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TECHNICAL SPECIFICATION

**Intelligent Transport Systems (ITS);
Testing;
Conformance test specifications for
Cooperative Awareness Basic Service (CA);
Part 2: Test Suite Structure and Test Purposes (TSS & TP)**

Reference

RTS/ITS-00153

Keywords

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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 Co-operative Awareness Basic Service (CA) 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 Co-operative Awareness Basic Service (CA) as defined in ETSI EN 302 637-2 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [6].

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [4] and ISO/IEC 9646-2 [5]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [7]) 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.

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

[1]   ETSI EN 302 637-2 (V1.3.2): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service".

[2]   ETSI TS 102 868-1 (V1.3.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Co-operative Awareness Messages (CAM); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma".

[3]   ETSI TS 102 871-1 (V1.3.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

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

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

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

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

2.2 Informative references

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.

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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 302 637-2 [1], ISO/IEC 9646-1 [4] and ISO/IEC 9646-7 [6] apply.

3.2 Abbreviations

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

ACC	Adaptive Cruise Control
ATS	Abstract Test Suite
BTP	Basic Transport Protocol
BTP-B	Basic Transport Protocol Type B
BV	valid test events for Behaviour tests
CA	Cooperative Awareness
CAM	Cooperative Awareness Messages
CAN	Controller Area Network
FMT	Message Format
GFQ	Generation Frequency
GN	GeoNetworking
INA	Information Adaptation
ISO	International Organization for Standardization
ITS	Intelligent Transport Systems
ITS-S	ITS station
IUT	Implementation Under Test
LF	Low Frequency
MSD	Message Dissemination
MSP	Message Processing
PAR	Lower-layer parameters
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
RSU	Road Side Unit
SHB	Single Hop Broadcast
SSP	Service Specific Permissions
TI	Timer tests
TP	Test Purposes
TS	Technical Specification
TSS	Test Suite Structure

4   Test Suite Structure (TSS)

4.1   Structure for CA tests

Table 1 shows the CA Test Suite Structure (TSS) including its sub-groups defined for conformance testing.

Table 1: TSS for CA

Root	Group	Sub-Group	Category
CAM	Message Dissemination		
		Message format	Valid
		Information adaptation	Valid
		Generation frequency	Valid and Timer
		lower layer parameters	Valid
	Message processing		Valid

The test suite is structured as a tree with the root defined as CAM. The tree is of rank 3 with the first rank a Group, the second a sub-group, and the third a category. The third rank is the standard ISO conformance test categories.

4.2   Test groups

4.2.1   Introduction

The test suite has a total of four levels. The first level is the root. The second level separates the root into various functional areas. The third level is the sub-functional areas if necessary. The fourth level is the standard ISO conformance test categories.

4.2.2   Root

The root identify the Co-operative Awareness Basic Service (CA) given in ETSI EN 302 637-2 [1].

4.2.3   Groups

This level contains two functional areas identified as:

- Message Dissemination

- Message Processing

4.2.4   Sub-Groups

This level contains four sub-functional areas identified only for the Message Dissemination group and defined as:

- Message format

- Information adaptation

- Generation frequency

- Lower-layer parameters

4.2.5   Categories

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

TP/<root>/<gr>/<sgr>/<x>/<nn> or TP/<root>/<gr>/<x>/<nn> when no <sgr>		
<root> = root	CAM	
<gr> = group	MSD	Message Dissemination
	MSP	Message Processing
<sgr> =sub- group	FMT	Message Format
	INA	Information Adaptation
	GFQ	Generation Frequency
	PAR	Lower-layer parameters
<x> = type of testing	BV	Valid Behaviour tests
	TI	Timer tests
<nn> = sequential number		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].

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

Being in the "Initial State" 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 302 637-2 [1].

5.1.5   Mnemonics for PICS reference

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

The PICS item column refers to Table/Item of ETSI TS 102 868-1 [2].

Table 3: Mnemonics for PICS reference

Mnemonic	PICS item
PICS_PUBLICTRANS	A.12/1
PICS_SPECIALTRANS	A.12/2
PICS_DANGEROUSGOODS	A.12/3
PICS_ROADWORKS	A.12/4
PICS_RESCUE	A.12/5
PICS_EMERGENCY	A.12/6
PICS_SAFETYCAR	A.12/7
PICS_SPECIALVEHICLECONTAINER	A.8/4
PICS_RSU	A.1/2
PICS_CAM_RECEPTION	A.3/2
PICS_CAM_GENERATION	A.3/1
PICS_SECURITY	ETSI TS 102 871-1 [3] A.32/12

5.2   Test purposes for CA

5.2.1   Message dissemination

5.2.1.1   Message format

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

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

Expected behaviour	

ensure that {
    when {
        a CAM is generated
    }
    then {
        the IUT sends a valid CAM
            containing ITS PDU header
                containing protocolVersion
                    indicating value 1
                and containing messageID
                    indicating value 2
}	

TP Id	TP/CAM/MSD/FMT/BV-02
Test objective	Check that LF container is included in first CAM since CA basic service activation
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

with {
   the IUT being in the "initial state"
   and the IUT has not sent any CAM yet
}

Expected behaviour

ensure that {
   when {
      a CAM is generated
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing lowFrequencyContainer
}

TP Id	TP/CAM/MSD/FMT/BV-03
Test objective	Check that LF container is included if time elapsed since the generation of the last CAM with the low frequency container generation is equal to or greater than 500 ms
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

with {
   the IUT being in the "initial state"
   and the IUT has sent a CAM
      containing cam
         containing camParameters
            containing lowFrequencyContainer at time TIME_1
   and the IUT has not sent CAM
      containing cam
         containing camParameters
            containing lowFrequencyContainer after TIME_1
}

Expected behaviour

ensure that {
   when {
      a CAM is generated at time TIME_2 >= (TIME_1 + 500 ms)
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing lowFrequencyContainer
}

TP Id	TP/CAM/MSD/FMT/BV-04
Test objective	Check that specialVehicle container is included in first CAM since CA basic service activation
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION AND PICS_SPECIALVEHICLECONTAINER
Initial conditions	

with {
   the IUT being in the "initial state"
   and the IUT is configured to advertise itself as a special vehicle
   and the IUT has not sent any CAM yet
}

Expected behaviour

ensure that {
   when {
      a CAM is generated
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing specialVehicleContainer
}

TP Id	TP/CAM/MSD/FMT/BV-05
Test objective	Check that specialVehicle container is included if time elapsed since the generation of the last CAM with the special vehicle container generation is equal to or greater than 500 ms
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION AND PICS_SPECIALVEHICLECONTAINER
Initial conditions	

with {
   the IUT being in the "initial state"
   and the IUT has sent a CAM
      containing cam
         containing camParameters
            containing specialVehicleContainer at time TIME_1
   and the IUT has not sent CAM
      containing cam
         containing camParameters
            containing specialVehicleContainer after TIME_1
}

Expected behaviour

ensure that {
   when {
      a CAM is generated at time TIME_2 >= (TIME_1 + 500 ms)
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing specialVehicleContainer
}

5.2.1.2   Information adaptation

TP Id	TP/CAM/MSD/INA/BV-01-X
Test objective	Check that latest value of in-vehicle data is included in CAM
Reference	ETSI EN 302 637-2 [1], clause 5.2
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

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

Expected behaviour

ensure that {
    when {
        the IUT is alerted about INFO
    }
    then {
        the IUT sends a valid CAM
            containing cam
                containing camParameters
                    containing FIELD set to VALUE
}

Variants			
#	**INFO**	**FIELD**	**VALUE**
01	Curvature value	highFrequencyContainer .basicVehicleContainerHighFrequency .curvature	Measured value
02	Brake pedal being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .brakePedalEngaged	1
03	Brake pedal being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .brakePedalEngaged	0
04	Gas pedal being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .gasPedalEngaged	1
05	Gas pedal being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .gasPedalEngaged	0
06	Emergency brake being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .emergencyBrakeEngaged	1
07	Emergency brake being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .emergencyBrakeEngaged	0
08	Collision warning being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .collisionWarningEngaged	1
09	Collision warning being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .collisionWarningEngaged	0
10	ACC being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .accEngaged	1

Variants			
#	**INFO**	**FIELD**	**VALUE**
11	ACC being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accActive .brakePedalEngaged	0
12	Cruise control being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .cruiseControlEngaged	1
13	Cruise control being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .cruiseControlEngaged	0
14	Speed limiter being engaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .speedLimiterEngaged	1
15	Speed limiter control being disengaged	highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .speedLimiterEngaged	0
16	Low beam headlights being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .lowBeamHeadlightsOn	1
17	Low beam headlights being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .lowBeamHeadlightsOn	0
18	High beam headlights being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .highBeamHeadlightsOn	1
19	High beam headlights being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .highBeamHeadlightsOn	0
20	Left turn signal being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .leftTurnSignalOn	1
21	Left turn signal being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .leftTurnSignalOn	0
22	Right turn signal being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .rightTurnSignalOn	1
23	Right turn signal being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .rightTurnSignalOn	0
24	Daytime running lights being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .daytimeRunningLightsOn	1
25	Daytime running lights being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .daytimeRunningLightsOn	0

Variants			
#	INFO	FIELD	VALUE
26	Reverse light being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .reverseLightOn	1
27	Reverse light being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .reverseLightOn	0
28	Fog lights being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .fogLightOn	1
29	Fog lights being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .fogLightOn	0
30	Parking lights being engaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .parkingLightsOn	1
31	Parking lights being disengaged	lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .parkingLightsOn	0
32	Heading value	highFrequencyContainer .basicVehicleContainerHighFrequency .heading	Measured value
33	Speed value	highFrequencyContainer .basicVehicleContainerHighFrequency .speed	Measured value
34	Drive direction value	highFrequencyContainer .basicVehicleContainerHighFrequency .driveDirection	Measured value
35	Yaw rate value	highFrequencyContainer .basicVehicleContainerHighFrequency .yawRate	Measured value

TP Id	TP/CAM/MSD/INA/BV-02
Test objective	Check that publicTransportContainer is included if vehicleRole is set to publicTransport(1)
Reference	ETSI EN 302 637-2 [1], clause B.11
PICS Selection	PICS_CAM_GENERATION AND PICS_PUBLICTRANS
Initial conditions	

with {
    the IUT being in the "initial state"
    the IUT's vehicle role being set to publicTransport(1)
}	

Expected behaviour	

ensure that {
    when {
        a CAM is generated
    }
    then {
        the IUT sends a valid CAM
            containing cam
                containing camParameters
                containing specialVehicleContainer
                    containing publicTransportContainer
}	

TP Id	TP/CAM/MSD/INA/BV-03
Test objective	Check that specialTransportContainer is included if vehicleRole is set to specialTransport(2)
Reference	ETSI EN 302 637-2 [1], clause B.12
PICS Selection	PICS_CAM_GENERATION AND PICS_SPECIALTRANS
Initial conditions	

```
with {
    the IUT being in the "initial state"
    the IUT's vehicle role being set to specialTransport(2)
}
```

Expected behaviour

```
ensure that {
    when {
        a CAM is generated
    }
    then {
        the IUT sends a valid CAM
            containing cam
                containing camParameters
                    containing specialVehicleContainer
                        containing specialTransportContainer
}
```

TP Id	TP/CAM/MSD/INA/BV-04
Test objective	Check that dangerousGoodsContainer is included if vehicleRole is set to dangerousGoods(3)
Reference	ETSI EN 302 637-2 [1], clause B.13
PICS Selection	PICS_CAM_GENERATION AND PICS_DANGEROUSGOODS
Initial conditions	

```
with {
    the IUT being in the "initial state"
    the IUT's vehicle role being set to dangerousGoods(3)
}
```

Expected behaviour

```
ensure that {
    when {
        a CAM is generated
    }
    then {
        the IUT sends a valid CAM
            containing cam
                containing camParameters
                    containing specialVehicleContainer
                        containing dangerousGoodsContainer
}
```

TP Id	TP/CAM/MSD/INA/BV-05
Test objective	Check that roadWorksContainerBasic is included if vehicleRole is set to roadWork(4)
Reference	ETSI EN 302 637-2 [1], clause B.14
PICS Selection	PICS_CAM_GENERATION AND PICS_ROADWORKS
Initial conditions	

```
with {
   the IUT being in the "initial state"
   the IUT's vehicle role being set to roadWork(4)
}
```

Expected behaviour

```
ensure that {
   when {
      a CAM is generated
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing specialVehicleContainer
                  containing roadWorksContainerBasic
}
```

TP Id	TP/CAM/MSD/INA/BV-06
Test objective	Check that rescueContainer is included if vehicleRole is set to rescue(5)
Reference	ETSI EN 302 637-2 [1], clause B.15
PICS Selection	PICS_CAM_GENERATION AND PICS_RESCUE
Initial conditions	

```
with {
   the IUT being in the "initial state"
   the IUT's vehicle role being set to rescue(5)
}
```

Expected behaviour

```
ensure that {
   when {
      a CAM is generated
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing specialVehicleContainer
                  containing rescueContainer
}
```

TP Id	TP/CAM/MSD/INA/BV-07
Test objective	Check that emergencyContainer is included if vehicleRole is set to emergency(6)
Reference	ETSI EN 302 637-2 [1], clause B.16
PICS Selection	PICS_CAM_GENERATION AND PICS_EMERGENCY
Initial conditions	

with {
   the IUT being in the "initial state"
   the IUT's vehicle role being set to emergency(6)
}

| **Expected behaviour** | |

ensure that {
   when {
      a CAM is generated
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing specialVehicleContainer
                  containing emergencyContainer
}

TP Id	TP/CAM/MSD/INA/BV-08
Test objective	Check that safetyCarContainer is included if vehicleRole is set to safetyCar(7)
Reference	ETSI EN 302 637-2 [1], clause B.17
PICS Selection	PICS_CAM_GENERATION AND PICS_SAFETYCAR
Initial conditions	

with {
   the IUT being in the "initial state"
   the IUT's vehicle role being set to safetyCar(7)
}

| **Expected behaviour** | |

ensure that {
   when {
      a CAM is generated
   }
   then {
      the IUT sends a valid CAM
         containing cam
            containing camParameters
               containing specialVehicleContainer
                  containing safetyCarContainer
}

5.2.1.3   Generation frequency

TP Id	TP/CAM/MSD/GFQ/TI-01
Test objective	Check that CAMs are not generated more frequently than T_GenCamMin
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

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

| **Expected behaviour** | |

ensure that {
   when {
      IUT sends a CAM
   }
   then {
      the IUT does not send any CAM before or upon expiry of T_GenCamMin
   }
}

TP Id	TP/CAM/MSD/GFQ/TI-02
Test objective	Check that CAMs are not generated less frequently than T_GenCamMax
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

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

Expected behaviour

ensure that {
   when {
      IUT sends a CAM
   }
   then {
      the IUT sends another CAM before expiry of T_GenCamMax
   }
}

TP Id	TP/CAM/MSD/GFQ/TI-03
Test objective	Check that T_GenCam is set to T_GenCamMax after generating N_GenCam due to condition 2
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

with {
   the IUT being in the "initial state"
   the IUT having sent a CAM at time TIME_1
   the IUT having sent an anticipated CAM due to condition 1 at time (TIME_1 + INTERVAL_1)
   the IUT having sent (N_GenCam - 1) subsequent CAMs every INTERVAL_1
}

Expected behaviour

ensure that {
   when {
      the IUT sends CAM
   }
   then {
      the IUT sends another CAM after expiry of T_GenCamMax
   }
}

TP Id	TP/CAM/MSD/GFQ/BV-04
Test objective	Check that CAM is generated immediately when the time elapsed since the last CAM generation is equal to or greater than T_GenCam_Dcc and the absolute difference between current heading of the originating ITS-S (towards North) and heading included in previous CAM exceeds 4°
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

with {
   the IUT being in the "initial state"
   the IUT having sent a CAM at time TIME_1
      containing cam
         containing camParameters
            containing highFrequencyContainer
               containing basicVehicleContainerHighFrequency
                  containing heading set to HEADING_1
   the IUT not having sent any other CAM
   the IUT is alerted about new heading value HEADING_2
      and abs(HEADING_2 – HEADING_1) > 4°
}

Expected behaviour

ensure that {
   when {
      T_GenCam_Dcc expires
   }
   then {
      the IUT sends a CAM immediately
   }
}

TP Id	TP/CAM/MSD/GFQ/BV-05
Test objective	Check that CAM is generated immediately when the time elapsed since the last CAM generation is equal to or greater than T_GenCam_Dcc and the current position and position included in previous CAM exceeds 4 m
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

with {
   the IUT being in the "initial state"
   the IUT having sent a CAM at time TIME_1
      containing cam
         containing camParameters
            containing basicContainer
               containing referencePositionset to POSITION_1
   the IUT not having sent any other CAM
   the IUT is alerted about new position value POSITION_2
      and distance(POSITION_2, POSITION_1) > 4 m
}

Expected behaviour

ensure that {
   when {
      T_GenCam_Dcc expires
   }
   then {
      the IUT sends a CAM immediately
   }
}

TP Id	TP/CAM/MSD/GFQ/BV-06
Test objective	Check that CAM is generated immediately when the time elapsed since the last CAM generation is equal to or greater than T_GenCam_Dcc and the absolute difference between current speed and speed included in previous CAM exceeds 0,5 m/s
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

```
with {
    the IUT being in the "initial state"
    the IUT having sent a CAM at time TIME_1
        containing cam
            containing camParameters
                containing highFrequencyContainer
                    containing basicVehicleContainerHighFrequency
                        containing speed set to SPEED_1
    the IUT not having sent any other CAM
    the IUT is alerted about new speed value SPEED_2
        and abs(SPEED_2 – SPEED_1) > 0,5 m/s
}
```

Expected behaviour

```
ensure that {
    when {
        T_GenCam_Dcc expires
    }
    then {
        the IUT sends a CAM immediately
    }
}
```

TP Id	TP/CAM/MSD/GFQ/TI-07
Test objective	Check that CAM is generated immediately when the time elapsed since the last CAM generation is equal to or greater than T_GenCam and equal to or greater than T_GenCam_Dcc
Reference	ETSI EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

```
with {
    the IUT being in the "initial state"
    the IUT having sent a CAM
}
```

Expected behaviour

```
ensure that {
    when {
        T_GenCam expires
        and T_GenCam_Dcc expires
    }
    then {
        the IUT sends another CAM
    }
}
```

TP Id	TP/CAM/MSD/GFQ/TI-08
Test objective	Check that maximum CAM generation frequency for RSU ITS-S is 1 Hz
Reference	ETSI EN 302 637-2 [1], clause 6.1.4
PICS Selection	PICS_CAM_GENERATION AND PICS_RSU
Initial conditions	
with { the IUT being in the "initial state" }	
Expected behaviour	
ensure that { when { IUT sends a CAM } then { the IUT does not send another CAM before 1 s } }	

5.2.1.4   Lower-layer parameters

TP Id	TP/CAM/MSD/PAR/BV-01
Test objective	Check that CAM is encapsulated in BTP type B packet
Reference	ETSI EN 302 637-2 [1], clause 5.3.4.1
PICS Selection	PICS_CAM_GENERATION
Initial conditions	
with { the IUT being in the "initial state" }	
Expected behaviour	
ensure that { when { a CAM is generated } then { the IUT sends a CAM encapsulated in a BTP-B packet } }	

TP Id	TP/CAM/MSD/PAR/BV-02
Test objective	Check that CAM is encapsulated in SHB packet
Reference	ETSI EN 302 637-2 [1], clause 5.3.4.1
PICS Selection	PICS_CAM_GENERATION
Initial conditions	
with { the IUT being in the "initial state" }	
Expected behaviour	
ensure that { when { a CAM is generated } then { the IUT sends a CAM encapsulated in a SHB packet } }	

TP Id	TP/CAM/MSD/PAR/BV-03
Test objective	Check that CAM is encapsulated in GN packet with lifetime less than 1 s
Reference	ETSI EN 302 637-2 [1], clause 5.3.4.1
PICS Selection	PICS_CAM_GENERATION
Initial conditions	

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

Expected behaviour	

ensure that {
    when {
        a CAM is generated
    }
    then {
        the IUT sends a CAM
            encapsulated in a GN packet
                containing Basic Header
                    containing Lifetime field
                        indicating value less than 1 s
    }
}	

5.2.2   Message processing

TP Id	TP/CAM/MSP/BV-01
Test objective	Check that content of received CAM is transmitted to applications and other facilities
Reference	ETSI EN 302 637-2 [1], clause 4.4
PICS Selection	PICS_CAM_RECEPTION
Initial conditions	

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

Expected behaviour	

ensure that {
    when {
        the IUT receives a valid CAM
    }
    then {
        the IUT forwards the CAM content to upper layers
        and the IUT forwards the CAM content to other facilities
    }
}	

TP Id	TP/CAM/MSP/BV-02
Test objective	Check that receiving ITS-S discards CAM if SSP value of the signing certificate is not consistent with the provided containers
Reference	ETSI EN 302 637-2 [1], clause 6.2.2.1
PICS Selection	PICS_CAM_RECEPTION AND PICS_SECURITY
Initial conditions	
with { the IUT being in the "initial state" }	
Expected behaviour	
ensure that { when { the IUT receives a secured CAM containing container CONTAINER_1 containing signing certificate containing SSP not indicating CONTAINER_1 } then { the IUT discards the CAM and the IUT does not forward the CAM content to upper layers and the IUT does not forward the CAM content to other facilities } }	

Annex A (informative):
Bibliography

- ETSI TS 102 894-2 (V1.2.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part2: Applications and facilities layer common data dictionary".

History

Document history		
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