	CI / VCI Identifier presented in a 64-bit EUI field	ISO 21218
CIP	Communication Interface Parameter	ISO/TS 16460
C-ITS	Cooperative ITS	ISO 21217
CMH	Cryptomaterial Handle	IEEE Std 1609.2™
CoA	IPv6 'Care-of Address'	ISO 21210
CPH	Communication Profile Handler	ISO/TS 17429
CPSP	Communication Profile Selection Process	ISO 17423
CRACA	Certificate Revocation Authorizing Certificate Authority	IEEE Std 1609.2™
CRL	certificate revocation list	IEEE Std 1609.2™
CRO	Communication Requirements and Objectives	ISO 17423
CS	Charging Spot	TS 101 556-1
CSH	Content Subscription Handler	ISO/TS 17429

Acronym / symbol	Definition	Reference
CSP	Communication Service Parameter	ISO 17423
CSP_AvgADUrate	Communication service parameter "Average ADU generation rate"	ISO 17423
CSP_CommDistance	Communication service parameter "Communication distance"	ISO 17423
CSP_DataConfidentiality	Communication service parameter "Need for data confidentiality"	ISO 17423
CSP_DataIntegrity	Communication service parameter "Need for data integrity"	ISO 17423
CSP_DestinationDomain	Communication service parameter "Destination domain"	ISO 17423
CSP_DestinationType	Communication service parameter "Destination type"	ISO 17423
CSP_Directivity	Communication service parameter "Directivity"	ISO 17423
CSP_ExpFlowLifetime	Communication service parameter "Expected flow lifetime"	ISO 17423
CSP_FlowType	Communication service parameter "Flow type"	ISO 17423
CSP_LogicalChannelType	Communication service parameter "Logical channel"	ISO 17423
CSP_MaxADU	Communication service parameter "Maximum ADU size"	ISO 17423
CSP_MaxLat	Communication service parameter "Maximum allowed latency"	ISO 17423
CSP_MaxPrio	Communication service parameter "Maximum priority"	ISO 17423
CSP_MinThP	Communication service parameter "Minimum throughput"	ISO 17423
CSP_NonRepudiation	Communication service parameter "Need for non-repudiation"	ISO 17423
CSP_PortNo	Communication service parameter "Port Number"	ISO 17423
CSP_Protocol	Communication service parameter "Protocol requirements"	ISO 17423
CSP_Resilience	Communication service parameter "Resilience"	ISO 17423
CSP_SessionCont	Communication service parameter "Session continuity"	ISO 17423

Acronym / symbol	Definition	Reference
CSP_SourceAuthentication	Communication service parameter "Source authentication"	ISO 17423
CSP_SpecificCommsProts	Communication service parameter "Specific communications protocols"	ISO 17423
CSR	certificate signing request	IEEE Std 1609.2™
CV	Connected Vehicle	ISO/TS 19091
DAD	Duplicate Address Detection	EN 302 636-4-1
DCC	Decentralized Congestion Control	TS 102 868-1
DENM	Decentralized Environmental Notification Message	EN 302 637-2
DGVL	Dynamic Geographical Virtual Link	EN 302 636-6-1
DHCP	Dynamic Host Configuration Protocol	ISO 21210
DLL	Data link layer	ISO 21218
DNI	Distinct null identifier	ISO 21218
DNS	Dynamic Name Server	ISO 21210
DPD	Duplicate Packet Detection	EN 302 636-4-1
DSRC	Dedicated short range communication (5,8 GHz back-scatter technology used in Europe for e.g. road tolling). This term is used in the USA to indicate IEEE 802.11 OCB communications in the 5.9 GHz band, see e.g. ISO 21215:2017	ISO 21218
DTLS	datagram TLS	ISO/TS 21177
ECC	elliptic curve cryptography	IEEE Std 1609.2™
ECDSA	Elliptic Curve Digital Signature Algorithm	IEEE Std 1609.2™
ECIES	Elliptic Curve Integrated Encryption Scheme	IEEE Std 1609.2™
ECU	Electronic Control Unit	EN 302 665
EDCA	enhanced distributed channel access	IEEE Std 802.11™
EEBL	Electronic Emergency Break Light	EN 302 637-3
EMA	Exponential Moving Average	EN 302 636-4-1
EPD	EtherType protocol discrimination	ISO 21215
ESP	Electronic Stability Program	TS 101 539-3
EUI	Extended universal identifier	ISO 21218

Acronym / symbol	Definition	Reference
EUI-64	64-bit EUI	ISO 21218
EVCS	Electrical Vehicle Charging Spot	TS 101 556-1
EVCSN	EVCS Notification	TS 101 556-1
FA	name of interface between ITS-S facilities layer and ITS-S application entity	ISO 21217
FlowID	identifier, being unique within an ITS station unit, that identifies an ITS-S flow	ISO 21217
FNTP	Fast networking & transport protocol	ISO 29281-1
FSAM	Fast service advertisement message	ISO 22418
FSAP	Fast service announcement protocol	ISO 22418
FSH	Facilities Services Handler	ISO/TS 17429
FSRM	Fast service response message	ISO 22418
GAC	Geographically-Scoped Anycast	EN 302 636-4-1
GBC	Geographically-Scoped Broadcast	EN 302 636-4-1
GCMA	Global Classification and Management of ITS Applications	ISO 17419
GF	Greedy Forwarding	EN 302 636-4-1
GN	GeoNetworking	EN 302 636-4-1
GPRS	General Packet Radio Service	EN 302 665
GUC	Geographically-Scoped Unicast	EN 302 636-4-1
GVL	Geographical Virtual Link	EN 302 636-6-1
HA	IPv6 home agent	ISO 21210
HoA	IPv6 home address	ISO 21210
HMI	Human Machine Interface	ISO 21217
HTG	Harmonization Task Group	ISO/TS 16460
HSM	Hardware Security Module	EN 302 665
IANA	Internet Assigned Numbers Authority	ISO 17419
IAT	International Atomic Time	ISO 18750
ICRW	Intersection Collision Risk Warning	TS 101 529-1

Acronym / symbol	Definition	Reference
ICS	Implementation conformance statement	ISO 21218
IIC	ITS station-internal management communications	ISO 24102-4
IICA	IIC agent	ISO 24102-4
IICM	IIC manager	ISO 24102-4
IICP	IIC protocol	ISO 24102-4
IN	name of interface between ITS-S access layer and ITS-S networking & transport layer	ISO 21217
IN-SAP	Communication SAP as offered by the CAL to the ITS-S networking & transport layer	ISO 21218
IP	Internet Protocol	ISO 21217
I-Parameter	Parameter of a CI or virtual CI (VCI) specified in ISO 21218:2017.	ISO 21215
IPsec	Internet Protocol security	ISO 21210
IPv6	IP version 6	ISO 21217
IR	Infra-Red	ISO 21217
IRN	infrastructure/roadside network	ISO/TS 21177
ITS	Intelligent Transport Systems	ISO 21217
ITS-ACID	ITS Application Context Identifier	ISO 17419
ITS-AID	ITS Application Identifier	ISO 17419
ITS-AOODID	Application Object Owner (designer) Identifier	ISO 17419
ITS-APDU	ITS Station Access layer Protocol Data Unit	ISO 21217
ITS-ASDU	ITS Station Access layer Service Data Unit	ISO 21217
ITS-ATT	ITS Access Technology Type	ISO 17419
ITS-FlowTypeID	ITS Flow Type Identifier	ISO 17419
ITS-FPDU	ITS Station Facility layer Protocol Data Unit	ISO 21217
ITS-FSDU	ITS Station Facility layer Service Data Unit	ISO 21217
ITS-LCH	ITS Logical Channel	ISO 17419
ITS-LCHID	ITS Logical Channel Identifier	ISO 17419
ITS-MsgSetID	ITS Message Set Identifier	ISO 17419

Acronym / symbol	Definition	Reference
ITS-MSOID	ITS Message Set Owner Identifier	ISO 17419
ITS-M5	Access technology specified in ISO 21215	ISO 21217
ITS-NTPDU	ITS Station Networking & Transport layer Protocol Data Unit Note to entry: The deprecated term ITS-NPDU is in use in published standards with the same meaning as ITS-NTPDU.	ISO 21217
ITS-NTSDU	ITS Station Networking & Transport layer Service Data Unit	ISO 21217
ITS-PN	ITS Port Number	ISO 17419
ITS-PR	ITS policy region	ISO 17419
ITS-PRID	ITS-PR Identifier	ISO 17419
ITS-ProtID	ITS Protocol Identifier	ISO 17419
ITS-ProtStckID	ITS Protocol Stack Identifier	ISO 17419
ITS-RR	ITS Regulatory Region	ISO 17419
ITS-RRID	ITS Regulatory Region Identifier	ISO 17419
ITS-S	ITS Station	ISO 21217
ITS-S MSE	ITS-S managed service entity	ISO/TS 17429
ITS-S-AP	ITS Station Application Process	ISO 21217
ITS-S-APDID	ITS-S Application Process Developer Identifier	ISO 17419
ITS-S-APID	ITS-S Application Process Identifier	ISO 17419
ITS-S-APID	ITS Station Application Process Identifier	ISO 24102-6
ITS-S-APIID	ITS-S Application Process Instance Identifier	ISO 17419
ITS-S-APP	ITS-S application Process Provisioner	ISO 17419
ITS-S-APPID	ITS-S Application Process Provider Identifier	ISO 17419
ITS-S-APPSSID	ITS-S Application Process Sink Source Identifier	ISO 17419
ITSC	ITS Communications	EN 302 665
ITS-SCP	ITS station communication profile	ISO 17423
ITS-S-CPID	ITS-S communication profile Identifier	ISO 17419
ITS-SCPS	ITS station communication protocol stack	ISO 17423

Acronym / symbol	Definition	Reference
ITS-SCU	ITS-S Communication Unit	ISO 21217
ITS-SCU-CMC	ITS-SCU Configuration Management Centre	ISO 17419
ITS-SCU-CMCID	ITS-SCU-CMD Identifier	ISO 17419
ITS-SCUID	ITS-SCU Identifier	ISO 17419
ITS-SCUID	Globally unique identifier of an ITS-SCU Note to entry: ITS-SCUID is specified in EN ISO 17419:2018 as a globally unique identifier, whilst ITS-SCU-ID is specified in this document as an addressing element for IIC.	ISO 24102-4
ITS-SCU-ID	ITS-SCU Identifier	ISO 24102-4
ITS-SecAlgID	ITS Security Algorithm Identifier	ISO 17419
ITS-SEMID	ITS Station Equipment Manufacturer Identifier	ISO 17419
ITS-S-FlowID	ITS Station Flow Identifier	ISO 24102-6
ITS-S-FlowTypeID	ITS-S flow type identifier (from 24102-6)	ISO 17423
ITS-S-FlowTypeID	ITS Flow Type Identifier	ISO 24102-6
ITS-SFS	ITS-S facility layer services	ISO 29281-1
ITS-S-FSID	ITS-S Facilities layer Service Identifier	ISO 17419
ITS-SSI	ITS Station State Information	ISO 24102-1
ITS-SU	ITS-S Unit	ISO 21217
ITS-SUID	ITS-SU Identifier	ISO 17419
ITS-SU-UID	ITS-SU User Identifier	ISO 17419
IUT	Implementation Under Test	ISO 18750
IVN	In-Vehicle Network	ISO 21217
L2TP	Layer Two Tunneling	ISO 21210
LAN	Local Area Network	ISO 21210
LCH	Logical Channel	ISO 21217
LCRW	Longitudinal Collision Risk Warning	TS 101 592-2
LDM	Local Dynamic Map	ISO 18750
LDM-DAT	LDM Data Attribute Type	ISO 18750

Acronym / symbol	Definition	Reference
LDM-DATID	LDM-DAT Identifier	ISO 18750
LDM-DD	LDM Data Dictionary	ISO 18750
LDM-DT	LDM Data Type	ISO 18750
LDM-DTID	LDM-DT Identifier	ISO 18750
LLC	Logical link control (sub-layer of the data link layer)	ISO 21215
LM	Localized Message	ISO/TS 16460
LocalCIID	CIID of a local CI	ISO 21218
LPD	LLC protocol discrimination	ISO 21215
LPDU	Link PDU	ISO 21215
LSB	Least significant bit	ISO 21218
LTE	Long Term Evolution	ISO 21217
MA	Name of the interface between the ITS-S management entity and ITS-S applications	ISO 21217
MAC	Medium access control (sub-layer of the data link layer)	IEEE Std 802™
MAC-48	48 bit MAC address	ISO 21218
MAE	Management Adaptation Entity	ISO 21217
MAP	Name of an ITS message set used to carry information on digital maps covering the area of intersections.	ISO 21217
MAT	Maximum Action Time	TS 101 539-1
MDRT	Maximum Driver Reaction Time	TS 101 539-1
MIB	Management Information Base	EN 302 637-2
MLT	Maximum Latency Time	TS 101 539-1
MCoA	Multiple Care-of Addresses	ISO 21210
MC-VCI	VCI for transmission to a multicast (group) MAC address	ISO 21218
MF	Name of the interface between the ITS-S management entity and the ITS-S facilities layer	ISO 21217
MFR	Most Forward within Radius	EN 302 636-4-1
MHL	Maximum Hop Limit	EN 302 636-4-1

Acronym / symbol	Definition	Reference
MHVB	Multi-Hop Vehicular Broadcast	EN 302 636-4-1
MI	Name of the interface between the ITS-S management entity and the ITS-S access layer	ISO 21217
MIB	Management Information Base	ISO 21217
MI-SAP	Management SAP as offered by the ITS-S management towards the MAE	ISO 21218
MN	Name of the interface between the ITS-S management entity and the ITS-S networking & transport layer	ISO 21217
MNN	IPv6 mobile network node (by extension an abbreviation for mobile ITS-S IPv6 LAN nodes)	ISO 21210
MNP	IPv6 mobile network prefix	ISO 21210
MR	IPv6 mobile router	ISO 21210
MS	Name of the interface between the ITS-S management entity and the ITS-S security entity	ISO 21217
MSB	Most significant bit	ISO 21218
MSD	Minimum Set of Data	TS 101 539-1
MSE	ITS station Managed Service Entity	ISO 21217
MSEGenFac	generic facilities ITS-S MSE	ISO/TS 17429
MSEGenFacID	generic facilities ITS-S MSE identifier	ISO/TS 17429
NEMO	NETwork Mobility	ISO 21210
NF	Name of the interface between the ITS-S networking & transport layer and the ITS-S facilities layer	ISO 21217
NoO	Notification of Obligations	ISO 18750
NPDU	Network PDU	ISO 21215
OBU	On-board unit Note to entry: Term used for DSRC [EN 12253]	ISO 21218
OCB	Outside the context of a BSS	ISO 21215
OoT	Obligation of Trust	ISO 18750
OSI	Open system interconnection	ISO 21218
OTP	one time password	ISO/TS 21177
OUI	Organizational universal identifier	ISO 21218

Acronym / symbol	Definition	Reference
P2PCD	peer-to-peer certificate distribution	IEEE Std 1609.2™
PathID	ITS station Path Identifier	ISO 24102-6
PAI	Position Accuracy Indicator	EN 302 636-4-1
PCH	Physical Channel	ISO 21217
PCI	Protocol Control Information	EN 302 636-4-1
PDM	Probe Data Management. Name of an ITS message set.	ISO 21217
PDR	Packet Data Rate	EN 302 636-4-1
PDU	Protocol Data Unit	ISO 21217
PDU _s	Protocol Data Units	ISO 24102-1
PFM, pfm	Path and Flow Management	ISO 24102-6
PHY	Physical (layer)	ISO 21215
PIN	Personal identification number	ISO 21218
PMI	Privilege Management Infrastructure	ISO 18750
POI	Point of Interest	ISO 21217
PSAP	Public Safety Access Point	TS 101 539-1
PSID	Provider Service Identifier	IEEE Std 1609.2™
PVD	Probe Vehicle Data. Name of an ITS message set.	ISO 21217
PVT	Position, Velocity and Time	ISO/TS 21176
P-ITS-SU	personal or portable ITS-SU	ISO 21217
QoS	Quality of Service	ISO 24102-1
R_ConnectRate	"Maximum rate per connection" rule	ISO 17423
R_ConnectTimeRate	"Maximum rate per connection time" rule	ISO 17423
R_DataUnitRate	"Maximum rate per data unit" rule	ISO 17423
R_FlatRate	"Flat Rate" rule	ISO 17423
R_StationAnonymity	"Need for station anonymity" rule	ISO 17423
R_StationAuthentication	"Support of station authentication" rule	ISO 17423
R_StationLocationPrivacy	"Need for station location privacy" rule	ISO 17423

Acronym / symbol	Definition	Reference
RemoteCIID	CIID of a VCI enabling MAC groupcast transmissions and MAC unicast communication	ISO 21218
REQN	Request message PDU, no response message PDU expected	ISO 22418
REQRES	Request or response message PDU out of the set REQW, REQN, RES	ISO 22418
REQW	Request message PDU, response message PDU expected	ISO 22418
RES	Response message PDU, acknowledging a REQW	ISO 22418
RHL	Remaining Hop Limit	EN 302 636-4-1
RHS	Road Hazard Signalling	TS 101 539-1
RI	Regulatory Information	ISO 24102-1
RLAN	Radio LAN	ISO 21215
RLT	Road Lane Topology	TS 101 539-2
RMC	Remote Management Client	ISO 24102-2
RMCH	Remote Management Communication Handler	ISO 24102-2
RMPE	Remote Management Protocol Execution	ISO 24102-2
RMS	Remote Management Server	ISO 24102-2
RSMP	Remote ITS-station Management Protocol	ISO 24102-2
RTC	Retransmit Counter	EN 302 636-4-1
RX CIP	Receiver CIP	ISO/TS 16460
RX/TX-CI	CI capable of operating in receive and transmit mode	ISO 21218
RX-CI	CI capable of operating in receive mode only	ISO 21218
RX-VCI	VCI for reception	ISO 21218
R-ITS-SU	roadside ITS-SU	ISO 21217
SA	Name of the interface between the ITS-S security entity and ITS-S applications	ISO 21217
SAE	Security adaptation entity	ISO 21218
SAEM	Service announcement essential message	EN 22418
SAL	ITS Station Access Layer	ISO 24102-6

Acronym / symbol	Definition	Reference
SAM	Service Advertisement Message	ISO/TS 16460
SAO	Signed Acceptance of Obligations	ISO 18750
SAP	Service Access Point	ISO 21217
SAP	Service Access Point	ISO/TS 16460
SBAS	Satellite-Based Augmentation System	ISO/TS 21176
SCC	Station Country Code	EN 302 636-4-1
SCF	Store Carry & Forward	EN 302 636-4-1
SCMH	Symmetric Cryptomaterial Handle	IEEE Std 1609.2™
SCN	sensor and control network	ISO/TS 21177
SDEE	secure data exchange entity	IEEE Std 1609.2™
SDS	secure data service	IEEE Std 1609.2™
SDU	Service Data Unit	ISO 21217
SF	Name of the interface between the ITS-S security entity and the ITS-S facilities layer	ISO 21217
SFL	ITS Station Facilities Layer	ISO 24102-6
S-FSAM	Secured FSAM	ISO 22418
S-FSRM	Secured FSRM	ISO 22418
SHB	Single Hop Broadcast	EN 302 636-4-1
SI	Name of the interface between the ITS-S security entity and the ITS-S access layer	ISO 21217
SIM	Subscriber identity module	ISO 21218
SME	ITS Station Management Entity --> This definition should be used in ISO 21217	ISO 24102-6
SMIB	Security Management Information Base	ISO 21217
SN	Name of the interface between the ITS-S security entity and the ITS-S networking & transport layer	ISO 21217
SNAP	Sub-network access protocol	ISO 21218
SNTL	ITS Station Networking and Transport Layer	ISO 24102-6
SOA	Service Oriented Architecture	ISO 21217

Acronym / symbol	Definition	Reference
SPAKE2	secure password authenticated key exchange 2	ISO/TS 21177
SPaT	Signal Phase and Timing. Name of an ITS message set.	ISO 21217
SRM	Signal Request Message. Name of an ITS message set.	ISO 21217
SRM	Service Response Message	ISO/TS 16460
SrvIniP	Service initialization phase	ISO 22418
SrvOpP	Service operation phase	ISO 22418
SSM	Signal Status Message. Name of an ITS message set.	ISO 21217
SSP	Service Specific Permissions	IEEE Std 1609.2™
SSTD	secure session between trusted devices	ISO/TS 21177
SUT	System Under Test	ISO 18750
TAI	Temps Atomique International	ISO 21218
TDMA	Time division multiple access	ISO 21218
TLS	transport layer security	ISO/TS 21177
TOPO	Name of an ITS message set used to carry information on digital maps covering the area of intersections.	ISO 21217
TPEG	Transport Protocol Experts Group	ISO/TS 17429
TPID	Transport Protocol IDentifier	ISO/TS 16460
TPID-FS	Transport Protocol Identifier - Feature Selector	ISO 29281-1
TPID-FS	Transport Identifier Feature Selector --> Duplicate wrong definition. To be deleted.	ISO 29281-1
TSB	Topologically Scoped Broadcast	EN 302 636-4-1
TTC	Time To Collision	TS 101 539-1
TTP	trusted third party	IEEE Std 1609.2™
TX CIP	Transmitter CIP	ISO/TS 16460
TX-CI	CI capable of operating in transmit mode only, either broadcast or multicast	ISO 21218
TX-VCI	VCI for unicast transmission	ISO 21218

Acronym / symbol	Definition	Reference
UC-VCI	VCI for reception from and transmission to a unicast MAC address	ISO 21218
UMTS	Universal Mobile Telecommunication System	ISO 21217
UPER	Unaligned Packed Encoding Rules	ISO 29281-1
UMTS	Universal MobileTelecommunications System	EN 302 665
UTC	Temps Universel Coordonné / Coordinated Universal Time	ISO 21218
VANET	Vehicular Ad-hoc NETwork	ISO/TS 16460
VCI	virtual communication interface	ISO 21217
VDS	Vehicle Type Descriptor	TS 101 539-1
VIN	Vehicle Identification Number	TS 101 539-1
VMS	Variable Message Sign	TS 101 539-1
VST	Vehicle Service Table	ISO 17419
V-ITS-SU	vehicle ITS-SU	ISO 21217
V2X	localized communications between a vehicle and its surrounding environment	ISO 21217
WAVE	Wireless Access in Vehicular Environment	IEEE Std 1609.3™
WSA	WAVE Service Advertisement	IEEE Std 1609.3™
WSMP	WAVE Short Message Protocol	IEEE Std 1609.3™

6 Globally unique identification

For operation of C-ITS, globally unique identifiers are needed, see e.g. ISO 17419 in 3.2.1. Assignment of new numbers can e.g. either be done by subsequent amendments to or revisions of the standards, in which the identifiers are specified, or by a C-ITS registration authority.

ISO/TC 204/WG 1 is working on rules to manage requests for allocation of numbers of globally unique identifiers, and on identifying the responsible authority or structured authorities.

A snap-shot of assigned values for some identifiers are provided on a "best knowledge basis" without any warranty on correctness at

— <http://its-standards.info/ITS%20Registries/ISO17419/ITSaidRegistry.html>.

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Note 2 to entry: Under revision with split into a multi-part document

Cooperative intelligent transport systems (C-ITS) — ITS station facility services

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Part 2: Facility services handler

Part 3: Content subscription handler

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Note to entry: To be revised

- [135] ETSI TS 102 797-3 V1.2.1, *Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for ITS station management (ISO 24102); Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma*

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- [157] ETSI TS 102 985-2 V1.2.1, *Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for non-IP networking (ISO 29281); Part 2: Test Suite Structure and Test Purposes (TSS & TP)*

Note to entry: To be revised

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Note to entry: To be revised

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