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Conformance test specifications for
Cooperative Awareness Basic Service (CA);
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 Cooperative 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 [i.4].

The ISO standards 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.5]) 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 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 (V1.4.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Co-operative Awareness Basic Service (CA); 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 9646-7 (1995): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

[i.5] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

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 [i.2] and ISO/IEC 9646-7 [i.4] 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> or** **TP/<root>/<gr>/<x>/<nn>-<v>**		
<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
	SSP	Service Specific Permissions
<x> = type of testing	BV	Valid Behaviour 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].

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 have been 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 tables and items of ETSI TS 102 868-1 [2]. The 'PICS item' as defined in ETSI TS 102 868-1 [2] shall be used to determine the test applicability.

Table 3: Mnemonics for PICS reference

Mnemonic	PICS item
PICS_PUBLICTRANS	A.2/1
PICS_SPECIALTRANS	A.2/2
PICS_DANGEROUSGOODS	A.2/3
PICS_ROADWORKS	A.2/4
PICS_RESCUE	A.2/5
PICS_EMERGENCY	A.2/6
PICS_SAFETYCAR	A.2/7
PICS_RSU	A.1/1
PICS_CAM_RECEPTION	A.3/2
PICS_CAM_GENERATION	A.3/1
PICS_IS_IUT_SECURED	A.4/1

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 AND NOT PICS_IS_IUT_SECURED
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 AND NOT PIC_RSU

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 AND NOT PIC_RSU

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
}
```