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Integrated broadband cable telecommunication networks (CABLE); Testing; Conformance test specifications for MAP-E technology; Part 2: Test Suite Structure and Test Purposes (TSS&TP)

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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Integrated broadband cable telecommunication networks (CABLE).

This present document produced for the transition technologies accommodates an urgent need in the industry to define requirements that enable seemless transition of Cable Networks to IPv6. Considering the depletion of IPv4 addresses, transition to IPv6 is required in order to enable continued growth of the customer base connected to Cable Networks and ensure service continuity for existing and new customers. High-quality connectivity to all kinds of IP-based services and networks is essential in todayls business and private life.

A plethora of transition technologies have been proposed in IETF, other standardization organizations and by manufacturers of IP technology to allow coexistence of IPv4 and IPv6 hosts, access and core networks as well as services. Each of these technology options is specified, implemented and deployed in various forms and stages. The present document is based on the requirements of ETSI TS 101 569-1 [1].

The present document is part 2 of a multi-part deliverable covering the conformance test specification for MAP-E technology, as identified below:

Part 1: "Protocol Implementation Conformance Statement (PICS) proforma";

Part 2: "Test Suite Structure and Test Purposes (TSS&TP)";

Part 3: "Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document provides the Test Suite Structure and Test Purposes (TSS&TP) descriptions for the IPv6 transition technology MAP-E to valaidate its implementation within a cable communications networks.

The tests are in reference to ETSI TS 101 569-1 [1], the ETSI specification for IPv6 transition technology.

The ISO standards for the methodology of conformance testing (ISO/IEC 9646-1 [i.1] and ISO/IEC 9646-2 [i.2]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [i.3]) are used as a basis for the test methodology.

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.

[1] ETSI TS 101 569-1: "Integrated Broadband Cable Telecommunication Networks (CABLE); Cable Network Transition to IPv6 Part 1: IPv6 Transition Requirements".

2.2 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] ISO/IEC 9646-1 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework- - Part 1: General concepts".

[i.2] ISO/IEC 9646-2 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 2: Abstract Test Suite specification".

[i.3] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

3 Abbreviations

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

ATS	Abstract Test Suite
B4	(MAP-E) Basic Bridging BroadBand element
CPE	Customer Premises Equipment
DF bit	Don't Fragment flag (in IPv4 header)
DHCP	Dynamic Host Configuration Protocol
DMR	Default Mapping Rule
DNS	Domain Name System
GW	GateWay
HTML	HyperText Markup Language

ICMP	Internet Control Message Protocol
IP	Internet Protocol
IPv4	IP version 4
IPv6	IP version 6
IUT	Implementation Under Test
LAN	Local Area Network
MAP	Mapping of Address and Port
MAP-E	Mapping of Address and Port Encapsulation mode
MSS	Maximum Segment Size
MTS	Methods for Testing and Specification
MTU	Maximum Transmission Unit
NAT	Network Address Translation/Network Address Translator
PD	Prefix Delegation
PICS	Procotol Implementation Conformance Statement
RA	Router Advertisement
TC	Test Case
TCP	Transmission Control Protocol
TP	Test Purpose

4 Test Suite Structure

The identifier of the TP is built according to table 1 as recommended in the MTS methodologies.

Table 1: TP naming convention for MAP-E

TP/<root>/<gr>/<sgr>/<x>/<nn>		
<root> = root	MAP-E	Mapping of Address and Port – Encapsulation Mode
<gr> = group	BR	Border Relay
	CPE	Customer Premise Equipment
<sgr> = sub-group	GWA	GatewayAssignment
	BF	Basic Function
	AS	Address Structure
	SC	Session Control
	AA	Anycast Addressing
	MSSC	Maximum Segment Size Clamping
	FRAG	Packet Fragmentation
<x> = type of testing	BV	Valid Behaviour tests
<nn> = sequential number		01 to 99
NOTE 1: A sub-group may not apply for all groups.		

5 Test Purposes (TP)

This clause proposes a TP proforma which is used in the present document. The fields of this proforma as used in the present document are explained in table 2.

Table 2: TP proforma field description

TP Header	
TP ID	The TP ID is a unique identifier according to the TP naming conventions in tables *
Test objective	Short description of test purpose objective according to the requirements from the base standard.
Reference	The reference indicates the clauses of the reference standard specifications in which the conformance requirement is expressed.
TP Behaviour	
Initial conditions (optional)	The initial conditions define in which initial state the IUT has to be to apply the actual TP. In the corresponding "Test Case" (TC), when the execution of the initial condition does not succeed, it leads to the assignment of an Inconclusive verdict.
Expected behaviour (TP body)	Definition of the events, which are parts of the TP objective, and the IUT are expected to perform in order to conform to the base specification. In the corresponding TC," Pass" or "Fail" verdicts can be assigned there.

5.1 TPs for BR

5.1.1 Basic Function

TP Id	TP/MAP-E/BR/BF/BV/01
Test objective	Check that the IUT supports the functionality of MAP-E base NAT mapping
Reference	[1]: clause 6.7.10.7 Feature: Packet Encapsulation
Initial conditions	
with { the IUT being properly provisioned and the interfaces are connected & functional }	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv6 packets containing IPv6 transport header containing source address indicating B4 IPv6 address containing destination address indicating IUT GW IPv6 address containing IPv4 payload containing source address indicating a private IPv4 address containing destination address indicating a public IPv4 address from multiple B4 devices } **then {** the IUT does a basic NAT mapping for each public IPv6 B4 address sourced and the IUT forwards packets to the destination with different IPv4 public addresses } }	

5.1.2 Address Structure

TP Id	TP/MAP-E/BR/AS/BV/01
Test objective	Check that the IUT supports the functionality of unknown destination response
Reference	[1]: clause 6.7.10.7 Feature: Packet Encapsulation
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional]	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv6 packets containing IPv6 transport header containing source address indicating CPE IPv6 address containing destination address indicating IUT GW IPv6 address containing IPv4 payload containing source address indicating a private IPv4 address containing destination address indicating a public IPv4 address from a single CPE and, the IPv4 destination is unknown by the IUT } **then {** the IUT responds by sending an ICMPv6 destination unreachable message (Type 1, Code 5) indicating the source address failed ingress/egress policy } }	

TP Id	TP/MAP-E/BR/AS/BV/02
Test objective	Check that the IUT supports dropping of packets using private IPv4 destination addresses
Reference	[1]: clause 6.7.10.7 Feature: Packet Encapsulation
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional]	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv6 packets containing IPv6 transport header containing source address indicating CPE IPv6 address containing destination address indicating IUT GW IPv6 address containing IPv4 payload containing source address indicating a private IPv4 address containing destination address indicating a **private IPv4 address** from a single CPE **then {** the IUT drops the packets } }	

TP Id	TP/MAP-E/BR/AS/BV/03
Test objective	Check that the IUT supports dropping of packets using broadcast IPv4 destination addresses
Reference	[1]: clause 6.7.10.7 Feature: Packet Encapsulation
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional]	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv6 packets containing IPv6 transport header containing source address indicating CPE IPv6 address containing destination address indicating IUT GW IPv6 address containing IPv4 payload containing source address indicating a private IPv4 address containing destination address indicating a **broadcast destination address** from a single CPE **then {** the IUT drops the packets } }	

5.1.3 Session Control

TP Id	TP/MAP-E/BR/SC/BV/01
Test objective	Check that the IUT supports session control within port ranges
Reference	[1]: clause 6.7.9.14 Feature: MAP- E Inbound Session control
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional the IUT is configured for a specific port range]	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv6 packets containing IPv6 transport header containing source address indicating CPE IPv6 address containing destination address indicating IUT GW IPv6 address containing IPv4 payload containing source address indicating a private IPv4 address containing destination address indicating a public IPv4 address from a single CPE device **then {** the IUT port maps to range configured and the IUT forwards the packet correctly } }	

5.1.4 Anycast Addressing

TP Id	TP/MAP-E/BR/AA/BV/01
Test objective	Check that the IUT supports Anycast GW addressing
Reference	[1]: clause 6.7.7.1 Feature: MAP-E Addressing
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional the IUT is configured with an Anycast address]	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv6 packets containing IPv6 transport header containing source address indicating B4 IPv6 address containing destination address indicating IUT GW IPv6 Anycast address containing IPv4 payload containing source address indicating a private IPv4 address containing destination address indicating a public IPv4 address from multiple CPE devices **then {** the IUT forwards packets to the destination } }	

5.1.5 MSS Clamping

TP Id	TP/MAP-E/BR/MSSC/BV/01
Test objective	Check that the IUT functions with MSS clamping
Reference	[1]: clause 6.7.7.5 Feature: MSS Clamping
Initial conditions	
with { the physical MTU (Phy-MTU) size being equal or greater than the MAP-E IPv6 packet between all devices and the MAP Tunnel MTU (MAP-MTU) being lower than the encapsulated softwired packet and the MSS value is below that of the TCP segment size of the incoming packet }	
Expected behaviour	
ensure that { **when {** the IUT receives an IPv4 packet containing source address indicating a private IPv4 address with a segment size greater than the IUT MSS value } **then {** the IUT drops the packet & returns a packet-too-big message to the oiriginator } }	

5.1.6 Fragmentation

TP Id	TP/MAP-E/BR/FRAG/BV/01
Test objective	Check that the IUT fragments an HTML IPv4 packet downstream
Reference	[1]: clause 6.7.7.4 Feature: MTU Size and Fragmentation
Initial conditions	
with { the physical MTU (Phy-MTU) size being equal or greater than the MAP-E IPv6 packet between all devices and the MAP Tunnel MTU (MAP-MTU) being lower than the encapsulated softwired packet }	
Expected behaviour	
ensure that { **when {** the IUT receives an HTML IPv4 packet containing source address indicating a private IPv4 address containing the DF bit indicating the value 0. with a packet size greater than the BR tunnel MTU } **then {** the IUT fragments that IPv4 packet and the IUT forwards correctly formatted IPv6 packets to the CPE } }	

5.2 TPs for CPE

5.2.1 Gateway Assignment

TP Id	TP/MAP-E/CPE/GWA/BV/01
Test objective	Check that IUT sends a DHCPv6 Request to the DHCPv6 Server after initialization
Reference	[1]: clause 6.7.9.1 Feature Device Provisioning
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional }	
Expected behaviour	
ensure that { **when {** the IUT goes online the IUT sends a DHCPv6 Request to DHCPv6 Server containing the Option fields publically routable IPv4 address (yiaddr) option 6 DNS option_S46_rule option _S46_BR option _S46_DMR } **then {** the IUT assigns the IPv6 addresses } }	

TP Id	TP/MAP-E/CPE/GWA/BV/02
Test objective	Check that IUT sends a DHCPv6 Request for LAN prefix deligation
Reference	[1]: clause 6.7.9.6 Feature: LAN Addressing - IPv6
Initial conditions	
with { the IUT is properly provisioned the interfaces are connected & functional }	
Expected behaviour	
ensure that { **when {** the IUT sends a DHCPv6 Request to DHCPv6 Server containing the Option fields IPv6 IA_PD } **then {** the IUT receives the response and, the IUT sends an RA containting the assigned prefix out towards the clients on the LAN } }	

5.2.2 Basic Function

TP Id	TP/MAP-E/CPE/BF/BV/01
Test objective	Check that the IUT supports the functionality of MAP-E NAT & encapsulation base function
Reference	[1]: clause 6.7.10.7 Feature: Packet Encapsulation
Initial conditions	
with { the IUT being properly provisioned and the interfaces are connected & functional }	
Expected behaviour	
ensure that { **when {** the IUT receives multiple HTML IPv4 packets containing source address indicating a private IPv4 address containing destination address indicating a public IPv4 address from multiple hosts } **then {** the IUT encapsulates each HTML IPv4 packet unchanged into IPv6 packet containing destination address indicating IPv6 BR GW address and the IUT forwards the packet to the BR } }	

5.2.3 Address Structure

TP Id	TP/MAP-E/CPE/AS/BV/01
Test objective	Check that the IUT supports dropping of packets using broadcast IPv4 destination addresses
Reference	[1]: clause 6.7.10.7 Feature: Packet Encapsulation
Initial conditions	
with { the IUT being properly provisioned and the interfaces are connected & functional }	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv4 packets containing IPv4 transport header containing source address indicating a private IPv4 address containing destination address indicating a **broadcast destination address** from a single CPE **then {** the IUT drops the packets } }	

5.2.4 Fragmentaton

TP Id	TP/MAP-E/CPE/FRAG/BV/01
Test objective	Check that the IUT fragments an HTML IPv4 packet upstream
Reference	[1]: clause 6.7.7.4 Feature: MTU Size and Fragmentation
Initial conditions	
with { the physical MTU (Phy-MTU) size being equal or greater than the MAP-E IPv6 packet between all devices and the MAP Tunnel MTU (MAP-MTU) being lower than the encapsulated softwired packet }	
Expected behaviour	
ensure that { **when {** the IUT receives an HTML IPv4 packet containing source address indicating a private IPv4 address containing the DF bit indicating the value 0. with a packet size greater than the MAP tunnel MTU } **then {** the IUT fragments that IPv4 packet and the IUT forwards correctly formatted IPv6 packets to the CPE } }	

5.2.5 MSS Clamping

TP Id	TP/MAP-E/CPE/MSSC/BV/01
Test objective	Check that the IUT functions with MSS clamping
Reference	[1]: clause 6.7.7.5 Feature: MSS Clamping
Initial conditions	
with { the physical MTU (Phy-MTU) size being equal or greater than the MAP-E IPv6 packet between all devices and the MAP Tunnel MTU (MAP-MTU) being lower than the encapsulated softwired packet and the MSS value is below that of the TCP segment size of the incoming packet }	
Expected behaviour	
ensure that { **when {** the IUT receives an HTML IPv4 packet containing source address indicating a private IPv4 address with a segment size greater than the IUT MSS value } **then {** and the IUT drops the packet & returns a packet-too-big message to the originator } }	

5.2.6 Session Control

TP Id	TP/MAP-E/CPE/SC/BV/01
Test objective	Check that the IUT supports session control within port ranges
Reference	[1]: clause 6.7.9.14 Feature: MAP- E Inbound Session control
Initial conditions	
with { the IUT being properly provisioned, and the interfaces are connected & functional, and the IUT is configured for a specific port range. }	
Expected behaviour	
ensure that { **when {** the IUT receives multiple IPv4 packets containing IPv4 transport header containing source address indicating a private IPv4 address containing destination address indicating a public IPv4 address from a single CPE device **then {** the IUT port maps to range configured and the IUT forwards the packet correctly } }	

Annex A (informative): Bibliography

ETSI TR 102 881 (V1.1.1) (June 2010): "Access, Terminals, Transmission and Multiplexing (ATTM); Cable Network Handbook".

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History

Document history		
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