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Technical Specification

Broadband Radio Access Networks (BRAN);
HiperMAN;
Conformance Testing for WiMAX/HiperMAN 1.2.1;
Part 3: Abstract Test Suite (ATS)

Reference

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Keywords

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Foreword

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

The present document was developed on the basis of the Abstract Test Suite (ATS) specification for HiperMAN systems that was in the advanced stage of development when the work was reoriented to produce joint HiperMAN/WiMAX specifications.

The present document is part 3 of a multi-part deliverable covering Broadband Radio Access Networks (BRAN); HiperMAN; Conformance Testing for WiMAX/HiperMAN 1.2.1, 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 Abstract Test Suite (ATS) to test BRAN HiperMAN1.2.1/WiMAX systems for conformance.

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

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [5] and ISO/IEC 9646-2 [6]) as well as the ETSI rules for conformance testing (ETS 300 406 [4]) are used as a basis for the test methodology.

Annex A provides the Tree and Tabular Combined Notation (TTCN) part of the ATS.

Annex B provides the Partial Protocol Implementation Extra Information for Testing (PIXIT) Proforma of the SS side ATS.

Annex C provides the Protocol Conformance Test Report (PCTR) Proforma of the SS side ATS.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
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  - for informative references.

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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] ETSI TS 102 178 (V1.2.1): "Broadband Radio Access Networks (BRAN); HiperMAN; Data Link Control (DLC) layer".

[2] IEEE 802.16-2004: "IEEE Standard for local and metropolitan area networks - Part 16: Air Interface for Fixed Broadband Wireless Access Systems".

[3] 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 for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands".

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

[5] ISO/IEC 9646-1/ITU-T Recommendation X.290: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[6] ISO/IEC 9646-2/ITU-T Recommendation X.291: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".

[7] ISO/IEC 9646-6/ITU-T Recommendation X.295: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".

[8] ISO/IEC 9646-7/ITU-T Recommendation X.296: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

[9] ETSI ES 201 873-1: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

[10] ETSI TS 102 210: "Broadband Radio Access Networks (BRAN); HIPERMAN; System profiles".

2.2 Informative references

[i.1] ISO 3166 (all parts): "Codes for the representation of names of countries and their subdivisions".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 9646-7 [8], TS 102 178 [1], and IEEE 802.16-2004 [2] as corrected by Corrigendum 1 of IEEE 802.16e-2005 [3] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TS 102 178 [1], ISO/IEC 9646-1 [5], ISO/IEC 9646-6 [7], ISO/IEC 9646-7 [8], IEEE 802.16-2004 [2] as corrected by Corrigendum 1 of IEEE 802.16-2005 [3] and the following apply:

ATM	Abstract Test Method
ATS	Abstract Test Suite
BS	Base Station
BW	BandWidth
CID	Connection IDentifier
CS	Convergence Sublayer
DHCP	Dynamic Host Configuration Protocol
DLC	Data Link Control
IP	Internet Protocol
IUT	Implementation Under Test
MAC	Medium Access Control
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
PCTR	Protocol Conformance Test Report

PIXIT	Partial Protocol Implementation Extra Information for Testing
REQ	REQuest
RNG	RaNGing
RSP	ReSPonse
RTG	Receive/Transmit Transition Gap
SS	Subscriber Station
SUT	System Under Test
TC	Test Case
TFTP	Trivial File Transfer Protocol
TLV	Type, Length, Value
TP	Test Purposes
TTCN	Tree and Tabular Combined Notation
TTG	Transmit/Receive Transition Gap

4 Abstract Test Method (ATM)

This clause describes the ATM used to test the IEEE 802.16-2004 [2] and HiperMAN DLC layer at the BS side and at the SS side.

4.1 IEEE 802.16-2004 and ETSI HiperMAN protocol layers

Figure 1 shows the mapping of the protocol layers of IEEE 802.16-2004 [2] and ETSI HiperMAN [1]. In the remaining text and figures of the present documentument only the ETSI terminology is used.

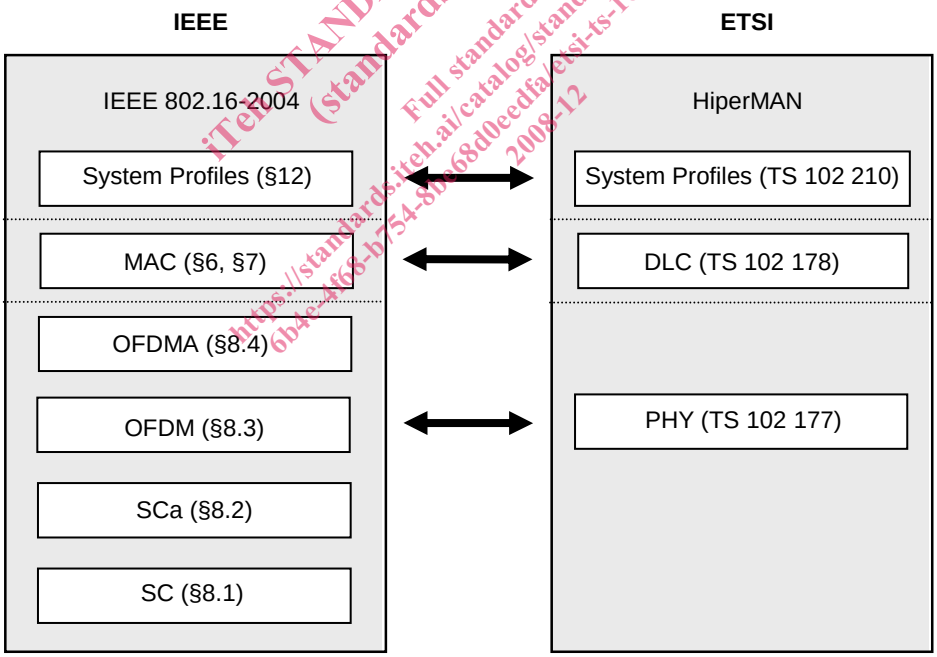

Figure 1: IEEE 802.16-2004 [2] and ETSI HiperMAN protocol layers

4.2 SS Test architecture

Figure 2 describes the DLC SS Test Configuration for testing the DLC layer of a product implementing the HiperMAN base standard. More information for this architecture is provided below.

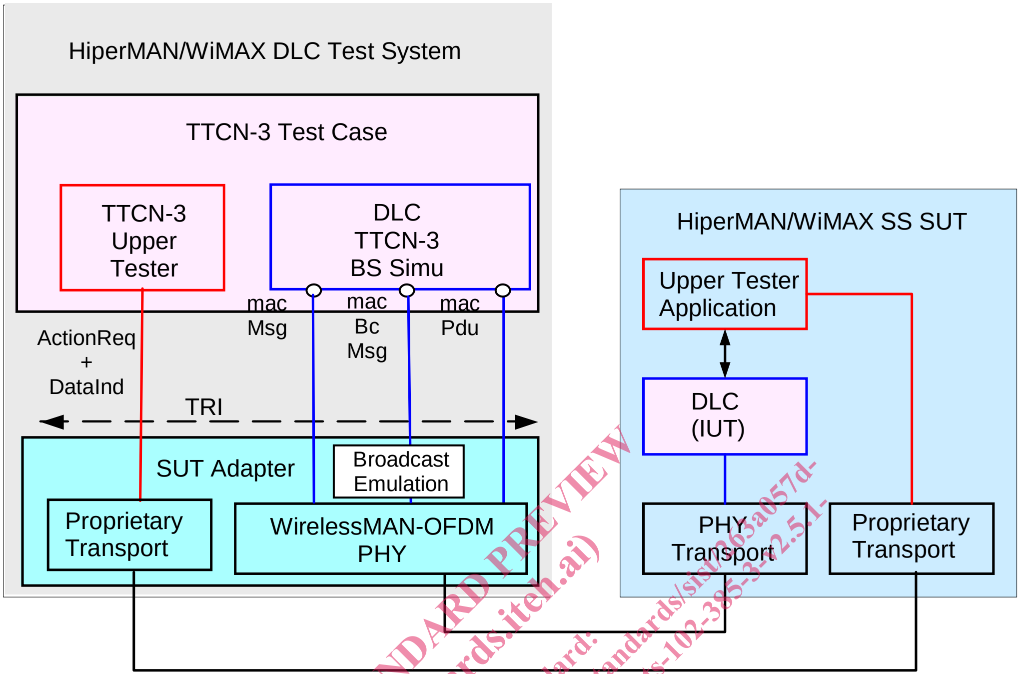

Figure 2: DLC SS Test Configuration

The DLC SS Test Configuration provides 1 test component:

- DLC TTCN-3 uses macMsg port to send and receive MAC management messages that belong to the Initial Ranging, Basic, Primary and Secondary connection. Final verdicts are set on the receive statements. Additionally to the MAC message received, the real raw data received before decoding by the test adapter are necessary for log interpretation and fields computation (i.e. checks of the HMAC digest for example). It is also important to have received the EC bit to know if the received content is encrypted and the EKS key number to know which of the two keys has to be used for decrypting.

- DLC TTCN-3 uses macPdu port to send and receive MAC PDUs. Final verdicts are set on the receive statements.

- DLC TTCN-3 controls via external functions the Upper Tester Application. The Upper Tester Application allows triggering of the IUT actions. Final verdicts are set on the return status of the external functions.

- DLC TTCN-3 controls via external functions the configuration of the Test Adapter. Final verdicts are set on the return status of the external functions.

4.3 BS Test architecture

Figure 3 describes the DLC BS Test Configuration for testing the DLC layer of a product implementing the HiperMAN base standard. More information for this architecture is provided below.

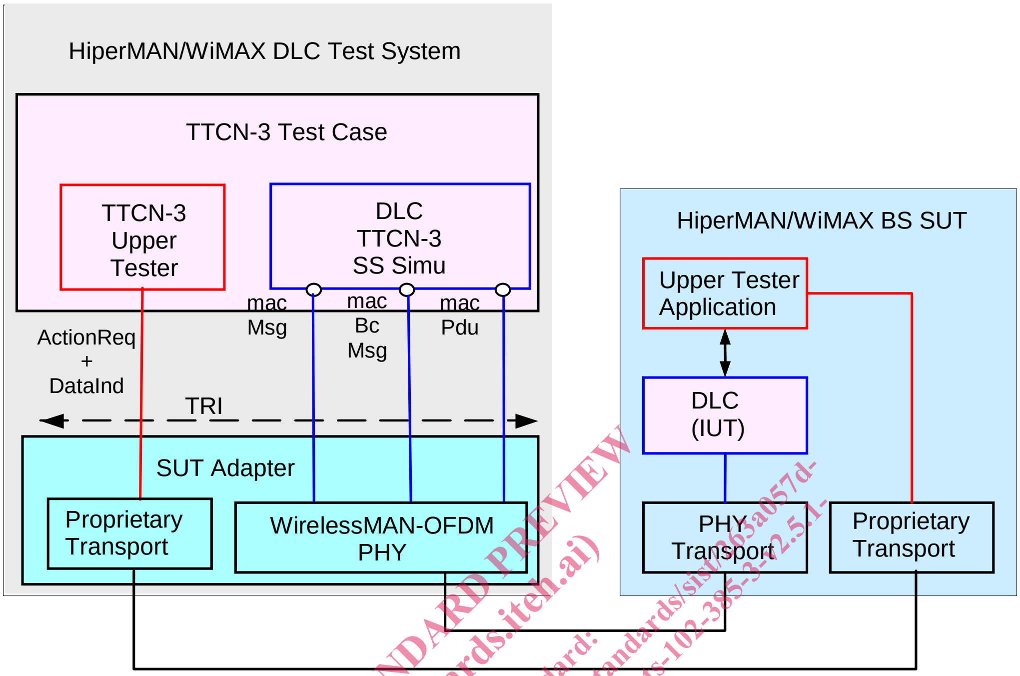

Figure 3: DLC BS Test Configuration

The DLC BS Test Configuration provides 1 test component:

- DLC TTCN-3 uses macMsg port to send and receive MAC management messages that belong to the Initial Ranging, Basic, Primary and Secondary connection. Final verdicts are set on the receive statements. Additionally to the MAC message received, the real raw data received before decoding by the test adapter is necessary for log interpretation and fields computation (i.e. checks of the HMAC digest for example). It is also important to receive the EC bit to know if the received content is encrypted and the EKS key number to know which of the two keys has to be used for decrypting.

- DLC TTCN-3 uses macBcMsg port to receive MAC management messages that belong to the Broadcast connection. Final verdicts are set on the return status of the receive functions. The MAC management messages that the Test Adapter shall support are listed in table 1.

- DLC TTCN-3 uses macPdu port to send and receive MAC PDUs. Final verdicts are set on the receive statements.

- The broadcast emulation handles the reception of the broadcast messages.

- DLC TTCN-3 controls via external functions the Upper Tester Application. Upper Tester Application allows triggering IUT actions. Final verdicts are set on the return status of the external functions.
- DLC TTCN-3 controls via external functions the configuration of the Test Adapter. Final verdicts are set on the return status of the external functions.

Table 1: Port macBcMsg

MAC management messages
DlMapMessage
UlMapMessage
DcdMessage
UcdMessage

5 Untestable Test Purposes

This clause gives a list of TP, which are not implemented in the ATS due to the chosen ATM or other restrictions.

Table 2: Untestable TP

Test Case Name	Reason
void	

6 ATS conventions

The ATS conventions are intended to give a better understanding of the ATS but they also describe the conventions made for the development of the ATS. These conventions shall be considered during any later maintenance or further development of the ATS.

The ATS conventions contain two clauses, the naming conventions and the implementation conventions. The naming conventions describe the structure of the naming of all ATS elements. The implementation conventions describe the functional structure of the ATS.

To define the ATS, the guidelines of ETS 300 406 [4] were considered.

6.1 Testing conventions

6.1.1 Testing States

BS Null: The BS is switched on and sends broadcast messages.

SS Null: The SS is switched on and is ready to receive broadcast messages.

6.1.2 HiperMAN default values: Reception and transmission at ATS level

IEEE 802.16-2004 [2] as corrected by Corrigendum 1 of IEEE 802.16e-2005 [3] (but not taking into account the Amendment 2) lists many default TLV values. IEEE 802.16-2004 [2] says that devices SHOULD NOT transmit TLVs if the default value applies. However, this is NOT a requirement. Thus, one tested device may not transmit the default TLVs (or a subset of these default TLVs) while another may transmit all TLVs including the defaults. Including all the possible combinations of sent and received default TLVs in an ATS is problematic:

- Therefore, for ATS purposes, all TLVs are assumed to be sent and received at the ATS level.
- The Test Adapter will fill in the missing received TLVs with a TLV containing the default value and pass it up to the ATS.
- The Test Adapter may or may not transmit default TLVs received from the ATS to the IUT. This is a test equipment vendor decision.

6.1.3 Templates

- Separate templates are defined for use in sending and receiving operations.
- Template definitions should avoid using matching attributes such as "*" or "?" for complete structured values, e.g. record or set of values.
- PIXIT parameter values are passed as parameters into templates.

6.1.4 Functions

The WMx ATS differentiates between external functions for which only the signature is specified and functions completely defined in the ATS. The completely defined functions are separated according to their use for SS or BS testing and preamble and postamble functions.

The SS and BS testing functions are grouped in a general configurations functions group and separate groups with functions used for testing different types of functionality.

Each type of function is implemented in a separate module, although there may be multiple modules for each function type. The following general rules apply:

- Functions use the "*runs on"* statement wherever this is possible.
- Each function provides a return value wherever this is possible. The return value used is the enumeration type "FncRetCode" defined in the WMx_Types.ttcn file.

EXAMPLE: WMx_Types.FncRetCode.

- The *stop* statement is used only for controlled test component shutdown.

6.2 Naming conventions

6.2.1 General guidelines

The naming convention is based on the following underlying principles:

- in most cases, identifiers should be prefixed with a short alphabetic string (specified in table 3) indicating the type of TTCN-3 element it represents;
- suffixes should not be used except in those specific cases identified in table 7;
- prefixes and suffixes should be separated from the body of the identifier with an underscore ("_");

EXAMPLE 1: `c_sixteen, t_wait_max`.