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)
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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 specification 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).

"must" and "must not" are NOT allowed in ETSI deliverables except when used in direct citation.
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 [7].

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [4] and ISO/IEC 9646-2 [5]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [8]) 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 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.

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".


2.2 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 reference 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".

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 [6] and ISO/IEC 9646-7 [7] apply.

3.2 Abbreviations

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

ATS Abstract Test Suite
BO Inopportune test events for 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
EVGN Message transmission - Event Generation
EVRP Message transmission - Message Repetition
EVTR Message transmission - Event Termination
EVUP Message transmission - Event Update
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
MSRV Message reception
PAR Message transmission - Lower-layer parameters
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>
<thead>
<tr>
<th>Root</th>
<th>Group</th>
<th>category</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEN</td>
<td>Message format</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Event Generation</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Event Update</td>
<td>Valid and Inopportune</td>
</tr>
<tr>
<td></td>
<td>Event Termination</td>
<td>Valid, Inopportune and Timer</td>
</tr>
<tr>
<td></td>
<td>Message Repetition</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Lower-layer parameters</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Message reception</td>
<td>Valid and Inopportune</td>
</tr>
<tr>
<td></td>
<td>Keep-alive Forwarding</td>
<td>Valid and Timers</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Identifier:</th>
<th>TP/&lt;root&gt;/&lt;gr&gt;/&lt;x&gt;&lt;nn&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;root&gt; = root</td>
<td>DEN</td>
</tr>
<tr>
<td>&lt;gr&gt; = group</td>
<td>MSGF Message transmission - Message format</td>
</tr>
<tr>
<td></td>
<td>EVGN Message transmission - Event Generation</td>
</tr>
<tr>
<td></td>
<td>EVUP Message transmission - Event Update</td>
</tr>
<tr>
<td></td>
<td>EVTR Message transmission - Event Termination</td>
</tr>
<tr>
<td></td>
<td>EVRP Message transmission - Message Repetition</td>
</tr>
<tr>
<td></td>
<td>PAR Message transmission - Lower-layer parameters</td>
</tr>
<tr>
<td></td>
<td>KAFW Keep-alive Forwarding</td>
</tr>
<tr>
<td>&lt;x&gt; = type of testing</td>
<td>BV Behaviour: Valid event tests</td>
</tr>
<tr>
<td></td>
<td>BO Behaviour: Inopportune event tests</td>
</tr>
<tr>
<td></td>
<td>TI Timer tests</td>
</tr>
<tr>
<td>&lt;nn&gt; = sequential number</td>
<td>01 to 99</td>
</tr>
</tbody>
</table>

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 are 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 Table/Item of ETSI TS 102 869-1 [2].
Table 3: Mnemonics for PICS reference

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>PICS item</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICS_DENM_GENERATION</td>
<td>A.2/1</td>
</tr>
<tr>
<td>PICS_DENM_UPDATE</td>
<td>A.2/2</td>
</tr>
<tr>
<td>PICS_DENM_REPETITION</td>
<td>A.2/3</td>
</tr>
<tr>
<td>PICS_DENM_CANCELLATION</td>
<td>A.2/4</td>
</tr>
<tr>
<td>PICS_DENM_NEGATION</td>
<td>A.2/5</td>
</tr>
<tr>
<td>PICS_DENM_RECEPTION</td>
<td>A.2/6</td>
</tr>
<tr>
<td>PICS_DENM_KAF</td>
<td>A.2/7</td>
</tr>
<tr>
<td>PICS_IMPACT_REDUCTION</td>
<td>A.12/2</td>
</tr>
<tr>
<td></td>
<td>ETSI TS 102 871-1 [3], A.32/12</td>
</tr>
</tbody>
</table>

5.2 Test purposes for DEN

5.2.1 Message Transmission

5.2.1.1 Message Format

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/ MSGF/BV-01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that protocolVersion is set to 1 and messageID is set to 1</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause B.1</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_GENERATION</td>
</tr>
</tbody>
</table>

**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
  }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/ MSGF/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that sent DENM contains at least one 'trace' DE</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause 6.1.3.2</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_GENERATION</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVGN/BV-01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that DEN Basic Service generates a new DENM on reception of a valid AppDENM_Trigger request</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause 6.1.2.1</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_GENERATION</td>
</tr>
</tbody>
</table>

#### 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
  }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVGN/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that a new ActionID value is assigned for each newly generated DENM</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause 6.1.1.1</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_GENERATION</td>
</tr>
</tbody>
</table>

#### 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
  }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVGN/BV-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that referenceTime is set to the current time when generating a DENM for a new event</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.2.1.3</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_GENERATION</td>
</tr>
<tr>
<td>Initial conditions</td>
<td>with {</td>
</tr>
<tr>
<td></td>
<td>the IUT being in the &quot;initial state&quot;</td>
</tr>
<tr>
<td></td>
<td>and the IUT having generated several events</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
<tr>
<td>Expected behaviour</td>
<td>ensure that {</td>
</tr>
<tr>
<td></td>
<td>when {</td>
</tr>
<tr>
<td></td>
<td>the IUT is requested to generate a new event</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
<tr>
<td></td>
<td>then {</td>
</tr>
<tr>
<td></td>
<td>the IUT sends a valid DENM</td>
</tr>
<tr>
<td></td>
<td>containing management container</td>
</tr>
<tr>
<td></td>
<td>containing referenceTime</td>
</tr>
<tr>
<td></td>
<td>indicating CLT</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVGN/BV-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that sequenceNumber is set to a next unused value each time an event is detected</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clauses 6.1.1.1 and 8.2.1.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_GENERATION</td>
</tr>
<tr>
<td>Initial conditions</td>
<td>with {</td>
</tr>
<tr>
<td></td>
<td>the IUT being in the &quot;initial state&quot;</td>
</tr>
<tr>
<td></td>
<td>and the IUT having generated several events</td>
</tr>
<tr>
<td></td>
<td>and the IUT having generated its last DENM</td>
</tr>
<tr>
<td></td>
<td>containing management container</td>
</tr>
<tr>
<td></td>
<td>containing actionID</td>
</tr>
<tr>
<td></td>
<td>containing sequenceNumber</td>
</tr>
<tr>
<td></td>
<td>indicating SEQ1</td>
</tr>
<tr>
<td></td>
<td>and no active event being associated with sequenceNumber SEQ1 + 1</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
<tr>
<td>Expected behaviour</td>
<td>ensure that {</td>
</tr>
<tr>
<td></td>
<td>when {</td>
</tr>
<tr>
<td></td>
<td>the IUT is requested to generate a new event</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
<tr>
<td></td>
<td>then {</td>
</tr>
<tr>
<td></td>
<td>the IUT sends a valid DENM</td>
</tr>
<tr>
<td></td>
<td>containing management container</td>
</tr>
<tr>
<td></td>
<td>containing actionID</td>
</tr>
<tr>
<td></td>
<td>containing sequenceNumber</td>
</tr>
<tr>
<td></td>
<td>indicating SEQ1 + 1</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
</tbody>
</table>
**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_DENMGENERATION

### 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 an active event being associated with sequenceNumber SEQ1 + 1
  and no active event being associated with sequenceNumber SEQ1 + 2
}

### 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 new StationID
  }
}

---

**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_DENMGENERATION

### Initial conditions

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
}

### 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 new StationID
  }
}

---
5.2.1.3 Event Update

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVUP/BV-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that DEN Basic Service generates an update DENM on reception of a valid AppDENM_update request</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 6.1.2.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_UPDATE</td>
</tr>
</tbody>
</table>

### Initial conditions

- 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

---

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVUP/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that the actionID is not changed by DENM update, as long as the stationID of the originating ITS-S remains unchanged</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clauses 6.1.2.2 and 8.2.1.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_UPDATE</td>
</tr>
</tbody>
</table>

### Initial conditions

- 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

- the IUT being in the "initial state"
- the IUT having generated an event containing management container containing actionID indicating ACTION_ID1 containing referenceTime indicating REFERENCETIME1

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 and containing referenceTime indicating CLT > REFERENCETIME1
  }
}

---

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

- the IUT being in the "initial state"
- the IUT having generated an event
- the IUT not having sent an event being associated with actionID ACTION_ID1 containing originatingStationID indicating its own stationID and containing sequenceNumber indicating SEQ1

Expected behaviour

- 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
  }
}
### Event Termination

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP:DEN/EVTR/BV-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that DEN Basic Service generates a cancellation DENM when application indicates the premature termination of an event for which it is the originator</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clauses 6.1.2.4 and 8.2.1.3</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_CANCELLATION</td>
</tr>
</tbody>
</table>

### 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 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
  }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP:DEN/EVTR/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>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</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 6.1.2.4</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_NEGATION</td>
</tr>
</tbody>
</table>

### 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
        and containing originatingStationID
          indicating stationID different from its own stationID
}

### Expected behaviour

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 isNegation
  }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVTR/BV-03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that referenceTime is set to the latest value received for this event in negation DENM</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clauses 6.1.2.4 and 8.2.1.3</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_NEGATION</td>
</tr>
</tbody>
</table>

### 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
          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
}

### Expected behaviour

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 referenceTime
            indicating value REFERENCETIME2
            indicating value isNegation
  }
}
**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**

```
with {
    the IUT being in the "initial state"
    and the IUT having generated an event
    containing management container
    containing actionID
    indicating ACTION_ID1
}
```

**Expected behaviour**

```
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 not containing situation container
        and not containing location container
        and not containing a la carte container
    }
}
```

---

**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**

```
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 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 isNegation
        and not containing situation container
        and not containing location container
        and not containing a la carte container
    }
}
```
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVTR/BO-06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>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)</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.2.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_CANCELLATION</td>
</tr>
</tbody>
</table>

**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).

---

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVTR/BO-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>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)</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.2.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_NEGATION</td>
</tr>
</tbody>
</table>

**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).
**5.2.1.5 Message Repetition**

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVRP/TI-01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that DEN Basic Service repeats DENM transmission according to repetitionInterval parameter provided by application</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clauses 6.1.2.3, 8.2.2 and 5.4.1.2</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_REPETITION</td>
</tr>
</tbody>
</table>

**Initial conditions**

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
}

**Expected behaviour**

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
  }
}
**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**

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
}

**Expected behaviour**

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
  }
}

---

**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**

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 the IUT having generated an update of the event associated with ACTION_ID1 modifying partly the event
}

**Expected behaviour**

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
  }
}
### 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

<table>
<thead>
<tr>
<th>Initial conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>the IUT being in the &quot;initial state&quot; 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 &gt; 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</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 } }</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Initial conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>the IUT being in the &quot;initial state&quot; and the IUT having received an AppDENM_trigger request from application layer not containing repetitionInterval and the IUT having generated the corresponding event containing management container containing actionID indicating ACTION_ID1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 } }</td>
</tr>
<tr>
<td>TP Id</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Test objective</td>
</tr>
<tr>
<td>Reference</td>
</tr>
<tr>
<td>PICS Selection</td>
</tr>
</tbody>
</table>

**Initial conditions**

with {
  the IUT being in the "initial state"
  and the IUT having received an AppDENM_trigger request from application layer
  not containing repetitionDuration
  and the IUT having generated the corresponding event
  containing management container
  containing actionID
  indicating ACTION_ID1
}

**Expected behaviour**

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
  }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVRP/BV-08</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that existing actionID in originating ITS-S are updated when stationID is modified</td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 6.1.1.2</td>
<td></td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_REPETITION</td>
<td></td>
</tr>
</tbody>
</table>

**Initial conditions**

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
  containing originatingStationID
  indicating STATION_ID_1
  and containing validityDuration
  indicating DURATION_1 and the IUT having changed its StationID
}

**Expected behaviour**

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 STATION_ID_1
    indicating its new StationID
  }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/EVRP/BV-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that actionID is not modified in repetitions of DENM if stationID is not modified</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.2.1.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_REPETITION</td>
</tr>
</tbody>
</table>

### Initial conditions

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_ID_1
      and containing validityDuration
        indicating DURATION_2
    and the IUT not having changed its StationID
}

### Expected behaviour

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
  }
}
**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**

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_ID_1
            and containing validityDuration
                indicating DURATION_2
            and containing referenceTime
                indicating REFERENCE_TIME_1
}

**Expected behaviour**

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 ACTION_ID_1
                and containing validityDuration
                    indicating DURATION_2
                and containing referenceTime
                    indicating REFERENCE_TIME_1
    }
}

**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**

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 > 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
}

**Expected behaviour**

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
    }
}
### 5.2.1.6 Lower-layer parameters

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/PAR/BV-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that DENM is encapsulated in BTP type B packet</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 5.4.2.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_GENERATION</td>
</tr>
</tbody>
</table>

**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
    }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/PAR/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that DENM is encapsulated in GBC packet</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 5.4.2.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_GENERATION</td>
</tr>
</tbody>
</table>

**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
    }
}
## 5.2.2 Message Reception

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/MSRV/BV-01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that receiving ITS-S transmits DENM to application if it concerns an unknown ActionID and if it is not a termination DENM</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause 8.4.2</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_RECEPTION</td>
</tr>
</tbody>
</table>

**Initial conditions**

```
| (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) |
```

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/MSRV/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause 8.4.2</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_RECEPTION</td>
</tr>
</tbody>
</table>

**Initial conditions**

```
| (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) |
```
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/MSRV/BO-03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that receiving ITS-S discards termination DENM if it concerns an unknown ActionID (IUT stationId and unknown SequenceNumber)</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.4.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_RECEPTION</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>with {</td>
</tr>
<tr>
<td>the IUT being in the &quot;initial state&quot;</td>
</tr>
<tr>
<td>and the IUT having sent several events</td>
</tr>
<tr>
<td>and the IUT not having sent DENM containing actionID indicating ACTION_ID1</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>ensure that {</td>
</tr>
<tr>
<td>when {</td>
</tr>
<tr>
<td>the IUT receives a termination DENM containing actionID indicating ACTION_ID1</td>
</tr>
<tr>
<td>}</td>
</tr>
<tr>
<td>then {</td>
</tr>
<tr>
<td>the IUT discards the DENM and the IUT does not forward the DENM content to upper layer</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/MSRV/BO-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that receiving ITS-S discards termination DENM if it concerns an unknown ActionID (non-IUT stationId and unknown SequenceNumber)</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.4.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_RECEPTION</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>with {</td>
</tr>
<tr>
<td>the IUT being in the &quot;initial state&quot;</td>
</tr>
<tr>
<td>and the IUT having received several events</td>
</tr>
<tr>
<td>and the IUT not having received DENM containing actionID indicating ACTION_ID1</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>ensure that {</td>
</tr>
<tr>
<td>when {</td>
</tr>
<tr>
<td>the IUT receives a termination DENM containing actionID indicating ACTION_ID1</td>
</tr>
<tr>
<td>}</td>
</tr>
<tr>
<td>then {</td>
</tr>
<tr>
<td>the IUT discards the DENM and the IUT does not forward the DENM content to upper layer</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>
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_2 less than REFERENCETIME_1
  }
  then {
    the IUT discards the DENM
    and the IUT does not forward the DENM content to upper layer
  }
}
**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**
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 greater than TIME_1
    }
    then {
        the IUT transmits the DENM content to upper layer
    }
}

---

**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_SECURITY

---

**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
            and containing referenceTime
                indicating REFERENCETIME_1
            and containing detectionTime
                indicating TIME_1
    }
    then {
        the IUT discards the DENM 
            and the IUT does not forward the DENM content to upper layer
    }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/MSRV/BO-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that receiving ITS-S discards DENM for existing event if SSP value of the signing certificate is not consistent with the causeCode</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.4.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_SECURITY</td>
</tr>
</tbody>
</table>

**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 VALUE_1
  containing signing certificate
  containing SSP
  indicating VALUE_1
}

**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 VALUE_2
    containing signing certificate
    containing SSP
    not indicating VALUE_2
  }
  then {
    the IUT discards the DENM
    and the IUT does not forward the DENM content to upper layer
  }
}
### 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

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
  }
}

---

### 5.2.3 Keep-Alive Forwarding

#### 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

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
}

### Expected Behaviour

ensure that {
  when {
    the timer T_Forwarding expires
  }
  then {
    the IUT reconstructs and sends the DENM associated to ACTION_ID1
  }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/BV-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>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</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.3</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

**Initial conditions**

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 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
}

**Expected behaviour**

ensure that {
    when {
        the timer T_Forwarding expires
    }
    then {
        the IUT reconstructs and sends the DENM associated to ACTION_ID1
    }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/TI-03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that forwarding delay is set to min(2 × transmissionInterval + rnd(0, 150 ms), validityDuration)</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.2.5</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

**Initial conditions**

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
}

**Expected behaviour**

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 × transmissionInterval + rnd (0, 150 ms), validityDuration)
    }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/BV-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that Forwarding ITS-S replaces the ITS PDU header of forwarded DENMs</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.2.7</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

### Initial conditions

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
}

### Expected behaviour

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
  }
}

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/BV-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that forwarding ITS-S does not change actionID</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.2.2</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

### Initial conditions

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
}

### Expected behaviour

ensure that {
  when {
    the timer T_Forwarding expires
  }
  then {
    the IUT reconstructs and sends the DENM
      containing management container
        containing actionID
          indicating ACTION_ID1
  }
}
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/BV-06</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test objective</strong></td>
<td>Check that forwarding ITS-S does not change referenceTime</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>ETSI EN 302 637-3 [1], clause 8.3.2.3</td>
</tr>
<tr>
<td><strong>PICS Selection</strong></td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

### Initial conditions

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
}

### Expected behaviour

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
  }
}
<table>
<thead>
<tr>
<th>TP id</th>
<th>TP/DEN/KAFW/BV-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that forwarding ITS-S does not change termination</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.2.4</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

### Initial conditions

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
}

### Expected behaviour

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
  }
}
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

- the IUT being in the "initial state"
- 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
- the IUT having starting timer T_Forwarding for this DENM
- the IUT not having received further DENM containing actionId indicating ACTION_ID1

### Expected behaviour

```
ensure that {
    when {
        the timer T_Forwarding expires
    }
    then {
        the IUT reconstructs and sends the DENM associated to ACTION_ID1 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
    }
}
```
<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/BV-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that forwarding ITS-S stops forwarding DENM after validity expiration</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.3</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

**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
        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
}

**Expected behaviour**

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
  }
}

---

<table>
<thead>
<tr>
<th>TP Id</th>
<th>TP/DEN/KAFW/BV-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test objective</td>
<td>Check that forwarding ITS-S stops forwarding DENM if it is outside relevance area</td>
</tr>
<tr>
<td>Reference</td>
<td>ETSI EN 302 637-3 [1], clause 8.3.3</td>
</tr>
<tr>
<td>PICS Selection</td>
<td>PICS_DENM_KAF</td>
</tr>
</tbody>
</table>

**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
        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
}

**Expected behaviour**

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
  }
}
### 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

<table>
<thead>
<tr>
<th>Document history</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V1.1.1</strong></td>
</tr>
<tr>
<td><strong>V1.2.1</strong></td>
</tr>
<tr>
<td><strong>V1.3.1</strong></td>
</tr>
<tr>
<td><strong>V1.4.1</strong></td>
</tr>
</tbody>
</table>