



TECHNICAL SPECIFICATION

**Intelligent Transport Systems (ITS);
Testing;
Conformance test specifications for
Decentralized Environmental Notification
Basic Service (DEN);
Part 2: Test Suite Structure and Test Purposes (TSS & TP)**

Reference

RTS/ITS-00173

Keywords

ITS, testing, TSS&TP

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Sous-Préfecture de Grasse (06) N° 7803/88

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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 <http://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 (V1.2.2): "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 (V1.5.1): "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 Definitions and abbreviations

3.1 Definitions

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

3.2 Abbreviations

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

| | |
|-------|--|
| ATS | Abstract Test Suite |
| 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-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 1 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 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 | 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, 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 } } | |

| | |
|---|--|
| TP Id | TP/DEN/EVGN/BV-08 |
| Test objective | Check that sequenceNumber is set to a next unused value each time an event is detected (Sequence number wrap around) |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.1.1 and 8.2.1.2 |
| PICS Selection | PICS_DENM_GENERATION |
| Initial conditions | |
| <pre> 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 an active event being associated with sequenceNumber SEQ1 + 1 and no active event being associated with sequenceNumber SEQ1 + 2 } </pre> | |
| Expected behaviour | |
| <pre> 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 + 2 } } </pre> | |

| | |
|---|---|
| TP Id | TP/DEN/EVGN/BV-10 |
| Test objective | Check that actionID are generated using newly assigned stationID when a pseudonym change occurs |
| Reference | ETSI EN 302 637-3 [1], clause 6.1.1.2 |
| PICS Selection | PICS_DENM_GENERATION |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having generated several events containing management container containing actionID containing originatingStationID indicating STATION_ID_1 and the IUT having changed its StationID } </pre> | |
| Expected behaviour | |
| <pre> 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 new StationID } } </pre> | |

5.2.1.3 Event Update

| | |
|---|--|
| TP Id | TP/DEN/EVUP/BV-01 |
| Test objective | Check that DEN Basic Service generates an update DENM on reception of a valid AppDENM_update request |
| Reference | ETSI EN 302 637-3 [1], clause 6.1.2.2 |
| PICS Selection | PICS_DENM_UPDATE |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having generated an event } | |
| Expected behaviour | |
| ensure that { when { the IUT receives an AppDENM_update request from the application layer } then { the IUT sends a valid DENM } } | |

| | |
|---|--|
| TP Id | TP/DEN/EVUP/BV-02 |
| Test objective | Check that the actionID is not changed by DENM update, as long as the stationID of the originating ITS-S remains unchanged |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.2.2 and 8.2.1.2 |
| PICS Selection | PICS_DENM_UPDATE |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having generated an event containing management container containing actionID indicating ACTION_ID1 and the IUT not having changed its stationID } | |
| Expected behaviour | |
| ensure that { when { the IUT receives an AppDENM_update request associated with ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 } } | |

| | |
|--|---|
| TP Id | TP/DEN/EVUP/BV-03 |
| Test objective | Check that referenceTime is set to the current time when generating a DENM for an updated event |
| Reference | ETSI EN 302 637-3 [1], clause 6.1.2.2 |
| PICS Selection | PICS_DENM_UPDATE |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having generated an event containing management container containing actionID indicating ACTION_ID1 containing referenceTime indicating REFERENCETIME1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT receives an AppDENM_update request associated with ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating CLT > REFERENCETIME1 } }</pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVUP/BO-04 |
| Test objective | Check that DEN Basic Service does not send any update DENM if actionID is not in originating ITS-S message table |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.1.2 |
| PICS Selection | PICS_DENM_UPDATE |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having generated an event and the IUT not having sent an event being associated with actionID ACTION_ID1 containing originatingStationID indicating its own stationID and containing sequenceNumber indicating SEQ1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT is requested to update an event associated to actionID ACTION_ID1 } then { the IUT does not send any DENM for this event } }</pre> | |

5.2.1.4 Event Termination

| | |
|--|--|
| TP Id | TP/DEN/EVTR/BV-01 |
| Test objective | Check that DEN Basic Service generates a cancellation DENM when application indicates the premature termination of an event for which it is the originator |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.2.4 and 8.2.1.3 |
| PICS Selection | PICS_DENM_CANCELLATION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having generated an event containing management container containing actionID indicating ACTION_ID1 and containing validityDuration indicating DURATION_1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives an <i>AppDENM_termination</i> request associated to ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing termination indicating value isCancellation } } | |

| | |
|--|--|
| TP Id | TP/DEN/EVTR/BV-02 |
| Test objective | Check that DEN Basic Service generates a negation DENM when application indicates the premature termination of an event for which it is not the originator |
| Reference | ETSI EN 302 637-3 [1], clause 6.1.2.4 |
| PICS Selection | PICS_DENM_NEGATION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having received an event containing management container containing actionID indicating ACTION_ID1 containing originatingStationID indicating stationID different from its own stationID } | |
| Expected behaviour | |
| ensure that { when { the IUT receives an <i>AppDENM_termination</i> request associated to ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing termination indicating value isNegation } } | |

| | |
|--|--|
| TP Id | TP/DEN/EVTR/BV-03 |
| Test objective | Check that referenceTime is set to the latest value received for this event in negation DENM |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.2.4 and 8.2.1.3 |
| PICS Selection | PICS_DENM_NEGATION |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received an event containing management container containing actionID indicating ACTION_ID1 containing originatingStationID indicating stationID different from its own stationID and containing referenceTime indicating REFERENCETIME1 and the IUT having received an event containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME2 > REFERENCETIME1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT receives an <i>AppDENM_termination</i> request associated to ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating value REFERENCETIME2 and containing termination indicating value isNegation } } </pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVTR/BV-04 |
| Test objective | Check that situation container, location container and a la carte container are not present in a cancellation DENM |
| Reference | ETSI EN 302 637-3 [1], clause 7.1.1 |
| PICS Selection | PICS_DENM_CANCELLATION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having generated an event containing management container containing actionID indicating ACTION_ID1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT receives an <i>AppDENM_termination</i> request associated to ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing termination indicating value isCancellation and not containing situation container and not containing location container and not containing a la carte container } }</pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVTR/BV-05 |
| Test objective | Check that situation container, location container and a la carte container are not present in a negation DENM |
| Reference | ETSI EN 302 637-3 [1], clause 7.1.1 |
| PICS Selection | PICS_DENM_NEGATION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an event containing management container containing actionID indicating ACTION_ID1 containing originatingStationID indicating stationID different from its own stationID }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT receives an <i>AppDENM_termination</i> request associated to ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing termination indicating value isNegation and not containing situation container and not containing location container and not containing a la carte container } }</pre> | |

| | |
|---|--|
| TP Id | TP/DEN/EVTR/BO-06 |
| Test objective | Check that DEN Basic Service does not send any termination DENM if actionID is not in originating ITS-S message table or receiving ITS-S message table (IUT stationID) |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.2 |
| PICS Selection | PICS_DENM_NEGATION OR PICS_DENM_CANCELLATION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having generated several events and the IUT not having sent event being associated with ACTION_ID1 containing originatingStationID indicating its own stationID and containing sequenceNumber indicating SEQ1 } | |
| Expected behaviour | |
| ensure that { when { the IUT is requested to terminate an event associated to ACTION_ID1 containing originatingStationID indicating its own stationID and containing sequenceNumber indicating SEQ1 } then { the IUT does not send any termination DENM for this event } } | |
| NOTE: Event associated to ACTION_ID1 cannot be present in receiving ITS-S message table as its stationID is IUT's stationID (see TP/DEN/EVTR/BV-07). | |

| | |
|---|--|
| TP Id | TP/DEN/EVTR/BO-07 |
| Test objective | Check that DEN Basic Service does not send any termination DENM if actionID is not in originating ITS-S message table or receiving ITS-S message table (non-IUT stationID) |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.2 |
| PICS Selection | PICS_DENM_NEGATION OR PICS_DENM_CANCELLATION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having received several events and the IUT not having received event being associated with ACTION_ID1 containing originatingStationID indicating STATION_ID1 different from its own stationID and containing sequenceNumber indicating SEQ1 } | |
| Expected behaviour | |
| ensure that { when { the IUT is requested to terminate an event associated to ACTION_ID1 containing originatingStationID indicating STATION_ID1 and containing sequenceNumber indicating SEQ1 } then { the IUT does not send any termination DENM for this event } } | |
| NOTE: Event associated to ACTION_ID1 cannot be present in originating ITS-S message table as its stationID is not IUT's stationID (see TP/DEN/EVTR/BV-06). | |

| | |
|--|---|
| TP Id | TP/DEN/EVTR/BV-08 |
| Test objective | Check that referenceTime is set to the current time when generating a cancellation DENM |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.1.3 |
| PICS Selection | PICS_DENM_CANCELLATION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having generated an event containing management container containing actionID indicating ACTION_ID1 and containing validityDuration indicating DURATION_1 and containing referenceTime indicating REFERENCETIME1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT receives an AppDENM_termination request associated to ACTION_ID1 from the application layer } then { the IUT sends a valid DENM containing management container containing actionID indicating ACTION_ID1 and containing termination indicating value isCancellation and containing referenceTime indicating CLT } }</pre> | |

5.2.1.5 Message Repetition

| | |
|---|--|
| TP Id | TP/DEN/EVRP/TI-01 |
| Test objective | Check that DEN Basic Service repeats DENM transmission according to repetitionInterval parameter provided by application |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.2.3, 8.2.2 and 5.4.1.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an AppDENM_trigger request from the application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT is alerted of expiration of the time associated with INTERVAL_1 } then { the IUT repeats the transmission of the valid DENM associated with ACTION_ID1 } }</pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVRP/BV-02 |
| Test objective | Check that the repeated DENM is always the most up-to-date message |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.2.3 and 8.2.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an AppDENM_trigger request from the application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1 and the IUT having generated an update of the event associated with ACTION_ID1 modifying partly the event }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT is alerted of expiration of the time associated with INTERVAL_1 } then { the IUT repeats the transmission of the most up-to-date valid DENM associated with ACTION_ID1 } }</pre> | |

| | |
|---|--|
| TP Id | TP/DEN/EVRP/BV-03 |
| Test objective | Check that DEN Basic Service stops retransmitting DENM after event's validityDuration expiration |
| Reference | ETSI EN 302 637-3 [1], clauses 6.1.2.4 and 8.2.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an AppDENM_trigger request from application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1 and containing validityDuration indicating DURATION_2 and the IUT having repeated (one or more times) the transmission of the valid DENM associated with ACTION_ID1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT is alerted of expiration of the time associated with DURATION_2 } then { the IUT stops the retransmission of the DENM associated with ACTION_ID1 } }</pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVRP/BV-04 |
| Test objective | Check that DEN Basic Service stops retransmitting DENM after event's repetitionDuration expiration |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1 and containing validityDuration indicating DURATION_2 and the IUT having repeated (one or more times) the transmission of the valid DENM associated with ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT is alerted of expiration of the time associated with DURATION_1 } then { the IUT stops the retransmission of the DENM associated with ACTION_ID1 } } </pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVRP/BV-05 |
| Test objective | Check that DEN Basic Service does not repeat transmission of DENM if repetitionInterval is not provided by application |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.1.5 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer not containing repetitionInterval and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT has detected that repetitionInterval is not provided for the event associated with ACTION_ID1 } then { the IUT does not repeat the transmission of the valid DENM associated with ACTION_ID1 } } </pre> | |

| | |
|--|--|
| TP Id | TP/DEN/EVRP/BV-06 |
| Test objective | Check that DEN Basic Service does not repeat transmission of DENM if repetitionDuration is not provided by application |
| Reference | ETSI EN 302 637-3 [1], clause 8.1.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer not containing repetitionDuration and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT has detected that repetitionDuration is not provided for the event associated with ACTION_ID1 } then { the IUT does not repeat the transmission of the valid DENM associated with ACTION_ID1 } }</pre> | |

| | |
|---|--|
| TP Id | TP/DEN/EVRP/BV-08 |
| Test objective | Check that existing actionID in originating ITS-S are updated when stationID is modified |
| Reference | ETSI EN 302 637-3 [1], clause 6.1.1.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID containing originatingStationID indicating STATION_ID_1 and containing validityDuration indicating DURATION_1 and the IUT having changed its StationID }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT changes its StationID and is alerted of expiration of the time associated with INTERVAL_1 } then { the IUT repeats the transmission of the valid DENM containing management container containing actionID containing originatingStationID indicating its new StationID } }</pre> | |

| | |
|--|---|
| TP Id | TP/DEN/EVRP/BV-09 |
| Test objective | Check that actionID is not modified in repetitions of DENM if stationID is not modified |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.1.2 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID_1 and containing validityDuration indicating DURATION_2 and the IUT not having changed its StationID } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT is alerted of expiration of the time associated with INTERVAL_1 } then { the IUT repeats the transmission of the valid DENM containing management container containing actionID indicating its ACTION_ID_1 } } </pre> | |

| | |
|--|---|
| TP Id | TP/DEN/EVRP/BV-10 |
| Test objective | Check that ReferenceTime is not modified in repetitions of DENM |
| Reference | ETSI EN 302 637-3 [1], clause 8.1.1.1 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer containing repetitionInterval indicating INTERVAL_1 and containing repetitionDuration indicating DURATION_1 and containing validityDuration indicating DURATION_2 > DURATION_1 and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID_1 and containing validityDuration indicating DURATION_2 and containing referenceTime indicating REFERENCE_TIME_1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT is alerted of expiration of the time associated with INTERVAL_1 } then { the IUT repeats the transmission of the valid DENM containing management container containing actionID indicating its ACTION_ID_1 and containing referenceTime indicating REFERENCE_TIME_1 } }</pre> | |

| | |
|--|---|
| TP Id | TP/DEN/EVRP/BV-11 |
| Test objective | Check that DEN Basic Service stops repeating DENM after event's default validityDuration expiration, when validityDuration was not provided |
| Reference | ETSI EN 302 637-3 [1], clause 8.2.1.5 |
| PICS Selection | PICS_DENM_REPETITION |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received an <i>AppDENM_trigger</i> request from application layer containing repetitionInterval indicating INTERVAL_1 > defaultValidityDuration and containing repetitionDuration indicating DURATION_1 and not containing validityDuration and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID_1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the IUT is alerted of expiration of the defaultValidityDuration } then { the IUT stops the repetition of the DENM associated with ACTION_ID1 } }</pre> | |

5.2.1.6 Lower-layer parameters

| | |
|---|--|
| TP Id | TP/DEN/PAR/BV-01 |
| Test objective | Check that DENM is encapsulated in BTP type B packet |
| Reference | ETSI EN 302 637-3 [1], clause 5.4.2.2 |
| PICS Selection | PICS_DENM_GENERATION |
| Initial conditions | |
| with { the IUT being in the "initial state" } | |
| Expected behaviour | |
| ensure that { when { a DENM is generated } then { the IUT sends a DENM encapsulated in a BTP-B packet } } | |

| | |
|---|---|
| TP Id | TP/DEN/PAR/BV-02 |
| Test objective | Check that DENM is encapsulated in GBC packet |
| Reference | ETSI EN 302 637-3 [1], clause 5.4.2.2 |
| PICS Selection | PICS_DENM_GENERATION |
| Initial conditions | |
| with { the IUT being in the "initial state" } | |
| Expected behaviour | |
| ensure that { when { a DENM is generated } then { the IUT sends a DENM encapsulated in a GBC packet } } | |

5.2.1.7 Service specific permissions

| TP Id | TP/DEN/SSP/BV-01-X | | | |
|--|---|----------------|--------------|---|
| Test objective | Check that IUT does not send a DENM if it is not permitted by signing certificate | | | |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 | | | |
| PICS Selection | PICS_DENM_GENERATION AND PICS_IS_IUT_SECURED | | | |
| Initial conditions | | | | |
| with { the IUT being in the "initial state" the IUT is authorized to sign DENMs with the certificate CERTIFICATE_X containing DENM SSP indicating bit at position SSP_BIT_X set to 0 } | | | | |
| Expected behaviour | | | | |
| ensure that { when { the IUT receives an AppDENM_trigger request from the application layer containing situation container containing eventType containing causeCode indicating CAUSE_CODE_X } then { the IUT does not send this DENM } } | | | | |
| Variants | | | | |
| X | CERTIFICATE_X | SSP_BIT_X | | CAUSE_CODE_X |
| | | Octet Position | Bit Position | |
| 01 | CERT_IUT_DENM_01 | 1 | 0 (80h) | trafficCondition(1) |
| 02 | CERT_IUT_DENM_02 | 1 | 1 (40h) | accident(2) |
| 03 | CERT_IUT_DENM_03 | 1 | 2 (20h) | roadworks(3) |
| 04 | CERT_IUT_DENM_04 | 1 | 3 (10h) | adverseWeatherCondition-Adhesion(6) |
| 05 | CERT_IUT_DENM_05 | 1 | 4 (08h) | hazardousLocation-SurfaceCondition(9) |
| 06 | CERT_IUT_DENM_06 | 1 | 5 (04h) | hazardousLocation-ObstacleOnTheRoad(10) |
| 07 | CERT_IUT_DENM_07 | 1 | 6 (02h) | hazardousLocation-AnimalOnTheRoad(11) |
| 08 | CERT_IUT_DENM_08 | 1 | 7 (01h) | humanPresenceOnTheRoad(12) |
| 09 | CERT_IUT_DENM_09 | 2 | 0 (80h) | wrongWayDriving(14) |
| 10 | CERT_IUT_DENM_10 | 2 | 1 (40h) | rescueAndRecoveryWorkInProgress(15) |
| 11 | CERT_IUT_DENM_11 | 2 | 2 (20h) | adverseWeatherCondition-ExtremeWeatherCondition(17) |
| 12 | CERT_IUT_DENM_12 | 2 | 3 (10h) | adverseWeatherCondition-Visibility(18) |
| 13 | CERT_IUT_DENM_13 | 2 | 4 (08h) | adverseWeatherCondition-Precipitation(19) |
| 14 | CERT_IUT_DENM_14 | 2 | 5 (04h) | slowVehicle(26) |
| 15 | CERT_IUT_DENM_15 | 2 | 6 (02h) | dangerousEndOfQueue(27) |
| 16 | CERT_IUT_DENM_16 | 2 | 7 (01h) | vehicleBreakdown(91) |
| 17 | CERT_IUT_DENM_17 | 3 | 0 (80h) | postCrash(92) |
| 18 | CERT_IUT_DENM_18 | 3 | 1 (40h) | humanProblem(93) |
| 19 | CERT_IUT_DENM_19 | 3 | 2 (20h) | stationaryVehicle(94) |
| 20 | CERT_IUT_DENM_20 | 3 | 3 (10h) | emergencyVehicleApproaching(95) |
| 21 | CERT_IUT_DENM_21 | 3 | 4 (08h) | hazardousLocation-DangerousCurve(96) |
| 22 | CERT_IUT_DENM_22 | 3 | 5 (04h) | collisionRisk(97) |
| 23 | CERT_IUT_DENM_23 | 3 | 6 (02h) | signalViolation(98) |
| 24 | CERT_IUT_DENM_24 | 3 | 7 (01h) | dangerousSituation(99) |

5.2.2 Message Reception

| | |
|---|---|
| TP Id | TP/DEN/MSRV/BV-01 |
| Test objective | Check that receiving ITS-S transmits DENM to application if it concerns an unknown ActionID and if it is not a termination DENM |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| with { the IUT being in the "initial state" having sent and the IUT not having received DENM containing management container containing actionID indicating ACTION_ID1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a DENM that is not a termination containing management container containing actionID indicating ACTION_ID1 } then { the IUT transmits the DENM content to upper layer } } | |

| | |
|--|---|
| TP Id | TP/DEN/MSRV/BV-02 |
| Test objective | Check that receiving ITS-S transmits DENM to application if it concerns a known ActionID and referenceTime is greater than highest value received for this ActionID |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having received DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_2 greater than REFERENCETIME_1 } then { the IUT transmits the DENM content to upper layer } } | |

| | |
|--|--|
| TP Id | TP/DEN/MSRV/BO-03 |
| Test objective | Check that receiving ITS-S discards termination DENM if it concerns an unknown ActionID (IUT stationId and unknown SequenceNumber) |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having sent several events and the IUT not having sent DENM containing actionID indicating ACTION_ID1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a termination DENM containing actionID indicating ACTION_ID1 } then { the IUT discards the DENM and the IUT does not forward the DENM content to upper layer } } | |

| | |
|--|--|
| TP Id | TP/DEN/MSRV/BO-04 |
| Test objective | Check that receiving ITS-S discards termination DENM if it concerns an unknown ActionID (non-IUT stationId and unknown SequenceNumber) |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having received several events and the IUT not having received DENM containing actionID indicating ACTION_ID1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a termination DENM containing actionID indicating ACTION_ID1 } then { the IUT discards the DENM and the IUT does not forward the DENM content to upper layer } } | |

| | |
|---|---|
| TP Id | TP/DEN/MSRV/BO-05 |
| Test objective | Check that receiving ITS-S discards DENM if referenceTime is less than highest value received for this ActionID |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having received DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_2 less than REFERENCETIME_1 } then { the IUT discards the DENM and the IUT does not forward the DENM content to upper layer } } | |

| | |
|---|---|
| TP Id | TP/DEN/MSRV/BO-06 |
| Test objective | Check that receiving ITS-S discards DENM if detectionTime is less than highest value received for this ActionID |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| with { the IUT being in the "initial state" and the IUT having received DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_1 and containing detectionTime indicating TIME_1 } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_1 and containing detectionTime indicating TIME_2 less than TIME_1 } then { the IUT discards the DENM and the IUT does not forward the DENM content to upper layer } } | |

| | |
|---|--|
| TP Id | TP/DEN/MSRV/BV-07 |
| Test objective | Check that receiving ITS-S transmits DENM to application if it concerns a known ActionID and referenceTime is equal to highest received value and detectionTime is greater than highest received value |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 |
| PICS Selection | PICS_DENM_RECEPTION |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_1 and containing detectionTime indicating TIME_1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT receives a DENM containing management container containing actionID indicating ACTION_ID1 and containing referenceTime indicating REFERENCETIME_1 and containing detectionTime indicating TIME_2 greater than TIME_1 } then { the IUT transmits the DENM content to upper layer } } </pre> | |

| TP Id | TP/DEN/MSRV/BO-08-X | | |
|--|---|--------------|---|
| Test objective | Check that receiving ITS-S discards DENM for new event if SSP value of the signing certificate is not consistent with the causeCode | | |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 | | |
| PICS Selection | PICS_DENM_RECEPTION AND PICS_IS_IUT_SECURED | | |
| Initial conditions | | | |
| with { the IUT being in the "initial state" } | | | |
| Expected behaviour | | | |
| ensure that { when { the IUT receives a secured DENM containing management container containing actionID indicating ACTION_ID1 containing situation container containing eventType containing causeCode indicating CAUSE_CODE_X containing signing certificate containing SSP not indicating SSP_BIT_X } then { the IUT discards the DENM and the IUT does not forward the DENM content to upper layer } } | | | |
| Variants | | | |
| X | SSP_BIT_X | | CAUSE_CODE_X |
| | Octet Position | Bit Position | |
| 01 | 1 | 0 (80h) | trafficCondition(1) |
| 02 | 1 | 1 (40h) | accident(2) |
| 03 | 1 | 2 (20h) | roadworks(3) |
| 04 | 1 | 3 (10h) | adverseWeatherCondition-Adhesion(6) |
| 05 | 1 | 4 (08h) | hazardousLocation-SurfaceCondition(9) |
| 06 | 1 | 5 (04h) | hazardousLocation-ObstacleOnTheRoad(10) |
| 07 | 1 | 6 (02h) | hazardousLocation-AnimalOnTheRoad(11) |
| 08 | 1 | 7 (01h) | humanPresenceOnTheRoad(12) |
| 09 | 2 | 0 (80h) | wrongWayDriving(14) |
| 10 | 2 | 1 (40h) | rescueAndRecoveryWorkInProgress(15) |
| 11 | 2 | 2 (20h) | adverseWeatherCondition-ExtremeWeatherCondition(17) |
| 12 | 2 | 3 (10h) | adverseWeatherCondition-Visibility(18) |
| 13 | 2 | 4 (08h) | adverseWeatherCondition-Precipitation(19) |
| 14 | 2 | 5 (04h) | slowVehicle(26) |
| 15 | 2 | 6 (02h) | dangerousEndOfQueue(27) |
| 16 | 2 | 7 (01h) | vehicleBreakdown(91) |
| 17 | 3 | 0 (80h) | postCrash(92) |
| 18 | 3 | 1 (40h) | humanProblem(93) |
| 19 | 3 | 2 (20h) | stationaryVehicle(94) |
| 20 | 3 | 3 (10h) | emergencyVehicleApproaching(95) |
| 21 | 3 | 4 (08h) | hazardousLocation-DangerousCurve(96) |
| 22 | 3 | 5 (04h) | collisionRisk(97) |
| 23 | 3 | 6 (02h) | signalViolation(98) |
| 24 | 3 | 7 (01h) | dangerousSituation(99) |

| TP Id | TP/DEN/MSRV/BO-09-X | | |
|--|--|--------------|---|
| Test objective | Check that receiving ITS-S discards DENM for existing event if SSP value of the signing certificate is not consistent with the causeCode | | |
| Reference | ETSI EN 302 637-3 [1], clause 8.4.2 | | |
| PICS Selection | PICS_DENM_RECEPTION AND PICS_IS_IUT_SECURED | | |
| Initial conditions | | | |
| with { the IUT being in the "initial state" and the IUT having received a secured DENM containing management container containing actionID indicating ACTION_ID1 containing situation container containing eventType containing causeCode indicating CAUSE_CODE_X containing signing certificate containing SSP indicating SSP_BIT_X } | | | |
| Expected behaviour | | | |
| ensure that { when { the IUT receives a secured DENM containing management container containing actionID indicating ACTION_ID1 containing situation container containing eventType containing causeCode indicating CAUSE_CODE_X containing signing certificate containing SSP not indicating SSP_BIT_X } then { the IUT discards the DENM and the IUT does not forward the DENM content to upper layer } } | | | |
| Variants | | | |
| X | SSP_BIT_X | | CAUSE_CODE_X |
| | Octet Position | Bit Position | |
| 01 | 1 | 0 (80h) | trafficCondition(1) |
| 02 | 1 | 1 (40h) | accident(2) |
| 03 | 1 | 2 (20h) | roadworks(3) |
| 04 | 1 | 3 (10h) | adverseWeatherCondition-Adhesion(6) |
| 05 | 1 | 4 (08h) | hazardousLocation-SurfaceCondition(9) |
| 06 | 1 | 5 (04h) | hazardousLocation-ObstacleOnTheRoad(10) |
| 07 | 1 | 6 (02h) | hazardousLocation-AnimalOnTheRoad(11) |
| 08 | 1 | 7 (01h) | humanPresenceOnTheRoad(12) |
| 09 | 2 | 0 (80h) | wrongWayDriving(14) |
| 10 | 2 | 1 (40h) | rescueAndRecoveryWorkInProgress(15) |
| 11 | 2 | 2 (20h) | adverseWeatherCondition-ExtremeWeatherCondition(17) |
| 12 | 2 | 3 (10h) | adverseWeatherCondition-Visibility(18) |
| 13 | 2 | 4 (08h) | adverseWeatherCondition-Precipitation(19) |
| 14 | 2 | 5 (04h) | slowVehicle(26) |
| 15 | 2 | 6 (02h) | dangerousEndOfQueue(27) |
| 16 | 2 | 7 (01h) | vehicleBreakdown(91) |

| Variants | | | |
|----------|----------------|--------------|--------------------------------------|
| X | SSP_BIT_X | | CAUSE_CODE_X |
| | Octet Position | Bit Position | |
| 17 | 3 | 0 (80h) | postCrash(92) |
| 18 | 3 | 1 (40h) | humanProblem(93) |
| 19 | 3 | 2 (20h) | stationaryVehicle(94) |
| 20 | 3 | 3 (10h) | emergencyVehicleApproaching(95) |
| 21 | 3 | 4 (08h) | hazardousLocation-DangerousCurve(96) |
| 22 | 3 | 5 (04h) | collisionRisk(97) |
| 23 | 3 | 6 (02h) | signalViolation(98) |
| 24 | 3 | 7 (01h) | dangerousSituation(99) |

| TP Id | TP/DEN/MSRV/BV-10 |
|---|---|
| Test objective | Check that receiving ITS-S replies to requestResponseIndication |
| Reference | ETSI EN 302 637-3 [1], clause B.40 |
| PICS Selection | PICS_DENM_RECEPTION AND PICS_IMPACT_REDUCTION |
| Initial conditions | |
| with { the IUT being in the "initial state" } | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT receives a DENM containing management container containing actionID indicating ACTION_ID1 containing a la carte container containing ImpactReductionContainer containing requestResponseIndication indicating 0 } then { the IUT sends a DENM containing management container containing actionID indicating ACTION_ID2 containing a la carte container containing ImpactReductionContainer containing requestResponseIndication indicating 1 } } </pre> | |

5.2.3 Keep-Alive Forwarding

| | |
|--|---|
| TP Id | TP/DEN/KAFW/BV-01 |
| Test objective | Check that forwarding ITS-S forwards DENM if no DENM with same ActionId has been received during forwarding delay |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.3 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing validityDuration indicating value more than 3 times greater than TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 } } </pre> | |

| | |
|---|--|
| TP Id | TP/DEN/KAFW/BV-02 |
| Test objective | Check that forwarding ITS-S forwards DENM if no DENM with same ActionId and referenceTime greater or equal to the last received DENM has been received during forwarding delay |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.3 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing referenceTime indicating REFERENCETIME_1 and containing validityDuration indicating value more than 3 times greater than TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT having received DENM containing actionID indicating ACTION_ID1 and containing referenceTime indicating value REFERENCETIME_2 < REFERENCETIME_1 and the IUT not having received further DENM containing actionID indicating ACTION_ID1 and containing referenceTime indicating value REFERENCETIME_3 > REFERENCETIME_1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 } } </pre> | |

| | |
|---|---|
| TP Id | TP/DEN/KAFW/TI-03 |
| Test objective | Check that forwarding delay is set to min (2 x transmissionInterval + rnd(0, 150 ms), validityDuration) |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.5 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing validityDuration indicating value DURATION_1 more than 3 times greater than TRANS_INTERVAL1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 at a point of time corresponding to min (2 x transmissionInterval + rnd (0, 150 ms), validityDuration) } } </pre> | |

| | |
|--|--|
| TP Id | TP/DEN/KAFW/BV-04 |
| Test objective | Check that Forwarding ITS-S replaces the ITS PDU header of forwarded DENMs |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.7 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing validityDuration indicating value more than 3 times greater than TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 containing ITS PDU header containing StationID indicating its own stationID } }</pre> | |

| | |
|--|--|
| TP Id | TP/DEN/KAFW/BV-05 |
| Test objective | Check that forwarding ITS-S does not change actionID |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.2 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre>with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing validityDuration indicating value more than 3 times greater than TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 }</pre> | |
| Expected behaviour | |
| <pre>ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM containing management container containing actionID indicating ACTION_ID1 } }</pre> | |

| | |
|---|---|
| TP Id | TP/DEN/KAFW/BV-06 |
| Test objective | Check that forwarding ITS-S does not change referenceTime |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.3 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing validityDuration indicating value DURATION_1 more than 3 times greater than TRANS_INTERVAL1 and containing referenceTime indicating REFERENCETIME_1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 containing management container containing referenceTime indicating REFERENCETIME_1 } } </pre> | |

| | |
|--|---|
| TP Id | TP/DEN/KAFW/BV-07 |
| Test objective | Check that forwarding ITS-S does not change termination |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.4 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received a DENM containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and containing validityDuration indicating value DURATION_1 more than 3 times greater than TRANS_INTERVAL1 and containing termination indicating isNegation and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 containing management container containing termination indicating isNegation } } </pre> | |

| | |
|---|--|
| TP Id | TP/DEN/KAFW/BV-08 |
| Test objective | Check that Forwarding ITS-S does not modify management, situation, location and alacarte containers when forwarding a DENM |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.7 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received a DENM containing management container indicating MANAGEMENTCONTAINER_1 and containing situation container indicating SITUATION_1 and containing location container indicating LOCATION_1 and containing alacarte container indicating ALACARTE_1 and containing transmissionInterval indicating TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the timer T_Forwarding expires } then { the IUT reconstructs and sends the DENM associated to ACTION_ID1 containing management container indicating MANACEMENTCONTAINER_1 and containing situation container indicating SITUATION_1 and containing location container indicating LOCATION_1 and containing alacarte container indicating ALACARTE_1 } } </pre> | |

| | |
|--|---|
| TP Id | TP/DEN/KAFW/BV-09 |
| Test objective | Check that forwarding ITS-S stops forwarding DENM after validity expiration |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.3 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received an event containing management container containing actionID indicating ACTION_ID1 and containing validityDuration indicating DURATION_1 and containing transmissionInterval indicating TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT is alerted of expiration of the time associated with DURATION_1 } then { the IUT stops to reconstruct and to send the DENM associated with ACTION_ID1 } } </pre> | |

| | |
|--|---|
| TP Id | TP/DEN/KAFW/BV-10 |
| Test objective | Check that forwarding ITS-S stops forwarding DENM if it is outside relevance area |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.3 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| <pre> with { the IUT being in the "initial state" and the IUT having received an event containing management container containing actionID indicating ACTION_ID1 and containing transmissionInterval indicating TRANS_INTERVAL1 and the IUT having starting timer T_Forwarding for this DENM and the IUT not having received further DENM containing actionID indicating ACTION_ID1 } </pre> | |
| Expected behaviour | |
| <pre> ensure that { when { the IUT is alerted that its position is now outside of the relevance area associated with ACTION_ID1 } then { the IUT stops to reconstruct and to send the DENM associated with ACTION_ID1 } } </pre> | |

| | |
|--|--|
| TP Id | TP/DEN/KAFW/BV-11 |
| Test objective | Check that forwarding ITS-S does not forward DENM is transmissionInterval is not present |
| Reference | ETSI EN 302 637-3 [1], clause 8.3.2.5 |
| PICS Selection | PICS_DENM_KAF |
| Initial conditions | |
| with { the IUT being in the "initial state" } | |
| Expected behaviour | |
| ensure that { when { the IUT receives a DENM containing actionID indicating ACTION_ID1 and not containing transmissionInterval } then { the IUT does not reconstruct and to send the DENM associated with ACTION_ID1 } } | |

Annex A (informative): Bibliography

- 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".

History

| Document history | | |
|-------------------------|-------------|-------------|
| V1.1.1 | March 2011 | Publication |
| V1.2.1 | August 2013 | Publication |
| V1.3.1 | May 2014 | Publication |
| V1.4.1 | July 2015 | Publication |
| V1.5.1 | March 2017 | Publication |