

ETSI TS 102 624-2 V1.2.1 (2009-11)

Technical Specification

**Broadband Radio Access Networks (BRAN);
HiperMAN;
Conformance Testing for the Network layer of
HiperMAN/WiMAX terminal devices;
Part 2: Test Suite Structure and Test Purposes (TSS&TP)**



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Reference

 RTS/BRAN-004T010-2

Keywords

 HiperMAN, layer 3, terminal, testing, TSS&TP

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN).

The present document specifies the Test Suite Structure and Test Purposes (TSS&TP) of the Network layer Release 1.5 for High Performance radio Metropolitan Area Network (HiperMAN) and WiMAX terminal devices.

The present document is part 2 of a multi-part deliverable covering HiperMAN; Conformance Testing for the Network Layer of HiperMAN/WiMAX terminal devices, 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)";

1 Scope

The present document contains the Test Suite Structure (TSS) and Test Purposes (TP) to test the HiperMAN/WiMAX terminals based on the WiMAX Forum Network Architecture specifications Release 1.5.

The objective of the present document is to provide a basis for conformance tests for WiMAX terminal equipment giving a high probability of air interface inter-operability between different manufacturers' WiMAX equipment.

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [21] and ISO/IEC 9646-2 [22]) as well as the ETSI rules for conformance testing (ETS 300 406 [20]) 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.

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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] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture, Stage 2: Architecture Tenets, Reference Model and Reference Points, Base Specification".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

- [2] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture, Stage 3: Detailed Protocols and Procedures, Base Specification".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

- [3] ETSI TS 102 624-1: "Broadband Radio Access Networks (BRAN); HiperMAN; Conformance Testing for the Network layer of HiperMAN/WiMAX terminal devices; Part 1: Protocol Implementation Conformance Statement (PICS) proforma".

- [4] IEEE 802.16e-2005: "IEEE Standard for Local and metropolitan area networks - Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems. Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands and Corrigendum 1".

NOTE: Available at <http://standards.ieee.org/getieee802/802.16.html>.

- [5] IETF RFC 791 (September 1981): "Internet Protocol".

- [6] IETF RFC 1256 (September 1991): "ICMP Router Discovery Messages".
- [7] IETF RFC 5216: "The EAP-TLS Authentication Protocol".
- [8] IETF RFC 2131 (March 1997): "Dynamic Host Configuration Protocol".
- [9] IETF RFC 2132 (March 1997): "DHCP Options and BOOTP Vendor Extensions".
- [10] IETF RFC 3344 (August 2002): "IP Mobility Support for IPv4".
- [11] IETF RFC 4187 (January 2006): "Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement (EAP-AKA)".
- [12] IETF RFC 5281: "Extensible Authentication Protocol Tunneled Transport Layer Security Authenticated Protocol Version 0 (EAP-TTLSv0)".
- [13] Void.
- [14] IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".
- [15] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".
- [16] IETF RFC 3315 (July 2003): "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)".
- [17] IETF RFC 3775 (June 2004): "Mobility Support in IPv6".
- [18] IETF RFC 4285 (January 2006): "Authentication Protocol for Mobile IPv6".
- [19] IETF RFC 5246: "The Transport Layer Security (TLS) Protocol Version 1.2".
- [20] ETSI ETS 300 406: "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [21] ISO/IEC 9646-1 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts". (See also ITU-T Recommendation X.290 (1991).
- [22] ISO/IEC 9646-2 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification". (See also ITU-T Recommendation X.291 (1991).
- [23] ISO/IEC 9646-6 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".
- [24] ISO/IEC 9646-7 (1995): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statement".
- [25] ETSI TS 155 205: "Digital cellular telecommunications system (Phase 2+); Specification of the GSM-MILENAGE algorithms: An example algorithm set for the GSM Authentication and Key Generation Functions A3 and A8 (3GPP TS 55.205 version 7.0.0 Release 7)".
- [26] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture; Stage 3: Architecture, detailed Protocols and Procedures: WiMAX Over-The-Air General Provisioning System Specification".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

- [27] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture; Stage 3: Architecture, detailed Protocols and Procedures: Over-The-Air Provisioning & Activation Protocol based on TR-069 Specification".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

[28] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture; Stage 3: Architecture, detailed Protocols and Procedures; WiMAX Over-The-Air Provisioning & Activation Protocol based on OMA DM Specifications".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

[29] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture; Stage 3: Architecture, detailed Protocols and Procedures; Emergency Services Support".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

[30] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture; Stage 3: Architecture, detailed Protocols and Procedures; IP Multimedia Subsystem (IMS) Interworking".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

[31] WiMAX Forum (Release 1.5): "WiMAX Forum Network Architecture; Protocol and Procedures for Location Based Services".

NOTE: Available at <http://www.wimaxforum.org/resources/documents/technical/release>.

[32] Void.

[33] IETF RFC 2782 (February 2000): "A DNS RR for specifying the location of services (DNS SRV)".

[34] IETF RFC 2616 (June 1999): "Hypertext Transfer Protocol -- HTTP/1.1".

[35] Open Mobile Alliance OMA-TS-DM-Protocol-V1-2-20070209-A (February 2007) (V1.2): "OMA Device Management Protocol".

[36] Broadband Forum (December 2007, Issue 1 Amnd. 2): "TR-069; CPE WAN Management Protocol v1.1".

[37] IETF RFC 5031 (January 2008): "A Uniform Resource Name (URN) for Emergency and Other Well-Known Services".

[38] Void.

[39] ETSI TS 124 229: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229 Release 7)".

[40] IETF RFC 4282 (December 2005): "The Network Access Identifier".

[41] ETSI TS 102 178: "Broadband Radio Access Networks (BRAN); HiperMAN; Data Link Control (DLC) layer".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI TS 102 624-3: "Broadband Radio Access Networks (BRAN); HiperMAN; Conformance Testing for the Network layer of HiperMAN/WiMAX terminal devices; Part 3: Abstract Test Suite (ATS)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 9646-7 [24], TS 102 178 [41] and IEEE 802.16e [4] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ISO/IEC 9646-1 [21], ISO/IEC 9646-6 [23], ISO/IEC 9646-7 [24], TS 102 178 [41], IEEE 802.16e [4] and the following apply:

AKA	Authentication and Key Agreement
AVP	Attribute Value Pair
BI	Invalid Behaviour
BO	Inopportune Behaviour
BS	Base Station
BU	Binding Update
BV	Valid Behaviour
DAD	Duplicate Address Detection
DHCP	Dynamic Host Configuration Protocol
DL	Downlink
EAP	Extensible Authentication Protocol
FQDN	Fully Qualified Domain Name
IP	Internet Protocol
ISF	Initial Service Flow
IUT	Implementation Under Test
MAC	Medium Access Control
MS	Mobile Station
NAI	Network Access Identifier
NAP	Network Access Provider
NSP	Network Service Provider
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
QoS	Quality of Service
TE	Test Equipment
TI	Timer
TLS	Transport Layer Security
TP	Test Purposes
TSS	Test Suite Structure
TTLS	Tunneled Transport Layer Security
UL	Uplink

4 Test Suite Structure (TSS)

4.1 Structure

Figure 1 shows the MS NWK Test Suite Structure (TSS) including its subgroups defined for conformance testing.

Group	Function	Sub-function
Network Entry		
Client DHCPv4		
Client MIP v4 mobility management		
IPv4 Transport		
Security		

Group	Function	Sub-function
	Device authentication (EAP-TLS)	
		Fragmentation
	User authentication (EAP-AKA)	
	User authentication (EAP-TTLSv0)	
		Fragmentation
	CMAC Keys	
	EAP-TTLSv0/MS-CHAP-v02	
IPv6 Transport		
Client MIP v6 mobility management		
OTA Provisioning and Activation		
	OMA	
		Bootstrap
		Provisioning
	TR-069 based	
		Bootstrap
		Provisioning
Emergency Services		
Location Based Services		
IP-IMS Interworking		

Figure 1: TSS for WiMAX Forum Network architecture

The test suite is structured as a tree with the root defined as MS representing the "Network architecture protocols for MS". The tree is of rank 3 with the first rank a Group, the second a Function, and the third a sub-function. The third rank is broken down into the standard ISO conformance test categories CA, BV, BI, BO and TI (discussed below).

4.2 Test groups

Each test group has up to a maximum of three levels. The first level is the protocol services. The second level separates the protocol services into the various functional areas. The third level are the sub-functional areas. The fourth level, if required, is used to indicate the category of the test of the test purpose. This fourth level is not shown in figure 1.

4.2.1 Protocol services

The protocol groups identify the Network Layer protocol services defined in WiMAX Forum Network Architecture [1], and [2] relevant for MS.

4.2.1.1 Network Discovery and Selection (NWE)

This test group contains test purposes for MS detection and selection of network service provider.

4.2.1.2 Proxy MIPv4 (DHCP)

This test group contains test purposes for MS Proxy MIPv4 behaviour (DHCP) including address acquisition, and address renewal.

4.2.1.3 Client MIPv4 (CMIPv4)

This test group contains test purposes for MS Client MIPv4 behaviour (CMIPv4) including registration, re-registration, session termination, and mobility management.

4.2.1.4 IPv4 Transport (IPv4)

This test group contains test purposes for specific IPv4 requirements (Fragmentation) defined in the Network Architecture.

4.2.1.5 Security (SEC)

This test group contains test purposes for MS authentication procedures, device and user authentication.

4.2.1.6 Client MIPv6 (CMIPv6)

This test group contains test purposes for MS Client MIPv6 (CMIPv6) procedures including registration, handover, session renewal, and termination.

4.2.1.7 IPv6 Transport (IPv6)

This test group contains test purposes for MS IPv6 address management, including acquisition, renewal, and fragmentation.

4.2.1.8 Over-The-Air (OTA) Provisioning and Activation

This test group contains test purposes for OTA MS management procedures based on either OMA or TR-069 protocols.

4.2.1.9 Emergency Services

This test group contains test purposes for MS Emergency Service functions.

4.2.1.10 Location Based Services

This test group contains test purposes for MS Location Based Service functions.

4.2.1.11 IP-IMS interworking

This test group contains test purposes for MS interworking with IP-IMS services.

4.2.2 Main test types

The main test types are the valid behaviour group, the invalid behaviour group and the inopportune behaviour group.

4.2.2.1 Valid Behaviour (BV) tests

This test group shall verify that the IUT reacts in conformity with the base specifications after receipt or exchange of valid Protocol Data Units (PDUs). Valid PDUs means that the exchange of messages and the content of the exchanged messages are considered as valid.

4.2.2.2 Invalid Behaviour (BI) tests

This test sub group shall verify that the IUT reacts in conformity with the base specifications after receipt of a syntactically invalid PDU.

4.2.2.3 Inopportune Behaviour (BO) tests

This test sub group shall verify that the IUT reacts in conformity with the base specifications after receipt of a syntactically correct PDU not expected in the actual message exchange.

4.2.2.4 Timer and counter (TI) tests

This test group shall verify that the IUT reacts in conformity with the base specifications after expiry of a defined timer or counter.

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP definition conventions

The TPs are defined by the rules shown in table 1.

Table 1: TP definition rules

TP Definition Item	Item Description
TP Id	The TP Id is a unique identifier formed according to the TP naming conventions defined in the clause below.
WiMAX Forum Nwrk Architecture Reference	A pointer to the base specification requirement from which the TP is derived (specification reference, clause and paragraph).
PICS Item	The PICS item(s) associated with this TP.
Initial Condition	The IUT's state to which the TP is applied.
Expected Behaviour	Definition of the events that are expected from the IUT pursuant to the base specification given a certain stimulus.
Notes	Additional optional information provided to the TP reader.

5.1.2 TP Identifier naming conventions

The identifier of the TP is built according to table 2.

Table 2: TP naming convention

Identifier:	TP/<pg>/<fg>/<sg>/<x>-H<nnn>	Name	Functionality
	<st> = side type	MS	Mobile Station
	<pg> = protocol group	NWE	Network Discovery and Selection
		CMIPv4	Client Mobile IP v4 mobility management
		IPv4	IP v4
		DHCP	Dynamic Host Configuration Protocol (PMIP4)
		SEC	Security
		IPv6	IP v6
		CMIPv6	Client Mobile IP v6 mobility management
		OTA	Over-The-Air Provisioning and Activation
		EMG	Emergency Services
		LBS	Location Based Services
		IMS	IP-IMS Interworking
	<fg> = function group		
		EAPTLS	Extensible Authentication Protocol - Transport Level Security
		EAPTTLSv0	Extensible Authentication Protocol Tunneled Transport Layer Security Authenticated Protocol Version 0
		EAPAKA	Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement
		OMA	Open Mobile Alliance protocols
		T69	Broadband Forum TR-069 protocols
	<sg> = subfunction group		
		BTS	Bootstrap
		PVS	Provisioning and Activation
	<x> = type of testing		
		BV	Valid Behavior
		TI	Timer Behavior
		BI	Invalid Behavior
	<nnn> = sequential number	Hnnn	(H000, H001, etc.)

5.1.3 Sources of TP definitions

All TPs are specified according to WiMAX Forum Network Architecture Stage 2, and 3 documents [1] and [2].

5.1.4 TP selection criteria name convention

The mapping relationship between selection criteria of the TP and answer items of PICS is listed in table 3.

Table 3: TP Selection Criteria name convention

Identifier:	Selection Criteria in TP	Answer Items in PICS [3]	Criteria
1	PIC_MNS	A.3/1	MS supports Manual NSP selection
2	PIC_ANS	A.32	MS supports Automatic NSP selection
3	PIC_CMIPv4	A.9/2	MS supports CMIPv4
4	PIC_EAPAKA	A.6/1	MS supports EAP-AKA user authentication.
5	PIC_EAPTTLS	A.6/2	MS supports EAP-TTLS user authentication.
6	PIC_DHCPv4	A.9/1	MS supports DHCP V4
7	PIC_DHCPv4_RA	A.12/2	MS supports re-use of assigned address
9	PIC_RRTM	A.13/5	MS supports Registration Request re-transmission
10	PIC_SAA	A.19/6	MS supports Stateful Address Autoconfiguration (DHCPv6)
11	PIC_IP6	A.1/4	MS supports IPv6
12	PIC_RELEASE	A.20/7	MS supports sending of message DHCPRELEASE
13	PIC_CMIPv6	A.15/2	MS supports CMIPv6 mobility management
14	PIC_OTA	A.1/5	MS supports OTA provisioning and activation
15	PIC_TR069	A.22/2 or A.23/2 or A.24/2	OTA MS supports OTA TR-069 based provisioning and activation
16	PIC_OMA	A.22/1 or A.23/1 or A.24/1	OTA MS supports OTA OMA based provisioning and activation
17	PIC_TPA	A.20/1	OTA MS is of type Model A
18	PIC_TPB1	A.20/2	OTA MS is of type Model B1
19	PIC_TPB2	A.20/3	OTA MS is of type Model B2
20	PIC_SIB	A.26/1	OTA MS (Model B) supports OMA server initiated bootstrap
21	PIC_LO	A.29/2	OTA OMA MS supports Large Objects
22	PIC_CM	A.30/2	OTA OMA MS supports client initiated polling for Continuous Management
23	PIC_EMG_VOIP	A.32/1	Support for VoIP service
24	PIC_EMG_RCG	A.32/2	MS recognizes Emergency Service calls
25	PIC_EMG_SIP	A.33/1	MS uses SIP in the VoIP Service
26	PIC_WLPN	A.35/3	MS supports WiMAX Location Protocol (WLP) negotiation
27	PIC_AGPS	A.32/3	MS supports Assisted GPS
28	PIC_SUPL	A.34/2	MS supports OMA Secure User Plane Location (SUPL)
29	PIC_IMS	A.1/7	MS supports IP-IMS interworking
30	PIC_WIB	A.28/2	MS supports Initial Bootstrap procedure