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Technical Specification

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

Reference
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Foreword

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

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.

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 (V1.2.1): "WiMAX Forum Network Architecture; Stage 1: Architecture Tenets, Reference Model and Reference Points, Part 1".

NOTE: Available at http://www.wimaxforum.org/technology/documents/WiMAX_Forum_Network_Architecture_Stage_2-3_Rel_1v1.2.zip.

[2] WiMAX Forum (V1.2.1): "WiMAX Forum Network Architecture, Stage 2: Architecture Tenets, Reference Model and Reference Points, Part 2".

NOTE: Available at http://www.wimaxforum.org/technology/documents/WiMAX_Forum_Network_Architecture_Stage_2-3_Rel_1v1.2.zip.

[3] WiMAX Forum (V1.2.1): "WiMAX Forum Network Architecture, Stage 3: Detailed Protocols and Procedures".

NOTE: Available at http://www.wimaxforum.org/technology/documents/WiMAX_Forum_Network_Architecture_Stage_2-3_Rel_1v1.2.zip.

[4] 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".

[5] 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.

[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] IETF RFC 3748 (June 2004): "Extensible Authentication Protocol (EAP)".

[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)".

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.

Not applicable.

[i.1] ETSI TS 102 178: "Broadband Radio Access Networks (BRAN); HiperMAN; Data Link Control (DLC) layer".

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 [i.1] and IEEE 802.16e-2005 [5] 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 [i.1], IEEE 802.16e-2005 [5] and the following apply:

AKA	Authentication and Key Agreement
AVP	Attribute Value Pair
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
TE	Test Equipment
TI	Timer
TLS	Transport Layer Security
TP	Test Purposes
TSS	Test Suite Structure
TTLS	Tunneled Transport Layer Security
UL	UplinkBI Invalid Behaviour

4 Test Suite Structure (TSS)

4.1 Structure

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

Group	Function	Sub-function
Network Entry (4.1)		
	Network Discovery (4.1.2)	
	Network Selection/re-selection 4.1.2)	
Addressing		
	CMIPv4	
		MS Registration
		MS Re-registration
		Session Termination
		CSN anchor mobility
	CMIPv6	
		MS Registration
		Inter-access Router Handover
		Session Renewal
		Session Termination
	IPv6 Stateless address management	
		Router Solicitation
		Without Router Solicitation
Client DHCPv4		
	Discover	
	Request-Response	
	Use of DHCP allocated IP address	
	DHCP Renew	
Security		
	Device authentication (4.4.1.2.1 stg3)	
		EAP-TLS
	User authentication	
		EAP-AKA
		EAP-TTLS
	EAP-AKA	
	EAP-TTLSv0/MS-CHAP-v02	
		Certificate Request
		Without Certificate Request
Network Entry and Exit		
	Nwk Entry - Single EAP (4.5.1.1)	
	Nwk Entry - Double EAP (4.5.1.2)	
	Nwk Exit – Normal mode (4.5.2.1)	
	Nwk Exit – Idle mode (4.5.2.2)	
Mobility (CSN anchored) 4.8		
	Client MIP4 (4.8.3)	
	Client MIP6 (4.8.4)	
IPv6		

Figure 1: TSS for WiMAX Forum Network architecture

The test suite is structured as a tree with the root defined as DLC-BS or DLC-MS representing the protocol groups "DLC for BS" or "DLC 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).

NOTE: For compatibility with TP identifier names in earlier releases of the HiperMAN DLC Test Purposes document, the protocol group "DLC for MS" in the present document is still denoted "SS".

4.2 Test groups

Each test group has a total 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 initiator (BS or MS) or the direction of communication (DL or UL). This fourth level is not shown in figure 1.

4.2.1 Protocol services

To be added in the next release.

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>		
	<st> = side type	MS	Mobile Station
	<pg> = protocol group	CMIPv4	Client Mobile IP v4
		DHCP	Dynamic Host Configuration Protocol
		QoS	Quality of Service
		SEC	Security
		IPv6	IP v6
		CMIPv6	Client Mobile IP v6
	<fg> = function group		To be added in subsequent releases
	<sg> = subfunction group		To be added in subsequent releases
	<x> = type of testing		To be added in subsequent releases
	<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], [2] and [3].

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	Criteria
1	PIC_CMIPV4	Ax.x [x]	MS supports CMIPv4 for address assignment
2	PIC_EAPAKA	Ay.y [x]	MS supports EAP-AKA user authentication.
3	PIC_EAPTTLS	Ay.y [x]	MS supports EAP-TTLS user authentication.
4	PIC_DHCPv4	A.2/1 [4]	MS supports DHCPv4
5	PIC_CMIPV4	A.2/2	MS supports CMIPv4
6			
7			
8			
9			
10			
11			
12			
13			

5.2 Test purposes for MS

5.2.1 Network selection and entry

TP ID	**TP/MS/NWE/BV-H000**
Reference	WFNA Stage3 [3]: section 4.1.2.3.1.
PICS Item	
Initial Condition	The IUT is attempting network entry using manual mode for NSP selection and NSPs are available to the IUT as a result of the NSP discovery procedure.
Expected Behaviour	Check that: When the IUT has entered and performed successful authentication to the selected NSP, the IUT indicates the selected NSP.
Test strategy	
Notes	Requires an upper tester.

TP ID	**TP/MS/NWE/BV-H0013**
Reference	WFNA Stage3 [3]: section 4.1.2.3.2.
PICS Item	
Initial Condition	The IUT is attempting network entry using automatic mode without user intervention and more NSPs are available including the Home NSP.
Expected Behaviour	Check that: The IUT initially selects and attempts authentication with the Home NSP and if successful the IUT indicates the selected NSP.
Test strategy	
Notes	Requires an upper tester.

TP ID	**TP/MS/NWE/BV-H002**
Reference	WFNA Stage3 [3]: section 4.1.2.2, figure 4-1.
PICS Item	
Initial Condition	The IUT is attempting network discovery.
Expected Behaviour	Check that when the IUT receives a SII-ADV or SBC-RSP with a Base Station ID with the NSP Identifier flag set to '0' (indicating only one NSP associated with NAP) no more NSP identification operations are performed.
Test strategy	
Notes	May be difficult to test.

5.2.2 DHCP group

TP ID	**TP/MS/DHCP/BV-H000**
Reference	WFNA Stage2p2 [2]: sections 7.2.1.3 and 7.8.1.8. WFNA Stage3 [3]: sections 4.8.2.1.2.1 and 4.8.2.1.7.1. RFC 2131 [8]: section 4.3.2.
PICS Item	PIC_DHCPv4.
Initial Condition	MS uses DHCP (and not MIP) for getting its PoA address from the network. The MS has completed initial network entry procedures including authentication and initial service flow (ISF) setup, i.e. initial connection establishment (DSA-REQ/RSP/ACK).
Expected Behaviour	Check that the IUT sends the DHCPDISCOVER message and that the message is formatted per RFC 2131 [8]. Detailed observation results are described in [2] Stage 3: section 4.8.2.1.7.1.
Test strategy	
Notes	