ETSI TS 103 724 V2.1.1 (2021-08)



Intelligent Transport Systems (ITS); iTeFacilities layer function; Interference Management Zone Message (IMZM); Release 2 ETSL TS Release 2

https://standards.iteh.ai/catalog/standards/sist/3d682fc1-2a9c-4a86-bb2d-19aa594e48cc/etsi-ts-103-724-v2-1-1-2021-08 Reference

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DTS/ITS-001947

Keywords

interoperability, ITS, safety, service, transport

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Foreword

 ETSI TS 103 724 V2.1.1 (2021-08)

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

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Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document defines the "Interference Management Zone Message" (IMZM) that is used to identify an interference management area with the aim to optimize the spectrum sharing between road ITS and other services/applications. The objective is to support the dynamic band sharing in co-channel and adjacent channel scenarios between ITS stations and other services and applications.

The message structure will be based on the existing CAM ProtectedCommunicationZones structure.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <u>https://docbox.etsi.org/Reference</u>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

[1]	ETSI EN 302 636-3; "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network architecture".
[2]	ETSI TS 102 894-2 (V1-31); "Intelligent Transport Systems (ITS); Users and applications requirements; Part 2; Applications and facilities layer common data dictionary".
[3]	Recommendation ITU-T X.691/ISO/IEC 8825-2 (1997-12): "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".
[4]	ETSI TS 103 097 (V1.3.1): "Intelligent Transport Systems (ITS); Security; Security header and certificate formats".
[5]	ETSI EN 302 637-2: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service".
[6]	ETSI TS 103 300-3: "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 3: Specification of VRU awareness basic service; Release 2".
NOTE: This	reference is to be replaced by reference to Common Data Dictionary for Release 2 when available.
[7]	ETSI TS 102 965: "Intelligent Transport Systems (ITS); Application Object Identifier (ITS-AID); Registration".
[8]	ETSI TS 102 731: "Intelligent Transport Systems (ITS); Security; Security Services and Architecture".
[9]	ETSI EN 302 636-5-1: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol".
[10]	IEEE 1609.2 TM : "IEEE Standard for Wireless Access in Vehicular EnvironmentsSecurity Services for Applications and Management Messages".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

- [i.1] ETSI TR 103 580: "Urban Rail ITS and Road ITS applications in the 5,9 GHz band; Investigations for the shared use of spectrum".
- [i.2] ETSI TR 102 863: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM); Rationale for and guidance on standardization".
- [i.3] ETSI EN 302 665: "Intelligent Transport Systems (ITS); Communications Architecture".
- [i.4] ETSI EN 302 636-4-1: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-tomultipoint communications; Sub-part 1: Media-Independent Functionality".
- [i.5] ETSI TS 102 894-1: "Intelligent Transport Systems (ITS); Users and applications requirements; Part 1: Facility layer structure, functional requirements and specifications".
- [i.6] ETSI TS 102 941: "Intelligent Transport Systems (ITS); Security; Trust and Privacy Management."
- [i.7] ETSI TS 101 539-1: "Intelligent Transport Systems (ITS); V2X Applications; Part 1: Road Hazard Signalling (RHS) application requirements specification".
- [i.8] ETSI TS 101 539-2: "Intelligent Transport Systems (ITS); V2X Applications; Part 2: Intersection Collision Risk Warning (ICRW) application requirements specification".
- [i.9] ETSI TS 101 539-3: "Intelligent Transport Systems (ITS); V2X Applications; Part 3: Longitudinal Collision Risk Warning (LCRW) application requirements specification".
- [i.10] ETSI TS 102 723-5: "Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 5: Interface between management entity and facilities layer".
- [i.11] ETSI TS 102 723-11: "Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 11: Interface between networking and transport layer and facilities layer".
- [i.12] ISO EN 17419: "Intelligent Transport Systems -- Cooperative Systems -- Classification and management of ITS applications in a global context".
- [i.13] ETSI EN 302 663 (V1.2.1): "Intelligent Transport Systems (ITS); ITS-G5 Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".
- [i.14] ETSI EN 303 613 (V1.1.1): "Intelligent Transport Systems (ITS); LTE-V2X Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".
- [i.15] ETSI EN 302 571: "Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.16] ETSI TS 102 792: "Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range".
- [i.17] EC Implementation Decision EU 2020/1426: "Commission Decision on the harmonised use of radio spectrum in the 5875-5935 MHz frequency band of safety-related applications of Intelligent Transport Systems (ITS) and repealing Decision 2008/671/EC".

Intelligent Transport Systems (ITS)", approved 14 March 2008, Amended 6 March 2020.

- [i.19] ECC Report 101: "Compatibility studies in the band 5855- 5925 MHz between Intelligent Transport Systems (ITS) and other systems, Bern, February 2007".
- [i.20] ISO/IEC 27001:2013: "Information technology -- Security techniques -- Information security management systems -- Requirements".
- [i.21] FIPS PUB 199: "Standards for Security Categorization of Federal Information and Information Systems".
- [i.22] SAE Surface Vehicle Standard J2945/5: "Service Specific Permissions and Security Guidelines for Connected Vehicle Applications".
- [i.23] ETSI TS 102 165-1: "CYBER; Methods and protocols; Part 1: Method and pro forma for Threat, Vulnerability, Risk Analysis (TVRA)".
- [i.24] CEN ISO/TS 19321: "Intelligent transport systems Cooperative ITS Dictionary of in-vehicle information (IVI) data structures".
- [i.25] ETSI TS 103 175: "Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium".
- [i.26] SAE J2735 (11-2009): "Dedicated Short Range Communications (DSRC) Message Set Dictionary".
- [i.27] ETSI TS 103 301: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services; Release 2".

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3 Definition of terms, symbols and abbreviations

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3.1 Terms

[i.18]

For the purposes of the present document, the terms given in ETSI EN 302 665 [i.3], ETSI TR 102 863 [i.2], SAE J2735 [i.26] and the following apply:

DMC Toff limit: idle time limit for Decentralized Mitigation Control, using a procedure similar to what is defined in ETSI TS 103 175 [i.25] for DCC

Interference Management Zone (IMZ): geographical area where spectrum can be shared dynamically to enable co-channel and adjacent channel scenarios between ITS stations and other services and applications

Interference Management Zone Message (IMZM): IMZ basic service PDU

Interference Management Zone Message (IMZM) data: partial or complete IMZM payload

ITS-G5: access technology to be used in frequency bands dedicated for European intelligent transport System (ITS)

NOTE: As defined in ETSI EN 302 663 [i.13].

LTE-V2X: access technology to be used in frequency bands dedicated for European intelligent transport System (ITS)

NOTE: As defined in ETSI EN 303 613 [i.14].

V2X: either vehicle to vehicle (V2V), or vehicle to infrastructure (V2I) and/or infrastructure to vehicle (I2V)

3.2 Symbols

Void.

3.3 Abbreviations

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

API	Application Programming Interface
ASN.1	Abstract Syntax Notation 1
BTP	Basic Transport Protocol
CA	Cooperative Awareness
CAM	Cooperative Awareness Message
C-ITS	Cooperative ITS
DCC	Decentralized Congestion Control
DE	Data Element
DF	Data Frame
DMC	Decentralized Mitigation Control
FA-SAP	Facilities/Applications Service Access Point
FL-SDU	Facility-layer Service Data Unit
GN	GeoNetworking
HMI	Human Machine Interface
I2V	Infrastructure-to-Vehicle
IMZ	Interference Management Zone
IMZM	Interference Management Zone Message
ISO	International Organization for Standardization
ITS	Intelligent Transport Systems
ITS-S	ITS Station
LDM	Local Dynamic Map
LTE	Long Term Evolution
MF-SAP	Management/Facilities Service Access Point DDFVIFW
MIB	Management Information Base
MSB	Most Significant Bit standards iteh.ai)
N&T	Networking & Transport layer
NF-SAP	Networking & Transport/Facilities Service Access Point
OSI	Open System Interconnection 103 724 V2.1.1 (2021-08)
PCI	Protocol Control Information alog/standards/sist/3d682tc1-2a9c-4a86-bb2d-
PDU	Packet Data Unit 9aa594e48cc/etsi-ts-103-724-v2-1-1-2021-08
PER	Packed Encoding Rules
POTI	Position and Time management
SAE	Society of Automotive Engineers
SAP	Service Access Point
SF-SAP	Security Facilities - Service Access Point
SHB	Single-Hop Broadcasting
SSP	Service Specific Permissions
UPER	Unaligned Packed Encoding Rules
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-everything

4 Introduction to Interference Management Zone (IMZ) basic service

4.1 Background

Cooperative ITS systems operate in license exempt frequency bands (e.g. 5 855 MHz to 5 925 MHz ETSI EN 302 571 [i.15], 63,72 GHz to 65,88 GHz) and have to share at least part of the spectrum with other co-primary services (for example, Urban Rail systems in the band 5 915 MHz to 5 925 MHz (see ETSI TR 103 580 [i.1]), 5 875 MHz to 5 925 MHz with Fixed Satellite Services (FSS) uplink). The interference impact can be two-fold: from ITS stations to co-primary services or from co-primary service to ITS-S. In the first case, a mitigation action can be required from the ITS-S to protect the co-primary service from being harmed (see next paragraph in clause 4.1). In the second case, the action may be expected from the ITS-S to protect itself or to inform the driver that the ITS-S is subject to an interference zone. In the present document, both types of zones are called interference management zones.

In order to be able to identify geographically limited areas where sharing is required, this geographical information needs to be communicated in a secure manner by a trusted entity using known certificates to the ITS stations intending to operate in these shared bands. Depending on the regulatory status of the services and applications to share with, actions can be taken by ITS stations to mitigate the impact of interference. These actions could be one or a combination of the following:

- Duty Cycle restrictions.
- Power restrictions.
- Switch off or receive only operation: ANDARD PREVIEW
- Increase transmitter idle time to reduce the channel load (e.g. through DCC Toff limit).
- Change of radio channel / radio band change, e.g. 5,9 GHz to 60 GHz.
- Awareness message to the user (human or machine) providing a clear information that in a given area there might be an issue (no specific mitigation action is required from the ITS-S in this case).

Similar operations can be envisaged for the protection of adjacent band (e.g. CEN DSRC tolling applications in the band 5 795 MHz to 5 815 MHz, see ETSI TS 102 792 [i.16]).

The Interference Management Zone service defined in the present document provides information about interference management zones where band sharing and coexistence are required. This is done through an Interference Management Zone Message (IMZM) which is in addition or substitutive to the CAM from infrastructure devices (see ETSI TS 103 301 [i.27] than the focused information contained in an infrastructure CAM. The message can be transmitted by existing Roadside Equipment (RSE) or by specific RSE managed by either the operator of the system to be protected or by road operators. It could also be transmitted by Onboard Equipment (OBE) as long as it is authorized and in the trusted domain. This may happen, for example, on a train that sends out IMZM when needed, or in an emergency vehicle or portable device of enforcement personnel, which then gets the possibility to provide protection of emergency messages when needed. In summary, the present document proposes a global description of the message that can be used as a toolbox by the relevant organizations to customize the IMZM suited to the interference management and sharing regulation they want to enforce. Accordingly, mitigation requirements specific to identified use cases are out of scope of the present document.

A specific interference management zone is defined locally around a well-defined position and is only valid for a limited time duration. Both depend on the type of interference management zone:

- Geographical extension: the interference management zone should only be taken into account as long as the ITS-S is travelling within the defined zones.
- Time validity of an interference management zone message: the validity can be from a few seconds to unlimited. For example, in the case of a warning to the user such as for interference in the vicinity of satellite stations, the zone is quasi static and always present. But this is only a warning, so no mitigation measures are necessary from the ITS-S, which is reflected in the specifications of the present document (see clause 7).

An RSE or relevant OBE can also send out an IMZM information related to other zones in the area which are not directly linked to its own position. This is similar to the protected zone information specified in the Cooperative Awareness Message (CAM, see ETSI EN 302 637-2 [5]), where there can be up to 16 areas in a single message.

A receiving ITS-S (vehicle or personal ITS-S) should be able to store the information of about up to 32 interference management zones in its memory.

Certification and trust domains: Since an IMZM can limit the performance of the ITS system or even prevent its operation, the operations linked to the IMZM should be authenticated by certificates as specified in ETSI TS 103 097 [4]. The message should be generated by infrastructure operators, using the same policies as other C-ITS messages, e.g. the CAM (see ETSI EN 302 637-2 [5]). The IMZM transmission shall be part of the overall ITS trust domain. The message generation entity can also be part of the potential victims' trust domain, whether this is implemented as a manual or automated integration. In the case of Urban Rail, the information about the needed IMZ would come from the Urban Rail trust domain as encrypted information and be sent out to the ITS-S in the surrounding area using a valid ITS certificate complying with ETSI TS 103 097 [4].

NOTE: Spectrum regulatory matters are out of scope of the present document. The spectrum regulators are to define the zones when the band sharing mechanisms are relevant from the regulatory point of view. For other zones (like potential interference from satellite uplink), the road operators have to define potential warning zones.

4.2 Services provided by IMZ basic service

The IMZ basic service is a Facilities layer entity that operates the IMZM protocol. It provides different services:

- reception of trigger from the application to start the IMZM transmission;
- reception of interference management zone information from the management entity and encoding of that information;
- sending of IMZMs; <u>ETSI TS 103 724 V2.1.1 (2021-08)</u>
- https://standards.iteh.ai/catalog/standards/sist/3d682fc1-2a9c-4a86-bb2d-
- receiving of IMZMs; and 19aa594e48cc/etsi-ts-103-724-v2-1-1-2021-08
- provision of the decoded information to the relevant entities in the ITS-S, depending on the action to be taken.

The IMZ basic service uses the services provided by the protocol entities of the ITS networking & transport layer to disseminate the IMZM.

4.3 Sending IMZM

Sending of IMZM consists of two activities: generation of IMZMs and transmission of IMZMs.

In IMZM generation, the originating ITS-S shall compose the IMZM, which is then delivered to the ITS networking & transport layer for dissemination.

The IMZM shall be transmitted over one or more communication media using one or more transport and networking protocols.

Security measures such as authentication shall be applied to the IMZM during the transmission process in coordination with the security entity.

4.4 Receiving IMZM

Upon receiving an IMZM, the IMZ basic service shall make the content of the IMZM available to the ITS applications via the MIB of the Management entity and to other facilities within the receiving ITS-S, such as the Local Dynamic Map (LDM) (see specification of the interface in clause 5.3.1). It shall apply all necessary security measures such as relevance or message integrity check in coordination with the security entity.