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Intelligent Transport Systems (ITS);
Testing;
Conformance test specifications for
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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 Decentralized Environmental Notification Basic Service (DEN) 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].

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Modal verbs terminology

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1 Scope

The present document contains the Abstract Test Suite (ATS) for Decentralized Environmental Notification Basic Service (DEN) as defined in ETSI EN 302 637-3 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [5].

The objective of the present document is to provide a basis for conformance tests for Decentralized Environmental Notification Basic Service (DEN) equipment giving a high probability of interoperability between different manufacturers' equipment.

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [2] and ISO/IEC 9646-2 [3]) 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.

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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] ETSI EN 302 637-3 (V1.2.2): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".

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

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

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

[8] 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".

[9] ETSI TS 102 869-1 (V1.4.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Decentralized Environmental Notification Messages (DENM); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

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[10] 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

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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 ETSI EN 302 637-3 [1], ISO/IEC 9646-1 [2] and ISO/IEC 9646-7 [5] apply.

3.2 Abbreviations

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

ASN.1	Abstract Syntax Notation One
ATM	Abstract Test Method
ATS	Abstract Test Suite
BO	Inopportune test events for Behaviour tests
BV	valid test events for Behaviour tests
CAN	Controller Area Network
DEN	Decentralized Environmental Notification Basic Service
DENM	Decentralized Environmental Notification Message
DRCX	DENM Reception
EG	ETSI Guide
EN	European Norm
ES	ETSI Standard
EUPD	Event Update
EVGN	Event Generation
EXTI	Expiration Time
ISO	International Organization for Standardization
ITS	Intelligent Transportation Systems
IUT	Implementation Under Test
LDM	Local Dynamic Map
MSGF	Message Format
MTC	Main Test Component
PCTR	Protocol conformance Test Report
PETY	Periodicity
PICS	Protocol Implementation Conformance Statement
PIXIT	Partial Protocol Implementation Extra Information for Testing
SA	System Adaptor
SAP	Service Access Point
SCS	System Conformance Statement
SCTR	Static conformance Test Report

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SLCI	Specific Location Container Information
SSCI	Specific Situation Container Information
SUT	System Under Test
TC	Test Case
TDEV	Two different events
TI	Timer tests
TNEV	Termination/Negation of an Event
TP	Test Purposes
TS	Technical Specification
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.

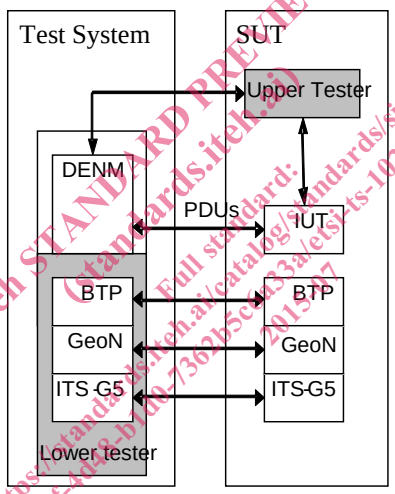

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Figure 1: Abstract protocol tester - DEN

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 DEN 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 DEN ATS. The DEN test component requires using only the Main Test Component (MTC). The MTC communicates with the DEN SUT over the denmPort. The denmPort is used to exchange DEN protocol messages between the DEN test component and the DEN IUT.

The Upper tester entity in the SUT enables triggering DEN functionalities by simulating primitives from application or LDM entities. It is required to trigger the DEN layer in the SUT to send DEN messages, which are resulting from upper layer primitives. Furthermore, receiving DEN messages may result for the DEN layer in sending primitives to the upper layer (sending Data to LDM, for instance).

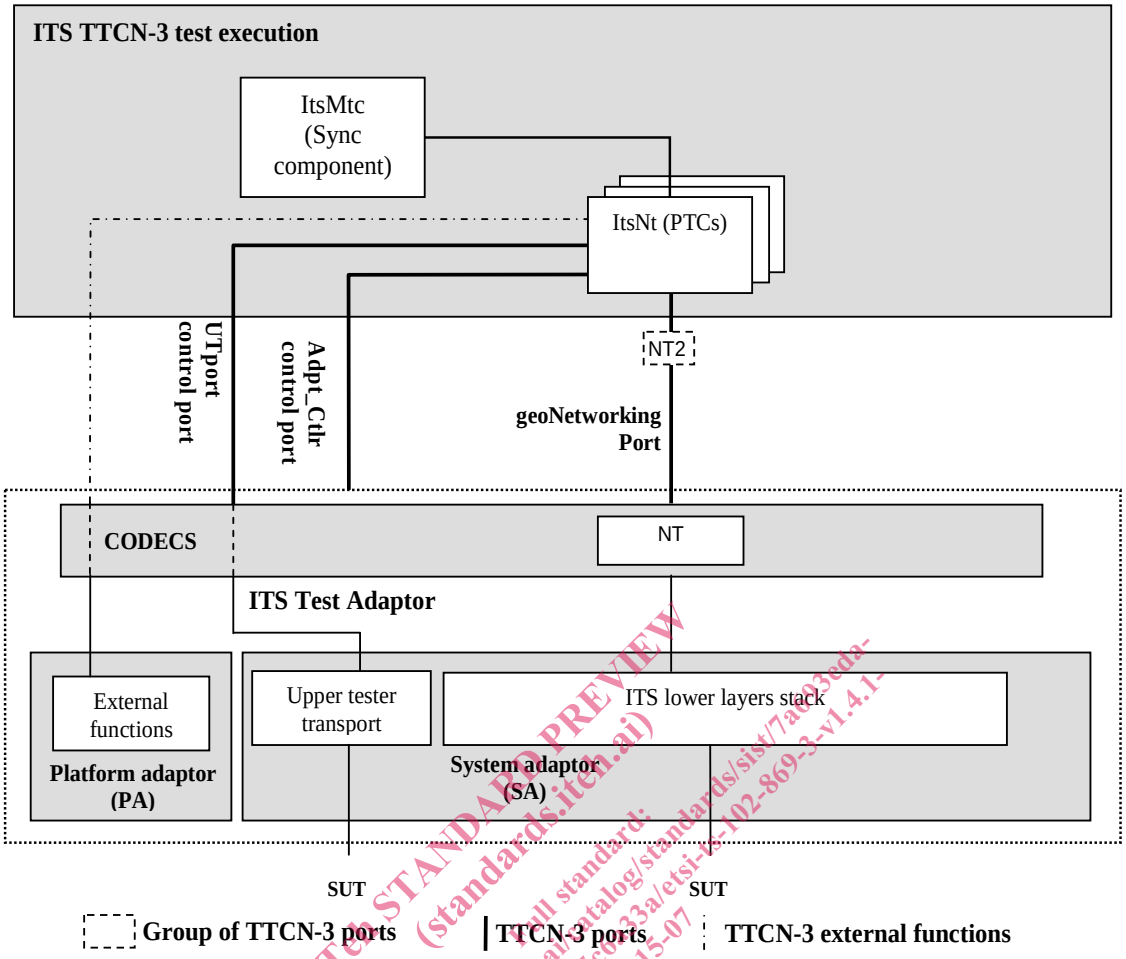

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Figure 2: Test system architecture

4.4 Ports and ASPs (Abstract Services Primitives)

4.4.1 Introduction

Two ports are used by the DEN ATS:

- The denmPort, of type DenmPort.
- The utPort of type UpperTesterPort.

4.4.2 Primitives of the denmPort

Two types of primitives are used in the denmPort:

- The DenmInd primitive, containing the received messages of type DenmPdu, and a timestamp corresponding to the receipt time.
- The DenmReq primitive containing the sent messages of type DenmPdu.

The DenmPdu type is declared in the DENM.asn ASN.1 module, following the ASN.1 definition from ETSI EN 302 637-3 [1].

```
DenmPdu ::= SEQUENCE {
    header  ItsPduHeader,
    denm    DecentralizedEnvironmentalNotificationMessage
}
```

4.4.3 Primitives of the utPort

This port uses two types of primitives:

- The UtInitialize primitive used to initialize IUT.
- The UtTrigger primitive used trigger upper layer events in IUT.

5 Untestable Test Purposes

Table 1 gives a list of TPs, which are not implemented in the ATS due to the chosen ATM or other restrictions.

Table 1: Untestable TP

Test purpose	Reason
TP/DEN/EVGN/BV-08	In order to achieve the situation of sequenceNumber wrap-around, 65 535 DENMs would need to be generated. With 10 DENMs sent per second, the test would need an execution time of 1,8 hours
TP/DEN/MSRV/BO-08	NOT implemented - No security elements in the ATS
TP/DEN/MSRV/BO-09	NOT implemented - No security elements in the ATS

6 ATS conventions

6.1 Introduction

The ATS conventions are intended to give a better understanding of the ATS but they also describe the conventions made for the development of the ATS. These conventions shall be considered during any later maintenance or further development of the ATS.

The ATS conventions contain two clauses, the testing conventions and the naming conventions. The testing conventions describe the functional structure of the ATS. The naming conventions describe the structure of the naming of all ATS elements.

To define the ATS, the guidelines of the document ETSI ETS 300 406 [6] were considered.

6.2 Testing conventions

6.2.1 Testing states

6.2.1.1 Initial state

All test cases start with the function f_prInitialState. This function brings the IUT in an "initialized" state by invoking the upper tester primitive UtInitialize.

6.2.1.2 Final state

All test cases end with the function f_poDefault. This function brings the IUT back in an "idle" state. As no specific actions are required for the idle state in ETSI EN 302 637-3 [1], the function f_ poDefault does not invoke any action.

As necessary, further actions may be included in the f_poDefault function.

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