



**Intelligent Transport Systems (ITS);
Vehicular Communications;
Basic Set of Applications;
Part 3: Specifications of Decentralized
Environmental Notification Basic Service**

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Foreword

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

The present document is part 3 of a multi-part deliverable covering Vehicular Communications; Basic Set of Applications, as identified below:

TS 102 637-1: "Functional Requirements";

EN 302 637-2: "Specification of Cooperative Awareness Basic Service";

EN 302 637-3: "Specifications of Decentralized Environmental Notification Basic Service".

The specification of the Decentralized Environmental Notification (DEN) basic service was initially developed in the European Car-to-Car Communication Consortium (C2C-CC) Manifesto [i.2] and in C2C-CC Message description: Decentralized Environmental Notification Message [i.3]. The service was evaluated by several initiatives, such as the C2C-CC demonstration in 2008, by ETSI Plugtest events and European projects including PRE-DRIVE C2X, DRIVE C2X, SafeSpot, CVIS, CoVeL, SCORE@F, simTD, etc. These evaluation efforts have provided feedback to ETSI TC ITS.

The present document replaces ETSI TS 102 637-3 [i.16] in whole. It includes improvements and enhancements of the DEN basic service specifications in ETSI TS 102 637-3 [i.16] according to the feedback provided by the various initiatives.

Proposed national transposition dates

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**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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Introduction

ITS use cases are distributed over multiple instances of ITS stations (ITS-S). ITS-Ss interact in the ITS networks to provide a large diversity of co-operating customer services that satisfy different types of functional and operational requirements.

ETSI TC ITS has defined a "Basic Set of Applications" (BSA) in ETSI TR 102 638 [1.1] that can be deployed within a three-year time frame after the completion of their standardization. In BSA, the Road Hazard Warning (RHW) application is composed of multiple use cases with the objective to improve road safety and traffic efficiency using vehicle-to-vehicle and vehicle-to-infrastructure communication technologies. ETSI TC ITS defines the decentralized environmental notification (DEN) basic service that supports the RHW application.

The DEN basic service is an application support facility provided by the facilities layer. It constructs, manages and processes the Decentralized Environmental Notification Message (DENM). The construction of a DENM is triggered by an ITS-S application. A DENM contains information related to a road hazard or an abnormal traffic conditions, such as its type and its position. The DEN basic service delivers the DENM as payload to the ITS networking & transport layer for the message dissemination. Typically for an ITS application, a DENM is disseminated to ITS-Ss that are located in a geographic area through direct vehicle-to-vehicle or vehicle-to-infrastructure communications. At the receiving side, the DEN basic service of an receiving ITS-S processes the received DENM and provides the DENM content to an ITS-S application. This ITS-S application may present the information to the driver if information of the road hazard or traffic condition is assessed to be relevant to the driver. The driver is then able to take appropriate actions to react to the situation accordingly.

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1 Scope

The present document provides specification of the DEN basic service, which is in support of the RHW application.

More specifically, the present document specifies the syntax and semantics of the "Decentralized Environmental Notification Message" (DENM) and the DENM protocol handling.

The DEN basic service may be implemented in an vehicle ITS-S, a road side ITS-S, a personal ITS-S or a central ITS-S.

2 References

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

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

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

2.1 Normative references

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

- [1] SAE J2735 (2009-11-19): "Dedicated Short Range Communications (DSRC) Message Set Dictionary".

NOTE: Available at: http://standards.sae.org/j2735_200911/.

- [2] ETSI EN 302 665 (V1.1.1): "Intelligent Transport Systems (ITS); Communications Architecture".
- [3] ETSI TS 102 636-3 (V1.1.1): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network Architecture".
- [4] ETSI EN 302 931 (V1.1.1): "Intelligent Transport Systems (ITS); Vehicular Communications; Geographical Area Definition".
- [5] ETSI TS 102 894-2 (V1.2.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary".
- [6] Recommendation ITU-T X.691/ISO/IEC 8825-2 (1997-12): "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".
- [7] ETSI EN 302 637-2 (V1.3.1): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service".

2.2 Informative references

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

- [i.1] ETSI TR 102 638 (V1.1.1): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions".

- [i.2] Car2Car Communication Consortium (2007-08): "Car2Car Communication Consortium Manifesto", Version 1.1.

NOTE: Available at <http://www.car-2-car.org>.

- [i.3] Car2Car Communication Consortium: "Message description: Decentralized Environmental Notification Message", Version 1.0.
- [i.4] ETSI TS 101 539-1: "Intelligent Transport Systems (ITS); V2X Applications; Part 1: Road Hazard Signalling (RHS) application requirements specification".
- [i.5] ETSI TS 101 539-2: "Intelligent Transport System (ITS); V2X Applications; Intersection Collision Risk Warning (ICRW) application requirements specification".
- [i.6] ETSI TS 101 539-3: "Intelligent Transport Systems (ITS); V2X Applications; Part 3: Longitudinal Collision Risk Warning (LCRW) application requirements specification".
- [i.7] ETSI EN 302 895: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM)".
- [i.8] 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-to-multipoint communications; Sub-part 1: Media-Independent Functionality".
- [i.9] ETSI EN 302 636-5-1: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol".
- [i.10] TISA specification TAWG11071 (2011-11-07, drafted to potentially become ISO/TS 21219 Part 15): "Intelligent Transport Systems (ITS) - Traffic and Travel Information (TTI) via Transport Protocol Experts Group, Generation 2 (TPEG2) - Part 15: Traffic Event Compact (TPEG2-TEC-3.1/001)".
- [i.11] ISO EN 17419: "Intelligent Transport Systems - Cooperative Systems - Classification and management of ITS applications in a global context".
- [i.12] ETSI TS 102 723-5: "Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 5: Interface between management entity and facilities layer".
- [i.13] ETSI TS 102 723-9: "Intelligent Transport Systems; OSI cross-layer topics; Part 9: Interface between security entity and facilities layer".
- [i.14] 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.15] ISO 3779 (2011-07): "Road vehicles - Vehicle identification number (VIN) Content and structure".
- [i.16] ETSI TS 102 637-3: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".
- [i.17] ETSI TS 103 097 (V1.1.1): "Intelligent Transport Systems (ITS); Security; Security header and certificate formats".
- [i.18] ETSI TR 102 965 (V1.1.1): "Intelligent Transport Systems (ITS); Application object identifier (ITS-AID); Registration list".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in SAE J2735 [1], ETSI EN 302 665 [2], ETSI EN 302 895 [i.7] and the following apply:

actionID: identifier of an detected event

à la carte container: container of DENM that includes information of the detected event in addition to management container, situation container and location container

NOTE: Due to coding constraints in programming language, the term "alacarte" is also used.

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

NOTE: The BSA is defined in ETSI TR 102 638 [i.1].

cancellation Decentralized Environmental Notification Message (DENM): DEN message type generated by the ITS-S, which originated the new DENM, indicating the event termination

Decentralized Environmental Notification (DEN) basic service: facility at the facilities layer to support ITS-S applications, DENM management and DENM dissemination

Decentralized Environmental Notification Message (DENM): ITS facilities layer PDU providing event information

Decentralized Environmental Notification Message (DENM) protocol: ITS facilities layer protocol that operates the DENM transmission, forwarding and reception

destination area: geographical area for DENM dissemination

NOTE: The destination area is specified in ETSI EN 302 931 [4].

downstream traffic: direction from the event position towards the departing traffic on the same carriageway

event: road hazard, driving environment, or traffic condition

facility: functionality, service or data provided by the ITS facilities layer

forwarding Intelligent Transport System Station (ITS-S): ITS-S that forwards DENMs and implements the DENM protocol

location container: container of DENM that includes location data of the detected event

management container: container of DENM that includes management data for DENM protocol

negation Decentralized Environmental Notification Message (DENM): DEN message type generated by an ITS-S other than the ITS-S, which originated the new DENM, indicating the event termination

new Decentralized Environmental Notification Message (DENM): DEN message type indicating that the event is detected for the first time

originating Intelligent Transport System Station (ITS-S): ITS-S that generates DENMs and implements the DENM protocol

receiving Intelligent Transport System Station (ITS-S): ITS-S that receives DENMs from the ITS networking & transport layer and implements the DENM protocol

relevance area: geographic area in which information concerning the event is identified as relevant for use or for further distribution

situation container: container of DENM that includes data related to the detected event

update Decentralized Environmental Notification Message (DENM): DEN message type indicating the evolution of the event

upstream traffic: direction from the event position towards the approaching traffic on the same carriageway

3.2 Symbols

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

actionID	Identifier of an event that is detected by an ITS-S
appDENM_trigger	Application request type to generate a new DENM for a newly detected event
appDENM_update	Application request type to generate an update DENM for an update of the event
appDENM_termination	Application request type to generate a cancellation or negation DENM for termination of the event
detectionTime	Timestamp at which an event or event update/termination is detected
IF.DEN1	Interface between the DEN basic service and ITS-S applications for DENM transmission
IF.DEN2	Interface between the DEN basic service and ITS-S applications for DENM reception
IF.Mng	Interface between the DEN basic service and the ITS management entity
IF.N&T	Interface between the DEN basic service and the ITS networking & transport layer
IF.SEC	Interface between the DEN basic service and the ITS security entity
referenceTime	Timestamp at which a new, update or cancellation DENM is generated by the DEN basic service

NOTE: A negation DENM contains the *referenceTime* of the DENM that is negated.

repetitionDuration	Duration of the DENM repetition
repetitionInterval	Time interval of the DENM repetition
stationID	Identifier of an ITS-S
T_F_VValidity	Timer that indicates the end of the DENM processing of one specific actionID of the forwarding ITS-S
T_Forwarding	Timer for the scheduling of the DENM forwarding by the forwarding ITS-S
T_O_VValidity	Timer that indicates the end of the DENM processing of one specific actionID of the originating ITS-S
T_R_VValidity	Timer that indicates the end of the DENM processing of one specific actionID of the receiving ITS-S
T_Repetition	Timer for the scheduling of the DENM repetition by the originating ITS-S
T_RepetitionDuration	Timer that indicates the end of the DENM repetition
termination	Parameter that indicates the termination of an event
transmissionInterval	Time interval for DENM transmission
validityDuration	Duration of the DENM validity

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 302 665 [2] and the following apply:

ABS	Anti-lock Braking System
AEB	Automatic Emergency Braking
API	Application Programming Interface
ASN.1	Abstract Syntax Notation One
BSA	Basic Set of Applications
BTP	Basic Transport Protocol
C2C-CC	Car to Car Communication Consortium
CA	Cooperative Awareness
DE	Data Element
DEN	Decentralized Environmental Notification
DENM	Decentralized Environmental Notification Message
DF	Data Frame
DSRC	Dedicated Short Range Communications
EEBL	Electronic Emergency Break Light
ESP	Electronic Stability Program
FA-SAP	Facilities-Application Service Access Point
GN	GeoNetworking
HMI	Human Machine Interface

ISO	International Standardization Organization
ITS	Intelligent Transport System
ITS-AID	ITS-Application IDentifier
ITS-S	ITS Station
KAF	Keep Alive Forwarding
LDM	Local Dynamic Map
LSB	Least Significant Bit
MF-SAP	Management Facilities Service Access Point
MSB	Most Significant Bit
NF-SAP	Network Facilities Service Access Point
OSI	Open System Interconnection
PCI	Protocol Control Information
PDU	Protocol Data Unit
PER	Packed Encoding Rules
RHW	Road Hazard Warning
SAE	Society of Automotive Engineers
SF-SAP	Security Facilities Service Access Point
SSP	Service Specific Permissions
TEC	Traffic Event Compact
TISA	Traveller Information Services Association
TPEG™	Transport Protocol Experts Group
TS	Technical Specification
TTI	Traffic and Travel Information
VDS	Vehicle Descriptor Section
WMI	World Manufacturer Identifier

4 DEN basic service introduction

4.1 Background

Decentralized Environmental Notification Message (DENM) is a facilities layer message that is mainly used by ITS applications in order to alert road users of a detected event using ITS communication technologies. DENM is used to describe a variety of events that can be detected by ITS stations (ITS-S). A set of ITS applications are specified in ETSI TS 101 539-1 [i.4], ETSI TS 101 539-2 [i.5], and ETSI TS 101 539-3 [i.6], which includes multiple ITS use cases.

The exchange of DENM among ITS-Ss is operated by DENM protocol.

The general processing procedure of an ITS use case that is supported by the DENM protocol is as follows:

- Upon detection of an event, an ITS-S transmits a DENM in order to disseminate the information about this event to other ITS-Ss located inside an area of relevance. The ITS-S that transmits DENM is denoted as originating ITS-S.
- DENM transmission is initiated and terminated by an ITS-S application at the ITS application layer. Examples are provided in ETSI TS 101 539-1 [i.4], ETSI TS 101 539-2 [i.5] and ETSI TS 101 539-3 [i.6].
- The transmission of a DENM may be repeated.
- DENM transmission may persist as long as the event is present.
- An ITS-S may forward a DENM. This ITS-S is denoted as forwarding ITS-S.
- The termination of DENM transmission is either automatically achieved by the facilities layer, i.e. the DEN basic service of the originating ITS-S when a predefined expiry time is reached, or by an ITS-S application that requests the generation of a DENM to inform that the event has terminated.
- An ITS-S, which receives a DENM, processes the information and may decide to present an appropriate warning or information to user, as long as the information in the received DENM is relevant to the ITS-S. This ITS-S is denoted as receiving ITS-S.