



Technical Report

**Intelligent Transport Systems (ITS);
Testing;
Part 2: Conformance test specification for Decentralized
Environmental Notification basic Service Message (DENM);
DENM validation report**

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Intelligent Transport System (ITS).

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.2].

Introduction

In response to EC mandate M/453, ETSI Technical Committee ITS has standardized base and test specifications for ITS protocols. In a next step a prototype TTCN-3 test system was built and validated. The present document and its related TR 103 099 [i.1] (Architecture of Conformance Validation Framework), describe the validation and design of the prototype TTCN-3 test system.

The action described in the present document has supported the implementation of ITS standards by:

- Making available validated and standardized test specifications and thus enabling the application of reliable certification schemes.
- Executing conformance validation framework against real Implementations Under Test (IUTs) from industry and thus providing these companies a conformance assessment of their implementations. During the lifetime of this action, the conformance validation framework was as well provided at ITS Cooperative Mobility Services Interoperability events.
- Releasing all software as open source and thus allowing industry to build and run their own conformance validation framework.

1 Scope

The present document is the validation report of the DENM conformance tests and it provides statistics of executed and validated DENM conformance tests. The information provided has been produced by validation against two prototype implementations from industry.

Furthermore, identified base specifications and test specification issues are listed in the present document.

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>.

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2.1 Normative references

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

Not applicable.

2.1 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 TR 103 099 (V1.1.1): "Intelligent Transport Systems (ITS); Architecture of conformance validation framework".
- [i.2] ETSI TR 103 061-1: "Intelligent Transport Systems (ITS); Testing; Part 1: Conformance test specification for Co-operative Awareness Messages (CAM); CAM validation report".
- [i.3] ETSI EG 201 015 (V1.1.1): "Methods for Testing and Specification (MTS); Specification of protocols and services; Validation methodology for standards using SDL; Handbook".

3 Abbreviations

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

ASN	Abstract Syntax Notation
ATS	Abstract Test Suite
CAM	Co-operative Awareness Message
CR	Change Request
DENM	Decentralized Environmental Notification Basic Service
EC	European Commission
ITS	Intelligent Transportation Systems
PASS	Test Case Verdict Pass
PICS	Protocol Implementation Conformance Statement
SUT	Implementation Under Test
TC	Test cases
TP	Test Purposes

TTCN	Testing and Test Control Notation (TTCN-3)
TTCN-3	Testing and Test Control Notation 3
UT	Upper Tester

4 Validation report

4.1 Validation level

Level 3 (Rigorous) abstract test suite validation has been performed, according to the validation handbook [i.3]:

- the test suite has been compiled on more than one TTCN-3 tool;
- the complete suite of tests has been implemented and executed on more than one test platform;
- the complete suite of tests have been executed against SUTs from a range of different suppliers;
- the operation and output traces of all the tests have been validated.

4.2 Source code evaluation

4.2.1 TTCN-3 version

The DENM abstract test suite is based on TTCN-3 edition 4.2.1 (TTCN3:2010).

4.2.2 TTCN-3 tools used for compilation

The test suite has been compiled using three different TTCN-3 tools, as detailed in table 1.

Table 1: TTCN-3 tools used for compilation

Supplier	Tool name	Version	Settings	Compilation result
TestingTech	TTworkbench	1.1.13	Support for very large integers ASN.1-Language-Support-v1.1.4	No error, no warning
Elvior	TestCast T3	6.3.1		No error, no warning
OpenTTCN	OpenTTCN Tester 2012	4.2.2		No error, no warning

4.3 Validation Process

4.3.1 Test Platforms

The validation test platform has been built as described in the conformance validation framework [i.1] using the following components.

Table 2: Validation test platform components

TTCN-3 Tool	TestingTech TTworkbench v13 with ASN.1 support plugin
Test Adapter	<ul style="list-style-type: none"> • Software: Implemented by STF424. ITS Test Adapter v1.1.1 • G5 Radio hardware: Cohda Wireless™ MK2 connected via Ethernet cable
Codec	Implemented by STF424. ITS Codec v1.1.1

4.3.2 SUTs

The following SUTs have been used to validate the DENM test suite.

Table 3: SUTs used for validation

Manufacturer	Product name	Version
Hitachi™ Europe SAS	DENM	1.1
NEC™ Europe LTD	DENM	development

4.3.3 Validation Status

Table 4 shows the validation status of each test case of the DENM abstract test suite.

Table 4: Testcase validation status

TC identifier	Verdict	Log analysis	Validated	Required test suite corrections
TC_DEN_MSGF_BV_01	PASS	OK	Yes	
TC_DEN_MSGF_BV_02	PASS	OK	Yes	
TC_DEN_EVGN_BV_01	PASS	OK	Yes	
TC_DEN_EVGN_BV_03	PASS	OK	Yes	
TC_DEN_EVGN_BV_04	PASS	OK	Yes	
TC_DEN_EVGN_BV_05	PASS	OK	Yes	
TC_DEN_EVGN_BV_06	PASS	OK	Yes	
TC_DEN_EVGN_BV_07	PASS	OK	Yes	
TC_DEN_EVGN_BV_08	PASS	OK	Yes	
TC_DEN_EVGN_BV_09	PASS	OK	Yes	
TC_DEN_EVGN_BV_10	PASS	OK	Yes	
TC_DEN_EVGN_BV_11	PASS	OK	Yes	
TC_DEN_EVGN_BV_12	PASS	OK	Yes	
TC_DEN_EVGN_BV_13	PASS	OK	Yes	
TC_DEN_EVGN_BV_14	PASS	OK	Yes	
TC_DEN_EVGN_BV_15	PASS	OK	Yes	
TC_DEN_SSCI_BV_01	PASS	OK	Yes	
TC_DEN_SSCI_BV_02	PASS	OK	Yes	
TC_DEN_SSCI_BV_03				
TC_DEN_PETY_BV_01	PASS	OK	Yes	
TC_DEN_PETY_BV_02	PASS	OK	Yes	
TC_DEN_TDEV_BV_01	PASS	OK	Yes	
TC_DEN_EXTI_BV_01	FAIL	Unable to set expiration time	-	
TC_DEN_EXTI_BV_02	FAIL	Unable to set expiration time	-	
TC_DEN_EXTI_BV_03	FAIL	Unable to set expiration time	-	
TC_DEN_EUPD_BV_01	FAIL	New event is created instead of updating current one.	Yes	
TC_DEN_TNEV_BV_01	PASS	OK	Yes	
TC_DEN_TNEV_BV_02	-	Unable to instantiate ActionId object in UT.	-	
TC_DEN_TNEV_BV_03	-	Unable to instantiate ActionId object in UT.	-	
TC_DEN_TNEV_BV_04	PASS	OK	Yes	
TC_DEN_DRCX_BV_01	PASS	OK	Yes	
TC_DEN_DRCX_BV_02	-	-	-	
TC_DEN_DRCX_BV_03	-	-	-	
TC_DEN_DRCX_BV_04	-	-	-	

4.4 Feedback to standardization process

During the DENM validation exercise, a number of issues were raised.

For each issue concerning PICS, TP or ATS, a bug report has been filled in ETSI's bug reporting tool (Mantis).

Issues found in SUT implementations have been signalled directly to the concerned manufacturer, joining detailed explanations and test logs.

4.4.1 Base standard issues

The following table lists the change requests reported by STF424 to ETSI TC ITS WG1.

Table 5: Change requests reported to working group

CR Id	Description
CD_20	Clarification for units of vehicle size measurement
CD_21	Coherent optionality definition for Confidence parameters
CD_23	Clarification of ReferencePosition definition
CD_24	Clarification of the meaning of 0 frequency value
CD_25	Clarification of the meaning of 0 trafficFlowEffect value
CD_26	DistanceToStopLine structure can be removed
CD_27	Clarification of DangerousGoods type
CD_28	TurnDirection should be an enumeration
CD_29	Clarification of algorithm and unit of Curvature and CurvatureChange
CD_30	trafficLightPriority parameter can directly utilise Priority type
CD_31	Additional door types could be added
CD_32	Internationalisation of text string types
CD_33	RoadSegmentID clarification is required
CD_34	Adding next stop location to PTLinesDescription
CD_35	ScheduleDeviation type update to support more than one hour delay
CD_36	Unused WiperSystemFront type can be removed
CD_37	Removal of informative Annex A
CD_39	Removal of Notes from B.17 - B.19 data elements definitions
CD_40	Clarification of the logic of data element descriptions in Annex B
CD_41	Clarification of Confidence handling
CD_42	Clarification of CauseCode and SubCauseCode interpretation
CD_43	TimeStamp semantics update
CD_44	Table 3 and Figure 5 removal/correction
CD_45	Section 6.2.2 cleanup
CD_46	Naming coherence in CAM section 7.2
CD_47	Removal of inline definitions
CD_48	Octet Alignment for easier encoding/decoding
CD_49	Life cycle management through the use of protocol version number instead of extensions
CD_52	Deletion of codec related comments

4.4.2 Test specification issues

Following problems have been found and reported. They will be addressed in the maintenance process:

- Mantis #5933: New test purpose to be written for ActionId element.

4.4.3 Typical SUT issues

The following SUT problems have been often encountered during DENM test suite validation:

- Frequency info not transmitted in DENM.
- DENM not transmitted at correct frequency.

Annex A: Bibliography

ETSI TS 102 637-3: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".

ETSI TS 102 869-1: "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".

ETSI TS 102 869-2: "Intelligent Transport Systems (ITS); Testing; Conformance test specification for Decentralized Environmental Notification Messages (DENM); Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

ETSI TS 102 869-3: "Intelligent Transport Systems (ITS); Testing; Conformance test specification for Decentralized Environmental Notification Messages (DENM); Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

ETSI ES 201 873-1 (V4.3.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

ETSI EG 202 798 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

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History

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V1.1.1	November 2012	Publication