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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 Systems (ITS).

The present document is part 2 of a multi-part deliverable covering Conformance test specifications for Decentralized Environmental Notification Basic Service (DEN) as identified below:

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

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

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

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 provides the Test Suite Structure and Test Purposes (TSS & TP) for Decentralized Environmental Notification Basic Service (DEN) as defined in ETSI EN 302 637-3 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [i.5].

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [i.2] and ISO/IEC 9646-2 [i.3]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [i.6]) are used as a basis for the test methodology.

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 https://docbox.etsi.org/Reference/.

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

[1] ETSI EN 302 637-3 (V1.3.1): "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 (V1.6.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Decentralized Environmental Notification Basic Service (DEN); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

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.

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 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 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

[i.2] ISO/IEC 9646-1 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 1: General concepts".

[i.3] ISO/IEC 9646-2 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 2: Abstract Test Suite specification".

[i.4] ISO/IEC 9646-6 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 6: Protocol profile test specification".

[i.5] ISO/IEC 9646-7 (1995): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".

[i.6] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 302 637-3 [1], ISO/IEC 9646-6 [i.4] and ISO/IEC 9646-7 [i.5] apply.

3.2 Symbols

Void.

3.3 Abbreviations

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

ATS	Abstract Test Suite
BO	Exceptional Behaviour tests
BTP	Basic Transport Protocol
BTP-B	Basic Transport Protocol type B
BV	valid test events for Behaviour tests
CAN	Controller Area Network
CLT	Current Local Time
DE	Data Element
DEN	Decentralized Environmental Notification
DENM	Decentralized Environmental Notification Message
GBC	Geographically-Scoped Broadcast
ISO	International Organization for Standardization
ITS	Intelligent Transportation Systems
ITS-AID	ITS Application Identifier
ITS-S	Intelligent Transport System - Station
IUT	Implementation Under Test
KAFW	Keep-Alive ForWarding
MSGF	Message Format
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
SSP	Service Specific Permissions
TI	Timer tests
TP	Test Purposes
TS	Test Suite
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 format	Valid
	Event Generation	Valid
	Event Update	Valid and Inopportune
	Event Termination	Valid, Inopportune and Timer
	Message Repetition	Valid
	Lower-layer parameters	Valid
	Message reception	Valid and Inopportune
	Keep-Alive Forwarding	Valid and Timers

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 functional area and the second rank is the standard ISO conformance test categories.

4.2 Test groups

4.2.1 Introduction

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.

4.2.2 Root

The root identifies the Decentralized Environmental Notification Basic Service (DEN) given in ETSI EN 302 637-3 [1].

4.2.3 Groups

This level contains height functional areas identified as:

- Message format.
- Event Generation.
- Event Update.
- Event Termination.
- Message Repetition.
- Lower-layer parameters.
- Message reception.
- Keep-alive Forwarding.

4.2.4 Categories

This level contains the standard ISO conformance test categories behaviour: valid events and inopportune events and Timer.

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP definition conventions

The TP definition is built according to ETSI 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> or TP/<root>/<gr>/<x>/<nn>-<v>**		
	<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
		PAR	Message transmission - Lower-layer parameters
		MSRV	Message reception
		KAFW	Keep-alive Forwarding
		SSP	Service Specific Permissions
	<x> = type of testing	BV	Behaviour: Valid event tests
		BO	Behaviour: Inopportune event tests
		TI	Timer tests
	<nn> = sequential number		01 to 99
	<v> = variant		01 to 99

5.1.3 Rules for the behaviour description

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

ETSI EN 302 637-3 [1] does not use the 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" refers to the starting point of the initial device configuration. There are no pending actions, no instantiated buffers or variables, which could disturb the execution of a test.

5.1.4 Sources of TP definitions

All TPs have been specified according to ETSI 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, table 3 introduce mnemonics name and the correspondence with the real PICS item number.

The PICS item column refers to tables and items of ETSI TS 102 869-1 [2]. The 'PICS item' as defined in ETSI TS 102 869-1 [2] shall be used to determine the test applicability.

Table 3: Mnemonics for PICS reference

Mnemonic	PICS item
PICS_DENM_GENERATION	A.2/1
PICS_DENM_UPDATE	A.2/2
PICS_DENM_REPETITION	A.2/3
PICS_DENM_CANCELLATION	A.2/4
PICS_DENM_NEGATION	A.2/5
PICS_DENM_RECEPTION	A.1/2
PICS_DENM_KAF	A.2/7
PICS_IMPACT_REDUCTION	A.2.8
PICS_IS_IUT_SECURED	A.3/1

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 2 and messageID is set to 1
Reference	ETSI EN 302 637-3 [1], clause B.1
PICS Selection	PICS_DENM_GENERATION
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 2
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	ETSI EN 302 637-3 [1], clause 6.1.3.2
PICS Selection	PICS_DENM_GENERATION
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	ETSI EN 302 637-3 [1], clause 6.1.2.1
PICS Selection	PICS_DENM_GENERATION
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 newly generated DENM
Reference	ETSI EN 302 637-3 [1], clause 6.1.1.1
PICS Selection	PICS_DENM_GENERATION
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 a newly created ActionID contains the StationID of the originating ITS-S that detected the event
Reference	ETSI EN 302 637-3 [1], clause 6.1.1.1
PICS Selection	PICS_DENM_GENERATION

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 originatingStationID
                        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	ETSI EN 302 637-3 [1], clauses 7.1.4 and B.17
PICS Selection	PICS_DENM_GENERATION

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	ETSI EN 302 637-3 [1], clause 8.2.1.3
PICS Selection	PICS_DENM_GENERATION
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-07
Test objective	Check that sequenceNumber is set to a next unused value each time an event is detected
Reference	ETSI EN 302 637-3 [1], clauses 6.1.1.1 and 8.2.1.2
PICS Selection	PICS_DENM_GENERATION
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 no active event being associated with sequenceNumber SEQ1 + 1
}	

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
}
}	