ETSI TR 103 061-3 V1.2.1 (2014-04)

Intelligent Transport Systems (ITS);
Testing;
Part 3: Conformance test specifications for Geographical addressing and forwarding for point-to-point and point-to-multipoint communications;
GeoNetworking validation report

Reference
RTR/ITS-00341

Keywords
ITS, OTE, testing

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
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

The present document is part 3 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 [i.9], 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 GeoNetworking conformance tests defined in TS 102 871-3 [i.2] derived from EN 302 636-4-1 (V1.2.0) [i.1]. It provides statistics of executed and validated GeoNetworking conformance tests. The information provided has been produced by validation against at least 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 302 636-4-1 (V1.2.0): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality".

[i.2] ETSI TS 102 871-3 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

[i.3] ETSI TS 102 871-3 (V1.2.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

[i.4] ETSI TS 102 871-2 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

[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: "Intelligent Transport Systems (ITS); Testing; Part 1: Conformance test specifications for Co-operative Awareness Messages (CAM); CAM validation report".

[i.9] EC mandate M/453: "Standardisation mandate addressed to CEN, CENELEC and ETSI in the field of Information and Communication Technologies to support the interoperability of co-operative Systems for Intelligent Transport in the European Community".

3 Abbreviations

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

ASN.1	Abstract Syntax Notation One
ATS	Abstract Test Suite
CAM	Co-operative Awareness Message
CBF	Contention Based Forwarding
DENM	Decentralized Environmental Notification Messages basic service
DEPV	Destination Position Vector
EC	European Commission
GAC	Geographically-scoped AnyCast
GN	GeoNetworking
ITS	Intelligent Transportat Systems
IUT	Implementation Under Test
LS	Location Service
PICS	Protocol Implementation Conformance Statement
SCF	Store Carry & Forward
SHB	Single Hop Broadcast
SO	SOurce
SOPV	SOurce Position Vector
SQN	SeQuence Number
SUT	System Under Test
TC	Test Cases
TP	Test Purposes
TSB	Topology Scoped Broadcast
TTCN-3	Testing and Test Control Notation 3
UC	UniCast
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 EG 201 015 [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 GeoNetworking abstract test suite is based on 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 conformance validation framework TR 103 099 [i.5] using the components as described in table 2.

Table 2: Validation test platform components

TTCN-3 Tool	TestingTech TTworkbench® v17 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/ G5 Radio hardware: Cohda Wireless™ MK2 connected via Ethernet cable
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 GeoNetworking test suite.

Table 3: SUTs used for validation

Manufacturer	Product name	Version
Hitachi™ Europe SAS	GN	Development
NEC™ Europe LTD	GN	Development
QMIC™	GN	Development
MARBEN™	GN	Development
ESK™	GN	Development
DENSO™	GN	Development
COMMSIGNIA™	GN	Development
AUTOTALKS™	GN	Development
COHDA™	GN	Development
KAPSCH™	GN	Development
ITRI™	GN	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 GeoNetworking abstract test suite.

Table 4: Testcase validation status

TC identifier	Verdict	Log analysis	Validated
TC_GEONW_FDV_BAH_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_BAH_BV_02	PASS	Yes	Yes
TC_GEONW_FDV_COH_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_COH_BV_02	PASS	Yes	Yes
TC_GEONW_FDV_COH_BV_03	PASS	Yes	Yes
TC_GEONW_FDV_COH_BV_04	PASS	Yes	Yes
TC_GEONW_FDV_BEA_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_BEA_BV_02	PASS	Yes	Yes
TC_GEONW_FDV_BEA_BV_03	PASS	Yes	Yes
TC_GEONW_FDV_BEA_BV_04	PASS	Yes	Yes
TC_GEONW_FDV_GUC_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_GBC_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_GAC_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_SHB_BV_01	PASS	Yes	Yes
TC_GEONW_FDV_TSB_BV_01	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_01	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_02	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_01	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_02	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_03	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_04	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_05	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_06	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_07	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_03_08	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_04	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_01	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_02	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_03	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_04	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_05	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_06	PASS	Yes	Yes
TC_GEONW_PON_LOT_BV_05_07	PASS	Yes	Yes
TC_GEONW_PON_LPV_BV_01	PASS	Yes	Yes
TC_GEONW_PON_SQN_BV_01	PASS	Yes	Yes
TC_GEONW_PON_SQN_BV_02	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_01	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_02	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_03	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_04	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_05	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_06	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_07	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_08	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_09	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_10	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_11	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_12	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_13	PASS	Yes	Yes
TC_GEONW_PON_LOS_BV_14	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_01	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_02	-	-	No
TC_GEONW_PON_FPB_BV_03	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_04	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_05	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_06	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_07	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_08	PASS	Yes	Yes

TC identifier	Verdict	Log analysis	Validated
TC_GEONW_PON_FPB_BV_09	-	-	No
TC_GEONW_PON_FPB_BV_10	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_11_01	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_11_02	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_11_03	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_11_04	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_11_05	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_12_01	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_12_02	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_12_03	PASS	Yes	Yes
TC_GEONW_PON_FPB_BV_12_04	PASS	Yes	Yes
TC_GEONW_PON_GNA_BV_01	PASS	Yes	Yes
TC_GEONW_PON_GNA_BV_02	-	-	No
TC_GEONW_PON_BEA_BV_01	PASS	Yes	Yes
TC_GEONW_PON_BEA_BV_02	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_01	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_02	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_03	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_04	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_05	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_06	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_07	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_08	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_09	PASS	Yes	Yes
TC_GEONW_PON_GUC_BV_10	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_01	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_02	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_03	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_04	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_05	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_06	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_07	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_08	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_09	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_10	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_11	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_12	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_19	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_20	PASS	Yes	Yes
TC_GEONW_PON_GBC_BV_21	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_01	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_02	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_03	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_04	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_05	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_06	PASS	Yes	Yes
TC_GEONW_PON_TSB_BV_07	PASS	Yes	Yes
TC_GEONW_PON_SHB_BV_01	PASS	Yes	Yes
TC_GEONW_PON_SHB_BV_02	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_01	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_02	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_03	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_04	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_05	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_06	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_07	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_08	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_09	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_10	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_11	PASS	Yes	Yes
TC_GEONW_PON_GAC_BV_12	-	-	No
TC_GEONW_PON_BAA_BV_01	-	-	No
TC_GEONW_PON_BAA_BV_02	-	-	No
TC_GEONW_PON_BAA_BV_03	-	-	No

TC identifier	Verdict	Log analysis	Validated
TC_GEONW_PON_BAA_BV_04	-	-	No
TC_GEONW_PON_BAA_BV_05	-	-	No
TC_GEONW_PON_BAA_BV_06	-	-	No
TC_GEONW_PON_BAA_BV_07	-	-	No
TC_GEONW_PON_BAA_BV_08	-	-	No
TC_GEONW_PON_BAA_BV_09		-	No
TC_GEONW_PON_BAA_BV_10		-	No
TC_GEONW_PON_BAA_BV_11		-	No
TC_GEONW_PON_BAA_BV_12		-	No
TC_GEONW_CAP_LOS_BV_01		-	No
TC_GEONW_CAP_FPB_BV_01		-	No
TC_GEONW_CAP_FPB_BV_02		-	No

4.4 Feedback to standardization process

4.4.1 Base standard issues

The following issues have been reported by STF462 to the ETSI TC ITS WG3 on EN 302 636-4-1 [i.1]:

- granularity of CBF algorithm: if position delta between 2 forwarders is too small, then the CBF timer delta becomes too small, too. TC ITS should define the granularity in which the CBF algorithm can work.
- SCF correction: the check of SCF (EN 302 636-4-1 [i.1], clause 9.3.8.2, step 2 should either be done in step 4) (after next hop determination) or it should be done directly in the algorithm in EN 302 636-4-1 [i.1], annex D and EN 302 636-4-1 [i.1], annex E.

  Current algorithm:

```
ADD P TO B
SET NH_LL_ADDR ← 0 # Indicates that packet is buffered
```

  New proposed algorithm:

```
IF (SCF == 1) THEN
    ADD P TO B
    SET NH_LL_ADDR ← 0 # Indicates that packet is buffered
ELSE
    SET NH_LL_ADDR ← BCAST
ENDIF
```

- Problem with flushing SO UC forwarding buffer in EN 302 636-4-1 [i.1], clause 9.3.10.3, step 9): buffers are only flushed if destination becomes a neighbour. But the case, where a neighbour appears and could be a suitable nextHop for another destination Dx, is not described. And hence Dx UC buffer is never flushed. TP/GEONW/PON/FPB/BV-02 as given in TS 102 871-2 [i.4] is at the moment no longer valid, but reflects a real situation to be tested.
- EN 302 636-4-1 [i.1], clause 9.3.8.3, forwarder operation to be restructured: there is a mix up of location table update and message update. None of the IUTs passed the tests on DEPV update in the message because of the unclear order of notes.
- SOPV is contained now in all extend header types, and in source/forwarder operations each time the SOPV processing is duplicated with slight differences. Moving SOPV in common header would allow having a single clause on CommonHeader Processing. Add SOPV to common header.

4.4.2 Test specification issues

The following problems have been found in TS 102 871-3 (V1.1.1) [i.2] and have been fixed in TS 102 871-3 (V1.2.1) [i.3]:

- Wrong parameters in the different test configurations
- Issues with Upper Tester primitives
- Wrong bit order of messages
- Adjustments in TTCN-3 altsteps required
- TTCN-3 template corrections

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 GeoNetworking test suite validation:

- UT endianess issue
- IUT does not start SQN to 0
- IUT does not increment SQN by 1
- IUT's LS buffer can hold only 1 packet
- UtInitialize should flush Neighbour table and buffers
- IUT does not update DEPV
- UtIndication not implemented

Annex A: Bibliography

ETSI TS 102 636-4-1 (V1.1.1): "Intelligent Transport System (ITS); Vehicular communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality".

ETSI TS 102 869-1 (V1.1.1): "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 (V1.1.1): "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 (V1.1.1): "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)".

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".

List of tables

History

Document history		
V1.1.1	November 2012	Publication
V1.2.1	April 2014	Publication