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Intelligent Transport Systems (ITS);
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Part 2: Test Suite Structure and Test Purposes (TSS&TP)

Reference

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Foreword

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

The present document is part 2 of a multi-part deliverable covering Conformance test specification for Decentralized Environmental Notification Messages (DENM) as identified below:

Part 1: "Test requirements and Protocol Implementation Conformance Statement (PICS) proforma";

Part 2: "Test Suite Structure and Test Purposes (TSS&TP)";

Part 3: "Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

1 Scope

The present document provides the Test Suite Structure and Test Purposes (TSS&TP) for Decentralized Environmental Notification Messages (DENM) as defined in TS 102 637-3 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [6].

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [3] and ISO/IEC 9646-2 [4]) as well as the ETSI rules for conformance testing (ETS 300 406 [7]) are used as a basis for the test methodology.

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.

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2.1 Normative references

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

[1] ETSI EN 302 637-3 (V1.2.0): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".

[2] ETSI TS 102 869-1 (V1.2.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specification for Decentralized Environmental Notification Messages (DENM); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma".

[3] ISO/IEC 9646-1 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 1: General concepts".

[4] ISO/IEC 9646-2 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 2: Abstract Test Suite specification".

[5] ISO/IEC 9646-6 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 6: Protocol profile test specification".

[6] ISO/IEC 9646-7 (1995): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".

[7] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

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 EG 202 798: "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 102 637-3 [1], ISO/IEC 9646-6 [5] and ISO/IEC 9646-7 [6] apply.

3.2 Abbreviations

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

BV	Valid Behaviour
CAN	Controller Area Network
CLT	Current Local Time
DE	Data Element
DEN	Decentralized Environmental Notification
DENM	Decentralized Environmental Notification Message
EVGN	Event Generation
ITS	Intelligent Transportation Systems
ITS-S	Intelligent Transport System - Station
IUT	Implementation Under Test
MSGF	Message Format
PDU	Protocol Data Unit
TP	Test Purposes
TSS	Test Suite Structure

4 Test Suite Structure (TSS)

4.1 Structure for DEN tests

Table 1 shows the DEN Test Suite Structure (TSS) including its subgroups defined for conformance testing.

Table 1: TSS for DEN

Root	Group	category
DEN	Message transmission	Valid behaviour
	--- Message format	Valid behaviour
	--- Event Generation	Valid behaviour
	--- Event Update	Valid behaviour
	--- Event Termination	Valid behaviour
	--- Message Repetition	Valid behaviour
	Message reception	Valid behaviour
	Keep-alive Forwarding	Valid behaviour

The test suite is structured as a tree with the root defined as DEN. The tree is of rank 2 with the first rank a Group, the second a category. The second rank is the standard ISO conformance test categories.

4.2 Test groups

The test suite has a total of three levels. The first level is the root. The second level separates the root into various functional areas. The third level is the standard ISO conformance test categories.

4.2.1 Root

The root identify the Decentralized environmental Notification Messages (DENM) given in TS 102 637-3 [1].

4.2.2 Groups

This level contains three functional areas identified as:

- Message transmission
- Message format
- Event Generation
- Event Update
- Event Termination
- Message Repetition
- Message reception
- Keep-alive Forwarding

4.2.3 Categories

This level contains the standard ISO conformance test categories limited to the valid behaviour.

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP definition conventions

The TP definition is built according to EG 202 798 [i.1].

5.1.2 TP Identifier naming conventions

The identifier of the TP is built according to table 2.

Table 2: TP naming convention

Identifier:	TP/<root>/<gr>/<x>/<nn>		
	<root> = root	DEN	
	<gr> = group	MSGF	Message transmission - Message format
		EVGN	Message transmission - Event Generation
		EVUP	Message transmission - Event Update
		EVTR	Message transmission - Event Termination
		EVRP	Message transmission - Message Repetition
		MSRV	Message reception
		KAFW	Keep-alive Forwarding
	<x> = type of testing	BV	Valid Behaviour tests
	<nn> = sequential number		01 to 99

5.1.3 Rules for the behaviour description

The description of the TP is built according to EG 202 798 [i.1].

The base standards are not using finite state machine concept. As consequence, the test purposes use a generic "Initial State" that corresponds to a state where the IUT is ready for starting the test execution. Furthermore, the IUT shall be left in this "Initial State", when the test is completed.

Being in the "Initial State", no pending actions, which could disturb the execution of following test purposes, are left in the IUT.

5.1.4 Sources of TP definitions

All TPs are specified according to EN 302 637-3 [1].

5.1.5 Mnemonics for PICS reference

To avoid an update of all TPs when the PICS document is changed, the following table introduce mnemonics name and the correspondence with the real PICS item number

Table 3: Mnemonics for PICS reference

Mnemonic	PICS item
PICS_KAF	A.2/5 [**Error! Reference source not found.**].

5.2 Test purposes for DEN

5.2.1 Message Transmission

5.2.1.1 Message Format

TP Id	TP/DEN/ MSGF/BV-01
Test objective	Check that protocolVersion is set to 1 and messageID is set to 1
Reference	EN 302 637-3 [1], clause B.1
PICS Selection	
Initial conditions	

with {
    the IUT being in the "initial state"
}	

Expected behaviour	

ensure that {
    when {
        the IUT receives an AppDENM_Trigger request from the application layer
    }
    then {
        the IUT sends a valid DENM
            containing ITS PDU header
                containing protocolVersion
                    indicating value 1
                and containing messageID
                    indicating value 1
}	

TP Id	TP/DEN/ MSGF/BV-02
Test objective	Check that sent DENM contains at least one 'trace' DE
Reference	EN 302 637-3 [1], clause 6.1.3.2
PICS Selection	
Initial conditions	

with {
the IUT being in the "initial state"
}	

Expected behaviour	

ensure that {
when {
the IUT receives an AppDENM_Trigger request from the application layer
}
then {
the IUT sends a valid DENM
containing location container
containing at least one 'trace'
}	

5.2.1.2 Event Generation

TP Id	TP/DEN/EVGN/BV-01
Test objective	Check that DEN Basic Service generates a new DENM on reception of a valid AppDENM_Trigger request
Reference	EN 302 637-3 [1], clause 6.1.2.1
PICS Selection	
Initial conditions	

with {
the IUT being in the "initial state"
}	

Expected behaviour	

ensure that {
when {
the IUT receives an AppDENM_Trigger request from the application layer
}
then {
the IUT sends a valid DENM
}
}	

TP Id	TP/DEN/EVGN/BV-02
Test objective	Check that a new ActionID value is assigned for each generated DENM
Reference	EN 302 637-3 [1], clause 6.1.1
PICS Selection	
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT having generated several events
}	

Expected behaviour	

ensure that {
when {
the IUT is requested to generate a new event
}
then {
the IUT sends a valid DENM
containing management container
containing actionID
indicating an unused value
}
}	

TP Id	TP/DEN/EVGN/BV-03
Test objective	Check that newly created ActionID contains the originator ITS-S ID
Reference	EN 302 637-3 [1], clause 6.1.1
PICS Selection	
Initial conditions	

with {
the IUT being in the "initial state"
}	

Expected behaviour	

ensure that {
when {
the IUT is requested to generate a new event
}
then {
the IUT sends a valid DENM
containing management container
containing actionID
containing originatorStationID
indicating its own StationID
}
}	

TP Id	TP/DEN/EVGN/BV-04
Test objective	Check that Cause and subcause values included in DENM as provided by application
Reference	EN 302 637-3 [1], clause 7.1.3
PICS Selection	
Initial conditions	

with {
the IUT being in the "initial state"
}	

Expected behaviour	

ensure that {
when {
the IUT receives an AppDENM_trigger request from the application layer
containing situation container
containing eventType
containing causeCode
indicating Value1
containing subCauseCode
indicating Value2
}
then {
the IUT sends a valid DENM
containing situation container
containing eventType
containing causeCode
indicating Value1
containing subCauseCode
indicating Value2
}
}	

TP Id	TP/DEN/EVGN/BV-05
Test objective	Check that referenceTime is set to the current time when generating a DENM for a new event
Reference	EN 302 637-3 [1], clause 8.1.1.2
PICS Selection	

Initial conditions

```
with {
    the IUT being in the "initial state"
    and the IUT having generated several events
}
```

Expected behaviour

```
ensure that {
    when {
        the IUT is requested to generate a new event
    }
    then {
        the IUT sends a valid DENM
            containing management container
                containing referenceTime                indicating CLT
    }
}
```

TP Id	TP/DEN/EVGN/BV-06
Test objective	Check that on startup, sequenceNumber is initialized with latest used value
Reference	EN 302 637-3 [1], clause 8.1.1.1
PICS Selection	

Initial conditions

```
with {
    the IUT being in the "initial state"
    and the IUT having generated several events
    and the IUT having generated its last DENM
        containing management container
            containing actionID
                containing sequenceNumber
                    indicating SEQ1
    and the IUT having been restarted
}
```

Expected behaviour

```
ensure that {
    when {
        the IUT is requested to generate a new event
    }
    then {
        the IUT sends a valid DENM
            containing management container
                containing actionID
                    containing sequenceNumber
                        indicating SEQ1 + 1
    }
}
```