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Intelligent Transport Systems (ITS);
Testing;
Part 2: Conformance test specifications for Decentralized Environmental Notification basic service Messages (DENM);
DENM validation report

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Intelligent Transport Systems (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.8].

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.5] (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 with 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 defined in TS 102 869-3 (V1.2.1) [i.2] derived from EN 302 637-3 [i.1]. It provides statistics of executed and validated DENM conformance tests. The information provided has been produced by validation against two prototype implementations from industry.

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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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 EN 302 637-3 (V1.2.0): "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".

[i.2] ETSI TS 102 869-3 (V1.2.1): "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)".

[i.3] ETSI TS 102 869-3 (V1.3.1): "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)".

[i.4] ETSI TS 102 894-2 (V1.1.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary".

[i.5] ETSI TR 103 099 (V1.2.1): "Intelligent Transport Systems (ITS); Architecture of conformance validation framework".

[i.6] 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".

[i.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".

[i.8] ETSI TR 103 061-1 (V1.2.1): "Intelligent Transport Systems (ITS); Testing; Part 1: Conformance test specifications for Co-operative Awareness Messages (CAM); CAM validation report".

3 Abbreviations

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

ASN	Abstract Syntax Notation
ATS	Abstract Test Suite
DENM	Decentralized Environmental Notification Message
EC	European Commission
ITS	Intelligent Transport Systems
IUT	Implementation Under Test
PASS	Test Case Verdict Pass
PICS	Protocol Implementation Conformance Statement
SUT	System Under Test
TC	Test cases
TP	Test Purposes
TTCN-3	Testing and Test Control Notation 3

4 Validation report

4.1 Validation level

Level 3 (Rigorous) abstract test suite validation has been performed, according to the validation handbook [i.6]:

- 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 has 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 4.5.1 (ES 201 873-1 (V4.5.1) [i.7]).

4.2.2 TTCN-3 tools used for compilation

The test suite has been compiled using two 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	1.1.16	Support for very large integers ASN.1-Language-Support-v1.1.4	No error, no warning
Elvior	TestCast T3	6.7.2.1		No error, no warning
NOTE: This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of these products.				

4.3 Validation Process

4.3.1 Test Platforms

The validation test platform has been built as described in the conformance validation framework [i.5] using the components as described in table 2.

Table 2: Validation test platform components

TTCN-3 Tool	TestingTech TTworkbench v16 with ASN.1 support plugin
Test Adapter	The applicable software tag is: http://forge.etsi.org/websvn/listing.php?repname=ITS.ITS&path=/tags/v1.2.1/ Radio hardware: Cohda Wireless™ MK2
Codec	The applicable software tag is: http://forge.etsi.org/websvn/listing.php?repname=ITS.ITS&path=/tags/v1.2.1/

4.3.2 SUTs

The SUTs listed in table 3 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
NOTE: This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of these products.		

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_EVUP_BV_01	PASS	OK	Yes	
TC_DEN_EVUP_BV_02	PASS	OK	Yes	
TC_DEN_EVUP_BV_03	PASS	OK	Yes	
TC_DEN_EVUP_BV_04	PASS	OK	Yes	
TC_DEN_EVTR_BV_01	PASS	OK	Yes	
TC_DEN_EVTR_BV_02	Tests not executed due to missing upper tester function or missing implemented features. TTCN code validated with peer review method.			
TC_DEN_EVTR_BV_03				
TC_DEN_EVTR_BV_04				
TC_DEN_EVTR_BV_05				
TC_DEN_EVTR_BV_06				
TC_DEN_EVTR_BV_07				
TC_DEN_EVRP_BV_01				
TC_DEN_EVRP_BV_02				
TC_DEN_EVRP_BV_03				
TC_DEN_EVRP_BV_04				
TC_DEN_EVRP_BV_05				
TC_DEN_EVRP_BV_06				
TC_DEN_MSRV_BV_01				
TC_DEN_MSRV_BV_02				
TC_DEN_MSRV_BV_03				
TC_DEN_MSRV_BV_04				
TC_DEN_MSRV_BV_05				
TC_DEN_MSRV_BV_06				
TC_DEN_MSRV_BV_07				
TC_DEN_KAFW_BV_01				
TC_DEN_KAFW_BV_02				
TC_DEN_KAFW_BV_03				
TC_DEN_KAFW_BV_04				
TC_DEN_KAFW_BV_05				
TC_DEN_KAFW_BV_06				
TC_DEN_KAFW_BV_07				
TC_DEN_KAFW_BV_08				
TC_DEN_KAFW_BV_09				
TC_DEN_KAFW_BV_10				

4.4 Feedback to standardization process

4.4.1 Base standard issues

No change requests were reported on base standards EN 302 637-3 [i.1] and TS 102 894-2 [i.4].

4.4.2 Test specification issues

Following problems have been found in TS 102 869-3 (V1.2.1) [i.2] and have been fixed in TS 102 869-3 (V1.3.1) [i.3].

- "TTCN-3 'encode' statements were missing".
- "Replace timer tc_wait by tc_nowait".

4.4.3 Typical SUT issues

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

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

- Incomplete support of Upper Tester interface.