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Intelligent Transport Systems (ITS);
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Conformance test specifications for
Signal Phase And Timing (SPAT) and Map (MAP);
Part 2: Test Suite Structure and Test Purposes (TSS & TP)

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

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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 Signal Phase And Timing (SPAT) and Map (MAP), 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 MAP-SPAT Messages (MAP-SPAT) as defined in SAE J2735 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [5].

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 (ETSI ETS 300 406 [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 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.

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

[1] SAE J2735 (2015-04-30): "Dedicated Short Range Communications (DSRC) Message Set Dictionary™".

[2] ETSI TS 103 191-1 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Signal Phase And Timing (SPAT) and Map (MAP); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

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

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

[7] ETSI EN 302 636-5-1 (V1.2.1): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol".

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 SAE J2735 [1], ISO/IEC 9646-1 [3] and in ISO/IEC 9646-7 [5] apply.

3.2 Abbreviations

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

ATS	Abstract Test Suite
BV	Valid test events for Behaviour tests
BTP	Basic Transport Protocol
GN	GeoNetworking
ISO	International Organization for Standardization
ITS	Intelligent Transport Systems
IUT	Implementation Under Test
MAP	MapData Messages
MSD	Message Dissemination
MSP	Message Processing
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
SAE	Society of Automotive Engineers
SHB	Single Hop Broadcast
SPAT	Signal Phase And Timing Messages
TP	Test Purposes
TSS	Test Suite Structure

4 Test Suite Structure (TSS)

4.1 Structure for MAP-SPAT tests

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

Table 1: TSS for MAP-SPAT

Root	Group	Category
MAP-SPAT	Message Dissemination	Valid
	Message processing	Valid

The test suite is structured as a tree with the root defined as MAP-SPAT. The tree is of rank 2 with the first rank a Group and the second a category. 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 MapData and SPAT Messages given in SAE J2735 [1].

4.2.3 Groups

This level contains two functional areas identified as:

- Message Dissemination
- Message Processing

4.2.4 Categories

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

5 Test Purposes (TPs)

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>		
	<root> = root	MAP-SPAT	
	<gr> = group	MSD	Message Dissemination
		MSP	Message Processing
	<x> = type of testing	BV	Valid event 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].

SAE J2735 [1] does not use 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 SAE J2735 [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 103 191-1 [2].

Table 3: Mnemonics for PICS reference

Mnemonic	PICS item
PICS_RSU	A.1/1
PICS_VEHICLE	A.1/2

5.2 Test purposes for MAP-SPAT

5.2.1 Message dissemination

TP Id	TP/MAP-SPAT/MSD/BV-01
Test objective	Verify that when sending a MapData message the DSRCmsgSubID is set to value 1.
Reference	SAE J2735 [1], clause 7.34
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a MapData message is generated
}
then {
the IUT sends a valid MapData message
containing DSRCmsgSubID
set to value 1
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-02
Test objective	Verify that when sending a SPAT message the DSRCmsgSubID is set to value 1.
Reference	SAE J2735 [1], clause 7.34
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a SPAT message is generated
}
then {
the IUT sends a valid SPAT message
containing DSRCmsgSubID
set to value 1
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-03
Test objective	Verify that when the IUT sends a new MapData message with a new content the MsgCount is set to one greater than the previous value sent.
Reference	SAE J2735 [1], clause 7.92
PICS Selection	PICS_RSU
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT has sent a MapData message
containing MsgCount
set to VALUE_1
}	

Expected behaviour	

ensure that {
when {
a new MapData message with a new content is generated
}
then {
the IUT sends a valid MapData message
containing MsgCount
set to VALUE_1 + 1
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-04 [1]
Test objective	Verify that when the IUT sends a new MapData message with a new content the MsgCount is set to 0 when the previous sent value was 127.
Reference	SAE J2735 [1], clause 7.92
PICS Selection	PICS_RSU
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT has sent a MapData message
containing MsgCount
set to 127
}	

Expected behaviour	

ensure that {
when {
a new MapData message with a new content is generated
}
then {
the IUT sends a valid MapData message
containing MsgCount
set to 0
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-05
Test objective	Repetition < 10 s. Verify that when the IUT is composing a new message with the same content as the most recent message with the same DSRCmsgID, and less than 10 seconds have elapsed since it sent the previous message, the IUT uses the same MsgCount value.
Reference	SAE J2735 [1], clause 7.92
PICS Selection	PICS_RSU
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT has sent a MapData message
containing MsgCount
set to VALUE_1
}	

Expected behaviour	

ensure that {
when {
a new MapData message with the same content is generated
and the repetition time is less than 10 s
}
then {
the IUT sends a valid MapData message
containing MsgCount
set to VALUE_1
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-06
Test objective	Repetition ≥ 10 s. Verify that when the IUT is composing a new message with the same content as the most recent message with the same DSRCmsgID, and at least 10 seconds have elapsed since it sent the previous message, the IUT sets the MsgCount to any valid value.
Reference	SAE J2735 [1], clause 7.92
PICS Selection	PICS_RSU
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT has sent a MapData message
containing MsgCount
set to VALUE_1
}	

Expected behaviour	

ensure that {
when {
a new MapData message with the same content is generated
and the repetition time is greater than or equal to 10 s
}
then {
the IUT sends a valid MapData message
containing MsgCount
set to any valid value
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-07
void	

TP Id	TP/MAP-SPAT/MSD/BV-08
Test objective	Verify that the MsgCRC (if present) is the last data element of the MapData message.
Reference	SAE J2735 [1], clause 7.93
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a MapData message is generated
}
then {
the IUT sends a valid MapData message
not containing MsgCRC
or
containing MsgCRC
as the last data element of the message
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-09
Test objective	Verify that the LayerType is not contained in the MapData message.
Reference	SAE J2735 [1], clause 7.83
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a MapData message is generated
}
then {
the IUT sends a valid MapData message
not containing LayerType
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-10
Test objective	Verify that the IntersectionReferenceID contained in the SPAT message correspond to a previously received intersection MAP.
Reference	SAE J2735 [1], clause 6.29
PICS Selection	PICS_RSU
Initial conditions	

with {
the IUT being in the "initial state"
and the IUT has sent a MapData message
containing IntersectionList
containing INTERSECTION_1
}	

Expected behaviour	

ensure that {
when {
a SPAT message is generated
}
then {
the IUT sends a valid SPAT message
containing IntersectionReferenceID
corresponding to INTERSECTION_1
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-11
Test objective	Verify that the MapData message is well formatted.
Reference	SAE J2735 [1], clause 10
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a MapData message is generated
}
then {
the IUT sends a valid MapData message
containing DSRCmsgSubID
set to value 0
containing MsgCount
not containing LayerType
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-12
Test objective	Verify that the SPAT message is well formatted.
Reference	SAE J2735 [1], clause 10
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a SPAT message is generated
}
then {
the IUT sends a valid SPAT message
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-13
void	

TP Id	TP/MAP-SPAT/MSD/BV-14
void	

TP Id	TP/MAP-SPAT/MSD/BV-15
Test objective	Verify that when sending a MapData message, the IUT encapsulates the message into a GN SHB message.
Reference	ETSI EN 302 636-5-1 [7], clause 11.2
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a MapData message is generated
}
then {
the IUT sends a valid MapData message encapsulated into a GN SHB message
}
}	

TP Id	TP/MAP-SPAT/MSD/BV-16
Test objective	Verify that when sending a SPAT message, the IUT encapsulates the message into a GN SHB message.
Reference	ETSI EN 302 636-5-1 [7], clause 11.2
PICS Selection	PICS_RSU
Initial conditions	

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

Expected behaviour	

ensure that {
when {
a SPAT message is generated
}
then {
the IUT sends a valid SPAT message encapsulated into a GN SHB message
}
}	

5.2.2 Message processing

TP Id	TP/MAP-SPAT/MSP/BV-01
Test objective	Verify that: when the IUT receives a GN SHB message encapsulating a MapData message, it pass the message to the application layer.
Reference	ETSI EN 302 636-5-1 [7], annex A.
PICS Selection	PICS_VEHICLE
Initial conditions	

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

Expected behaviour	

ensure that {
when {
the IUT receives a valid MapData message encapsulated into a GN SHB message
}
then {
the IUT forwards the MapData message content to upper layers
}
}	

TP Id	TP/MAP-SPAT/MSP/BV-02
Test objective	Verify that: when the IUT receives a GN SHB message encapsulating a SPAT message, it passes the message to the application layer.
Reference	ETSI EN 302 636-5-1 [7], annex A.
PICS Selection	PICS_VEHICLE
Initial conditions	

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

Expected behaviour	

ensure that {
when {
the IUT receives a valid SPAT message encapsulated into a GN SHB message
}
then {
the IUT forwards the SPAT message content to upper layers
}
}	

Annex A (normative): Communication Parameter Settings

The MAP/SPAT PDU shall be disseminated with the communication settings defined in table A.1.

Table A.1:Communication Parameter Settings

Parameter	Value
BTP type	2 (BTP header type B)
BTP source port	N/A
BTP Destination port	As specified in ETSI EN 302 636-5-1 [7]
BTP destination port info	N/A
GN Packet transport type	SHB (Header Type: 5, Header Sub-type: 0)
GN Destination address	N/A
GN Communication profile	N/A
GN Maximum hop limit	N/A
GN Traffic class	N/A
DCC parameters	N/A
Length	Length of GN, BTP, Security header, PDU
Data	GN, BTP, Security header, PDU

Annex B (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

Document history		
V1.1.1	September 2015	Publication