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Intelligent Transport Systems (ITS);
Testing;
Conformance test specifications for
Facilities layer protocols and communication requirements
for infrastructure services;
Part 3: Abstract Test Suite (ATS) and Protocol Implementation
eXtra Information for Testing (PIXIT)

Reference

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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 3 of a multi-part deliverable covering Conformance test specification for Facilities layer protocols and communication requirements for infrastructure services 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)".

The development of ITS test specifications follows the guidance provided in the ETSI EG 202 798 [i.1]. Therefore, the ATS documentation outlined in the present document is also based on the guidance provided in ETSI EG 202 798 [i.1].

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 contains the Abstract Test Suite (ATS) for MAPEM-SPATEM, IVIM and SREM-SSEM as defined in SAE J2735 [1] and ETSI TS 103 301 [2] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [i.7].

The objective of the present document is to provide a basis for conformance tests for MAPEM-SPATEM, IVIM and SREM-SSEM equipment giving a high probability of interoperability between different manufacturers' equipment.

The ISO standards for the methodology of conformance testing (ISO/IEC 9646-1 [i.4] and ISO/IEC 9646-2 [i.5]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [i.8]) 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.

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 (2016-03): "Dedicated Short Range Communications (DSRC) Message Set Dictionary™".

[2] ETSI TS 103 301 (V1.1.1) (2016-11): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services".

[3] ETSI TS 103 191-1 (V1.2.1): "Intelligent Transport Systems (ITS); Facilities layer protocols and communication requirements for infrastructure services; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

[4] ETSI TS 103 191-2 (V1.2.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Facilities layer protocols and communication requirements for infrastructure services; Part 2: Test Suite Structure and Test Purposes (TSS & TP)".

[5] 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".

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.

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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".

[i.2] ETSI TS 103 096-3 (V1.3.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

[i.3] ETSI TR 103 099 (V1.4.1): "Intelligent Transport Systems (ITS); Architecture of conformance validation framework".

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

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

[i.6] ISO/IEC 9646-6 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 6: Protocol profile test specification".

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

[i.8] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[i.9] ETSI ES 201 873-1 (V4.5.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

[i.10] ETSI ES 201 873-7 (V4.5.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 7: Using ASN.1 with TTCN-3".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given SAE J2735 [1], ISO/IEC 9646-1 [i.4] and in ISO/IEC 9646-7 [i.7] apply.

3.2 Abbreviations

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

ASN Abstract Syntax Notation
ATM Abstract Test Method
ATS Abstract Test Suite
BI Invalid Syntax or Behaviour Tests
BV Valid Behaviour Tests
ES ETSI Standard
IS Infrastructure Services
ISO International Organization for Standardization
ITS Intelligent Transport Systems
IUT Implementation Under Test
IVI Infrastructure to Vehicle Information
IVIM IVI-Message
MAPEM MapData Messages
MSD MesSage Dissemination
MSP Message Processing
MTC Main Test Component
PCTR Protocol Conformance Test Report
PICS Protocol Implementation Conformance Statement
PIXIT Partial Protocol Implementation eXtra Information for Testing
PX Pixit

RLT	Road and Lane topology
SAE	Society of Automotive Engineers
SAP	Service Access Point
SCS	System Conformance Statement
SCTR	System Conformance Test Report
SPATEM	Signal Phase And Timing Messages
SREM	Signal Request Message
SSEM	Signal Response Message
SUT	System Under Test
TC	Test Case
TLC	Traffic Light Control
TLM	Traffic Light Manoeuvre
TP	Test Purposes
TSS	Test Suite Structure
TTCN	Testing and Test Control Notation

4 Abstract Test Method (ATM)

4.1 Abstract protocol tester

The abstract protocol tester used by this test suite is described in figure 1. The test system simulates valid and invalid protocol behaviour, and analyses the reaction of the IUT.

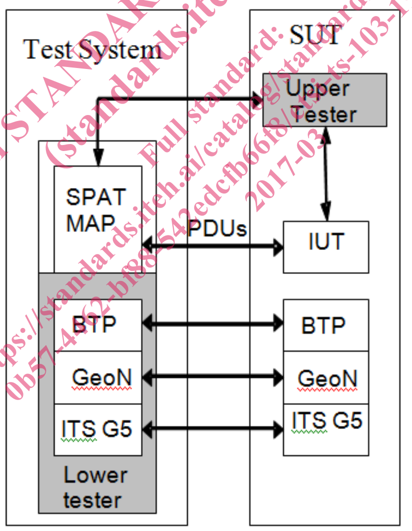

Figure 1: Abstract protocol tester - MAPEM SPATEM case

4.2 Test Configuration

This test suite uses a unique test configuration in order to cover the different test scenarios. In this configuration, the tester simulates one ITS station implementing the MAPEM SPATEM protocol.

4.3 Test architecture

The present document implements the general TTCN-3 test architecture described in ETSI EG 202 798 [i.1], clauses 6.3.2 and 8.3.1.

Figure 2 shows the test architecture used in for the MAPEM SPATEM ATS case. The MAPEM SPATEM test component requires using only the Main Test Component (MTC). The MTC communicates with the MAPEM SPATEM SUT over the MapemSpatemPort. The MapemSpatemPort is used to exchange MAPEM SPATEM protocol messages between the MAPEM SPATEM test component and the MAPEM SPATEM IUT.

NOTE: The same behaviour applies for IVIM and SREM SSEM.

The Upper tester entity in the SUT enables triggering MAPEM SPATEM functionalities by simulating primitives from application. It is required to trigger the MAPEM SPATEM layer in the SUT to send MAPEMs, which are resulting from upper layer primitives. Furthermore, receiving MAPEMs may result for the MAPEM SPATEM layer in sending primitives to the upper layer.

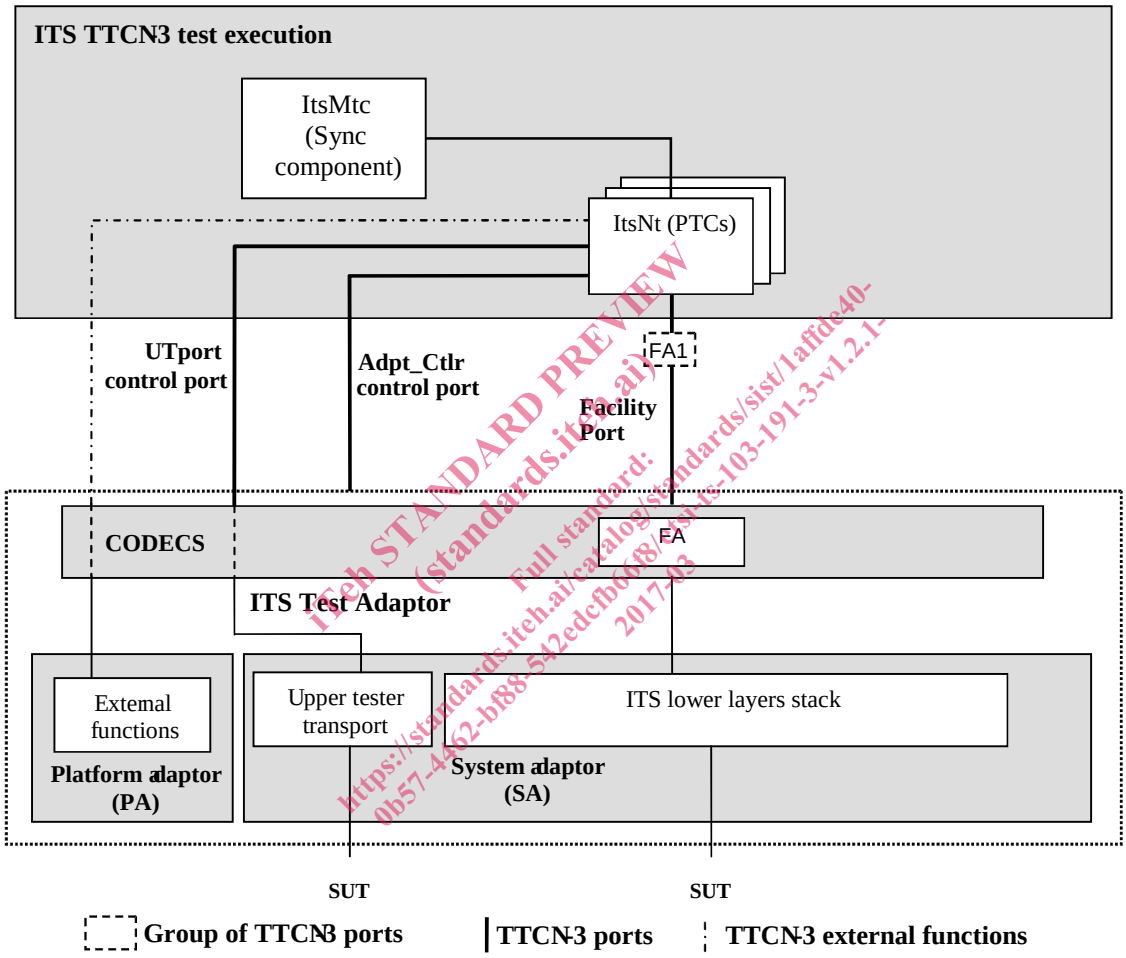

Figure 2: Test system architecture

4.4 Ports and ASPs (Abstract Services Primitives)

4.4.1 Introduction

Two ports are used by the MAPEM SPATEM ATS:

- The mapemSpatemPort, of type MapemSpatemPort.
- The utPort, of type UpperTesterPort.

Two port are used by the IVIM ATS:

- The ivimPort, of type IvimPort.

- The utPort, of type UpperTesterPort.

Two ports are used by the SREM SSEM ATS:

- The sremSsemPort, of type SremSsemPort.
- The utPort, of type UpperTesterPort.

4.4.2 MAPEM SPATEM ATS

4.4.2.1 Primitives of the mapemSpatemPort

Four types of primitives are used in the mapSpatPort:

- The MapemInd primitive used to receive messages of type MapemMsg (MAPEM_PDU + RawData).
- The SpatemInd primitive used to receive messages of type SpatemMsg (SPATEM_PDU + RawData).
- The MapemReq primitive used to send messages of type MAPEM_PDU.
- The SpatemReq primitive used to send messages of type SPATEM_PDU.

These four primitives use the MAPEM type and the SPATEM type, which is declared in the ETSI_TS_103301.asn ASN.1 module, following the ASN.1 definition from SAE J2735 [1].

4.4.2.2 Primitives of the utPort

This port uses six types of primitives:

- The UtInitialize primitive used to initialize IUT.
- The UtMapemSpatemTrigger primitive used to trigger upper layer events in IUT.
- The UtInitializeResult primitive used to receive upper layer result of initialization in IUT.
- The UtMapemSpatemTriggerResult primitive used to receive upper layer result of triggering MAPEM-SPATEM in IUT.
- The UtMapemEventInd primitive used to receive upper layer event of MAPEM_PDU in IUT.
- The UtSpatemEventInd primitive used to receive upper layer event of SPATEM_PDU in IUT.

4.4.3 IVIM ATS

4.4.3.1 Primitives of the ivimPort

Four types of primitives are used in the mapSpatPort:

- The ivimInd primitive used to receive messages of type IvimMsg (IVIM_PDU + RawData).
- The IvimReq primitive used to send messages of type IVIM_PDU.

These two primitives use the IVIM_PDU type, which is declared in the ETSI_TS_103301.asn ASN.1 module contained in the archive ts_10319103v010201p0.zip which accompanies the present document, following the ASN.1 definition from SAE J2735 [1].