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Intelligent Transport Systems (ITS);
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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 specifications for Decentralized Environmental Notification Basic Service (DEN) as identified below:

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

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

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

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

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

2 References

2.1 Normative references

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

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

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

[1] ETSI EN 302 637-3 (V1.3.1): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".

[2] ETSI TS 102 869-1 (V1.6.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Decentralized Environmental Notification Basic Service (DEN); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

2.2 Informative references

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

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

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

[i.1] ETSI EG 202 798 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

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

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

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

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

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

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

3.2 Symbols

Void.

3.3 Abbreviations

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

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

4 Test Suite Structure (TSS)

4.1 Structure for DEN tests

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

Table 1: TSS for DEN

Root	Group	category
DEN	Message format	Valid
	Event Generation	Valid
	Event Update	Valid and Inopportune
	Event Termination	Valid, Inopportune and Timer
	Message Repetition	Valid
	Lower-layer parameters	Valid
	Message reception	Valid and Inopportune
	Keep-Alive Forwarding	Valid and Timers

The test suite is structured as a tree with the root defined as DEN. The tree is of rank 2 with the first rank a functional area and the second rank is the standard ISO conformance test categories.

4.2 Test groups

4.2.1 Introduction

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

4.2.2 Root

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

4.2.3 Groups

This level contains height functional areas identified as:

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

4.2.4 Categories

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

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP definition conventions

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

5.1.2 TP Identifier naming conventions

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

Table 2: TP naming convention

Identifier:	**TP/<root>/<gr>/<x>/<nn> or TP/<root>/<gr>/<x>/<nn>-<v>**		
	<root> = root	DEN	
	<gr> = group	MSGF	Message transmission - Message format
		EVGN	Message transmission - Event Generation
		EVUP	Message transmission - Event Update
		EVTR	Message transmission - Event Termination
		EVRP	Message transmission - Message Repetition
		PAR	Message transmission - Lower-layer parameters
		MSRV	Message reception
		KAFW	Keep-alive Forwarding
		SSP	Service Specific Permissions
	<x> = type of testing	BV	Behaviour: Valid event tests
		BO	Behaviour: Inopportune event tests
		TI	Timer tests
	<nn> = sequential number		01 to 99
	<v> = variant		01 to 99

5.1.3 Rules for the behaviour description

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

ETSI EN 302 637-3 [1] does not use the finite state machine concept. As consequence, the test purposes use a generic "Initial State" that corresponds to a state where the IUT is ready for starting the test execution. Furthermore, the IUT shall be left in this "Initial State", when the test is completed.

Being in the "Initial State" refers to the starting point of the initial device configuration. There are no pending actions, no instantiated buffers or variables, which could disturb the execution of a test.

5.1.4 Sources of TP definitions

All TPs have been specified according to ETSI EN 302 637-3 [1].

5.1.5 Mnemonics for PICS reference

To avoid an update of all TPs when the PICS document is changed, table 3 introduce mnemonics name and the correspondence with the real PICS item number.

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

Table 3: Mnemonics for PICS reference

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

5.2 Test purposes for DEN

5.2.1 Message Transmission

5.2.1.1 Message Format

TP Id	TP/DEN/ MSGF/BV-01
Test objective	Check that protocolVersion is set to 2 and messageID is set to 1
Reference	ETSI EN 302 637-3 [1], clause B.1
PICS Selection	PICS_DENM_GENERATION
Initial conditions	

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

Expected behaviour	

ensure that {
when {
the IUT receives an AppDENM_Trigger request from the application layer
}
then {
the IUT sends a valid DENM
containing ITS PDU header
containing protocolVersion
indicating value 2
and containing messageID
indicating value 1
}	

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

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

Expected behaviour	

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

5.2.1.2 Event Generation

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

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

Expected behaviour	

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

TP Id	TP/DEN/EVGN/BV-02
Test objective	Check that a new ActionID value is assigned for each newly generated DENM
Reference	ETSI EN 302 637-3 [1], clause 6.1.1.1
PICS Selection	PICS_DENM_GENERATION
Initial conditions	

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

Expected behaviour	

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

TP Id	TP/DEN/EVGN/BV-03
Test objective	Check that a newly created ActionID contains the StationID of the originating ITS-S that detected the event
Reference	ETSI EN 302 637-3 [1], clause 6.1.1.1
PICS Selection	PICS_DENM_GENERATION

Initial conditions

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

Expected behaviour

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

TP Id	TP/DEN/EVGN/BV-04
Test objective	Check that cause and subcause values included in DENM as provided by application
Reference	ETSI EN 302 637-3 [1], clauses 7.1.4 and B.17
PICS Selection	PICS_DENM_GENERATION

Initial conditions

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

Expected behaviour

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

TP Id	TP/DEN/EVGN/BV-05
Test objective	Check that referenceTime is set to the current time when generating a DENM for a new event
Reference	ETSI EN 302 637-3 [1], clause 8.2.1.3
PICS Selection	PICS_DENM_GENERATION
Initial conditions	

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

Expected behaviour	

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

TP Id	TP/DEN/EVGN/BV-07
Test objective	Check that sequenceNumber is set to a next unused value each time an event is detected
Reference	ETSI EN 302 637-3 [1], clauses 6.1.1.1 and 8.2.1.2
PICS Selection	PICS_DENM_GENERATION
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT having generated several events
and the IUT having generated its last DENM
containing management container
containing actionID
containing sequenceNumber
indicating SEQ1
and no active event being associated with sequenceNumber SEQ1 + 1
}	

Expected behaviour	

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

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

```
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 sequenceNumber
                        indicating SEQ1 + 2
    }
}
```

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

```
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

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

```
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
}
```

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

```
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
}
```

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
    }
}
```

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 *App*DENM_*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
}
}	

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 *App*DENM_*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
}
}	

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

```
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
                and containing termination
                    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
    }
}
```

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	

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
}	

Expected behaviour	

ensure that {
when {
the IUT receives an *App*DENM_*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
}
}	

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	

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 containing validityDuration
                indicating DURATION_2 and the IUT having repeated (one or more times) the transmission of the valid
DENM associated with ACTION_ID1
}
```

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

Initial conditions

```
with {
    the IUT being in the "initial state"
    and the IUT having received an App DENM_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
}
```

Expected behaviour

```
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
    }
}
```

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

```
with {
    the IUT being in the "initial state"
    and the IUT having received an App DENM_trigger request from application layer
        not containing repetitionInterval
    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 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
    }
}
```

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

```
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
    }
}
```

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

```
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 its new StationID
    }
}
```

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

```
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 its ACTION_ID_1
                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

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 and CR#0002 for ETSI EN 302 637-3 [1] ("Type of ServiceSpecificPermissions in the DENM standard") (see note).
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 appPermission item
            containing psid
                indicating DENM ITS-AID
            containing bitmapSSP                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)

NOTE: Available at https://docbox.etsi.org/ITS/Open/CRs/CR%20EN%20302%20637-3%230002.docx.

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 tess 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	

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
}
}	

TP Id	TP/DEN/MSRV/BO-08
Test objective	Check that receiving ITS-S discards DENM if DENM messages are not permitted by the signing certificate
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 signing certificate
not containing appPermission item
containing psid
indicating DENM ITS-AID
}
then {
the IUT discards the DENM
and the IUT does not forward the DENM content to upper layer
}
}	

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 and CR#0002 for ETSI EN 302 637-3 [1] ("Type of ServiceSpecificPermissions in the DENM standard") (see note).
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 appPermission item
                    containing psid
                        indicating DENM ITS-AID
                    containing bitmapSSP
                        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)

NOTE: Available at https://docbox.etsi.org/ITS/Open/CRs/CR%20EN%20302%20637-3%230002.docx.

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 and CR#0002 for ETSI EN 302 637-3 [1] ("Type of ServiceSpecificPermissions in the DENM standard") (see note).
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 appPermission item
                containing psid
                    indicating DENM ITS-AID
                containing bitmapSSP
                    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 appPermission item
                    containing psid
                        indicating DENM ITS-AID
                    containing bitmapSSP
                        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)

Variants			
X	SSP_BIT_X		CAUSE_CODE_X
	Octet Position	Bit Position	
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)
NOTE: Available at https://docbox.etsi.org/ITS/Open/CRs/CR%20EN%20302%20637-3%230002.docx.			

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

```
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

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	

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
}
}	

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

```
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
}
```

Expected behaviour

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

TP Id	TP/DEN/KAFW/TI-03
Test objective	Check that forwarding delay is set to min (2 × 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

```
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)
    }
}
```

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

```
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
    }
}
```

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

```
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
    }
}
```

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

```
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
    }
}
```

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

```
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

```
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
}
```

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 MANACEMENTCONTAINER_1
            and containing situation container
                indicating SITUATION_1
            and containing location container
                indicating LOCATION_1
            and containing alacarte container
                indicating ALACARTE_1
    }
}
```

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

```
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
    }
}
```

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

```
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

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