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Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Co-operative Awareness Messages (CAM); Part 2: Test Suite Structure and Test Purposes (TSS & TP)

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

The present document is part 2 of a multi-part deliverable covering Conformance test specification for Co-operative Awareness Messages (CAM) as identified below:

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

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

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

1 Scope

The present document provides the Test Suite Structure and Test Purposes (TSS & TP) for Co-operative Awareness Messages (CAM) as defined in 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 [3] and ISO/IEC 9646-2 [4]) as well as the ETSI rules for conformance testing (ETS 300 406 [7]) are used as a basis for the test methodology.

2 References

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

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

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

2.1 Normative references

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

| [1] | ETSI EN 302 637-2 (V1.3.0): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service". |
|-----|---|
| [2] | ETSI TS 102 868-1 (V1.2.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specification for Decentralized Environmental Notification Messages (DENM); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma". |
| [3] | ISO/IEC 9646-1 (1994): "Information technology Open Systems Interconnection Conformance testing methodology and framework - Part 1: General concepts". |
| [4] | ISO/IEC 9646-2 (1994): "Information technology Open Systems Interconnection Conformance testing methodology and framework Part 2: Abstract Test Suite specification". |
| [5] | Void. |
| [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". |
| [8] | Void. |

2.2 Informative references

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 EN 302 637-2 [1], ISO/IEC 9646-1 [3] and in ISO/IEC 9646-7 [6] apply.

3.2 Abbreviations

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

| ACC | Adaptive Cruise Contro |
|-----|---------------------------------|
| BI | Invalid Behaviour |
| BV | Valid Behaviour |
| CA | Cooperative Awareness |
| CAM | Co-operative Awareness Messages |
| CAN | Controller Area Network |
| FMT | Message Format |
| GFQ | Generation Frequency |
| INA | INformation Adaptation |
| ITS | Intelligent Transport Systems |
| IUT | Implementation Under Test |
| LF | Low Frequency |
| MSD | Message Dissemination |
| MSP | MesSage Processing |
| PDU | Protocol Data Unit |
| TP | Test Purposes |
| TSS | Test Suite Structure |
| | |

4 Test Suite Structure (TSS)

4.1 Structure for CAM tests

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

Table 1: TSS for CAM

| Root | Group | Sub-Group | category |
|------|-----------------------|------------------------|-----------------|
| CAM | Message Dissemination | | Valid behaviour |
| | | Message format | Valid behaviour |
| | | Information adaptation | Valid behaviour |
| | | Generation frequency | Valid behaviour |
| | Message processing | | Valid behaviour |

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

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.

The root identify the Co-operative Awareness Messages (CAM) given in EN 302 637-2 [1].

4.2.2 Groups

This level contains two functional areas identified as:

- Message Dissemination
- Message Processing

4.2.3 Sub-Groups

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

- Message format
- Information adaptation
- Generation frequency

4.2.4 Categories

This level contains the standard ISO conformance test categories limited to the valid behaviour and the invalid behaviour.

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP definition conventions

The TP definition is built according to 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>/<sgr>/<x>/<nn> or TP/<root>/<gr>/<x>/<nn> when no <sgr></sgr></nn></x></gr></root></nn></x></sgr></gr></root> | | |
|------------|---|-----|-----------------------------------|
| | <root> = root</root> | CAM | |
| | <gr> = group</gr> | MSD | Message Dissemination |
| | | MSP | Message Processing |
| | <sgr> =sub- group</sgr> | FMT | Message Format |
| | | INA | Information Adaptation |
| | | GFQ | Generation Frequency |
| | <x> = type of testing</x> | BV | Valid Behaviour tests |
| | | BI | Invalid Syntax or Behaviour Tests |
| | <nn> = sequential number</nn> | | 01 to 99 |

5.1.3 Rules for the behaviour description

The description of the TP is built according to 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 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.

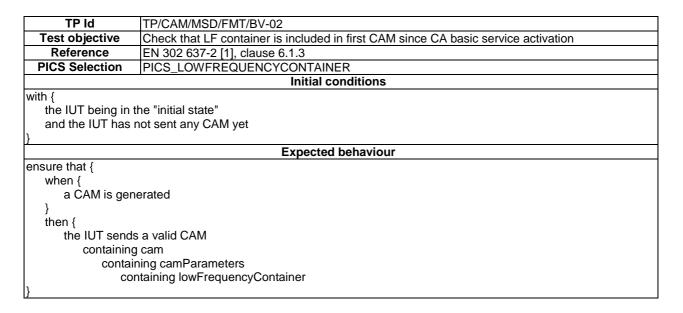
| Mnemonic | PICS item |
|------------------------------|-------------|
| PICS_PUBLICTRANS | A.12/1 [2] |
| PICS_SPECIALTRANS | A.12/2 [2] |
| PICS_DANGEROUSGOODS | A.12/3 [2] |
| PICS_ROADWORKS | A.12/4 [2] |
| PICS_RESCUE | A.12/5 [2] |
| PICS_EMERGENCY | A.12/6 [2] |
| PICS_SAFETYCAR | A.12/7 [2] |
| PICS_LOWFREQUENCYCONTAINER | A.8/3 [2] |
| PICS_SPECIALVEHICLECONTAINER | A.8/4 [2] |
| PICS_T_GENCAM | A.22//5 [2] |
| PICS_T_GENCAMDCC | A.22//4 [2] |
| PICS_T_GENCAMMAX | A.22//1 [2] |
| PICS_T_GENCAMMIN | A.22//2 [2] |

Table 3: Mnemonics for PICS reference

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 | EN 302 637-2 [1], clause B.1 | |
| PICS Selection | | |
| | Initial conditions | |
| with { | | |
| the IUT being in t | the "initial state" | |
| } | | |
| | Expected behaviour | |
| ensure that { | | |
| when { | | |
| a CAM is gen | nerated | |
| } | | |
| then { | | |
| the IUT sends | s a valid CAM | |
| containing | g ITS PDU header | |
| contair | ining protocolVersion | |
| ind | dicating value 1 | |
| and co | ontaining messageID | |
| | dicating value 2 | |
| } | Ŭ | |



| TP ld | 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 or greater than 500 ms |
| Reference | EN 302 637-2 [1], clause 6.1.3 |
| PICS Selection | PICS_LOWFREQUENCYCONTAINER |
| | Initial conditions |
| with { | |
| the IUT being in | |
| and the IUT has | |
| containing ca | |
| | g camParameters |
| | ining lowFrequencyContainer at time TIME_1 |
| and the IUT has | |
| containing ca | |
| | g camParameters |
| conta | ining lowFrequencyContainer after TIME_1 |
| } | Expected behaviour |
| ensure that { | |
| when { | |
| | nerated at time TIME_2 >= (TIME_1 + 500 ms) |
| د م CANINIS GEI | $\frac{1}{100} = \frac{1}{100} = \frac{1}$ |
| then { | |
| • | ls a valid CAM |
| containin | |
| | ining camParameters |
| | ntaining 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 | EN 302 637-2 [1], clause 6.1.3 |
| PICS Selection | PICS_SPECIALVEHICLECONTAINER |
| | Initial conditions |
| with { | |
| the IUT being in the | ne "initial state" |
| and the IUT is cor | nfigured to advertise itself as a special vehicle |
| | not sent any CAM yet |
| } | |
| | Expected behaviour |
| ensure that { | |
| when { | |
| a CAM is gene | erated |
| } | |
| then { | |
| the IUT sends | a valid CAM |
| containing | cam |
| contain | ning camParameters |
| | taining specialVehicleContainer |
| } | |
| <i>~</i> | |

| TP Id TP/CAM/MSD/FMT/BV-05 Test objective Check that special/vehicle container is included if time elapsed since the generation of the last CAM with the special vehicle container generation is equal or greater than 500 ms Reference EN 302 637-2 [1], clause 6.1.3 PICS Selection PICS_SPECIALVEHICLECONTAINER with { Initial conditions with { containing cam containing cam containing special/vehicleContainer at time TIME_1 and the IUT has not sent CAM containing cam containing cam containing cam containing cam containing cam containing special/vehicleContainer at time TIME_1 and the IUT has not sent CAM containing cam containing cam containing special/vehicleContainer after TIME_1 Expected behaviour ensure that { when { a CAM is generated at time TIME_2 >= (TIME_1 + 500 ms) | | · |
|--|----------------------|--|
| CAM with the special vehicle container generation is equal or greater than 500 ms Reference EN 302 637-2 [1], clause 6.1.3 PICS Selection PICS_SPECIALVEHICLECONTAINER Initial conditions with { Initial conditions with { containing tame and 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 cam containing cam containing camParameters containing camParameters containing camParameters containing camParameters containing camParameters containing specialVehicleContainer after TIME_1 } Expected behaviour ensure that { when { | | TP/CAM/MSD/FMT/BV-05 |
| Reference EN 302 637-2 [1], clause 6.1.3 PICS Selection PICS_SPECIALVEHICLECONTAINER Initial conditions with { Initial conditions with { containing in the "initial state" and the IUT being in the "initial state" containing cam containing cam containing camParameters containing specialVehicleContainer at time TIME_1 and the IUT has not sent CAM containing camParameters containing cam containing camParameters containing cam containing camParameters containing cam containing camParameters containing specialVehicleContainer after TIME_1 | Test objective | Check that specialVehicle container is included if time elapsed since the generation of the last |
| PICS Selection PICS_SPECIAL/VEHICLECONTAINER Initial conditions with { the IUT being in the "initial state" and the IUT bas sent a CAM containing cam containing camParameters containing special/vehicleContainer at time TIME_1 and the IUT has not sent CAM containing cam containing cam containing camParameters containing cam containing cam containing special/vehicleContainer after TIME_1 Expected behaviour ensure that { when { | | CAM with the special vehicle container generation is equal or greater than 500 ms |
| 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 camParameters containing camParameters containing camParameters containing camParameters containing specialVehicleContainer after TIME_1 Expected behaviour ensure that { when { | Reference | EN 302 637-2 [1], clause 6.1.3 |
| 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 { } | PICS Selection | PICS_SPECIALVEHICLECONTAINER |
| 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 } <u>Expected behaviour</u> ensure that { when { | | Initial conditions |
| 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 { | with { | |
| 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 { | the IUT being in the | he "initial state" |
| 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 { | and the IUT has s | sent a CAM |
| containing specialVehicleContainer at time TIME_1 and the IUT has not sent CAM containing cam containing camParameters containing specialVehicleContainer after TIME_1 } <u>Expected behaviour</u> ensure that { when { | containing car | n |
| and the IUT has not sent CAM containing cam containing camParameters containing specialVehicleContainer after TIME_1 } Expected behaviour ensure that { when { | containing | camParameters |
| containing cam containing camParameters containing specialVehicleContainer after TIME_1 } Expected behaviour ensure that { when { | | |
| containing camParameters containing specialVehicleContainer after TIME_1 } Expected behaviour ensure that { when { | and the IUT has n | not sent CAM |
| containing specialVehicleContainer after TIME_1 } Expected behaviour ensure that { when { | | |
| Expected behaviour ensure that { when { | | |
| ensure that { when { | contain | ing specialVehicleContainer after TIME_1 |
| ensure that { when { | } | |
| when { | | Expected behaviour |
| | • | |
| a CAM is generated at time TIME_2 >= (TIME_1 + 500 ms) | • | |
| | a CAM is gene | erated at time TIME_2 >= (TIME_1 + 500 ms) |
| | } | |
| then { | · · · | |
| the IUT sends a valid CAM | | |
| containing cam | 5 | |
| containing camParameters | | |
| containing specialVehicleContainer | con | taining special venicle ontainer |

5.2.1.2 Information adaptation

| 1 | TP Id | TP/CAM/MSD/INA/B | V-01-X | | |
|----------|------------------|------------------------|--|---|------------------------|
| Too | st objective | | ue of in-vehicle data is i | ncluded in CAM | |
| | eference | | | | |
| | | EN 302 637-2 [1], cla | | | |
| PIC | S Selection | See permutation tabl | | | |
| | | | Initial conditions | | |
| with { | | | | | |
| the I | UT being in the | "initial state" | | | |
| } | | | | | |
| - | | | Expected behaviou | ır | |
| ensure t | • | | | | |
| whe | | | | | |
| t | he IUT is alerte | d about INFO | | | |
| } | | | | | |
| then | | | | | |
| t | he IUT sends a | | | | |
| | containing ca | | | | |
| | | g camParameters | | | |
| | conta | ining FIELD set to VAL | UE | | |
| } | | | Varianta | | |
| щ | | 01-1-1-2 | Variants | | |
| # | - | Status | INFO | FIELD | |
| 01 | m | | | | VALUE |
| | | | Curvature value | highFrequencyContainer | Measured |
| | | | | .basicVehicleContainerHighFrequency | |
| | | | | .basicVehicleContainerHighFrequency .curvature | Measured value |
| 02 | m | | Brake pedal | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer | Measured |
| 02 | m | | | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer .basicVehicleContainerHighFrequency | Measured value |
| 02 | m | | Brake pedal | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl | Measured value |
| | m | | Brake pedal being engaged | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .brakePedalEngaged | Measured value 1 |
| 02 | m | | Brake pedal being engaged Brake pedal | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .brakePedalEngaged highFrequencyContainer | Measured value |
| | | | Brake pedal being engaged Brake pedal being | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .brakePedalEngaged highFrequencyContainer .basicVehicleContainerHighFrequency | Measured value 1 |
| | | | Brake pedal being engaged Brake pedal | .basicVehicleContainerHighFrequency .curvature highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .brakePedalEngaged highFrequencyContainer | Measured value 1 |

| # | Status | Variants INFO | FIELD | VALUE |
|---------|----------------------------|--|---|-------|
| # 04 | m | Gas pedal being engaged | highFrequencyContainer .basicVehicleContainerHighFrequency | 1 |
| | | | .accelerationControl .gasPedalEngaged | |
| 05 | m | Gas pedal being disengaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl | 0 |
| 06 | | Emorgonov | .gasPedalEngaged | 1 |
| 06 | m | Emergency brake being engaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .emergencyBrakeEngaged | 1 |
| 07 | m | Emergency brake being disengaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .emergencyBrakeEngaged | 0 |
| 08 | m | Collision warning being engaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .collisionWarningEngaged | 1 |
| 09 | m | Collision warning being disengaged | highFrequencyContainer basicVehicleContainerHighFrequency .accelerationControl .collisionWarningEngaged | 0 |
| 10 | m | ACC being engaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .accEngaged | 1 |
| 11 | m | ACC being disengaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accActive .brakePedalEngaged | 0 |
| 12 | m | Cruise control being engaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .cruiseControlEngaged | 1 |
| 13 | m | Cruise control being disengaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .cruiseControlEngaged | 0 |
| 14 | m | Speed limiter being engaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .speedLimiterEngaged | 1 |
| 15 | m | Speed limiter control being disengaged | highFrequencyContainer .basicVehicleContainerHighFrequency .accelerationControl .speedLimiterEngaged | 0 |
| 16 | PICS_LOWFREQUENCYCONTAINER | Low beam headlights being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .lowBeamHeadlightsOn | 1 |
| 17 | PICS_LOWFREQUENCYCONTAINER | Low beam headlights being disengaged | IowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .lowBeamHeadlightsOn | 0 |
| 18 | PICS_LOWFREQUENCYCONTAINER | High beam headlights being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .highBeamHeadlightsOn | 1 |
| 19 | PICS_LOWFREQUENCYCONTAINER | High beam headlights being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .highBeamHeadlightsOn | 0 |

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| | | Variants | | |
|----|----------------------------|---|---|-------------------|
| # | Status | INFO | FIELD | VALUE |
| 20 | PICS_LOWFREQUENCYCONTAINER | Left turn signal being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .leftTurnSignalOn | 1 |
| 21 | PICS_LOWFREQUENCYCONTAINER | Left turn signal being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .leftTurnSignalOn | 0 |
| 22 | PICS_LOWFREQUENCYCONTAINER | Right turn signal being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .rightTurnSignalOn | 1 |
| 23 | PICS_LOWFREQUENCYCONTAINER | Right turn signal being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .rightTurnSignalOn | 0 |
| 24 | PICS_LOWFREQUENCYCONTAINER | Daytime running lights being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .daytimeRunningLightsOn | 1 |
| 25 | PICS_LOWFREQUENCYCONTAINER | Daytime running lights being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .daytimeRunningLightsOn | 0 |
| 26 | PICS_LOWFREQUENCYCONTAINER | Reverse light being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .reverseLightOn | 1 |
| 27 | PICS_LOWFREQUENCYCONTAINER | Reverse light being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .reverseLightOn | 0 |
| 28 | PICS_LOWFREQUENCYCONTAINER | Fog lights being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .fogLightOn | 1 |
| 29 | PICS_LOWFREQUENCYCONTAINER | Fog lights being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .fogLightOn | 0 |
| 30 | PICS_LOWFREQUENCYCONTAINER | Parking lights being engaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .parkingLightsOn | 1 |
| 31 | PICS_LOWFREQUENCYCONTAINER | Parking lights being disengaged | lowFrequencyContainer .basicVehicleContainerLowFrequency .exteriorLights .parkingLightsOn | 0 |
| 32 | m | Heading value | highFrequencyContainer .basicVehicleContainerHighFrequency .heading | Measured value |
| 33 | m | Speed value | highFrequencyContainer .basicVehicleContainerHighFrequency .speed | Measured value |
| 34 | m | Drive direction value | highFrequencyContainer .basicVehicleContainerHighFrequency .driveDirection | Measured value |
| 35 | m | Yaw rate value | highFrequencyContainer .basicVehicleContainerHighFrequency .yawRate | Measured value |

| TDU | |
|----------------------|---|
| TP ld | TP/CAM/MSD/INA/BV-02 |
| Test objective | Check that publicTransportContainer is included if vehicleRole is set to publicTransport(1) |
| Reference | EN 302 637-2 [1], clause B.11 |
| PICS Selection | PICS_PUBLICTRANS |
| | Initial conditions |
| with { | |
| the IUT being in the | he "initial state" |
| the IUT's vehicle | role being set to publicTransport(1) |
| } | |
| | Expected behaviour |
| ensure that { | <u>.</u> |
| when { | |
| a CAM is gene | erated |
| } | |
| then { | |
| the IUT sends | a valid CAM |
| containing | cam |
| | ning camParameters |
| | ning specialVehicleContainer |
| | containing publicTransportContainer |
| } | |
| , | |
| | |
| | |

| TP ld | TP/CAM/MSD/INA/BV-03 | |
|--------------------------------------|---|--|
| Test objective | Check that specialTransportContainer is included if vehicleRole is set to specialTransport(2) | |
| Reference | EN 302 637-2 [1], clause B.12 | |
| PICS Selection | PICS_SPECIALTRANS | |
| | Initial conditions | |
| with { | | |
| the IUT being in the | ne "initial state" | |
| the IUT's vehicle r | role being set to specialTransport(2) | |
| } | | |
| | Expected behaviour | |
| ensure that { | | |
| when { | | |
| a CAM is gene | erated | |
| } | | |
| then { | | |
| the IUT sends a valid CAM | | |
| containing cam | | |
| containing camParameters | | |
| containing specialVehicleContainer | | |
| containing specialTransportContainer | | |
| } | | |

| TP ld | TP/CAM/MSD/INA/BV-04 |
|---------------------|---|
| | Check that dangerousGoodsContainer is included if vehicleRole is set to dangerousGoods(3) |
| | EN 302 637-2 [1], clause B.13 |
| | |
| PICS Selection | PICS_DANGEROUSGOODS |
| | Initial conditions |
| with { | |
| the IUT being in th | |
| the IUT's venicle r | role being set to dangerousGoods(3) |
| } | F (11) (1) |
| | Expected behaviour |
| ensure that { | |
| when { | |
| a CAM is gene | erated |
| } | |
| then { | |
| the IUT sends | a valid CAM |
| containing | cam |
| contain | ing camParameters |
| cont | taining specialVehicleContainer |
| (| containing dangerousGoodsContainer |
| 1 | |

| TP Id | TP/CAM/MSD/INA/BV-05 | |
|------------------------------------|---|--|
| Test objective | Check that roadWorksContainerBasic is included if vehicleRole is set to roadWork(4) | |
| Reference | EN 302 637-2 [1], clause B.14 | |
| PICS Selection | PICS_ROADWORKS | |
| | Initial conditions | |
| with { | | |
| the IUT being in the | ne "initial state" | |
| the IUT's vehicle r | role being set to roadWork(4) | |
| } | | |
| | Expected behaviour | |
| ensure that { | | |
| when { | | |
| a CAM is gene | erated | |
| } | | |
| then { | | |
| the IUT sends a valid CAM | | |
| containing cam | | |
| containing camParameters | | |
| containing specialVehicleContainer | | |
| containing roadWorksContainerBasic | | |
| } | | |

| TP ld | TP/CAM/MSD/INA/BV-06 | |
|--------------------------|---|--|
| Test objective | Check that rescueContainer is included if vehicleRole is set to rescue(5) | |
| Reference | EN 302 637-2 [1], clause B.15 | |
| PICS Selection | PICS_RESCUE | |
| | Initial conditions | |
| with { | | |
| the IUT being in t | he "initial state" | |
| the IUT's vehicle | role being set to rescue(5) | |
| } | | |
| | Expected behaviour | |
| ensure that { | | |
| when { | | |
| a CAM is gen | erated | |
| } | | |
| then { | | |
| the IUT sends | a valid CAM | |
| containing cam | | |
| containing camParameters | | |
| cor | ntaining 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 | EN 302 637-2 [1], clause B.16 | | |
| PICS Selection | PICS_EMERGENCY | | |
| | Initial conditions | | |
| with { | | | |
| the IUT being in the | he "initial state" | | |
| the IUT's vehicle | role being set to emergency(6) | | |
| } | | | |
| | Expected behaviour | | |
| ensure that { | | | |
| when { | | | |
| a CAM is gene | erated | | |
| } | } | | |
| then { | | | |
| the IUT sends | the IUT sends a valid CAM | | |
| containing cam | | | |
| containing camParameters | | | |
| containing specialVehicleContainer | | | |
| | | | |
| | containing emergencyContainer | | |
| } | | | |

| TP ld | TP/CAM/MSD/INA/BV-08 | | |
|------------------------------------|---|--|--|
| Test objective | Check that safetyCarContainer is included if vehicleRole is set to safetyCar(7) | | |
| Reference | EN 302 637-2 [1], clause B.17 | | |
| PICS Selection | PICS_SAFETYCAR | | |
| | Initial conditions | | |
| with { | | | |
| the IUT being in the | ne "initial state" | | |
| the IUT's vehicle | role being set to safetyCar(7) | | |
| } | | | |
| | Expected behaviour | | |
| ensure that { | | | |
| when { | | | |
| a CAM is gene | erated | | |
| } | | | |
| 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/BV-01 | | |
|--|--|--|--|
| Test objective | Check that CAMs are not generated more frequently than T_GenCamMin | | |
| Reference | EN 302 637-2 [1], clause 6.1.3 | | |
| PICS Selection | PICS_T_GENCAMMIN | | |
| | Initial conditions | | |
| with { | | | |
| the IUT being in the | e "initial state" | | |
| } | | | |
| Expected behaviour | | | |
| ensure that { | | | |
| when { | | | |
| IUT sends a CA | IUT sends a CAM | | |
| } | } | | |
| then { | | | |
| the IUT does not send any CAM before or upon expiry of T_GenCamMin | | | |
| } | | | |
| | | | |
| ensure that { when { IUT sends a CA } then { | Expected behaviour | | |

| TP ld | TP/CAM/MSD/GFQ/BV-02 | | |
|--|--|--|--|
| Test objective | Check that CAMs are not generated less frequently than T_GenCamMax | | |
| Reference | EN 302 637-2 [1], clause 6.1.3 | | |
| PICS Selection | PICS_T_GENCAMMAX | | |
| | Initial conditions | | |
| with { | | | |
| the IUT being in th | e "initial state" | | |
| } | | | |
| | Expected behaviour | | |
| ensure that { | | | |
| when { | when { | | |
| IUT sends a CAM | | | |
| } | | | |
| then { | | | |
| the IUT sends another CAM before expiry of T_GenCamMax | | | |
| } | | | |
| } | | | |

| TP ld | TP/CAM/MSD/GFQ/BV-03 |
|--------------------|---|
| Test objective | Check that TGenCam is set to T_GenCamMax after generating N_GenCam due to condition 2 |
| Reference | EN 302 637-2 [1], clause 6.1.3 |
| PICS Selection | PICS_T_GENCAMMAX |
| | Initial conditions |
| with { | |
| the IUT being in t | he "initial state" |
| the IUT having se | ent a CAM at time TIME_1 |
| the IUT having se | ent an anticipated CAM due to condition 1 at time (TIME_1 + INTERVAL_1) |
| the IUT having se | ent (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 |
| } | |
| ŀ | |
| | |
| TP Id | TP/CAM/MSD/GFQ/BV-04 |
| Test objective | |
| rest objective | Check that CAM is generated immediately when the time elapsed since the last CAM generation is equal or greater than T_GenCam_Dcc and the absolute difference between |
| | current direction of the originating ITS-S (towards North) and direction included in previous |
| | CAM exceeds 4° |
| Reference | |
| PICS Selection | EN 302 637-2 [1], clause 6.1.3 PICS_T_GENCAMDCC |
| FIGS Selection | |

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 ld | 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 or greater than T_GenCam_Dcc and the current position and position | | |
| | included in previous CAM exceeds 4 m | | |
| Reference | EN 302 637-2 [1], clause 6.1.3 | | |
| PICS Selection | PICS_T_GENCAMDCC | | |
| | Initial conditions | | |
| with { | | | |
| the IUT being in th | ne "initial state" | | |
| the IUT having se | nt a CAM at time TIME_1 | | |
| containing can | 1 | | |
| containing | camParameters | | |
| contain | ing basicContainer | | |
| | containing referencePositionset to POSITION_1 | | |
| | g sent any other CAM | | |
| | about new position value POSITION_2 | | |
| and distance(F | $POSITION_2, POSITION_1) > 4 m$ | | |
| } | | | |
| | Expected behaviour | | |
| ensure that { | | | |
| when { | | | |
| T_GenCam_D | cc expires | | |
| } | | | |
| then { | | | |
| the IUT sends | 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 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 | EN 302 637-2 [1], clause 6.1.3 | | | | |
| PICS Selection | PICS_T_GENCAMDCC | | | | |
| Initial conditions | | | | | |
| with { | | | | | |
| the IUT being in the "initial state" | | | | | |
| the IUT having sent a CAM at time TIME_1 | | | | | |
| containing cam | 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(SPEE | and $abs(SPEED_2 - SPEED_1) > 0,5 m/s$ | | | | |
| } | | | | | |
| | Expected behaviour | | | | |
| ensure that { | | | | | |
| when { | | | | | |
| T_GenCam_Do | cc expires | | | | |
| } | | | | | |
| then { | | | | | |
| the IUT sends a CAM immediately | | | | | |
| } | | | | | |
| } | | | | | |

| TP ld | TP/CAM/MSD/GFQ/BV-07 | | | |
|----------------------|---|--|--|--|
| Test objective | | | | |
| - | generation is equal or greater than T_GenCam and equal or greater than T_GenCam_Dcc | | | |
| Reference | EN 302 637-2 [1], clause 6.1.3 | | | |
| PICS Selection | PICS_T_GENCAM AND PICS_T_GENCAMDCC | | | |
| | Initial conditions | | | |
| with { | | | | |
| the IUT being in the | ne "initial state" | | | |
| the IUT having se | nt a CAM | | | |
| } | | | | |
| | Expected behaviour | | | |
| ensure that { | | | | |
| when { | | | | |
| T_GenCam ex | (pires | | | |
| and T_GenCa | m_Dcc expires | | | |
| } | | | | |
| then { | | | | |
| the IUT sends | another CAM | | | |
| } | | | | |
| } | | | | |

5.2.2 Message processing

| TP ld | TP/CAM/MSP/BV-01 | | | |
|--|--|--|--|--|
| Test objective | Check that content of received CAM is transmitted to applications and other facilities | | | |
| Reference | EN 302 637-2 [1], clause 4.2.2 | | | |
| PICS Selection | | | | |
| Initial conditions | | | | |
| with { | | | | |
| the IUT being in the "initial state" | | | | |
| } | | | | |
| Expected behaviour | | | | |
| ensure that { | | | | |
| when { | | | | |
| the IUT receives a valid CAM | | | | |
| } | | | | |
| then { | | | | |
| | rds the CAM content to upper layers | | | |
| and the IUT forwards the CAM content to other facilities | | | | |
| } | | | | |
| } | | | | |

• ETSI TS 102 637-1: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 1: Functional Requirements".

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- ETSI TS 102 637-4: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic set of applications; Part 4: Operational Requirements".
- ETSI TS 102 894-2 (V1.1.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part2: Applications and facilities layer common data dictionary".

History

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|------------------|------------|-------------|--|--|
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