

TECHNICAL CODE

SPECIFICATION FOR ASYMMETRIC DIGITAL SUBSCRIBER LINE (ADSL) TRANSCEIVERS

First Revision

Developed by



Registered by



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MCMC MTSFB TC T010:2014

DEVELOPMENT OF TECHNICAL CODES

The Communications and Multimedia Act 1998 ('the Act') provides for Technical Standards Forum designated under section 184 of the Act or the Malaysian Communications and Multimedia Commission ('the Commission') to prepare a technical code. The technical code prepared pursuant to section 185 of the Act shall consist of, at least, the requirement for network interoperability and the promotion of safety of network facilities.

Section 96 of the Act also provides for the Commission to determine a technical code in accordance with section 55 of the Act if the technical code is not developed under an applicable provision of the Act and it is unlikely to be developed by the Technical Standards Forum within a reasonable time.

In exercise of the power conferred by section 184 of the Act, the Commission has designated the Malaysian Technical Standards Forum Bhd (MTSFB) as a Technical Standards Forum which is obligated, among others, to prepare the technical code under section 185 of the Act.

A technical code prepared in accordance with section 185 shall not be effective until it is registered by the Commission pursuant to section 95 of the Act.

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Committee Representation

The Fixed Terminal Working Group under the Malaysian Technical Standards Forum Bhd (MTSFB) which developed this Technical Code consists of representatives from the following organisations:

AJV Holding Sdn Bhd

AZ-Technology Sdn Bhd

D Link Corporation Sdn Bhd

Panasonic Malaysia

SIRIM QAS International Sdn Bhd

Telekom Malaysia Berhad

TIME dotCom Berhad

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FOREWORD

This technical code for the Specification for Asymmetric Digital Subscriber Line (ADSL) Transceivers (First Revision) ('this Technical Code') was developed pursuant to section 185 of the Act 588 by the Malaysian Technical Standards Forum Bhd (MTSFB) via its Fixed Terminal Working Group.

This Technical Code was developed for the purpose of certifying communications equipment under the Communications and Multimedia (Technical Standards) Regulations 2000.

This Technical Code cancels and replaces Technical Specification for Asymmetric Digital Subscriber Line (ADSL) Transceivers, SKMM FTS ADSL Rev. 1.01.2007.

This Technical Code shall continue to be valid and effective until reviewed or cancelled.

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**SPECIFICATION FOR ASYMMETRIC DIGITAL SUBSCRIBER LINE (ADSL)
TRANSCEIVERS**

1. Scope

1.1 This Technical Code defines the physical layer characteristics of the Asymmetrical Digital Subscriber Line (ADSL) transceivers. The purpose of the specification is to ensure proper interworking of ADSL transceivers at the customer end (ATU-R) and network operator end (ATU-C) in terms of interaction, electrical characteristics and ADSL interoperability. It defines a variety of frame bearers in connection with or without an underlying service. For example:

- a) ADSL transmission simultaneously on the same pair with voice band service; and
- b) ADSL transmission without any underlying service, optimized for deployment with ADSL over voice band service in the same binder cable.

1.2 ADSL Transceivers shall be designed for multi-mode operation, supporting one or more of the following ADSL Transceivers standards:

- a) ADSL Transceivers (ITU-T Rec. G.992.1) outlined in Section A;
- b) Splitterless ADSL Transceivers (ITU-T Rec. G.992.2) outlined in Section B;
- c) ADSL2 Transceivers (ITU-T Rec. G.992.3) outlined in Section C;
- d) Splitterless ADSL2 Transceivers (ITU-T Rec. G.992.4) outlined in Section D;
- e) ADSL2+ Transceivers – Extended Bandwidth (ITU-T Rec. G.992.5) outlined in Section E; and
- f) ADSL Interoperability Test Plan (DSL Forum Technical Report TR-067) Section F.

1.3 ADSL Transceivers, supporting the ADSL2, Splitterless ADSL2 or ADSL2+ standards shall be backward compatible and capable of interacting with network equipment which supports only the ADSL and Splitterless ADSL standards.

1.4 The ADSL interoperability test plan facilitates ADSL over POTS and ISDN CPE/DSLAM interoperability testing. This test plan embodies operators' definitions of ADSL interoperability (between one DSLAM and one CPE at a time). The test plan focuses on physical layer testing, and also validation and verification of selected higher layer functionality. The test plan defines dynamic interoperability (performance) as expected by leading carriers, specifying simulated network conditions under which interoperability is required. The performance points in this test plan are based on ATU-C equipment, capable of providing the maximum allowable power.

ATU-C equipment unable to provide this transmit power is considered to be out of the scope of this interoperability test plan.

This test plan defines tests for various physical layer functionalities and some higher layer functionalities.

2. Normative references

The following normative references are indispensable for the application of this Technical Code. For dated references, only the edition cited applies. For undated references, the latest edition of the normative references (including any amendments) applies.

See Annex A.

3. Abbreviations

ADSL	Asymmetrical Digital Subscriber Line
AOC	ADSL Overhead Control
ATM	Asynchronous Transfer Mode
ATU	ADSL Transceiver Unit
ATU-C	ATU at Central Office
ATU-R	ATU at Remote End
BMAP	Broadband Modem Access Protocol
CPE	Customer Premises Equipment
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
EOC	Embedded Operation Channel
FEXT	Far End Cross(X) Talk
IEEE	Institute of Electrical Electronics Engineers
ISDN	Integrated Services Digital Network
ISP	Internet Standard Protocol
ITU	International Telecommunication Union
NIC	Network Interface Card
PDN	Premises Distribution Network
POTS	Plain Old Telephone Service
PPPoE	Point-to-point Over Ethernet
STM	Synchronous Transfer Mode
TCM	Time-Compression Multiplexing

4. General Application Reference Models

4.1 Standardizing requirements for ADSL Transceivers is carried out at the U interface points of the application reference models shown in Figures 1 to 4.

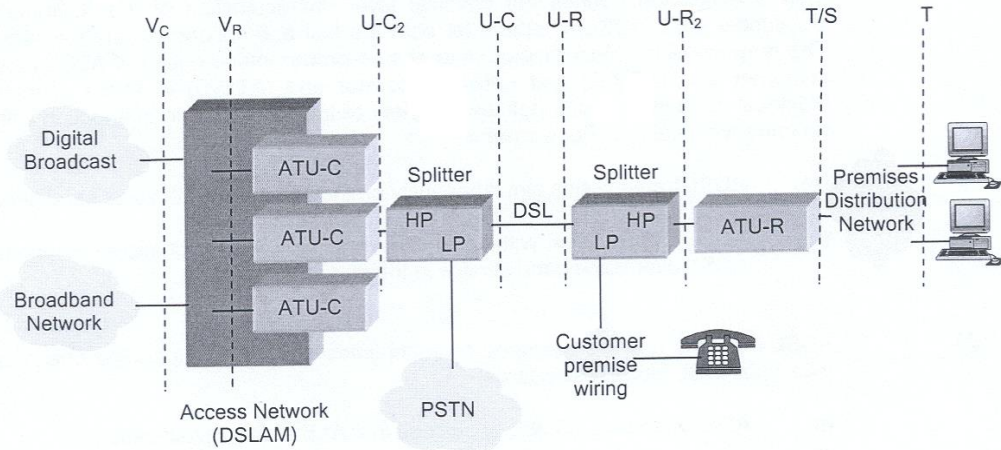


Figure 1. Generic application reference model for remote deployment with splitter

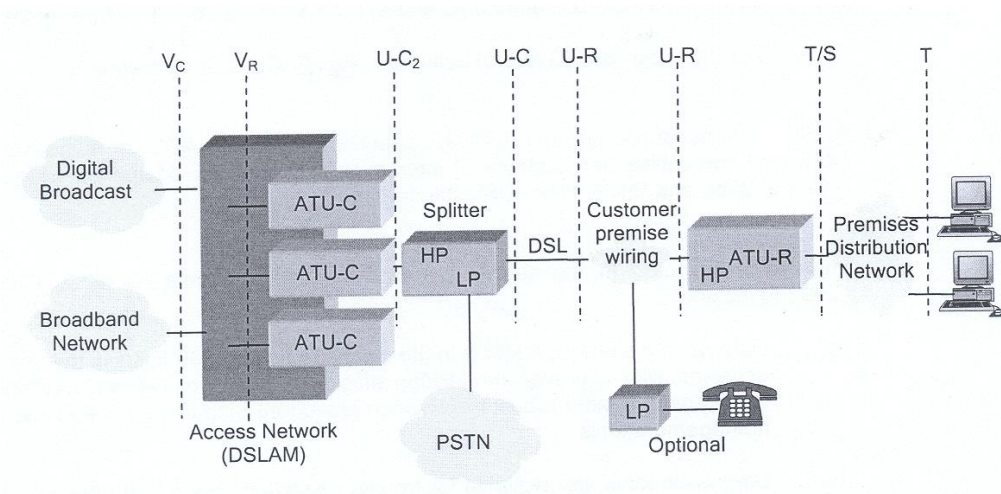


Figure 2. Generic application reference model for splitterless remote deployment

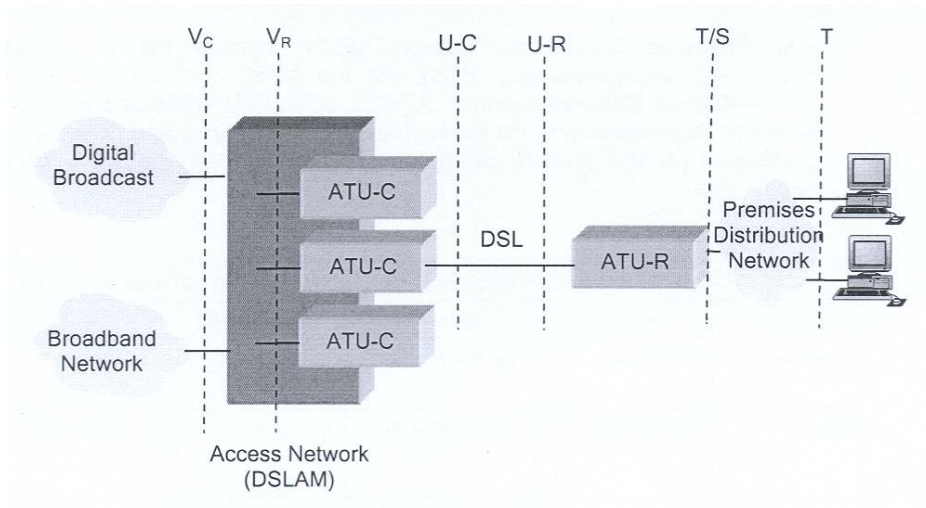


Figure 3. Data service application model

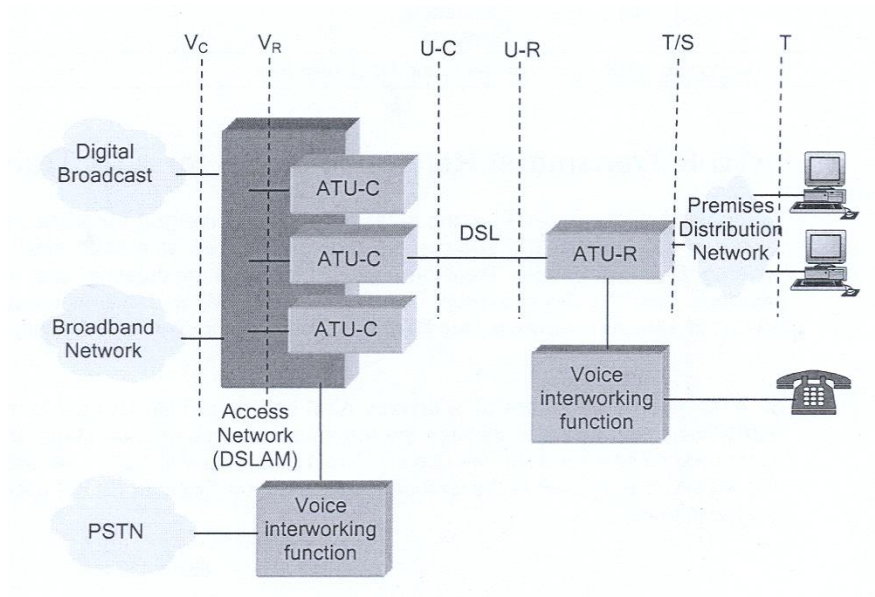


Figure 4. Voice over data service application model

Notes:

- i) U-C and U-R interfaces are fully defined in this Technical Specification.
- ii) V-C interface may consist of interfaces to one or more ATM switching systems.
- iii) High-pass (HP) filters, which are part of the splitters, may be integrated into the ATU-x; if so, U-C2 and U-R2 will become the same as U-C and U-R interfaces, respectively.
- iv) Due to asymmetry of signals on the line, transmitted signals shall be distinctively specified at the U-R and U-C reference points.
- v) T/S may interface to in-building Ethernet, ATM25, USB, IEEE-1394 or home phone-line network (HomePNA).

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4.2 The Premises Distribution Network (PDN) defines the technology for connecting subscribers' equipment (e.g. PCs) with the ADSL transceivers (ATU-R). This PDN may be provided as an Ethernet interface, ATM25, USB, IEEE-1394 or a HomePNA backbone. The selection depends mainly on subscribers' mix of services and network or service providers' preference in the ATU-R interfaces. Table 1 shows the PDN alternatives and their capabilities.

Table 1. Premises Distribution Network Alternatives and Capabilities

PDN	ATM25	Ethernet	HomePNA	USB	IEEE-1394
Bandwidth	25 Mbps	10/100 Mbps	10 Mbps+	12 Mbps (half-duplex)	400 Mbps (half-duplex)
Reach	50 m (Cat 5)	100 m (Cat 3)	500 feet in-house phone wiring	5m (shielded)	4.6 m (shielded)
Installation	PC NIC	Most PCs require NIC	PC NIC	Included with PCs	Included with PCs
Protocol	Native ATM, PPP, RFC 1483	PPP via BMAP, PPPoE, tunnelling bridging	PPPoE, bridging	PPP via BMAP	PPP via BMAP

* Throughput to ADSL loop is limited by the ADSL data rate

5. Requirements

5.1 General requirements

5.1.1 Power supply requirements

5.1.1.1 For AC powered TE, the operating voltage shall be rated/ marked at 230V or 240V in line with the country's nominal voltage and frequency in accordance to MS IEC 60038. If the product is rated with multiple or a range of voltages, voltage range between 230V (+10%,-6%) shall be included. Testing shall be conducted based on 230V (+10%,-6%) or 240V and other relevant voltages, if the product is marked with multiple or a range of voltages.

5.1.1.2 Product shall be rated/ marked at 50Hz and testing shall be conducted at 50Hz. If the product is marked at 50/60Hz or 50-60Hz then testing shall be conducted either at 50Hz or 60Hz, whichever is more unfavorable.

5.1.1.3 Where external power supply is used, e.g. AC adaptor, it shall not affect the capacity of the equipment to meet this specification. Adaptor must be pre-approved by the relevant regulatory body before it can be used with the equipment.

5.1.2 Power supply cord and mains plug requirements

The equipment shall be fitted with a suitable and appropriate approved power supply cord and mains plug. Both are regulated products and must be pre-approved by the relevant regulatory body before it can be used with the equipment.

The power supply cord shall be certified according to:

- a) MS 140; or
- b) BS 6500; or
- c) IEC 60227-5; or
- d) IEC 60245-4.

The mains plug shall be certified according to:

- a) 13 A fused plugs: MS 589: Part 1 or BS 1363: Part 1; or
- b) 2.5 A, 250 V, flat non-rewirable two-pole plugs: MS 1578 or BS EN 50075.

5.1.3 Marking requirements

The requirements shall be marked with the following information:

- a) Supplier/manufacturer's name or identification mark;
- b) Supplier/manufacturer's model or type reference; and
- c) Other markings as required by the relevant standards.

The marking shall be legible, indelible and readily visible. All information on the marking shall be either in Malay or English Language.

5.2 Interoperability

ATU-R Transceiver and ATU-C are dynamically interoperable if they implement a common and compatible set of features, functions and options and can demonstrate satisfactory mutual communication in a real network architecture environment as performance test conditions are varied and exercised. It is mandatory that the ATU-R be tested with the respective Internet Service Provider (ISP) to ensure interoperability. The general reference model for interoperability is shown in Figure 5.

5.3 Safety and health requirements

The equipment shall comply with the safety requirements defined in MS IEC 60950-1. The supplier shall submit full type test report to MS IEC 60950-1 or equivalent standards.

5.4 Electromagnetic compatibility (EMC) requirements

The equipment shall comply with the EMC emissions requirements as defined in the MS CISPR 22 or equivalent standards. The requirements shall cover radiated and conducted emission.

5.5 Lightning and Surge protection requirements

Primary and secondary lightning and surge protection shall be provisioned with 6kV and 3kA in accordance with ITU-T K.21.

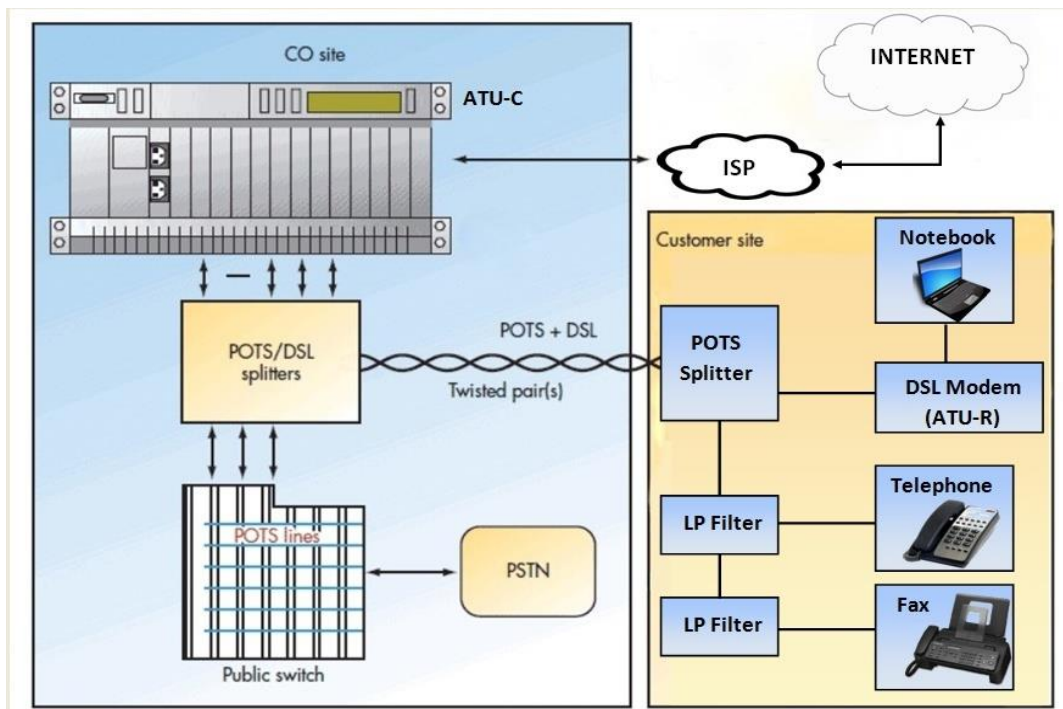


Figure 5. General reference model for interoperability

5.6 Internet Protocol Requirements (IPv6)

It is mandatory that the ATU-R be tested with the respective Internet Service Provider (ISP) to ensure IPv6 interoperability.

Section A

Asymmetric Digital Subscriber Line (ADSL) Transceivers
(ITU-T Recommendation G.992.1)

Table 2. ADSL Transceivers

TITLE	ITU-T Rec. G.992.1	CR	Remarks
Scope	1	GID	-
System reference modal	1.1	GID	-
Objectives	1.2	GID	-
References	2	GID	-
Definitions	3	GID	-
Abbreviations	4	GID	-
Reference models	5	GID	-
ATU-C transmitter reference models	5.1	GID	-
ATU-C transmitter reference models	5.2	M	ATM mode of transportation shall be supported.
Transport capacity	6	GID	-
Transport of STM data	6.1	NA	-
Transport of ATM data	6.2	M	-
ADSL system overheads and total bit rates	6.3	M	Full overhead framing mode shall be supported. Reduced overhead framing mode in optional.
ATU-C Functional Characteristics	7	GID	-
STM transmission protocol specific functionalities	7.1	GID	-
ATM transport protocol specific functionalities	7.2	GID	The provision of ATM transport mode is network dependent.
Network timing reference	7.3		-
Framing	7.4	GID	
Scramblers	7.5	GID	-
Forward error correction	7.6	GID	-
Tone ordering	7.7	GID	-
Constellation encoder (Treillis code version)	7.8	GID	-
Constellation encoder (No trellis coding)	7.9	GID	-

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Table 2. ADSL Transceivers (Continued)

TITLE	ITU-T Rec. G.992.1	CR	Remarks
Gain scaling	7.10	GID	-
Modulation	7.11	GID	-
Cyclic prefix	7.12	GID	-
Transmitter dynamic range	7.13	GID	-
ATU-C downstream transmitter spectral masks	7.14	GID	-
Dual bit mapping and rate conversion (Annex C only)	7.15	GID	-
FEXT bit mapping (Annex C only)	7.16	GID	-
ATU-R Functional Characteristics	8	M	Framing modes for ATM transport shall be supported
STM transmission protocol specific functionalities	8.1	NA	-
ATM transport protocol specific functionalities	8.2	M	-
Network timing reference	8.3	O	-
Framing	8.4	M	-
Scramblers	8.5	M	-
Forward error correction	8.6	M	-
Tone ordering	8.7	M	-
Constellation encoder - Trellis version	8.8	M	-
Constellation encoder - Uncoded version	8.9	M	-
Gain scaling	8.10	M	-
Modulation	8.11	M	-
Cyclic prefix	8.12	M	-
Transmitter dynamic range	8.13	M	-
ATU-R upstream transmitter spectral response	8.14	M	-
Dual bit mapping and rate conversion (Annex C only)	8.15	NA	-
FEXT bit mapping (Annex C only)	8.16	NA	-
EOC operations and maintenance	9	NA	-

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Table 2. ADSL Transceivers (Continued)

TITLE	ITU-T Rec. G.992.1	CR	Remarks
Clear EOC	9.1	O	-
Embedded operations channel (EOC) requirements	9.2	M	Shall comply with requirements for communication between the ATU-C and ATU-R for in-service and out-of-service maintenance.
In-service performance monitoring and surveillance	9.3	M	-
Initialization	10	M	-
Overview	10.1	M	-
Handshake - ATU-C	10.2	GID	-
Handshake - ATU-R	10.3	O	-
Transceiver training - ATU-C	10.4	M	-
Transceiver training - ATU-R	10.5	M	-
Channel analysis (ATU-C)	10.6	M	-
Channel analysis (ATU-R)	10.7	M	-
Exchange - ATU-C	10.8	M	-
Exchange - ATU-R	10.9	M	-
AOC on-line adaptation and reconfiguration	11	M	-
The ADSL overhead control (AOC) channel	11.1	M	-
Specific requirements for an ADSL system operating in the frequency band above POTS	Annex A	M	-
Specific requirements for an ADSL system operating in the frequency band above ISDN as defined in ITU-T Rec. G.961 Appendices I and II	Annex B	NA	-
Specific requirements for an ADSL system operating in the same cable as ISDN as defined in ITU-T Rec. G.961 Appendix III	Annex C	NA	-
ATU-C and ATU-R state diagrams	Annex D	GID	-
POTS and ISDN-BA Splitters	Annex E	GID	-
Type 1 - European	E.1	GID	If applicable, POTS splitter shall comply with the requirements specified in SKMM FTS PSTN
Impedance Matching	E.1.1	GID	-

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Table 2. ADSL Transceiver (Continued)

TITLE	ITU-T Rec. G.992.1	CR	Remarks
Return loss	E.1.2	GID	-
Insertion loss	E.1.3	GID	-
Insertion loss distortion	E.1.4	GID	-
Isolation	E.1.5	GID	-
Signal power	E.1.6	GID	-
Ringing	E.1.7	GID	-
Unbalance about earth	E.1.8	GID	-
Frequencies and levels for pulse metering	E.1.9	NA	-
Type 2 – North America	E.2	NA	-
Type 3 – ADSL above ISDN (ITU-T G.961 Appendix I or II)	E.3	NA	-
Type 4 – Type for Japan	E.4	NA	-
ATU-x Classification and Performance for Region A (Other than Europe)	Annex F	GID	-
ATU-x Classification and Performance for Region B (Europe)	Annex G	GID	-
ATM Layer to Physical Layer Logical Interface	Appendix I	GID	-
Dynamic (on-line) Rate Adaptation	Appendix II	GID	-
Compatibility with other customer premise equipment	Appendix III	GID	-
Bibliography	Appendix IV	GID	-

Section B

Splitterless Asymmetric Digital Subscriber Line (ADSL) Transceivers
(ITU-T Recommendation G.992.2)

Table 3. Splitterless ADSL Transceivers

TITLE	ITU-T Rec. G.992.2	CR	Remarks
Scope	1	GID	-
References	2	GID	-
Definitions and abbreviations	3	GID	-
Reference models	4	GID	Support of ATM is required. ADSL transceivers (ATU-R) shall support bearer channel AS0 downstream and LS0 upstream.
Transport capacity	5	M	-
ATU interfaces	6	-	-
ATU interface for ATM transport	6.1	M	-
ATU PMD to TC Logical Interface	6.2	GID	-
ATU Functional Characteristics	7	-	-
ATM Transport Protocol Specific Functionalities	7.1	M	-
Network Timing Reference	7.2	O	-
Framing	7.3	M	-
Scrambler	7.4	M	-
Reed Solomon Forward Error Correction	7.5	M	-
Interleaver	7.6	M	-
Tone ordering	7.7	M	-
Constellation encoder	7.8	M	-
Gain scaling	7.9	M	-
Modulation	7.10	M	-
Cyclic prefix	7.11	M	-
Transmitter dynamic range	7.12	M	-
Embedded operations channel (EOC)	8	-	-
EOC introduction	8.1	M	-
EOC message encoding	8.2	M	-

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Table 3. Splitterless ADSL Transceivers (Continued)

TITLE	ITU-T Rec. G.992.2	CR	Remarks
EOC message description	8.3	M	-
EOC Protocol	8.4	M	-
Clear EOC	8.5	O	-
ADSL overhead channel (AOC)	9	-	-
The ADSL overhead control (AOC) channel introduction	9.1	O	-
AOC message encoding	9.2	M	-
Bit swap operation	9.3	O	-
AOC protocol	9.4	M	-
In-service performance monitoring and surveillance	10	GID	-
ADSL line related primitives	10.1	M	-
ATM data path related primitives	10.2	M	-
Other ADSL indicators, parameters and signals	10.3	M	-
Test parameters	10.4	M	-
Other failures and parameters	10.5	M	-
Initialization	11	-	-
Overview	11.1	M	-
Handshake – ATU-C	11.2	GID	-
Handshake – ATU-R	11.3	M	-
Handshake power levels	11.4	M	-
Escape from Handshake to Fast Retrain	11.5	O	-
Power Levels in Transceiver Training, Channel Analysis and Exchange	11.6	M	-
Transceiver training – ATU-C	11.7	M	-
Transceiver training – ATU-R	11.8	M	-
Channel analysis (ATU-C)	11.9	M	-
Channel analysis (ATU-R)	11.10	M	-
Exchange – ATU-C	11.11	M	-
Exchange – ATU-R	11.12	M	-
Fast retrain Non-overlapped	12	O	-
Power management	13	O	-
Spectrum Operation	Annex A	M	-

Table 3. Splitterless ADSL Transceivers *(Continued)*

TITLE	ITU-T Rec. G.992.2	CR	Remarks
Overlapped Spectrum Operation	Annex B	M	
ADSL above POTS co-existing in the same binder as TCM-ISDN DSL	Annex C	GID	-
System Performance for North America	Annex D	GID	-
System Performance for Europe	Annex E	GID	-
-	Appendix I	GID	-
Guide to scenarios for the implementation of the various procedures in Recommendations G.994.1 and G.992.2	Appendix II	GID	-
Compatibility with other Customer Premises Equipment	Appendix III	O	-

Section C

Asymmetric Digital Subscriber Line Transceivers 2 (ADSL2)
(ITU-T Recommendation G.992.3)

Table 4. ADSL Transceivers 2

TITLE	ITU-T Rec. G.992.3	CR	Remarks
Scope	1	GID	-
References	2	GID	-
Definitions	3	GID	-
Abbreviations	4	GID	-
Reference models	5	GID	Application models may include: 1. Generic application reference model for remote deployment with splitter 2. Generic application reference model for splitterless remote deployment 3. Data service application model 4. Data with POTS service application model 5. Data with ISDN service application model 6. Voice over data service application model
Transport Protocol Specific Transmission Convergence (TPS-TC) function	6	-	-
Transport capabilities	6.1	M	-
Interface signals and primitives	6.2	M	-
Control parameters	6.3	M	-
Data plane procedures	6.4	M	-
Management plane procedures	6.5	O	-
Initialization procedure	6.6	M	-
On-line reconfiguration.	6.7	M	-
Power management mode	6.8	M	-
Physical Media Specific Transmission Convergence (PMS-TC) function	7	-	-
Transport capabilities	7.1	M	-
Additional functions	7.2	M	-

Table 4. ADSL Transceivers 2 (Continued)

TITLE	ITU-T Rec. G.992.3	CR	Remarks
Block interface signals and primitives	7.3	M	-
Block diagram and internal reference point signals	7.4	M	-
Control parameters	7.5	M	-
Frame structure	7.6	M	-
Data plane procedures	7.7	M	-
Control plane procedures	7.8	M	-
Management plane procedures	7.9	M	-
Initialization procedures	7.10	M	-
On-line reconfiguration	7.11	M	-
Power management mode	7.12	M	-
Physical media dependent function	8	-	-
Transport capabilities	8.1	M	-
Additional functions	8.2	M	-
Block interface signals and primitives	8.3	M	-
Control parameters	8.5	M	-
Constellation encoder for data symbols	8.6	M	-
Constellation encoder for synchronization and L2 exit symbols	8.7	M	-
Modulation	8.8	M	-
Transmitter dynamic range	8.9	M	-
Transmitter spectral masks	8.10	M	-
Control plane procedures	8.11	M	-
Management plane procedures	8.12	M	-
Initialization procedures	8.13	M	-
Short initialization procedures	8.14	O	-
Loop diagnostics mode procedures	8.15	M	-
On-line reconfiguration of the PMD function	8.16	M	-
Power management in the PMD function	8.17	M	-
Management Protocol Specific Transmission Convergence (MPS-TC) functions	9	GID	-
Transport functions	9.1	M	-
Additional functions	9.2	M	-

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Table 4. ADSL Transceivers 2 (Continued)

TITLE	ITU-T Rec. G.992.3	CR	Remarks
Block interface signals and primitives	9.3	M	-
Management plane procedures	9.4	M	-
Power management	9.5	M	-
Dynamic behavior	10	M	-
Initialization	10.1	M	-
On-line Reconfiguration (OLR)	10.2	M	-
Power management	10.3	M	-
Specific requirements for an ADSL system operating in the frequency band above POTS	Annex A	M	-
Specific requirements for an ADSL system operating in the frequency band above ISDN as defined in ITU-T Rec. G.961 Appendices I and II	Annex B	NA	-
Specific requirements for an ADSL system operating in the same cable as ISDN as defined in ITU-T Rec. G.961 Appendix III	Annex C	NA	-
ATU-C and ATU-R state diagrams	Annex D	GID	-
POTS and ISDN Basic Access Splitters	Annex E	GID	-
Type 1 – POTS splitter – Europe	E.1	O	-
Type 2 – POTS splitter – North America	E.2	O	-
Type 3 – ISDN (ITU-T Rec. G.961 Appendix I or II) Splitter – Europe	E.3	NA	-
Type 4 – POTS splitter – Japan ATU-x performance requirements for region A (North America)	E.4	O	-
ATU-x performance requirements for region B (Europe)	Annex G	O	-
Specific requirements for a synchronized symmetrical DSL (SSDSL) system operating in the same cable binder as ISDN as defined in ITU-T Rec. G.961 Appendix III	Annex H	NA	-

Table 4. ADSL Transceivers 2 (Continued)

TITLE	ITU-T Rec. G.992.3	CR	Remarks
All digital mode ADSL with Improved spectral compatibility with ADSL over POTS	Annex I	O	-
All Digital Mode ADSL with improved spectral compatibility with ADSL over ISDN	Annex J	NA	-
TPS-TC functional descriptions	Annex K	GID	-
STM Transmission Convergence (STM-TC) function	K.1	NA	-
ATM Transmission Convergence (ATM-TC) function	K.2	M	-
Packet transmission convergence function (PTM-TC)	K.3	O	-
ATM layer to physical layer logical interface	Appendix I	GID	-
Compatibility with other customer premises equipment	Appendix II	GID	-
The impact of primary protection devices on line balance	Appendix III	GID	-
Bibliography	Appendix IV	GID	-

Section D

Splitterless Asymmetric Digital Subscriber Line Transceivers 2 (Splitterless ADSL2)

(ITU-T Recommendation G.992.4)

Table 5. Splitterless ADSL Transceivers 2

TITLE	ITU-T Rec. G.992.4	CR	Remarks
Scope	1	GID	-
References	2	GID	-
Definitions	3	GID	-
Abbreviations	4	GID	-
Reference models	5	GID	Application models may include: 1. Generic application reference model for splitterless remote deployment 2. Data service application model 3. Data with POTS service application model 4. Voice over data service application model
Transport Protocol Specific Transmission Convergence (TPS-TC) function	6	M	-
Physical Media Specific Transmission Convergence (PMS-TC) function	7	M	-
Physical media dependent function	8	M	-
Management Protocol Specific Transmission Convergence (MPS-TC) functions	9	M	-
Control Protocol Specific Transmission Convergence (CPS-TC) functions	10	-	Further study by ITU-T
Dynamic behavior	11	M	-
Specific requirements for an ADSL system operating in the frequency band above POTS	Annex A	M	-

Table 5. Splitterless ADSL Transceivers 2 (Continued)

TITLE	ITU-T Rec. G.992.4	CR	Remarks
Specific requirements for an ADSL system operating in the same cable as ISDN as defined in ITU-T Rec. G.961 Appendix III	Annex C	NA	-
ATU-C and ATU-R state diagrams	Annex D	GID	-
POTS and ISDN-BA splitters	Annex E	GID	-
ATU-x performance requirements for region A (North America)	Annex F	-	Further study by ITU-T
-	Annex G	-	Intentionally left blank
-	Annex H	-	Intentionally left blank
All digital mode ADSL with improved spectral compatibility with ADSL over POTS	Annex I	O	-
-	Annex J	-	Intentionally left blank
TPS-TC functional descriptions	Annex K	M	-

Section E

**Asymmetric Digital Subscriber Line (ADSL) Transceivers –
Extended Bandwidth (ADSL2+)**
(ITU-T Recommendation G.992.5)

Table 6. ADSL Transceivers – Extended Bandwidth

TITLE	ITU-T Rec. G.992.5	CR	Remarks
Scope	1	GID	-
References	2	GID	-
Definitions	3	GID	-
Abbreviations	4	GID	-
Reference models	5	GID	Application models may include: 1. Generic application reference model for remote deployment with splitter 2. Generic application reference model for splitterless remote deployment 3. Data service application model 4. Data with POTS service application model 5. Data with ISDN service application model 6. Voice over data service application model
Transport Protocol Specific Transmission Convergence (TPS-TC) function	6	M	-
Physical Media Specific Transmission Convergence (PMS-TC) function	7	M	-
Physical media dependent function	8	-	-
Transport capabilities	8.1	M	-
Additional functions	8.2	M	-
Block interface signals and primitives	8.3	M	-
Block diagram and internal reference point signals	8.4	M	-
Control parameters	8.5	M	-
Constellation encoder for data symbols	8.6	M	-

Table 6. ADSL Transceivers – Extended Bandwidth (Continued)

TITLE	ITU-T Rec. G.992.5	CR	Remarks
Constellation encoder for synchronization and L2 exit symbols	8.7	M	-
Modulation	8.8	M	-
Transmitter dynamic range	8.9 3	M	-
Transmitter spectral masks	8.10	M	-
Control plane procedures	8.11	M	-
Management plane procedures	8.12	M	-
Initialization procedures	8.13	M	-
Short initialization procedures	8.14	O	-
Loop diagnostics mode procedures	8.15	M	-
On-line reconfiguration of the PMD function	8.16	M	-
Power management in the PMD function	8.17	M	-
Management Protocol Specific Transmission Convergence (MPS-TC) functions	9	GID	-
Transport functions Block interface signals and primitives 9.3 M Refer to § 9.3/G.992.3	9.1	M	-
Additional functions	9.2	M	-
Management plane procedures	9.4	M	-
Power management	9.5	M	-
Dynamic behavior	10	M	-
Specific requirements for an ADSL system operating in the frequency band above POTS	Annex A	M	-
Specific requirements for an ADSL system operating in the frequency band above ISDN as defined in ITU-T Rec. G.961 Appendices I and II	Annex B	NA	-
Specific requirements for an ADSL system operating in the same cable as ISDN as defined in ITU-T Rec. G.961 Appendix III	Annex C	NA	-
ATU-C and ATU-R state diagrams	Annex D	GID	-
POTS and ISDN-BA splitters	Annex E	GID	-
ATU-x performance requirements for region A (North America)	Annex F	-	Further study by ITU-T

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Table 6. ADSL Transceivers – Extended Bandwidth *(Continued)*

TITLE	ITU-T Rec. G.992.5	CR	Remarks
ATU-x performance requirements for region B (Europe)	Annex G	-	Further study by ITU-T
Specific requirements for a synchronized symmetrical DSL (SSDSL) system operating in the same cable binder as ISDN as Defined in ITU-T Rec. G.961 Appendix III	Annex H	-	Further study by ITU-T
All digital mode ADSL with Improved spectral compatibility With ADSL over POTS	Annex I	O	-
All Digital Mode ADSL with improved spectral compatibility with ADSL over ISDN	Annex J	NA	-
TPS-TC functional descriptions	Annex K	M	-
-	Annex L	-	-
Specific requirements for an ADSL system with extended upstream bandwidth, operating in the frequency band above POTS 1.	Annex M	O	-
ATM layer to physical layer logical interface	Appendix I	GID	-
Compatibility with other customer premises equipment	Appendix II	GID	-
The impact of primary protection devices on line balance	Appendix III	GID	-
PSD template to be used in capacity calculations with in-band transmit spectrum shaping	Appendix IV	GID	-
Bibliography	Appendix V	GID	-

Section F

ADSL Interoperability Test Plan
(DSL Forum Technical Report TR-067)

Table 7. ADSL Interoperability Test Plan

Title	TR-067	CR	Remarks
Equipment features			
DSLAM	6.1	M	Refer to Table 6.1.1:DSLAM Features (Informative)
CPE	6.2	M	Refer to Table 6.2.1:CPE Features Tables (Informative)
Expected results	6.3	M	The results columns of Table 6.1.1 and 6.2.1 shall be completed to indicate whether each feature is included with the DSLAM or CPE transceivers.
Test configurations			
The test configuration is based on type of Transceivers. Refer to Appropriate figures in Clause 7.0.			
Physical layer test cases			
ADSL functionality tests	8.1	M	9 individual tests – 9 must be passed
Sudden applications of RFI	8.2	M	A test that more closely replicates the very rapid increases in amplitude of RFI that occur on real circuits.
DSL noise spikes/surges tests	8.3	M	10 individual tests – 10 must be passed (recovery or retrain after noise condition)
Stress test	8.4	M	1 individual test – 1 must be passed
Electrical compatibility tests	8.5	M	4 individual tests – 4 must be passed
Higher layer test cases			
Layer ATM connectivity tests	9.1	M	9 individual tests – 8 must be passed (all except Test 9.1.5)
3 Ethernet or USB interface RFC 2684 [10] bridged mode	9.2	M	42 individual tests – 42 must be passed
RFC 2516 [11] PPPoE end-to-end connectivity test	9.3	M	1 individual tests – 1 must be passed
RFC 2364 [12] PPPoA end-to-end connectivity test	9.4	M	1 individual tests – 1 must be passed
RFC 2684 [10] end-to-end connectivity test	9.5	M	1 individual tests – 1 must be passed
Usability test	9.6	M	1 individual tests – 1 must be passed

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Table 7. ADSL Interoperability Test Plan (Continued)

Physical layer test cases for system using G.992.1 (ADSL Interoperability Test Plan, TR-067)			
North American Test set	Annex A.1	M	Applicable for ADSL over POTS
European Test set	Annex A.2	M	Applicable for ADSL over POTS
Specific Test Set-up Information	Annex B.1	GID	Applicable for ADSL over ISDN
European Test set	Annex B.2	O	Applicable for ADSL over ISDN
Physical layer test cases for system using G.992.1	Annex C	GID	Applicable for ADSL co-exist with TCM-ISDN

NOTES:

- i) System Under Test (SUT) shall comply either Annex A.1 or Annex A.2.
- ii) The following notations are used in the Specification:
 - CR - Conformance requirement defines features and functions that must be supported at minimum.
 - M - Mandatory requirements
 - Optional requirement, which become mandatory when features and functions are supported.
 - NA - Not Applicable
 - GID - General Information and Definitions

Annex A
(Normative)

Normative references

BS EN 50075	Flat non-wireable two pole plugs 2.5 A 250 V with cord for the connection of class II- Equipment for household and similar propose
BS 1363:Part 1	13A plugs, socket outlets, adaptors and connection units
BS 6500	Flexible cords rated up to 300, 500 V for use with appliances and equipment intended for domestic offices and similar environments
DSL FORUM TR-067	ADSL Interoperability Test Plan
IEC 60227-5	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)
IEC 60245-4	Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables
ITU-T Rec. G.992.2	Splitterless Asymmetric Digital Subscriber Line (ADSL) Transceivers
ITU-T Rec. G.992.3	Asymmetric Digital Subscriber Line Transceivers 2 (ADSL2)
ITU-T Rec. G.992.4	Splitterless Digital Subscriber Line Transceivers 2 (Splitterless ADSL2)
ITU-T Rec. G.992.5	Asymmetric Digital Subscriber Line (ADSL) Transceivers – Extended Bandwidth (ADSL2+)
MS CISPR 22	Information Technology Equipment – Radio disturbance characteristics – Limits and methods of measurement
MS IEC 60038	IEC Standard Voltages
MS IEC 60950-1	Information Technology Equipment – Safety
MS 140	Specification for insulated flexible cords and cables
MS 589:Part 1	Specification for 13A plugs, socket – outlets, adaptors and connection units : Part 1: Specification for rewirable and non-rewirable 13A plugs
MS 1578	Specification for flat non-rewirable two-pole plus, 2.5 A, 250 V, with cord, for the connection of class II – Equipment for household and similar purposes

Annex B
(Informative)

Amendments

Amendments to SKMM FTS ADSL Rev. 1.01:2007		
Page	Clause	Items Amended
Cover	-	The document has adopted new numbering system and cover page. It has been renumbered as "MCMC MTSFB TC T010:2014".
i	-	Explanatory note on the development of Technical Codes has been included.
2	2	New clause on normative references has been included.
2	3	The abbreviations have been updated.
5	5.1.1	Power supply requirements have been revised based on the Information Booklet 2012 Edition, Approval of Electrical Equipment, issued by the Energy Commission.
6	-	Old clause 5.2 on compliance standards for ADSL transceivers have been removed.
6	5.2	Interoperability requirements have been updated to mandate testing requirement with the respective Internet Service Provider.
6	5.5	New clause on lightning and surge protection requirements has been included.
7	5.5 (Figure 5)	Figure 5 on the general reference model for interoperability has been updated.
7	5.6	New clause on IPv6 requirements has been included.
26	Annex A	The normative references have been updated.

Acknowledgements

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