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Technical Specification

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)".

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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".

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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

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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.

4.2.1 Root

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.

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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>**		
	<root> = root	CAM	
	<gr> = group	MSD	Message Dissemination
		MSP	Message Processing
	<sgr> =sub- group	FMT	Message Format
		INA	Information Adaptation
		GFQ	Generation Frequency
	<x> = type of testing	BV	Valid Behaviour tests
		BI	Invalid Syntax or Behaviour Tests
	<nn> = sequential number		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.

Table 3: Mnemonics for PICS reference

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]

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5.2 Test purposes for CAM

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 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	EN 302 637-2 [1], clause 6.1.3
PICS Selection	PICS_LOWFREQUENCYCONTAINER
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
}	

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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 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 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	EN 302 637-2 [1], clause 6.1.3
PICS Selection	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
}	

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