



Technical Report

**Intelligent Transport Systems (ITS);  
Testing;  
Part 5: IPv6 over GeoNetworking validation report**

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**Reference**

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

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## 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.

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# 1 Scope

The present document is the validation report of the IPv6 over GeoNetworking conformance tests and it provides statistics of executed and validated IPv6 over GeoNetworking 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.

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# 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.

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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".

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# 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
EC	European Commission
EUI	64-bit Global Identifier
GN	GeoNetworking
GVL	Geographical Virtual Link
ITS	Intelligent Transportation Systems
MAC	Medium Access Control
PICS	Protocol Implementation Conformance Statement
RA	Router Advertisement
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 IPv6 over GeoNetworking 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 details**

Supplier	Tool name	Version	Compilation result
TestingTech	TTworkbench	1.1.13	No error
Elvior	TestCast T3	6.3.1	No error
OpenTTCN	OpenTTCN Tester 2012	4.2.2	No error

### 4.3 Validation Process

#### 4.3.1 Validation method

#### 4.3.2 Test Platforms

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

**Table 2: Validation test platform components**

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

### 4.3.3 SUTs

The following SUTs have been used to validate the IPv6 over Geonetworking test suite.

**Table 3: SUTs used for validation**

Manufacturer	Product name	Version
Hitachi™ Europe SAS	IPv6 over GeoNwt	2.1.0
NEC™ Europe LTD	IPv6 over GeoNwt	2.1.3

### 4.3.4 Validation Status

Table 4 shows the validation status of each test case of the IPv6 over Geonetworking abstract test suite.

**Table 4: Validated IUTs details**

TC identifier	Verdict	Log analysis	Validated	Required test suite corrections
TC_IPV6GEO_MG_GVL_BV_01	PASS	OK	Yes	
TC_IPV6GEO_MG_GVL_BV_02	PASS	OK	Yes	
TC_IPV6GEO_MG_GVL_BV_03	-	Anycast handling in base specification is incorrect		
TC_IPV6GEO_MG_GVL_BV_04	-	Anycast handling in base specification is incorrect		
TC_IPV6GEO_MG_GVL_BV_05	PASS	OK	Yes	
TC_IPV6GEO_MG_GVL_BV_06	-	-		
TC_IPV6GEO_MG_TVL_BV_01	PASS	OK	Yes	
TC_IPV6GEO_MG_TVL_BV_02	PASS	OK	Yes	
TC_IPV6GEO_MG_TVL_BV_03	-	-		
TC_IPV6GEO_MG_TVL_BV_04	PASS	OK	Yes	
TC_IPV6GEO_MR_GVL_BV_01	FAIL	Destination MAC address to be checked	No	
TC_IPV6GEO_MR_GVL_BV_02	PASS	OK	Yes	
TC_IPV6GEO_MR_GVL_BV_03	-	Anycast handling in base specification is incorrect		
TC_IPV6GEO_MR_GVL_BV_04	-	Anycast handling in base specification is incorrect		
TC_IPV6GEO_MR_GVL_BV_05	PASS	OK	Yes	
TC_IPV6GEO_MR_GVL_BV_06	FAIL	Almost impossible to get RA from UT. Need to update interface list to start capture thread	No	This test is impossible to execute
TC_IPV6GEO_MR_GVL_BV_07	FAIL	Spec needs to be clarified (IPv6 Destination address check / on-link prefix)	No	
TC_IPV6GEO_MR_GVL_BV_08	FAIL	Spec is wrong - issue #5802 is wrong	No	
TC_IPV6GEO_MR_GVL_BV_09	-	-		
TC_IPV6GEO_MR_TVL_BV_01	PASS	OK	Yes	
TC_IPV6GEO_MR_TVL_BV_02	PASS	OK	Yes	
TC_IPV6GEO_VM_NVI_BV_01	PASS	Interface's mac address not checked	No	
TC_IPV6GEO_VM_NVI_BV_02	-	-		

## 4.4 Feedback to standardization process

During the IPv6 over GeoNetworking 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

- Clause 8.2.2 on Inbound Traffic defines that IPv6 Router shall discard IPv6 packets which are addressed to destinations not corresponding to GVL prefix. It is proposed to remove this restriction to allow end-2-end communication between IPv6 hosts that are behind the IPv6 routers.
- Clause 8.2.2 on Inbound Traffic defines that IPv6 Router shall discard IPv6 packets of type geoBroadcast which do not contain a RouterAdvertisement. It is proposed to remove this restriction to allow other types of multicast packets to be handled.
- Clause 8.2.2 deals with geobroadcast and geoanycast in the same manner. It is proposed to define separate behaviour for the 2 cases. It is important to note that IPv6 anycast packet cannot be handled using GeoAnycast packet (GeoAnycast recipient may not be IPv6 recipients), but should be carried using IPv6 Neighbour Discovery and GeoUnicast.

### 4.4.2 Test specification issues

- Mantis #5939: TSS&TP, minor, TPs should check that Ether type indicates IPv6.

### 4.4.3 Typical SUT issues

The following SUT problems have been often encountered during IPv6 over GeoNetworking test suite validation:

- Unsupported feature: current SUTs do not support fully the base specification.
- Bad MAC address usage, not conformant to IPv6 standards.
- Bad correspondence between GN address, IPv6 address and Mac address, which makes reverse-EUI generation impossible.



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## Annex A: Bibliography

ETSI TS 102 636-6-1 (V1.1.1): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 6: Internet Integration; Sub-part 1: Transmission of IPv6 Packets over GeoNetworking Protocols".

ETSI TS 102 859-1 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Transmission of IP packets over GeoNetworking; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma".

ETSI TS 102 859-2 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Transmission of IP packets over GeoNetworking; Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

ETSI TS 102 859-3 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Transmission of IP packets over GeoNetworking; 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

<b>Document history</b>		
V1.1.1	November 2012	Publication