

# ETSI TS 102 620 V1.1.1 (2008-02)

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*Technical Specification*

## **Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT): IPv4 to IPv6 Transitioning; Interoperability Test Suite**

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**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

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Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
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## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

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## Introduction

IPv6 is the next generation Internet. It gives vastly increased address space and true end-to-end communication. It has improved security and mobility features and allows 'plug-and-play' connection to the network. The complexity of implementing IPv6 technology and the relative openness of IETF standards means that wide-ranging and effective testing of IPv6 products will be one of the key factors in ensuring the deployment, interoperability, security and reliability of the IPv6 infrastructure.

The present document specifies interoperability tests for IPv4 to IPv6 Transitioning. The test suite results from and analysis of RFC 2529 [4], RFC 2765 [5], RFC 2766 [6], RFC 3056 [7], RFC 3596 [8], RFC 4213 [9] and RFC 4214 [10], the extraction of the requirements contained in these documents, and a selection of the requirements which could be tested by interoperability means.

The methodology and framework used to analyse the RFCs, to extract the requirements, write the Test Purposes, and the test descriptions is described in TS 102 351 [1]. The reader is strongly encouraged to read TS 102 351 [1] in order to make the best usage of the present document.

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# 1 Scope

The present document specifies the interoperability Test Descriptions (TDs) with integrated Test Purposes (TPs) for the selected IPv4 to IPv6 TRansitioning standards. The TDs are presented in the tabular form specified in TS 102 424 [1] and the TPs are defined using the TPLan notation also described in ES 202 553 [2].

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## 2 References

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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.

### 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI TS 102 351: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); IPv6 Testing: Methodology and Framework".
- [2] ETSI ES 202 553: "Methods for Testing and Specification (MTS); TPLan: A notation for expressing test Purposes".
- [3] ETSI TS 102 599 "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); IPv6 to IPv4 Transitioning; Requirements Catalogue".
- [4] IETF RFC 2529: "Transmission of IPv6 over IPv4 Domains without Explicit Tunnels".
- [5] IETF RFC 2765: "Stateless IP/ICMP Translation Algorithm (SIIT)".
- [6] IETF RFC 2766: "Network Address Translation - Protocol Translation (NAT-PT)".
- [7] IETF RFC 3056: "Connection of IPv6 Domains via IPv4 Clouds".
- [8] IETF RFC 3596: "DNS Extensions to support IP Version 6".
- [9] IETF RFC 4213: "Basic Transition Mechanisms for IPv6 Hosts and Routers".

- [10] IETF RFC 4214: "Intra-Site Automatic Tunnel Addressing Protocol (ISATAP)".
- [11] ETSI TS 102 424: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements of the NGN network to support Emergency Communication from Citizen to Authority".

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## 3 Abbreviations

### 3.1 Abbreviations

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

EUT	Equipment Under Test
MTU	Maximum Transmission Unit
PMTU	Path MTU
QE	Qualified Equipment
TP	Test Purpose
TD	Test Description
TPLan	Test Purpose Language
TSS	Test Suite Structure

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## 4 IPv6 Security Interoperability Test Specification

### 4.1 Test Descriptions

The IPv6 Security Interoperability Test Descriptions (TDs) defined in the following clauses are derived from the Test Purposes (TPs) specified in annex B.

Test Description presentation and concepts are explained in TS 102 351 [1].

Requirements referred to within the Test Description (example: RQ\_003\_1016) are all contained in TS 102 599 [3], the IPv6 to IPv4 Transitioning "Requirements catalogue".

#### 4.1.1 Index of test grouping

In the present document, tests have been grouped according to the original RFC from which they were extracted.

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NOTE: Test Descriptions covering requirements coming from more than one group are repeated in the relevant groups.

## 4.1.2 Test Descriptions

### Group 1: RFC2529 - Transmission of IPv6 over IPv4 Domains without Explicit Tunnels

Test Description			
<b>Identifier:</b>	TD_TRA_1009_01	<b>Test Purpose:</b>	TP_TRA_1009_01
<b>Summary:</b>	"A 6over4 node builds a link-local address for an IPv4 virtual interface using the interface IPv4 address"		
<b>Roles:</b>	6over4_Node	<b>Configuration:</b>	CF_TRA_01
<b>References:</b>	RQ_003_1009, RQ_003_1012, RQ_003_1016		
<pre>with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         to the link_local_address of EUT }   then { QE1 indicates receipt of the response from EUT } }</pre>			
<b>Pre-test conditions:</b>			
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE1 to send an Echo Request to the link-local address of EUT.		
2	Check: does QE1 receive an Echo Reply from EUT	Yes	No
<b>Observations:</b>			

Test Description			
<b>Identifier:</b>	TD_TRA_1027_01	<b>Test Purpose:</b>	TP_TRA_1027_01
<b>Summary:</b>	"A 6over4 router must join the all-nodes multicast address"		
<b>Roles:</b>	6over4_Router	<b>Configuration:</b>	CF_TRA_13
<b>References:</b>	RQ_003_1027		
<pre>with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         to the all_nodes_multicast_address }   then { QE1 indicates receipt of the response from EUT } }</pre>			
<b>Pre-test conditions:</b>			
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE1 to send an Echo Request to the all-nodes-multicast-address.		
2	Check: does QE1 receive an Echo Reply from EUT.	Yes	No
<b>Observations:</b>	Do not forget to put the virtual ethernet interface in the ping query.		

Test Description			
<b>Identifier:</b>	TD_TRA_1027_02	<b>Test Purpose:</b>	TP_TRA_1027_02
<b>Summary:</b>	"A 6over4 router must join the all-routers multicast address"		
<b>Roles:</b>	6over4_Router	<b>Configuration:</b>	CF_TRA_13
<b>References:</b>	RQ_003_1027		
<pre> with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         to the all_routers_multicast_address }   then { QE1 indicates receipt of the response from EUT } } </pre>			
<b>Pre-test conditions:</b>			
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE1 to send an Echo Request to the all-routers-multicast-address.		
2	Check: does QE1 receive an Echo Reply from EUT.	Yes	No
<b>Observations:</b>	Do not forget to put the virtual ethernet interface in the ping query.		

Test Description			
<b>Identifier:</b>	TD_TRA_1027_03	<b>Test Purpose:</b>	TP_TRA_1027_03
<b>Summary:</b>	"A 6over4 router must join the solicited-node multicast address corresponding to its IPv6 address"		
<b>Roles:</b>	6over4_Router	<b>Configuration:</b>	CF_TRA_13
<b>References:</b>	RQ_003_1027		
<pre> with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         to the solicited_node_multicast_address of EUT }   then { QE1 indicates receipt of the response from EUT } } </pre>			
<b>Pre-test conditions:</b>			
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE1 to send an Echo Request to the solicited-node-multicast-address of the EUT.		
2	Check: does QE1 receive an Echo Reply from EUT.	Yes	No
<b>Observations:</b>	Do not forget to put the virtual ethernet interface in the ping query.		

Group 2: RFC2765 - Stateless IP/ICMP Translation Algorithm (SIIT)

Group 2.1: Translating from IPv4 to IPv6

Test Description			
<b>Identifier:</b>	TD_TRA_3003_01	<b>Test Purpose:</b>	TP_TRA_3003_01
<b>Summary:</b>	"When the IPv4 Sender does not perform PMTU discovery, the translator shall fragment the IPv4 packet so that it fits in 1280 bytes IPv6"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3003		
<pre> with {   EUT configured not to use PMTU on Network_A } ensure that {   when { QE1 sends a packet of length 1500         indicating that a response is requested to QE2 }   then { QE1 indicates receipt of the response from QE2 } } </pre>			
<b>Pre-test conditions:</b>	EUT configured not to use PMTU on Network_A		
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE1 to send an Echo Request of length 1500 to QE2		
2	Check: does QE1 receive an Echo Reply from QE2	YES	NO
<b>Observations:</b>			



Test Description			
<b>Identifier:</b>	TD_TRA_3014_01	<b>Test Purpose:</b>	TP_TRA_3014_01
<b>Summary:</b>	"The SIIT_Translator must copy the TTL value from IPv4 headers to the Hop Limit in the resulting IPv6 headers. During translation, the translator shall decrement the TTL value or IPv6 Hop Limit"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3014, RQ_003_3015		
<pre> with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 4         to QE2 }   then { QE1 indicates receipt of the response from QE2 }   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 3         to QE2 }   then { QE1 receives no response from QE2 } } </pre>			
<b>Pre-test conditions:</b>			
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE1 to send an Echo Request indicating TTL of 4 to QE2		
2	Check: does QE1 receive an Echo Reply from QE2	YES	NO
3	Cause QE1 to send an Echo Request indicating TTL of 3 to QE2		
4	Check: does QE1 receive an Echo Reply from QE2	NO	YES
<b>Observations:</b>			

Test Description			
<b>Identifier:</b>	TD_TRA_3016_01	<b>Test Purpose:</b>	TP_TRA_3016_01
<b>Summary:</b>	"As part of forwarding the packet, if the translator has decremented the IPV4 TTL (before translation) it shall not decrement the IPV6 Hop Limit (After translation). The SIIT_Translator must not decrement 2 times."		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3016		
<pre> with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 3         to QE2 }   then { QE1 receives no response from QE2 }   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 4         to QE2 }   then { QE1 indicates receipt of the response from QE2 }   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 5         to QE2 }   then { QE1 indicates receipt of the response from QE2 } } </pre>			
<b>Pre-test conditions:</b>			
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE1 to send an Echo Request indicating TTL of 3 to QE2		
2	Check: does QE1 receive an Echo Reply from QE2	NO	YES
3	Cause QE1 to send an Echo Request indicating TTL of 4 to QE2		
4	Check: does QE1 receive an Echo Reply from QE2	YES	NO
5	Cause QE1 to send an Echo Request indicating TTL of 5 to QE2		
6	Check: does QE1 receive an Echo Reply from QE2	YES	NO
<b>Observations:</b>			

Test Description				
<b>Identifier:</b>	TD_TRA_3017_01	<b>Test Purpose:</b>	TP_TRA_3017_01	
<b>Summary:</b>	"As part of decrementing the TTL value, the SIIT_Translator needs to check for zero and if present, send the ICMPv4 ttl exceeded error"			
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02	
<b>References:</b>	RQ_003_3017			
<pre> with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 4         to QE2 }   then { QE1 indicates receipt of the response from QE2 }   when { QE1 sends a packet indicating that a response is requested         and indicating TTL of 2         to QE2 }   then { QE1 indicates Time_Exceeded } } </pre>				
<b>Pre-test conditions:</b>				
<b>Step</b>	<b>Test Sequence</b>		<b>Verdict</b>	
			<b>Pass</b>	<b>Fail</b>
1	Cause QE1 to send an Echo Request indicating TTL of 4 to QE2			
2	Check: does QE1 receive an Echo Reply from QE2		YES	NO
3	Cause QE1 to send an Echo Request indicating TTL of 2 to QE2			
4	Check: does EUT indicate Time_Exceeded to QE1		YES	NO
<b>Observations:</b>	Check TP_TRA_3017_01, last "then" is perform by EUT.			

Test Description				
<b>Identifier:</b>	TD_TRA_3018_01	<b>Test Purpose:</b>	TP_TRA_3018_01	
<b>Summary:</b>	"When translating IPv4 to IPv6, the IPv6 source Address and Destination field shall be constructed with the low-order 32bits (IPv4 Source or Destination) and the high-order 96bits (IPv4-mapped prefix or IPv4-translated"			
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02	
<b>References:</b>	RQ_003_3018, RQ_003_3019			
<pre> with { } ensure that {   when { QE1 sends a packet indicating that a response is requested         to QE2 }   then { QE1 indicates receipt of the response } } </pre>				
<b>Pre-test conditions:</b>				
<b>Step</b>	<b>Test Sequence</b>		<b>Verdict</b>	
			<b>Pass</b>	<b>Fail</b>
1	Cause QE1 to send an Echo Request to QE2			
2	Check: does QE1 receive an Echo Reply from QE2		YES	NO
<b>Observations:</b>				

Test Description				
<b>Identifier:</b>	TD_TRA_3037_01	<b>Test Purpose:</b>	TP_TRA_3037_01	
<b>Summary:</b>	"A SIIT_Translator must be able to translate ICMPv4 Echo Requests to ICMPv6 Echo Requests, by changing the type and adjusting the checksum"			
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02	
<b>References:</b>	RQ_003_3034, RQ_003_3037, RQ_003_3038			
<pre> with { } ensure that {   when { QE1 sends an Echo_Request to QE2 }   then { QE1 indicates receipt of an Echo_Reply from QE2 } } </pre>				
<b>Pre-test conditions:</b>				
<b>Step</b>	<b>Test Sequence</b>		<b>Verdict</b>	
			<b>Pass</b>	<b>Fail</b>
1	Cause QE1 to send an Echo Request to QE2			
2	Check: does QE1 receive an Echo Reply from QE2		YES	NO
<b>Observations:</b>				

Test Description			
<b>Identifier:</b>	TD_TRA_3039_01	<b>Test Purpose:</b>	TP_TRA_3039_01
<b>Summary:</b>	"A SIIT_Translator must be able to translate ICMPv4 Echo Replies to ICMPv6 Echo Replies, by changing the type and adjusting the checksum"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3034, RQ_003_3039, RQ_003_3040		
with { } ensure that { when { QE2 sends an Echo_Request to QE1 } then { QE2 indicates receipt of an Echo_Reply from QE1 } }			
<b>Pre-test conditions:</b>			
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE2 to send an Echo Request to QE1		
2	Check: does QE2 receive an Echo Reply from QE1	YES	NO
<b>Observations:</b>			

Test Description			
<b>Identifier:</b>	TD_TRA_3051_01	<b>Test Purpose:</b>	TP_TRA_3051_01
<b>Summary:</b>	"A SIIT_Translator must translate ICMPv4 Destination Unreachable (net unreachable) messages to ICMPv6 Destination Unreachable (no route to destination) messages"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3051		
with {   QE3 configured with no route for IPv4_mapped_packets } ensure that { when { QE2 sends a packet indicating that a response is requested to QE1 } then { QE2 indicates that QE1 is not reachable } }			
<b>Pre-test conditions:</b>	QE3 is configured with no route for IPv4_mapped_packets		
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE2 to send an Echo Request to QE1		
2	Check: does QE3 indicate Destination Unreachable (net unreachable) to QE2	YES	NO
<b>Observations:</b>	Check TP_TRA_3051_01, last "then" is perform by QE3.		

Test Description			
<b>Identifier:</b>	TD_TRA_3053_01	<b>Test Purpose:</b>	TP_TRA_3053_01
<b>Summary:</b>	"A SIIT_Translator must translate ICMPv4 Destination Unreachable (port unreachable) messages to ICMPv6 Destination Unreachable (port unreachable) messages"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3053		
with {   QE1 configured not to listen on UDP_port_80 } ensure that { when { QE2 sends a UDP_packet to QE1 on UDP_port_80 } then { QE2 indicates that the port is not reachable } }			
<b>Pre-test conditions:</b>	QE1 is configured not to listen on UDP_port_80		
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE2 to send an UDP_packet to QE1 on UDP_port_80		
2	Check: does QE3 indicate Destination Unreachable (port unreachable) to QE2	YES	NO
<b>Observations:</b>	What is the best option to cause QE2 sends a UDP_packet to QE1 on UDP_port_80?		

Test Description			
<b>Identifier:</b>	TD_TRA_3057_01	<b>Test Purpose:</b>	TP_TRA_3057_01
<b>Summary:</b>	"A SIIT_Translator must translate ICMPv4 Destination Unreachable (administratively prohibited) messages to ICMPv6 Destination Unreachable (administratively prohibited) messages"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3057		
<pre> with {     QE3 configured to block packets from QE2 } ensure that {     when { QE2 sends a packet indicating that a response is requested            to QE1 }     then { QE2 indicates that communication with QE1            is administratively prohibited } } </pre>			
<b>Pre-test conditions:</b>	QE3 is configured to block packets from QE2 to QE1		
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE2 to send an Echo Request to QE1		
2	Check: does QE3 indicate communication with QE1 is administratively prohibited to QE2	YES	NO
<b>Observations:</b>	Check TP_TRA_3057_01, last "then" is perform by QE3.		

Test Description			
<b>Identifier:</b>	TD_TRA_3059_01	<b>Test Purpose:</b>	TP_TRA_3059_01
<b>Summary:</b>	"A SIIT_Translator must translate ICMPv4 Time Exceeded messages to ICMPv6 Time Exceeded messages"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3059, RQ_003_3060		
<pre> with { } ensure that {     when { QE2 sends a packet indicating that a response is requested            and indicating TTL of 4            to QE1 }     then { QE2 indicates receipt of the response from QE1 }     when { QE2 sends a packet indicating that a response is requested            and indicating TTL of 3            to QE1 }     then { QE2 indicates Time_Exceeded } } </pre>			
<b>Pre-test conditions:</b>			
Step	Test Sequence	Verdict	
		Pass	Fail
1	Cause QE2 to send an Echo Request indicating TTL of 4 to QE1		
2	Check: does QE2 receive an Echo Reply from QE1	YES	NO
3	Cause QE2 to send an Echo Request indicating TTL of 3 to QE1		
4	Check: does QE3 indicate Time_Exceeded to QE2	YES	NO
<b>Observations:</b>	Check TP_TRA_3059_01, last "then" is perform by QE3.		

Test Description			
<b>Identifier:</b>	TD_TRA_3063_01	<b>Test Purpose:</b>	TP_TRA_3063_01
<b>Summary:</b>	"A SIIT_Translator must translate IPv4 packets with an IPv4 address compatible with the pool of IPv4_Translated Address of IPv6 Nodes"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3063		
with { } ensure that { when { QE2 sends a packet indicating that a response is requested to QE1 } then { QE2 indicates receipt of the response } }			
<b>Pre-test conditions:</b>			
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE2 to send an Echo Request to QE1		
2	Check: does QE2 receive an Echo Reply from QE1	YES	NO
<b>Observations:</b>			

Test Description			
<b>Identifier:</b>	TD_TRA_3064_01	<b>Test Purpose:</b>	TP_TRA_3064_01
<b>Summary:</b>	"A SIIT_Translator must translate ICMPv4 Destination Unreachable (host unreachable) messages to ICMPv6 Destination Unreachable (no route to destination) messages"		
<b>Roles:</b>	SIIT_Translator	<b>Configuration:</b>	CF_TRA_02
<b>References:</b>	RQ_003_3064		
with {   QE1 disconnected } ensure that { when { QE2 sends a packet indicating that a response is requested to QE1 } then { QE2 indicates that QE1 is not reachable } }			
<b>Pre-test conditions:</b>	QE1 is disconnected from the Network_A		
<b>Step</b>	<b>Test Sequence</b>	<b>Verdict</b>	
		<b>Pass</b>	<b>Fail</b>
1	Cause QE2 to send an Echo Request to QE1		
2	Check: does QE3 indicate QE1 is unreachable to QE2	YES	NO
<b>Observations:</b>	Check TP_TRA_3064_01, last "then" is perform by QE3.		