

# ETSI TS 102 385-2 V2.5.1 (2008-12)

Technical Specification

## Broadband Radio Access Networks (BRAN); HiperMAN; Conformance Testing for WiMAX/HiperMAN 1.2.1; Part 2: Test Suite Structure and Test Purposes (TSS&TP)



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Reference

RTS/BRAN-004T002-2R5

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Keywords

broadband, FWA, DLC, MAC, HiperMAN, radio,  
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 is part 2 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)".

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# 1 Scope

The present document contains the Test Suite Structure (TSS) and Test Purposes (TP) to test the BRAN HiperMAN 1.2.1 Data Link Control (DLC) layer.

The objective of this test specification is to provide a basis for conformance tests for HiperMAN equipment giving a high probability of air interface inter-operability between different manufacturers' HiperMAN 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.

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# 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] 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".

NOTE: See also ITU-T Recommendation X.290 (1991).

- [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 Statement".
- [9] IEEE 802.3: "IEEE Standard for Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".

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

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## 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], IEEE 802.16-2004 [2] and IEEE 802.16e-2005 [3] apply.

### 3.2 Abbreviations

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

ACK	ACKnowledgment
AES	Advanced Encryption Standard
AK	Authorization Key
ATM	Asynchronous Transfer Mode
BE	Best Effort
BPSK	Binary Phase Shift Keying
BSN	Block Sequence Number
BW	BandWidth
BWA	BandWidth Allocation and polling
CA	Certification Authority
CBC	Cipher Block Chaining
CDC	Channel Descriptor Change
CDM	Channel Descriptors and Maps
CDS	Classifier DSx Signaling
CID	Connection IDentifier
CINR	Carrier to noise and INterference Ratio



CLS	CLaSSification
CRC	Cyclic Redundancy Check
CS	Convergence Sublayer
DCD	Downlink Channel Descriptor
DES	Data Encryption Standard
DIUC	Downlink Interval Usage Code
DLC	Data Link Control layer
DSA	Dynamic Service Addition
DSC	Dynamic Service Change
DSD	Dynamic Service Deletion
DSx	Dynamic Service addition, change or deletion
ECB	Electronic Control Block
EKS	Encryption and Key Scheduling
FC	Frame Count
FDD	Frequency Division Duplexing
FPC	Fast Power Control
FSM	Finite State Machine
FWA	Fixed Wireless Access
HMAC	Hashed Message Authentication Code
HT	Header Type
IE	Information Element
IPC	IP Connectivity
IUT	Implentation Under Test
KEK	Key Encryption Key
KU	Key Usage
MAC	Medium Access Control
MIB	Management Information Base
NACK	Negative ACKnowledgment
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
PCU	Packet CS Usage
PDU	Protocol Data Unit
PHS	Payload Header Suppression
PHSI	Payload Header Suppression Index
PHSV	Payload Header Suppression Verify
PHY	PHYSical layer
PMP	Point-to-MultiPoint
PRNG	Periodic Ranging
QoS	Quality of Service
RER	REset and Re-registration
RNG	RaNGing
RSP	ReSPonse
RXD	Receive Data
SA	Security Association
SAID	Security Association IDentity
SAM	Security Association Management
SAP	Service Access Point
SDU	Service Data Unit
SNMP	Simple Network Management Protocol
TDD	Time Division Duplexing
TFTP	Trivial File Transfer Protocol
TLV	Type, Length, Value
TP	Test Purposes
TSS	Test Suite Structure
Tx	Transmit
TXD	Transmit Data
UCD	Uplink Channel Descriptor
UGS	Unsolicited Grant Service

## 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
	Map and frame Structure	
		Initialization
		Operational
		Relevance
	Channel Descriptors	
	Channel Descriptor Change	
		Uplink
		Downlink
Radio Link Control		
	Initial Ranging	
	Periodic Ranging	
	Downlink Burst Profile Management	
		To a Less Robust Profile
		To a More Robust Profile
	Negotiate Basic Capabilities	
Registration, IP connectivity and TFTP		
	Registration	
	IP Connectivity	
Privacy and Key Management		
	Authentication/ Authorization	
		Initialization
		Operational
	TEK	
		Initialization
		Operational
	Security Association Management	
	Encryption and Key Scheduling	
		Key Usage
		Encryption
		Decryption
	Certificates	
Dynamic Services		
	Dynamic Service Addition	
	Dynamic Service Change	
	Dynamic Service Deletion	
	QoS Parameter Sets	
Bandwidth Allocation and Polling		
	Request/Grant	
	Multicast Polling	
Reset and Re-registration		
Clock Comparison		
MAC PDU		
	Packing	
	Fragmentation	
	PDU concatenation	
	CRC	
	ARQ	
		Setup
		Reset
		Receive Data
		Transmit Data
Packet CS		
	Packet CS Usage	
	Classifier DSx Signaling	
	Classification	

Group	Function	Sub-function
		IPv4 and IPv6
		Ethernet
		VLAN
		IP over Ethernet
		IP over VLAN
	Payload Header Suppression	
Service Flow Control		
Adaptive Antenna Support		

**Figure 1: TSS for HiperMAN DLC**

The test suite is structured as a tree with the root defined as DLC-BS or DLC-SS representing the protocol groups "DLC for BS" or "DLC for SS". 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 as defined in clause 4.2.2.

## 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 SS) or the direction of communication (DL or UL). This fourth level is not shown in figure 1.

### 4.2.1 Protocol services

The protocol groups identify the DLC protocol services given in TS 102 178 [1] and IEEE 802.16-2004 [2].

#### 4.2.1.1 Channel descriptors and maps

This protocol group contains the test purposes for the DCD, UCD, DL-MAP, and UL-MAP messages that provide channel parameters and burst mapping. Such functions as Scanning for the Downlink Channel and Obtaining Uplink Parameter are included.

#### 4.2.1.2 Radio Link Control (RLC)

This protocol group contains the test purposes for Initial Ranging/Automatic Adjustments, Negotiating Basic Capabilities, Periodic Ranging, and Downlink Profile management.

#### 4.2.1.3 Registration, IP connectivity, and TFTP

This protocol group includes the test purposes for Registration during Initialization, IP Connectivity during Initializations, Time of Day Establishment, and the Transfer of Operational Parameters.

#### 4.2.1.4 Privacy and key management

The functions included in this protocol group are Authentication/Authorization, Certification, Reauthorization, TEK Exchange, TEK Update, TEK Scheduling, Security Association Management, Encryption, and Decryption.

#### 4.2.1.5 Dynamic services

Dynamic service addition, change, and deletion for both BS-Initiated and DS-Initiated behaviour are in this protocol group.

#### 4.2.1.6 Bandwidth allocation and polling

This protocol group includes the bandwidth request/grant functions for stand-alone, piggyback and focused contention.

#### 4.2.1.7 Reset and re-registration

Reset and re-registration functions are included in this protocol group.

#### 4.2.1.8 Clock comparison

The clock comparison function in this group is used in network systems with service flows carrying information that requires the SSs to reconstruct their network clock signals, e.g. DS1 and DS3.

#### 4.2.1.9 MAC PDU Construction

The functions included in this protocol group are PDU Packing, Fragmentation, Concatenation, CRC Use, ARQ Reset, ARQ Receive, and ARQ Transmit.

#### 4.2.1.10 Packet convergence sublayer

The service specific packet Convergence Sublayer (CS) resides on top of the MAC sublayer and utilizes, via the MAC SAP, the services provided by the MAC sublayer. The CS performs the following functions:

- Accepting higher-layer PDUs.
- Classifying higher-layer PDUs.
- Processing (if necessary) classified higher-layer PDUs.
- Delivering PDUs to the appropriate MAC SAP.

#### 4.2.1.11 DLC MAC Sublayer

The MAC sublayer provides the core MAC functionality of system access, bandwidth allocation, connection establishment, and connection maintenance. It receives data from the various convergence sublayers classified to particular MAC connections. QoS is applied to the transmission and scheduling of data over the PHY. The MAC sublayer also performs authentication, secure key exchange, and encryption management.

### 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.
IEEE 802.16 [2] 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/<st>/<pg>/<fg>/<sg>/<ini>/<x>-H<nnh>		
	<st> = side type	BS	Base Station
		SS	Subscriber Station
	<pg> = protocol group	CDM	Channel Descriptors and Maps
		RLC	Radio Link Control
		INI	Registration, IP Connectivity, and Parameter Transfer
		PKM	Privacy and Key Management
		DS	Dynamic Services
		BWA	BandWidth Allocation and Polling
		RER	REset and Re-registration
		CCC	CloCk Comparison
		MAC	MAC PDU Construction
		PCS	Packet CS
		SF	Service Flow control
		AAS	Adaptive Antenna Support
	<fg> = function group	MAP	MAp and frame structure
		CD	Channel Descriptors
		CDC	Channel Descriptor Change
		IRNG	Initial RangINg
		PRNG	Periodic RangINg
		DBPC	Downlink Burst Profile Management
		SBC	Negotiate Basic Capabilities
		REG	REGistration
		IPC	IP Connectivity
		AUTH	AUTHentication/AUTHorization
		TEK	Encryption Key Transfer
		SAM	Security Association Management
		EKS	Encryption and Key Scheduling
		CERT	CERTificates
		DSA	Dynamic Service Addition
		DSC	Dynamic Service Change
		DSD	Dynamic Service Deletion