



Telstra Technology Innovation & Products  
Voice & Mobility

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**IP 1149**

**Issue 6**

**THE TELSTRA ADSL NETWORK – LISTING  
REQUIREMENTS FOR CPE**

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## 1. INTRODUCTION

ADSL Access enables Telstra's Public Switched Telephone Network (PSTN) customers to make and receive calls in the usual manner, while simultaneously accessing high-speed data applications. This service access is based on ADSL modem technology that enables existing twisted pair telephone lines to support broadband (BB) data applications concurrently with POTS.

Telstra's ADSL implementation is based on international standards, however one is not guaranteed inter-operability with external vendors' CPE. Accordingly an inter-operability process has been developed and is defined in this document.

A minimum level of service management is required for Telstra to maintain service quality and assurance levels that are specified in this document.

## 2. PURPOSE

This document outlines the listing requirements for connection to the Telstra ADSL network for ADSL CPE including:

- Modems,
  - Bridged, 10Base T.
  - Routed, 10Base T or ATM 25.
  - USB.
- NIC cards, 10Base T.
- Test Equipment.
- Filters (line, central).
- Client Software (PPPoE or PPPoA).

It will describe the testing requirements for connection to the Telstra telephone exchange ADSL network (DSLAM) and the procedure to certify third party CPE equipment based on relevant ADSL standards. Meeting the required specifications will ensure proper inter-operability and required service levels are achieved.

Telstra has described the ADSL interfaces in the document "Telstra Service Interface Specification for ADSL".

This document does not address any of the local loop or POT's network integrity, interference & safety issues which are included in the Telecommunications Labelling Notice and relevant ACA, ACIF & EMC standards. CPE should meet all ACA labelling requirements before the start of inter-operability testing.

### 3. INTER-OPERABILITY

All ADSL CPE must comply with the Telecommunications labelling notice. This is a mandatory requirement for all customer equipment before it is connected to a carrier's network. Importers and manufacturers of ADSL CPE should refer to the ACA web site [www.aca.gov.au/standards](http://www.aca.gov.au/standards).

Since these mandatory requirements only cover health, safety, PSD and EMC issues, Telstra has developed additional inter-operability processes to ensure inter-operability between the customer modem and the ADSL access network.

The ADSL CPE market is open to all manufacturers and Telstra is pro-active in fostering a good working relationship with Industry to deliver nation-wide quality and a supportable service. Telstra service extends to the CPE interface, which must meet required standards that this document will outline.

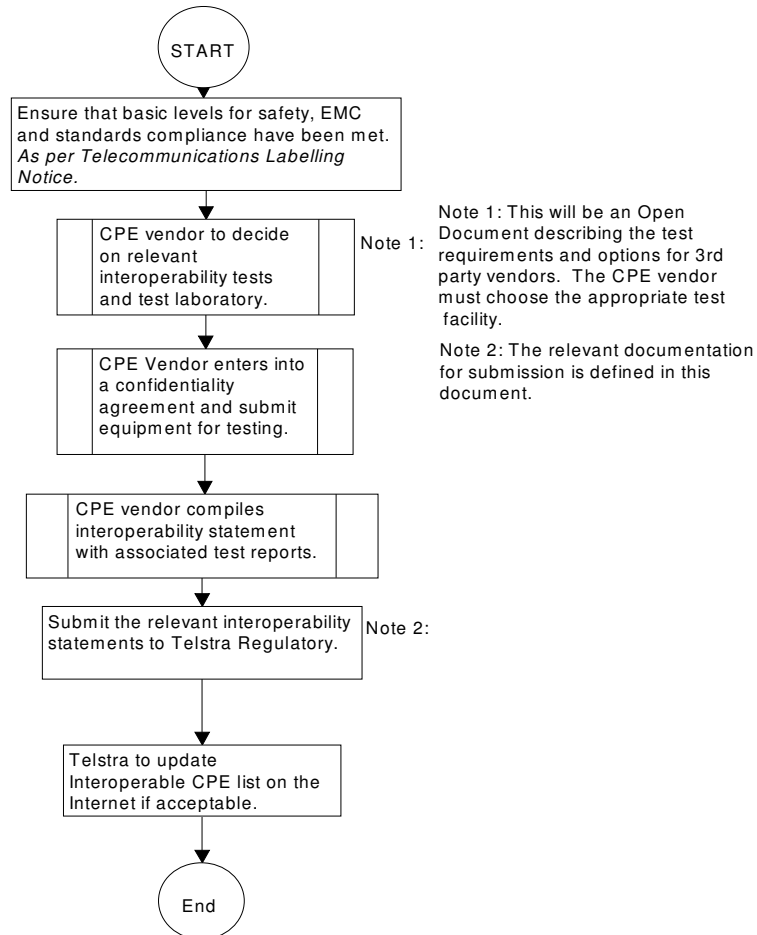
The inter-operability process is necessary to ensure that end-users have access to the quality of broadband services and superior technical support expected from Telstra

Telstra does not intend to mandate the CPE design and physical quality issues. These will, as with previous products, be driven by market forces.

## 4. PROCESS

A flowchart depicting the process requirements for inter-operability testing with Telstra ADSL network is shown below. This document will describe the process in detail.

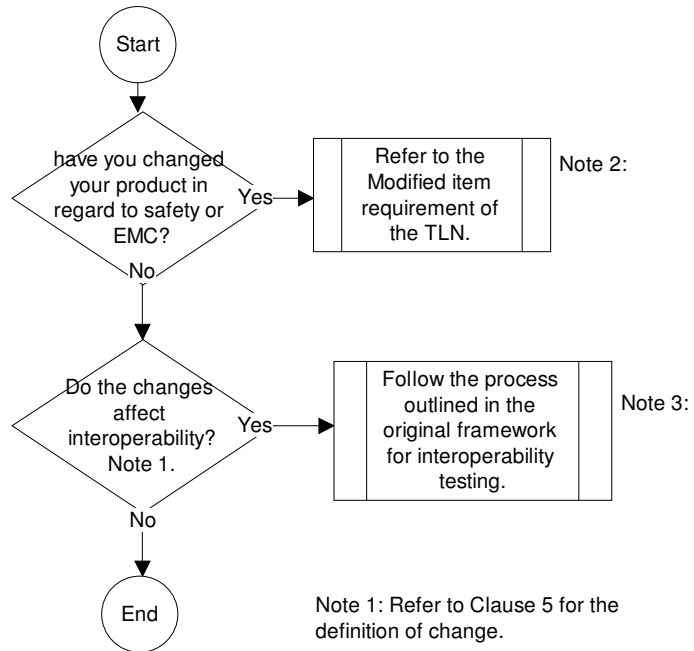
### INTEROPERABILITY FRAMEWORK FOR ADSL CPE



**FIGURE 1 - Flow Chart “Inter-Operability Accreditation Process”**

Where a product change is likely to affect inter-operability of previously listed CPE, the Flow Chart in Figure 2 overleaf describes the process for requalifying the affected CPE for inter-operability with the Telstra network.

## Change Management Process



Note 1: Refer to Clause 5 for the definition of change.

Note 2: Supplier cannot distribute this product unless it meets the legal obligation applicable to it.

Note 3: Telstra will not guarantee interoperability with the Telstra network if the product has changed.

TLN: Telecommunications Labelling Notice

**FIGURE 2 - Flow Chart 2 “Change Management Process”**



## 5. TEST REQUIREMENTS

The following section will outline the specific product, testing requirements and responsibilities for all CPE.

It is recommended the suppliers set up a permanent Telstra ADSL access service in their premises for testing purposes

### 5.1 Overview

Product groups such as modems and routers (with compatible ADSL Interface) that are actively involved in the direct provision of service to a customer shall be tested comprehensively for data transfer including the IP layer.

Other non-active products such as filters need only comply with the specific interface (ACIF S.002, Appendix F) requirements for the product and also compliance to Telstra Technical Reference RCIT 0004, (copy available from Telstra website – <http://www.telstra.com.au/adsl/equipmnt.htm>).

Telstra will maintain a list of interoperable CPE products on a public database for the benefit of consumers. This list is subject to change at any time by Telstra.

Alcatel through Comtest and Nortel have agreed to provide Inter-operability testing facilities for the purpose of CPE certification and client software evaluation, (see Annex 1).

The relevant test authority will verify that specific CPE has been tested and passed test inter-operability requirements with the Telstra's exchange multiplexer equipment as deployed in Telstra's network. However the test facility operator cannot guarantee that all CPE of the same type will operate to the required standards.

Telstra does not warrant that a positive test outcome for an item of equipment guarantees the compatibility of that item of equipment with all Alcatel CO ADSL equipment in the Telstra network. Neither Telstra nor the test facility providers shall be liable for any loss or damage suffered by a third party vendor should an item of equipment pass testing but subsequently fail to function properly with the Alcatel CO ADSL equipment in the Telstra network.

The third party vendor shall be responsible for the submission of all relevant documentation to Telstra (see Section 6.1 within) for the assessment of connectivity.

This document and the relevant test facility documentation do not constitute a formal contract. They merely outline the procedure by which inter-operability with the Telstra ADSL network is obtained. A formal

contract will be signed between the testing house and the third party before commencement of any inter-operability work.

The Telstra ADSL network termination technology is known as either CMUX, ASAM or AM3x. The CMUX has both BB and NB applications. The ASAM has only BB applications and is the Alcatel ADSL international platform. The AM3x has only BB applications and is the NEC ADSL international platform. This inter-operability document is only concerned with the ADSL BB component, in particular, inter-operability with the DSLAM and the existing Telstra CAN.

## 5.2 Interface Specification

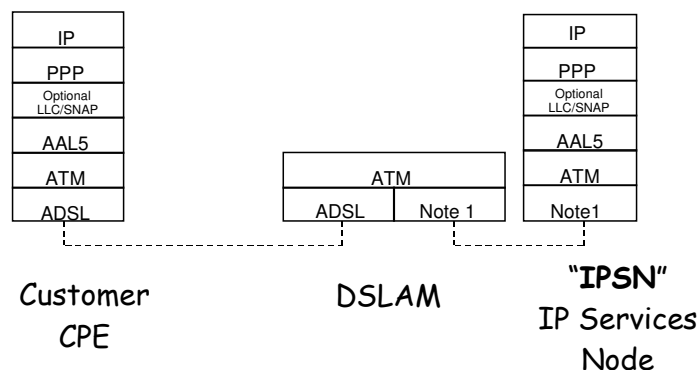
In reference to ITU-T G.992.1, Figure 3, “ADSL System Reference Model”, the following interfaces shall be tested in accordance as per the standard ITU-T G.992.1 -

- T/S customer Interface, Physical Interface to the customer.
- U-R2, U-C2 Interface, Physical ADSL copper interface.

The end to end system between T/S and V-C must be able to transport IP services described in “TSIS (Telstra Service Interface Specification) for ADSL access”.

The customer interface of the device under test must be 10 Base T, ATMF-25, NIC or USB. Other interfaces are available and will be defined in future applications. It is required that supporting evidence be provided showing that applications defined by Telstra and launched over these interfaces operate faultlessly.

A typical protocol stack at the customer interface is :



Note 1. Telstra Network Transmission Layer

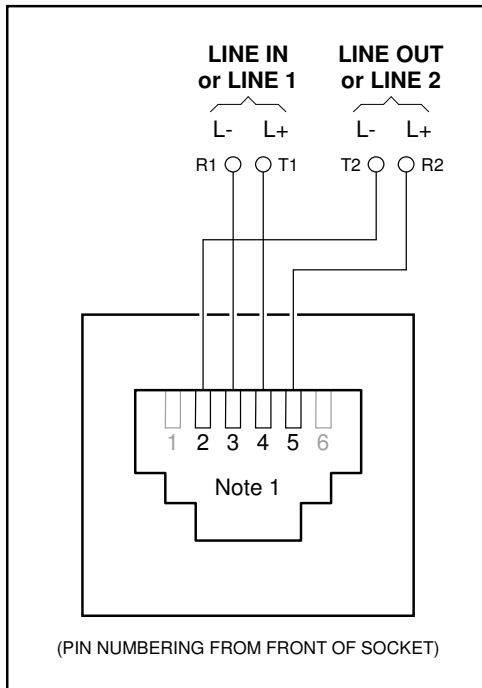
**Figure 2 - Protocols for ADSL Access: IP/PPP/AAL5/ATM (PPP over ATM for PC NIC card)**

The U-R2, C-C2 interface is defined adequately in 4.2 and Annex 2, including the ATM layer requirements. Other protocol stacks can be found in Telstra document DC.030 (access on the Telstra website – <http://www.telstra.com.au/adsl/equipmnt.htm>).

## 5.2.1 Physical ADSL Interface

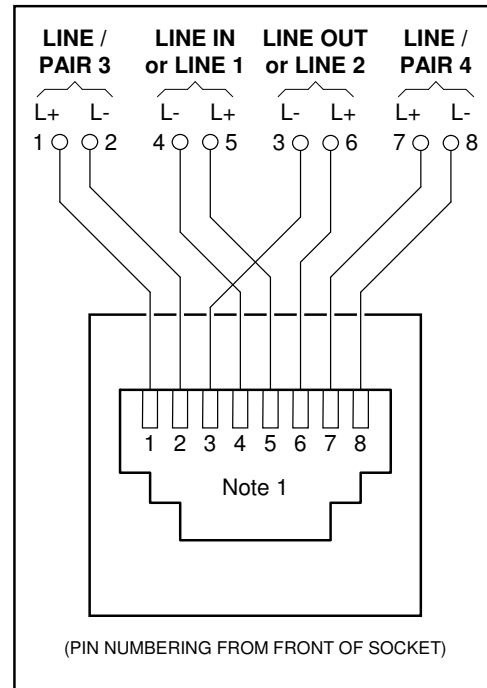
### 5.2.1.1 Physical Connection – Modem to POTS Line

**Telstra standard 6 way Modular socket (RJ11) –**



**Note 1:** Details associated with Line 1 must be applied.

**Telstra standard 8 way Modular socket (RJ45) – Use Line 1.**



**Note 1:** Details associated with Line 1 must be applied.

### 5.2.1.2 Physical Interface – Testing Requirements

The testing requirements for the CPE physical interface include:

- Verification of the various protocols involved in DMT start-up, handshake, synchronisation, etc. These tests are performed in collaboration with the third party. If necessary, modifications to third party hardware or software will be jointly determined during the process.

- General inter-operability with Alcatel and NEC DSLAM equipment as deployed in the Australian network by Telstra. This involves synchronisation, correct operation of the rate adaptation mechanism, verification of the QoS classes, verification of the Reed-Solomon and Trellis mechanisms, modem set up, client software, etc.
- Performance when connected to the Alcatel and NEC DSLAMs. This includes ADSL and ATM performance on various line lengths (reach rate & loop tests), verification of the BER, performance under noise conditions (ADSL "A" noise) all as specified by ETSI.
- Annex 2 outlines the Network Management standards for inter-working with Telstra ADSL management systems by providing the full range of functionality tests.

### 5.2.2 Testing of ADSL CPE Filters/Splitters

These products are used to decouple voice-band PSTN customer equipment from a carrier access line to which ADSL modem equipment is connected. Two types of low pass splitters are addressed in this document. These are the "in-line" (or Distributed splitters) used individually with each item of voiceband customer equipment (a number of splitters are required to work in parallel without degrading the POTS performance). The centralised (or Remote splitters) is hard-wired at the lead-in access at the customer premises after which all voice-band CPE cabling radiates (single splitter working), **Note:** the Remote splitter shall not have plugs or sockets available as cable connection interface.

It is possible that the splitter devices may be incorporated into the ADSL equipment. Where this is the case, these requirements will be applicable to the relevant circuitry performing the filter function.

If both the LPF and HPF are housed within the modem, the vendor must prove this will not cause a POTS failure due to failure or replacement of the modem.

All splitters shall be tested in accordance with requirements of ACA, ACIF S.002 Appendix F and Telstra Technical Reference – RCIT.0004 (this document is available on the Telstra website - <http://www.telstra.com.au/adsl/equipmnt.htm>). The product shall pass those requirements and test results showing compliance and shall be submitted for certification as per Section 6 and also included in the Declaration of Conformance & Compliance shown in Annex 5.

### 5.3 Equipment Management

In order to ensure that proper fault resolution can be performed on the ADSL network, a minimum level of equipment management is required. This includes information that needs to be obtained by the Network Management Software from the ADSL CPE.

Therefore the ADSL CPE should support a minimal subset of open standard management features.

Included in this set of management features are the ones listed below.

Main management features to be supported on ADSL CPE as detailed in Annex 3 include:

- Line statistics measurement facility (either on customer VC, or on separate VC) including BER, ES, SES, S/N etc.
- Dying gasp support on CPE. Final trouble transmission sequence to DSLAM prior to CPE shutdown.
- Line loss, tones on/off, up/down conditions etc.
- Modem details – make, model, serial number, firmware, etc.

### 5.4 Client software

Client software forms a portion of products defined within IP end to end testing described in Annex 4. A separate test laboratory as listed in Annex 1 will be available for testing. Client software need not be certified and may be evaluated in the laboratory. To enable listing by Telstra as a compliant suite of software, the compliance report must be submitted to Telstra.

Client software addresses various protocol control related issues.

- Low-layer media-dependent encapsulation
- Error detection
- Negotiation of low-layer framing options
- Mechanisms for user authentication
- Mechanisms to establish the network protocol
- Mechanism to establish the compression methods
- Mechanism to establish the encryption methods.

These methods of establishing IP connectivity between the CPE device and a service provider provide a higher level of integrity and flexibility to the end user. There are many forms and functions of packages offered by independent developers. The various packages must however comply with RFC's that are controlled by the Internet Engineering Task Force (IETF). Each RFC specifies a feature or a group of features that pertain to the functionality of the software package.

All PPP client software must conform to the following Internet standards:

- STD 0051 (PPP)
- RFC 1332 (IPCP)
- RFC 1994 (CHAP)
- RFC 1483 (MPE)

#### **5.4.1 PPPoE Client software**

Client software used to launch PPPoE sessions shall conform to RFC 2516, A method for transmitting PPP Over Ethernet (PPPoE), February 1999.

#### **5.4.2 PPPoATM**

PPPoA is typically used with dedicated ADSL Network Interface Cards. In this instance, the NIC manufacturer will normally provide device driver software.

The standard with which the device driver must comply is:

- **RFC 2364 - PPP Over AAL5** G. Gross, M. Kaycee, A. Li, A. Malis, J. Stephens July 1998

Refer to Annex 4 for specific requirements.

Refer to Telstra TSIS DC.030 for specific details on RFC compliance requirements and the protocol stack for each customer scenario.

Refer to Nortel customer information document "Client Software Inter-operability Requirements for Connection to the Telstra Network". Telstra will provide an IP address and web-site to test to.

## 6. TEST RESULTS

### 6.1 Submission to Telstra.

Submission to Telstra of compliant statements is mandatory for connection of hardware and system to the ADSL network. Submission of Client Software compliance is optional, however Telstra will not list any software as compliant and available for use unless a full proof of compliance statement is submitted and certified.

Prior to listing on the telstra.com/adsl web-site, Telstra requires the CPE supplier to make a formal submission (see address at end of this section) including copies of declarations and documentation as outlined below.

The following information must be provided before listing:

- **Product Description.** A complete description of the ADSL equipment including type, brand, marketing name, model number, revision status, firmware and software details.
- **Customer Support.** Contact details for customer support arrangements in Australia. It is also recommended that suppliers have a Telstra ADSL service that can be used as a modem test line, if required.
- **ACA Compliance Folder.** A copy of the Declaration of Conformity that has been prepared for the ACA customer equipment compliance record as required by the Telecommunications Labelling Notice and the EMC Framework.

This declaration needs to cover all the applicable customer equipment standards for health, safety, network integrity, power spectral density and electromagnetic compatibility; ie TS001/AS3260, ACIF S.002– Appendix F, ACIF S.043.1, ACIF S.043.2 (TS006 is not longer acceptable), AS3548 and AS/NZS 60950.

This declaration should also be supported with copies of the certification and summary statements from the Recognised Testing Authorities that prepared the test reports for the ACA compliance folder.

Safety testing shall assume a TNV-3 line termination and EMC shall comply with Class B requirements.

- **Inter-Operability.** A copy of the Australian supplier's **Declaration of Conformity** against the inter-operability requirements of Annex 5 within.

This declaration **must also be supported** by a statement of inter-

operability and compliance with all relevant sections IP 1149 from **Comtest Laboratories** (see Annex 1). Note: University of New Hampshire Inter-Operability Lab reports will not be accepted.

- **Checklist**. A completed checklist statement of modem compatibility items as described in Annex 3 within. An authorised person from within the vendor's company shall sign this **Compatibility Checklist Declaration** in the same manner as specified in Annex 5.
- **Alterations**. If alterations occur to the device under test during the certification process, the vendor shall notify Telstra of how they will address the different identification of these pre and post certified variations of this same equipment.

**Vendor address for formal submissions/contacts to Telstra:**

Telstra ADSL Inter-operability Officer  
15<sup>th</sup> Floor  
242 Exhibition Street  
Melbourne, VIC, 3000.

## **6.2 Acceptance of Submission by Telstra**

If Telstra deems the equipment suitable for connection to the Telstra Network, a statement to that effect will be issued to the third party vendor.

Telstra will then update the compliant vendors database held on the Telstra web-site.



## 7. SUBSEQUENT RESUBMISSION FOR RETEST

Once equipment has been tested with the criteria above, re-submission, retest and request for certification from Telstra will only be required if there is a “major change” to the firmware or hardware of the product. A “major change” is any change yielding a functional or safety compromise to the current product.

This can be firmware, software or hardware oriented. It is expected that the CPE vendor will be totally responsible in deeming whether the change warrants re-submission and retest. Products may require retesting under the following conditions:

- Internal hardware changes when external characteristics are altered.
- Labelling changes where they affect safety.
- Changes in the product model number.
- Additional physical electrical interfaces.
- Firmware upgrades/alterations.
- Software upgrades/alterations.

In addition a review of safety and EMC compliance may also be linked to these “major changes”. The CPE vendor will be totally responsible for safety and EMC compliance folder upkeep in accordance with the requirements of the Telecommunications Labelling Notice.

**Any changes to the ADSL product that is deemed “major change” may cause the need for a small but basic test to confirm of any or not degradation to the original certified product. Any changes to the listed certified ADSL product must be approved by the Telstra Inter-operability Officer. Any altered ADSL product that has not had the variation approved shall remain NOT CERTIFIED until this process has been completed satisfactory. If ADSL products is deemed to have had “minor changes” are found to be degraded enough to fail the IP1149 certification process, it will then be the CPE vendor’s responsibility to arrange a full IP1149 certification test.**

## 8. DEFINITIONS

The following words, acronyms and abbreviations are referred to in this document.

A “**finished product**” is one that is deemed functional to International standards, described in Annex A, by the CPE supplier and has passed all relevant ACA safety and EMC standards.

A “**product in development**” is one that requires design and development to achieve “finished product” stage.

A “**CPE Vendor**” is defined as the Modem manufacturer, supplier or the party that requires testing, including “**Third Party Vendor**”.

For the purposes of this document “**inter-operability**” means that testing has been undertaken to a level that satisfies Telstra requirements allowing connection to the Telstra ADSL DSLAM network. This guarantees a basic level of functionality such as training, retraining and the transfer of data between the Exchange ADSL equipment and the CPE as well as safety and EMC compliance.

Term	Definition
<b>ADSL</b>	Asymmetric Digital Subscriber Line
<b>ACA</b>	Australian Communication Authority
<b>ACIF</b>	Australian Communication Industry Forum
<b>ANSI</b>	American National Standards Institute
<b>AOC</b>	ADSL Overhead control Channel
<b>ASAM</b>	ADSL Subscriber Access Multiplexer
<b>ATM</b>	Asynchronous Transfer Mode
<b>ATMF</b>	ATM Forum
<b>ATU-C</b>	ADSL Transceiver Unit-Exchange End (DSLAM)
<b>ATU-R</b>	ADSL Transceiver Unit-Remote End (Modem)
<b>BB</b>	Broad Band
<b>BB-ISDN</b>	Broadband - Intergrated Services Digital Network
<b>BER</b>	Bit Error Rate
<b>CAN</b>	Customer Access Network
<b>CHAP</b>	Challenge Handshake Authentication Protocol
<b>CLP</b>	Cell Loss Priority
<b>CMUX</b>	Customer Multiplexer
<b>CPE</b>	Customer Premises Equipment
<b>CRC<sub>F</sub></b>	Cyclic Redundancy Check for Fast channel
<b>CRC<sub>I</sub></b>	Cyclic Redundancy Check for Interleaved channel
<b>DAC</b>	Digital to Analog Converter
<b>DMT</b>	Discrete Multi-tone
<b>DSL</b>	Digital Subscriber Line
<b>DSLAM</b>	DSL Access Multiplexer
<b>E1</b>	2Mbit/s
<b>EMC</b>	Electro Magnetic Compatibility
<b>EOC</b>	Embedded Operations Channel
<b>ES</b>	Errored Seconds
<b>ETSI</b>	European Technical standards Institute

<b>Exchange</b>	Telephone Exchange, Central Office
<b>FEC</b>	Forward Error Correction
<b>FDM</b>	Frequency Division Multiplexing
<b>HDSL</b>	High speed Digital subscriber Line
<b>HPF</b>	High Pass Filter
<b>IB</b>	Indicator Bit
<b>IDFT</b>	Inverse Discreet Fourier Transform
<b>IETF</b>	Internet Engineering Task Force
<b>IPCP</b>	IP Control Protocol
<b>IP</b>	Internet Protocol
<b>IPSN</b>	Internet Protocol Services Node (also known as TAS)
<b>ISDN</b>	Intergrated Services Digital Network
<b>ITEC</b>	International Standards Body
<b>LPF</b>	Low Pass Filter
<b>LT</b>	Line Termination
<b>MDF</b>	Main Distribution Frame
<b>MIB</b>	Managed Information Base
<b>MPE</b>	Multi-Protocol Encapsulation
<b>MSB</b>	Most Significant Bit
<b>MTU</b>	Maximum Transmission Unit
<b>NB</b>	Narrow Band
<b>NE</b>	Network Element
<b>NIC</b>	Network Interface Card
<b>NT</b>	Network Termination
<b>NTR</b>	Network Timing Reference
<b>NU</b>	Network Unit
<b>OAM</b>	Operation, Administration & Maintenance
<b>POTS</b>	Plain Old Telephone Service
<b>PPP</b>	Point-to-Point Protocol
<b>PPPoA</b>	Point-to-Point Protocol over ATM
<b>PPPoE</b>	Point-to-Point Protocol over Ethernet
<b>PSD</b>	Power Spectral Density
<b>PSTN</b>	Public Switched Telephone Service
<b>PTI</b>	Payload Type Identifier
<b>QAM</b>	Quadrature Amplitude Modulation
<b>RFC</b>	Request for Comment
<b>RU</b>	Remote Unit
<b>SES</b>	Severely Errored Seconds
<b>SM</b>	Service Module
<b>S/N</b>	Signal to Noise
<b>TAS</b>	Access Concentrator (see IPSN)
<b>TC</b>	Transmission Convergence
<b>TLN</b>	Telecommunication Labelling Notice
<b>TSIS</b>	Telstra Service Interface Specification
<b>UNI</b>	User to Network Interface
<b>VC</b>	Virtual Circuit
<b>VF</b>	Voice Frequency

## 9. REFERENCES

1. ITU G.99X.X series.
  - G.992.1 – Full Rate G.DMT, G.Heavy.
  - G.992.2 – Splitterless, G.Lite, UADSL.
  - G.994.1 – Handshake Procedure for DSL Transceivers, G.HS.
  - G.996.1 – Test Procedures for DSL Transceivers.
  - G.997.1 – Physical Layer Management for DSL Transceivers.
2. Telstra Service Interface Specification (TSIS) for ADSL Access. DC.030 (access Telstra web-site - <http://www.telstra.com.au/adsl/equipmnt.htm> for details).
3. 3AU 48075 AAAA Inter-operability Compliance Testing Requirements for Connection to the Telstra ADSL network
4. ACIF S.002 Analogue Inter-working and Non Interference Requirements for Customer Equipment Connected to the PSTN.
5. Nortel, Client Software Inter-operability Requirements for Connection to the Telstra Network.
6. **RFC 2364** *PPP Over AAL5* G. Gross, M. Kaycee, A. Li, A. Malis, J. Stephens July 1998
7. **RFC 1483** *Multi-protocol Encapsulation Over ATM Adaptation Layer 5*, July 1993
8. **RFC 1332** *The PPP Internet Protocol Control Protocol (IPCP)* G. McGregor May 1992 Obsoletes 1172 PROPOSED
9. **STD 0051** *The Point-to-Point Protocol (PPP)* W. Simpson, Editor July 1994 ASCII Obsoletes RFC1549 STD.
10. Telstra Reference - RCIT 0004 Splitter Specification for ADSL/POTS Spectrum Sharing, (access Telstra web-site - <http://www.telstra.com.au/adsl/equipmnt.htm> for details).

## 10. ANNEX 1 - TEST LABORATORIES

Test Lab.	Address	Contact	Phone No.	Expertise
Comtest	1/570 City Rd South Melbourne 3205 VIC. Australia	Peter Arms	03 9645 5933	IP Testing  Filters  ADSL Modem Testing

Product	Test Requirements	Certificates Required (Refer to Section 6.1 within)
Modem	Common TLN Requirements.  ADSL Line testing to International standards  IP Testing	TLN certificates ADSL Line testing and IP  Annex 3  Annex 5
Routers	Common TLN Requirements.  ADSL Line testing to International standards  IP Testing	TLN certificates ADSL Line testing and IP  Annex 3  Annex 5
Filters  See Section 5.2.2	Common TLN Requirements.  ACIF Requirements RCIT 0004	TLN Certificates  Annex 5
Client Software	Annex 4 requirements Nortel requirements	Nortel Certificate Annex 5

## 11. ANNEX 2 - ADSL TEST CRITERIA

Third party equipment shall be tested in accordance with the following relevant ADSL international standard:

- ITU-T G.992.X series (test, handshake, PLOAM, Lite and DMT).

In addition, testing shall be undertaken and results shall be provided showing the performance of the modem under the following conditions:

### Default performance test configurations:

Parameter	Graph 1	Graph 2
Rate adaptive	Yes	Yes
Noise margin	6 dB	6 dB
Depth of Interleave	0	64

### Noise tests:

- Tests with noise shall equate to 3.7km of 0.40mm cable at 1.5Mbit/s downstream and 256kbit/s upstream using values of 0dB and 6dB noise margin.
- Tests without noise and including taps (ITU-T, Loop No. 8) shall equate to 4.0km of 0.40mm cable at 1.5 Mbit/s downstream and 256kbit/s upstream using values of 0dB and 6dB noise margin.

Results shall be supplied in the format shown in Figure A2.1 below (sample only).

### Performance when connected to the Alcatel DSLAM:

This includes ADSL & ATM performance on various line lengths and loops, verification of the BER/FER and performance under selected noise conditions.

Eg.

#### Loop Tests;

- White Noise -140.0dBm/Hz
- Crosstalk set to ADSL NEXT -75.0dBm
- No noise.

#### Reach Rate Tests;

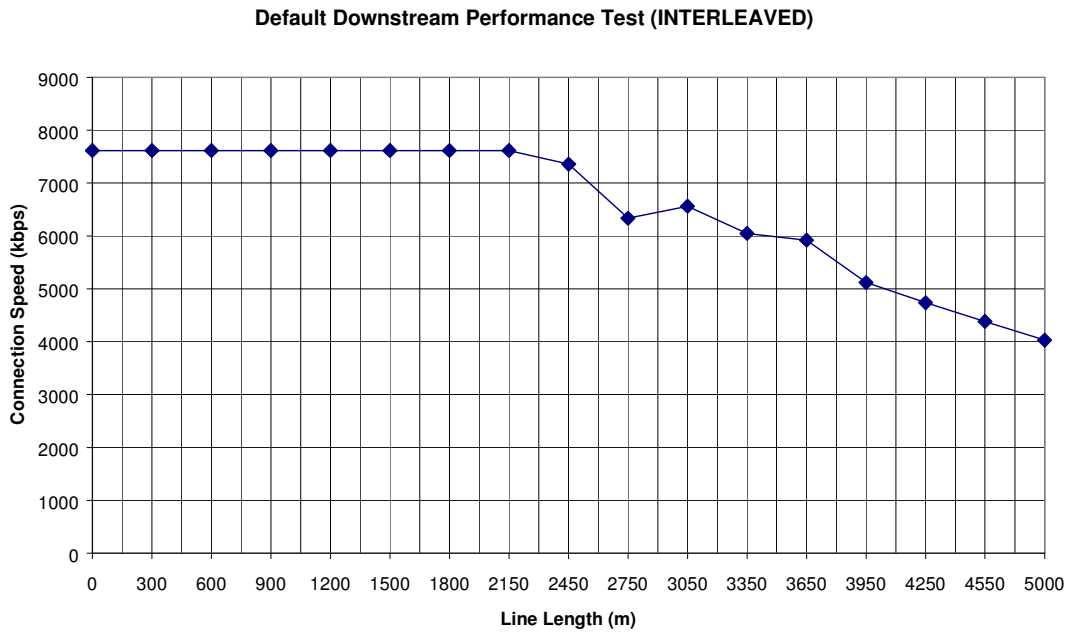
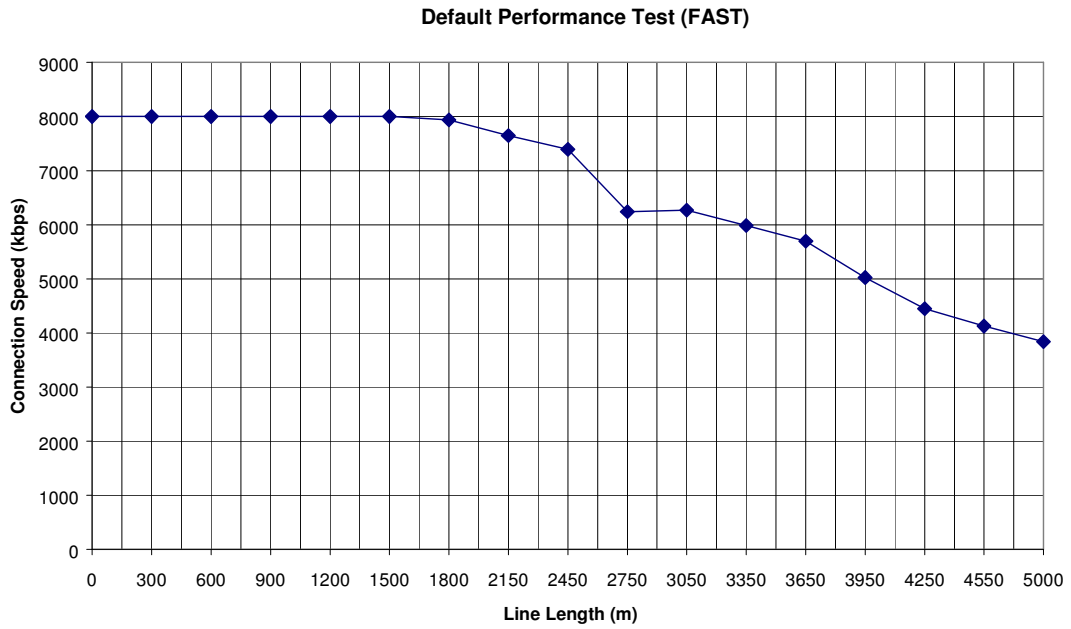
- No Noise
- ADSL "A" noise test @ -49.4dBm.

#### Frame Error Rate/Bit Error Rate Tests;

- No Noise
- Null loop
- 2km loop with ADSL "A" noise test @ -49.4dBm, includes ring/off hook testing.
- 4km loop with ADSL "A" noise test @ -49.4dBm, includes ring/off hook testing.

**Impulse Noise Tests;**

- ADSL-c1 impulse set @ 22mvolts, with a rate of 100 pulses/sec.



**FIGURE A2.1 – Graphical Sample (Downstream)**

This ITU-T standard provides the specification of the subscriber line interface. It refers to publicly available standards wherever possible. The ATU-C transmitter characteristics are described as they apply to the Telstra ADSL DSLAM and remote (eg., Remote Access Multiplexer and cabinet-based) equipment.

The ATU-R transmitter requirements are specified with respect to inter-operability with the Telstra ATU-C. ATU-C characteristics and ATU-R requirements that may affect inter-operability of the Telstra ATU-C with an ATU-R that complies with ITU-T G.992.1 are highlighted in this document.

### **11.0.1 ADSL Interoperability Testing**

Testing is conducted in a controlled laboratory without the variables associated with a "live" network connection. This enables tests to be performed achieving repeatable and reliable results.

As the tests are designed to ascertain if the device under test can interoperate with Telstra's services an Alcatel and NEC DSLAMs are required. The DSLAMs are to be at the current version in hardware and software to ensure the laboratory model is kept consistent with Telstra's network. The DSLAMs are configured in FAST and INTERLEAVE modes.

Equipment required for this Inter-operability testing model includes a wireline simulator capable of simulating European line lengths of 0 to 5000 metres of various wire gauges, noise simulators, an ADSL Low Pass Filter/Splitter, a POTS service including a telephone handset and a server using Win2000 Server Software for FTP and HTTP servers.

ATM/Ethernet traffic Generator/Analyser is required for most testing.

#### **Tests include:**

- Basic Connections
- Reach Rate
- Loop
- Impulse noise
- IP Connectivity
- Frame Error Rate
- Ring
- Off hook
- Throughput
- MTU size rate.



## 11.0.2 Basic Connections Testing

To ensure:

- ATU-R synchronises with the ATU-C,
- ATU-C reports “Loss of Power” when power is removed from the ATU-R,
- ATU-C reports “Loss of Link” when the ADSL line is removed from the ATU-R,
- The ATU-R once synchronised does not slip out of synchronisation by observing the synchronisation status for approx 5 minutes..

Record the downstream and upstream bit rates for both Fast and Interleave modes.

## 11.0.3 Reach Rate Testing

The ATU-R under test is connected to the ATU-C and has 60 seconds to synchronise. The downstream and upstream line sync rates are recorded.

The test is performed three times at each line lengths (0, 300, 600, 900, 1200, 1500, 1800, 2200, 2500, 2800, 3100, 3400, 3700, 4000, 4200, 4500 and 5000 metres of 0.4 mm wire.) and under the following line conditions. Synchronisation within 60 seconds is considered a successful synchronisation and is reflected in the synchronisation success ratio (SSR).

The line conditions for reach rate testing are:

- Fast Mode - No noise
- Interleave Mode - No noise
- Fast Mode – ETSI ADSL noise = Noise Model “A” at -49.4 dBm inserted at the ATU-C and ATU-R sides of the wireline simulator.
- Interleave Mode – ETSI ADSL noise = Noise Model “A” at -49.4 dBm inserted at the ATU-C and ATU-R sides of the wireline simulator.

When connected with 3700m of 0.4 mm of line, the ATU-R under test is to synchronise with the ATU-C at no less than 1500 kbps downstream and 256 kbps upstream.

#### 11.0.4 Loop Testing

The device under test is to synchronise to the ATU-C when connected with the wire line simulator set to ITU-T loops 1 to 8 and with the following line conditions (noise is inserted at the ATU-C and ATU-R sides of the wireline simulator).

The line conditions for loop testing are:

- Fast Mode - No noise
- Interleave Mode - No noise
- Fast Mode - White noise at -140 dBm/Hz
- Interleave Mode - White noise at -140 dBm/Hz
- Fast Mode - White noise at -140 dBm/Hz and DSL NEXT noise at -75.0 dBm
- Interleave Mode - White noise at -140 dBm/Hz and DSL NEXT noise at -75.0 dBm

The synchronised rate is to be no less than 1500 kbps downstream and 256 kbps upstream.

#### 11.0.5 Impulse Noise Testing

The ATU-R under test is to synchronise to the ATU-C when connected in FAST and INTERLEAVE modes and with the wireline simulator set to the following:

- 3700 m of 0.4mm with type ADSL-c1 impulse noise at 22 mV and 100 pps. Noise impairments are set at the ATU-C and ATU-R sides of the wireline simulator.

The synchronised rate is to be no less than 1500 kbps downstream and 256 kbps upstream.

#### 11.0.6 Frame Error Rate Testing

The ATU-R under test is connected to the ATU-C via a NULL loop and a PPPoE/A session is established. Both the downstream and upstream line synchronisation rates are recorded.

The frame rates of the ATM/Ethernet network emulator are set to 75% of the recorded line rates. Frame rates are based on a 1492 byte frame.

The lost and errored frames are measured and a lost and errored frame rate is computed. The Telstra DSLAM service requirement is 7 errored seconds in every hour, which equates to an errored frame rate of  $1.94 \times 10^{-3}$ . These tests are performed in both FAST and INTERLEAVE modes.

Tests are performed using each type of port of the ATU-R.

### 11.0.7 Ring Testing

The ATU-R under test is connected to the ATU-C at a given line length and a PPPoE/A session is established. Both the downstream and upstream line synchronisation rate is recorded.

The frame rate of the ATM/Ethernet network emulator is set to 75% of the recorded line rate. Frame rates are based on a 1492 byte frame.

The ATU-R under test and an ACA approved telephone handset is connected to the wire line simulator via a Telstra listed certified splitter. Ten bursts of ring are applied to the line while the frame error rate is being measured.

The frame error rate test is repeated with the wire line simulator set to the following conditions:

- 2000 m – ETSI ADSL noise = Noise Model “A” at -49.4 dBm inserted at the ATU-C and ATU-R sides of the wireline simulator.
- 4000 m - ETSI ADSL noise = Noise Model “A” at -49.4 dBm inserted at the ATU-C and ATU-R sides of the wireline simulator.

A burst of ring is defined as - 400 ms *ON*, 200 ms *OFF*, 400 ms *ON* 2000 ms *OFF*.

The ring signal level is 75Vrms and frequency is 25 Hz.

The Telstra DSLAM service requirement is 7 errored seconds in every hour, which equates to an errored frame rate of  $1.94 \times 10^{-3}$ .

This test is performed in both FAST and INTERLEAVE modes.

### 11.0.8 Off Hook Testing

The ATU-R under test is connected to the ATU-C at a given line length and a PPPoE/A session is established. Both the downstream and upstream line synchronisation rate is recorded.

The frame rate of the ATM/Ethernet network emulator is set to 75% of the recorded line rate. Frame rates are based on a 1492 byte frame.

The frame error rate test is repeated with the wire line simulator set to the following conditions:

- 2000 m - ETSI ADSL noise = Noise Model “A” at -49.4 dB inserted at the ATU-C and ATU-R sides of the line.
- 4000 m - ETSI ADSL noise = Noise Model “A” at -49.4 dB inserted at the ATU-C and ATU-R sides of the line.

The device under test and a telephone handset is connected to the wire line simulator via a C10 Remote Splitter (Model – C10100E). The handset is lifted and a call placed. The handset is allowed to receive ring tone and

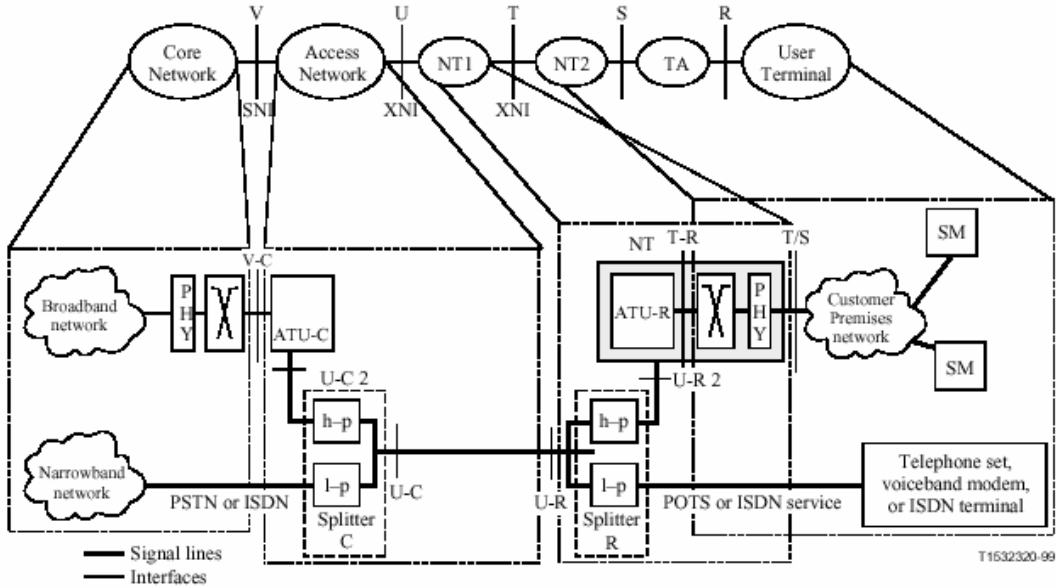
is then replaced onto the cradle. This is repeated ten times.

The Telstra DSLAM service requirement is 7 errored seconds in every hour, which equates to an errored frame rate of  $1.94 \times 10^{-3}$ .

This test is performed in both FAST and INTERLEAVE modes.

### 11.1 System Reference Model

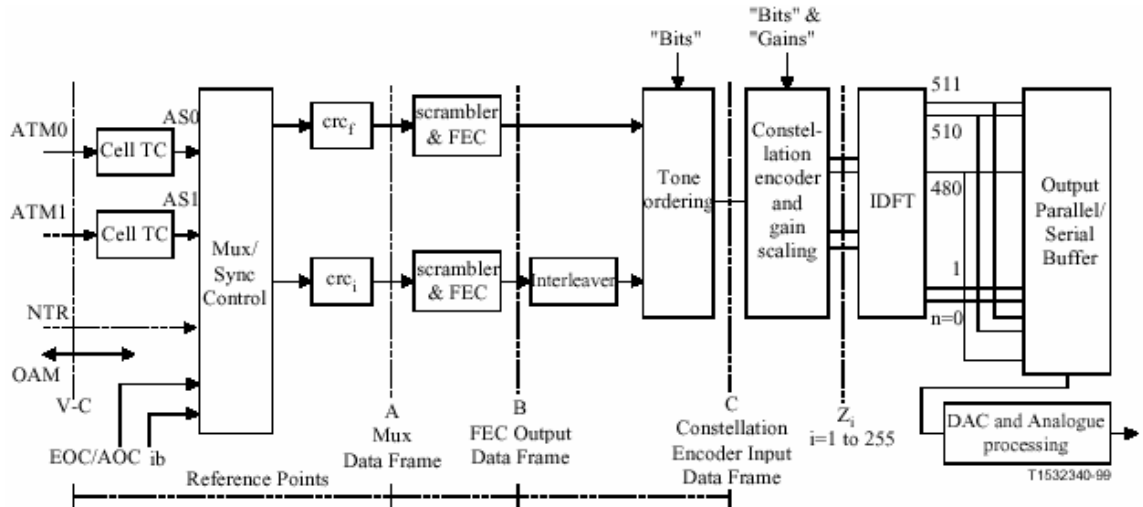
The system reference model shown in Figure 1-1 is from ITU-T G.992.1.



**FIGURE A2.2 – ADSL System Reference Model**

## 11.2 ATU-C Transmitter Reference Model

The ATU-C transmitter complies with Section 5.1.2 of ITU-T G.992.1. The ATU-C transmitter reference model shown in Figure 5.2 is from ITU-T G.992.1.



NOTE – Solid versus dashed lines are used to indicate required versus optional capabilities respectively. This figure is not intended to be complete in this respect, see clauses 6 and 7 for specific details.

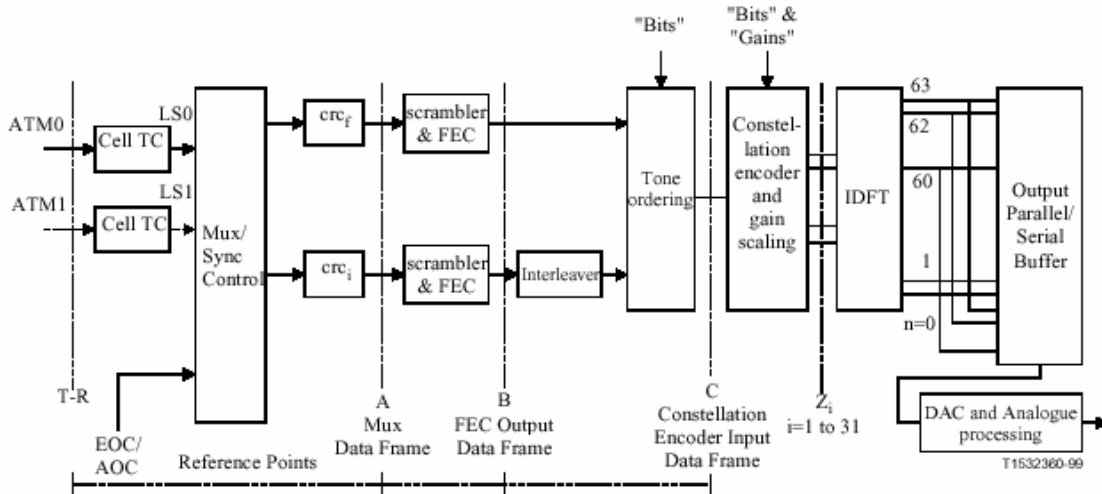
**FIGURE A2.3 – ATU-C Transmitter Reference Model**

The ATU-C preserves byte boundaries between the V-C and the U-C interface.

The ATU-C carries the ATM cell header CLP bit in the MSB at the U-C interface.

### 11.3 ATU-R Transmitter Reference Model

The ATU-R transmitter shall comply with Section 5.2.2 of ITU-T G.992.1. The ATU-R transmitter reference model shown in Figure 5.4 is from ITU-T G.992.1.



NOTE – Solid versus dashed lines are used to indicate required versus optional capabilities respectively. This figure is not intended to be complete in this respect, see clauses 6 and 8 for specific details.

**FIGURE A2.4 – ATU-R Transmitter Reference Model**

The ATU-R shall preserve byte boundaries between the T-R and the U-R interface.  
 The ATU-R shall carry the ATM cell header CLP bit in the MSB at the U-R interface.

### 11.4 Transport Capacity

The transport capacity of the ATU-C complies with Section 6.2 of ITU-T G.992.1. It supports downstream transmission at all multiples of 32kbit/s up to a net data rate of 6.144Mbit/s, and upstream reception at all multiples of 32kbit/s up to a net data rate of 640kbit/s upstream.

The transport capacity of the ATU-R shall comply with Section 6.2 of ITU-T G.992.1. It shall support downstream reception at all multiples of 32kbit/s up to a net data rate of 6.144 Mbit/s, and upstream transmission at all multiples of 32kbit/s up to a net data rate of 640kbit/s.

The maximum downstream transport capacity of the ATU-C implementation is  $255 \times 32 = 8160\text{kbit/s}$  (total data rate). The actual downstream transport capacity depends upon the line characteristics measured at modem initialisation. The ADSL system overhead depends on the modem configuration and can be as low as 32kbit/s.

## 11.5 ATU-C Functional Characteristics

The ATU-C (CPE modem) shall comply with Section 7 of G.992.1 [1] unless explicitly stated in the following subsections.

### 11.5.1 ATM Transport Protocol Specific Functionalities

#### 11.5.1.1 Framing Structure for ATM Transport

In compliance with G.992.1 [1] with the following exceptions:

- The ATU-C receiver does not support framing structure 0. This does not affect inter-operability with an ATU-R compliant with G.992.1 [1]. However, inter-operability with an ATM-over-STM ATU-R is not assured (see G.992.1 [1]).
- The ATU-C does not support the insertion of a Network Timing Reference in ib23-20. The downstream indicator bits 23-20 are always coded 1111.

### 11.5.2 Network Timing Reference

The Network Timing Reference (NTR) is not inserted at the ATU-C (see 11.5.1.1)

### 11.5.3 Transmitter Spectral Response

In compliance with G.992.1 [1] with the following additional functionality:

If the maximum transmit PSD is configured to -40dBm/Hz at modem initialisation, the Transmitter Spectral Response complies with the downstream transmitter spectral mask as specified in Section 7 and Annex A of G.992.1 [1]. If a higher maximum transmit PSD is configured (for example, -38, -36, or -34dBm/Hz), the Transmitter Spectral Response may exceed this downstream transmitter spectral mask (by 2, 4, or 6dB respectively) at frequencies above 220kHz (that is, tone 51 and higher).

### 11.5.4 Transmitter Power Spectral Density and Aggregate Power Level

In compliance with G.992.1 [1].

If the ATU-R uses the additional functionality described in 7.14 and Annex A of G.992.1 [1] aggregate power limitation of 20.4dBm in the 25.875 to 1104kHz band is maintained.

## 11.6 ATU-R Functional Characteristics

The ATU-R shall comply with Section 8 of G.992.1 [1] unless explicitly stated in the following subsections.

### 11.6.1 STM Transmission Protocol Specific Functionality

Not applicable.

## 11.7 Operations and Maintenance

The ATU-C complies with Section 9 of G.992.1 [1] unless explicitly stated in the following subsections.

The ATU-R shall comply with Section 9 of G.992.1 [1] unless explicitly stated in the following subsections.

## 11.8 Initialisation

The ATU-C complies with the initialisation sequence as described in Section 10 of G.992.1 [1]. Any differences between this specification and G.992.1 [1] are noted in the following subsections.

The ATU-R shall comply with the initialisation sequence as described in Section 10 of G.992.1 [1]. Any differences between this specification and G.992.1 [1] are noted in the following subsections.

### 11.8.1 Exchange

The ATU-R shall take into account the restrictions in the R-B&G table as specified in G.992.1 [1] while allowing for the additional functionality described in 7.14 and for lower  $g_i$  values:

- For tone 64,  $b_i=0$  and  $g_i=1$  (pilot).
- Sum of  $g_i^2$  over tones 6 to 255 is no greater than 250.
- Up to tone 50, all  $g_i$  values shall be in the  $[-12.0, +2.5]$  dB range.
- From tone 51, all  $g_i$  values shall be in the  $[-12.0, +2.5+2n]$  dB range, with  $n=0$  to 3, corresponding to a maximum transmit PSD of -40, -38, -36, and -34dBm/Hz, respectively, (as configured by the ATU-C at initialisation).
- All  $b_i$  values shall be less than or equal to  $N_{downmax}$  (see C-MSG1).

## 11.9 Online Adaptation and Re-configuration

The ATU-C complies with Section 11 of G.992.1 [1]. The ATU-C updates the upstream B&G table in such a way that the restrictions applicable to the upstream B&G table at initialisation (see Section 10) are still fulfilled.

The ATU-R shall comply with Section 11 of G.992.1 [1]. The ATU-R shall update the downstream B&G table in such a way that the restrictions applicable to the downstream B&G table at initialisation (see Section 10) are still fulfilled.

## 11.10 Loop Plant, Impairments, and Testing

ITU-T G.992 is not applicable. Refer to specification within this document and/or to ACIF requirements.

## 11.11 Electrical Characteristics

ITU-T G.992 is not applicable. Refer to specification within this document and/or to ACIF requirements.



## 11.12 Physical Characteristics

ITU-T G.992 is not applicable. Refer to specification within this document and/or to ACIF requirements.

## 11.13 Environmental Conditions

ITU-T G.992 is not applicable. Refer to specification within this document and/or to ACIF requirements.

## 11.14 ATM Inter-operability

This appendix lists the ATM features of the ATU-R and is intended as a guideline for third-party ATM systems to successfully inter-operate with the ATU-R. These requirements apply to the ADSL and ATM Forum 25.6Mbit/s interfaces only.

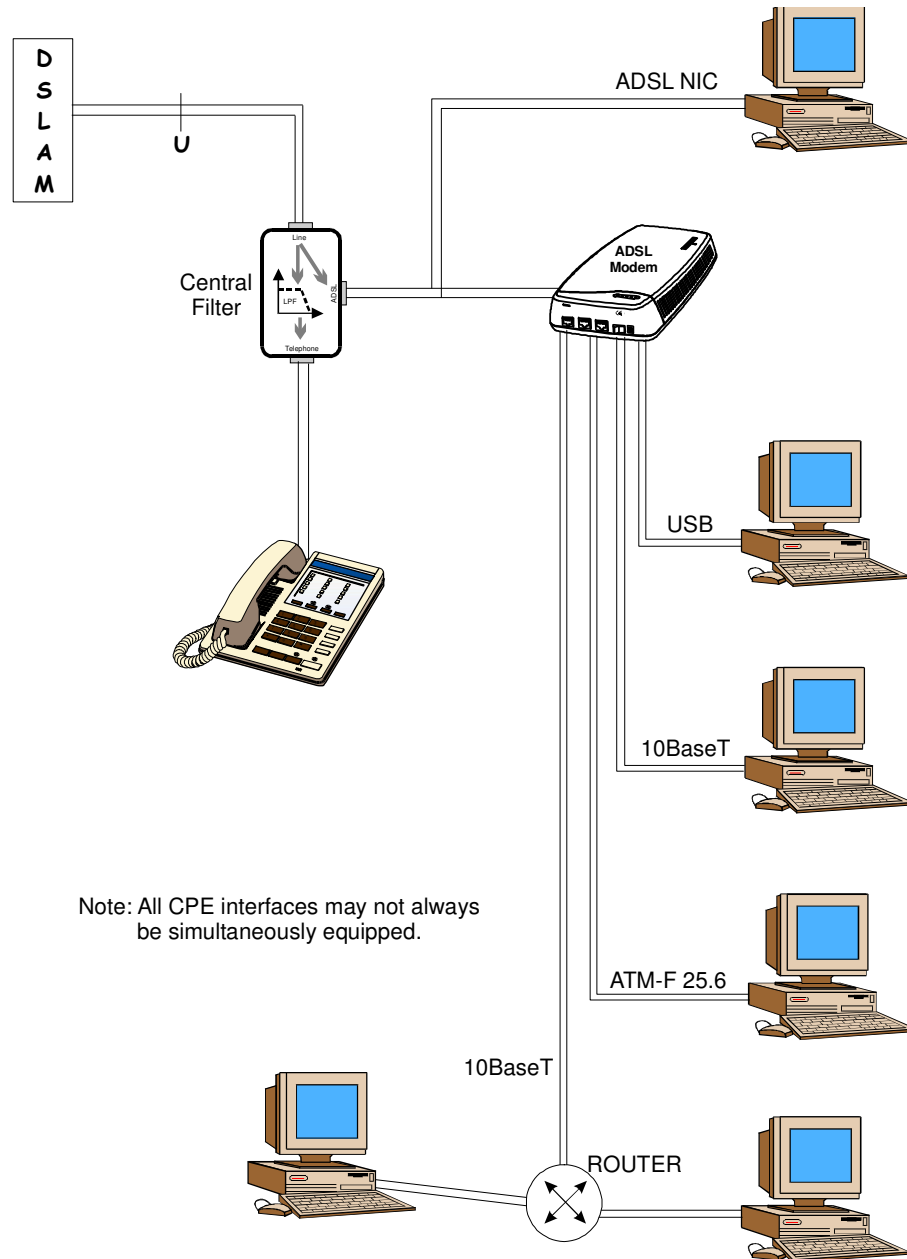
### Referenced Documents:

- [ITU-T I.361] ITU-T Recommendation I.361 ISDN Overall Network Aspects and Functions (11/95). B-ISDN ATM Layer Specification.
- [ITU-T I.363.5] ITU-T Recommendation I.363.5 ISDN Overall Network Aspects and Functions (08/96). B-ISDN ATM Adaptation Layer Specification: Type 5 AAL.
- [ITU-T I.432] ITU-T Recommendation I.432.1 - B-ISDN User-Network Interface - Physical Layer Specification: General Characteristics, August 1996.
- [ITU-T I.610] ITU-T Recommendation I.610 - B-ISDN Operation and Maintenance Principles and Functions (11/95).
- [ITU-T I.731] Types and general characteristics of ATM equipment. COM 15-R 41-E (12/95).
- [ITU-T I.732] Functional characteristics of ATM equipment. COM 15-R 41-E (12/95).
- [ATMF25.6] ATM Forum AF-PHY-0040.000 - Physical Interface Specification for 25.6Mbit/s over Twisted Pair Cable.
- [ATMF3.1] ATM Forum AF-UNI-0010.002 - ATM User-Network Interface Specification V3.1.
- [ATMF Traffic] ATM Forum AF-TM-0056.000 - Traffic Management Specification Version 4.0.
- [RFC1483] RFC 1483 Multi-protocol Encapsulation over ATM Adaptation Layer 5.
- [IEEE802.3] ISO/IEC 8802-3: 1996(E) (ANSI/IEEE Std 802.3, 1996 Edition). 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.

## 11.15 Reference Model

The ADSL CPE, is located at the customer's premises and allows small and residential offices to access remote infrastructures using ATM/ADSL technology on standard public telephony copper pairs.

The ADSL CPE contains the ATU-R, which is the ADSL modem, the POTS splitter, and additional interfaces toward the customer's equipment.



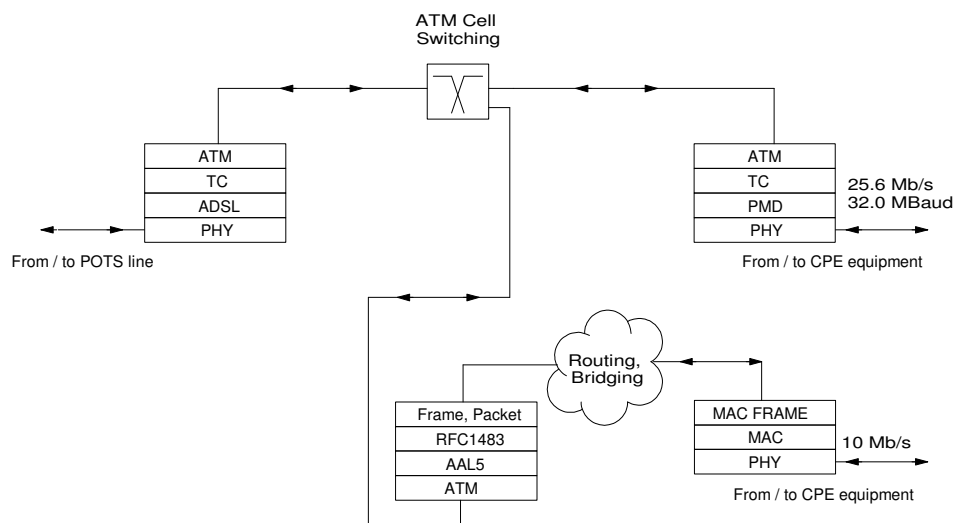
**FIGURE A2.5 – Reference Configuration**

The scope of this appendix is to provide the essential ATM information to successfully inter-operate with the ADSL CPE ATM layers. This information applies to the ADSL and ATM Forum 25.6Mbit/s interfaces only and where appropriate relevant information about the ATM/Ethernet functionality is given.

The information in this document is valid for Alcatel 1000 ADSL DSLAM technology, release R3.0 and higher (Feature Group).

For describing the ATM inter-operability, the ATM reference model is used to specify the various aspects. It is assumed the reader is familiar with this model and its terminology.

The layers involved are shown in Figure A2.6.



**FIGURE A2.6 – ADSL CPE Reference Model**

The base documents for ATM layer specifications are:

- [ITU-T I.731] and [ITU-T I.732]
- [ITU-T I.361]
- [ATMF UNI 3.1]

All features are supported in both upstream and downstream directions unless otherwise stated.

## 11.16 U Interface: ATM Layer User Plane

From the Ethernet interface with respect to ATM functionality, the ADSL CPE is an ATM end system. This implies the ADSL CPE is an endpoint for the ATM-Ethernet VPC/VCC connections. The ATM-Ethernet VPC/VCC connections are logically terminated and at this same point the AAL5 layer is accessed.

<b>p-t-p, p-t-mp Connections</b>	The ADSL CPE supports point-to-point (p-t-p) connections but no point-to-multipoint (p-t-mp) connections.
<b>Cell Header Format</b>	The cell header format and header encoding/decoding is compliant with ITU's public UNI format as specified in [ITU-T I.361].
<b>GFC Field</b>	<p>The ADSL CPE acts as <i>uncontrolled equipment</i> as defined in [ITU-T I.361]. No action shall be taken on GFC field settings of received cells. Moreover, the ADSL CPE shall force non-zero GFC bits to zero for cells <i>in transit</i>.</p> <p>The DSLAM's GFC processing is also as described above, that is:</p> <ul style="list-style-type: none"><li>➤ Cells sourced by the DSLAM have their GFC field always set to zero.</li><li>➤ Cells received by the DSLAM from the ADSL line with non-zero GFC field have this field forced to zero.</li></ul>
<b>VPI Field</b>	<p>Although the whole UNI VPI range from 0 through 255 can be processed by the ADSL CPE, only VPI 0, 1, 2, 3, 4, and 5 are of importance for ATMF-25.6 user traffic, and VPI 8 is of importance for Ethernet user traffic. All ATM cells arriving with VPI values other than these values shall be silently discarded. Note there is one VP/VC which is not mentioned here due to its special purpose, that is, loop-back (described later). The values given above apply to both upstream and downstream directions, that is, no header translation is done.</p>
<b>VCI Field</b>	<p>For VPI's 0 through 5 - ATMF-25.6 traffic, the ADSL CPE is transparent for the VCI fields in the ATM header, hence all VCI values from 0 up to 65535 can be used.</p> <p>In addition, the reserved VCI values 0 through 31 are also transparently relayed; the ADSL CPE acts as a true ATM VP cross-connect.</p> <p>For VPI 8 (Ethernet traffic), only VCI values 35, 43,</p>

51, and 59 are of importance.

<b>PTI Field</b>	<p>The PTI field encoding/decoding is compliant with [ITU-T I.361].</p> <p>For cells in transit, that is, cells flowing between the ADSL and ATM 25.6 interfaces, the bits/cells listed below are treated in a transparent manner:</p> <ul style="list-style-type: none"><li>➤ EFCI bit</li><li>➤ AUU bit</li><li>➤ F5 cells</li><li>➤ RM cells</li><li>➤ Reserved cells</li></ul> <p>For the terminated Ethernet connections, only the least significant bit of the PTI field (ATM user to ATM user indication bit) is currently used. It is encoded/decoded as specified in [ITU-T I.361] and [ITU-T I.363.5] marking the end of an AAL5 SAR-PDU. All other bits are set to zero for transmitted cells and are treated as <i>don't care</i> for received cells.</p>
<b>CLP Bit</b>	<p>The CLP bit marking is in accordance with [ITU-T I.361] and [ITU-T I.371].</p> <p>Currently the ADSL CPE does not react to the CLP bit and leaves this bit unaffected for cells in transit. For the terminated Ethernet connections, this bit is set to zero for transmitted cells and is treated as <i>don't care</i> for received cells.</p>
<b>HEC Field</b>	<p>The HEC fields of ATM cells are generated and verified in accordance with [ITU-T I.432].</p> <p>In downstream direction, the HEC field is used for cell delineation as described in [ITU-T I.432]. Because of the bursty nature of ADSL errors, the HEC method capable of single-bit error correction is not applied (as specified in ADSL specification ITU-T G.992.1). Hence cells in which error(s) are detected in the header are silently discarded.</p>
<b>Cell Rate Decoupling</b>	<p>At the ADSL ATM interface, cell rate decoupling is achieved through <u>idle cell</u> insertion and extraction. Unassigned cells are never sent, and, if received, they are silently discarded.</p> <p>For the UNI type of ATM interface, the difference between idle and unassigned cells is shown below:</p>

Cells	GFC	VPI	VPI	VCI	VCI	VCI	VCI	PTI	CLP
Idle	0000	0000	0000	0000	0000	0000	0000	000	0
Unassigned	0000	0000	0000	0000	0000	0000	0000	xxx	1

Idle cells belong to the physical layer where the ATM header fields GFC, VPI, and VCI do not apply.

### Quality of Service Support

Currently the service classes listed below are supported by the ADSL CPE:

- CBR
- VBR real time
- VBR non-real time
- Best Effort
- UBR+

More information about the service classes can be found in [ATMF Traffic].

### QoS Aware Connection Patterns

No explicit mechanism exists for selecting a specific service class. This action is done implicitly by configuring the appropriate VPI and/or VCI value in the application. In order to provide sufficient flexibility, two connection patterns exist: one based on VCI values and the other based on VPI values.

Provided that the VPI= 0, then the VCI values to be used for the service classes are given below:

- CBR:  $VCI = 32 + 8^*i$
- VBR real time:  $VCI = 33 + 8^*i$
- VBR non-real time:  $VCI = 34 + 8^*i$
- Best Effort:  $VCI = 35 + 8^*i$
- UBR+:  $VCI = 36 + 8^*i$

where  $i = 0$  through 15.

The same result can be obtained by using the VPI values below with any VCI:

- CBR:  $VPI = 1$
- VBR real time:  $VPI = 2$
- VBR non-real time:  $VPI = 3$
- Best Effort:  $VPI = 4$
- UBR+:  $VPI = 5$

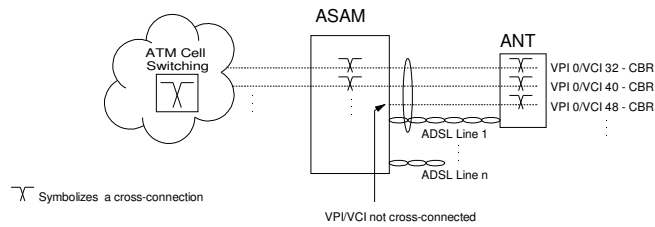
Applications sourcing and/or sinking cells on these specific virtual channels will experience the service provided by the respective classes. The internal scheduler of the ADSL CPE discriminates cell streams

based on their VPI and/or VCI values and guarantees that the CDV, CTD, and CLR tolerances for a particular cell stream remain within the boundaries configured for the specific class.

Both connection patterns can be used simultaneously. For example, traffic sent on virtual channels with VPI 0/VCI 36 and VPI 5/any VCI is treated as UBR+ type of traffic.

In order for applications to benefit from the selected service classes, it is a requirement that these applications shape their traffic according to the values supplied by the operator.

Although the VCI values previously listed are default values configured in the ANT, this does not mean there are actual connections. The Network Operator must provision these virtual channels and their associated properties in the DSLAM. This is shown in Figure A2.7 for clarity.



**FIGURE A2.7 – Connection Provisioning**

As described previously, the VCI values designated for ATM-Ethernet traffic are  $35 + 8*j$  ( $j$  is limited to the range 0 to 3 for Ethernet), implying that the service class for Ethernet traffic is Best Effort.

**Loop-backs**

At the U interface, all downstream cells with VPI 0/VCI 21 and VPI 1/VCI 21 arriving at the ADSL CPE are looped back upstream with identical VPI/VCI values. The service class associated with these loop-back channels is of type CBR.

**AAL5 Functionality**

The AAL5 entity in the ADSL CPE is compliant with [ITU-T I.363.5]. The AAL5 entity is only of importance for the terminated ATM-Ethernet connections. Specific AAL5 requirements are listed below:

- Service Specific Convergence Sub-layer (SSCS) is null.
- AAL5 message mode is used.

- Corrupted data delivery option is not used.
- CPCS–Loss–Priority (CPCS–LP) parameter is set to 0 in upstream direction and ignored in downstream direction.
- CPCS–Congestion–Indication (CPCS–CI) parameter is set to 0 in upstream direction and ignored in downstream direction.
- CPCS–User–to–User–Indication (CPCS–UU) parameter is set to 0 in upstream direction and ignored in downstream direction.
- Reception Status parameter has no meaning because the corrupted data delivery option is not used.

**Multi-Protocol Encapsulation In AAL5**

The ADSL CPE supports [RFC 1483] for encapsulation / decapsulation of frames. The default encapsulation method is LLC/SNAP.

### 11.17 U Interface: ATM Layer Control Plane

The ADSL CPE supports signalling tunnelling, that is, it does not terminate or does not originate signalling messages but relays them transparently between its ports.

Consequently, the signalling requirements to which end systems must comply are imposed by ATM switches deeper in the network terminating the signalling messages.

### 11.18 U Interface: ATM Layer Management Plane

The ADSL CPE is a plug–and–play device in the sense that all parameters are pre-configured with suitable defaults.

It must be noted the ADSL front end is configured/managed by its central office counterpart through the ADSL EOC channel but this is in fact of no importance to the ATM layer.

### 11.19 F4/F5 Support

The ADSL CPE is compliant with the F4/F5 OAM insertion/extraction and processing requirements specified in [ITU–T I.610].

In the current CMUX release, there is no F4/F5 support. All F4 and F5 cells with VPI values within the ATMF 25.6 range are transparently relayed. ASAM and AM3x fully supports this F4/F5 feature.

The terminated Ethernet connections do not generate F4/F5 cells and there is no action on received F4/F5 cells.

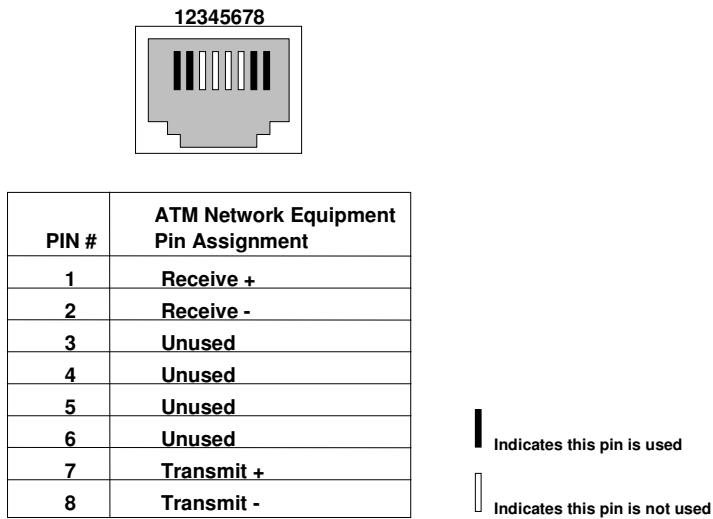


## 11.20 T/S Interface: ATMF–25.6 Physical Layer

All information previously described for the U interface is equally valid for the ATMF–25.6 interface. However, some information is repeated here to highlight small differences and to give a better general understanding.

The ADSL CPE is fitted with the IEC 603–7 Media Interface Connector (commonly referred to as RJ–45) and marked ATMF–25 on the back of the ADSL CPE (see Figure A2.8).

The contact assignment of the UTP–MIC of the ADSL CPE complies to the assignment designated for ATM Network Equipment, specified in [ATMF 25.6] §2.4.1.8.



**FIGURE A2.8 – Contact Assignment of ATM Forum MIC of the ADSL CPE**

## 11.21 T/S Interface: ATM Layer User Plane

From the ATMF–25.6 interface with respect to ATM functionality, the ADSL CPE is an intermediate ATM system.

This implies the ADSL CPE is an endpoint for a VPC but not for a VCC connection. The ADSL CPE is capable of terminating VC links and VP links but there is no AAL5 layer functionality associated with the ATMF–25.6 interface.

<b>GFC Field</b>	Similar to the ADSL interface, the ANT shall take no action on GFC field settings of received cells. Moreover, it shall force non zero GFC bits to zero for cells in transit.
<b>VPI Field</b>	As previously described for the ATMF–25.6 interface, only VPI 0, 1, 2, 3, 4 and 5 are of importance for user data. All ATM cells arriving with a VPI value other than these shall be silently discarded. These values apply to both upstream and downstream directions.
<b>VCI Field</b>	The ADSL CPE is transparent for the VCI fields in the ATM header, hence all VCI values from 0 up to 65535 can be used. In addition, the reserved VCI values 0 through 31 are also transparently relayed.
<b>PTI Field</b>	Identical to description of ATM Layer User Plane at the U interface.
<b>CLP Bit</b>	Identical to description of ATM Layer User Plane at the U interface.
<b>HEC Field</b>	The HEC method for error detection/correction operates in detection mode only similar to the ADSL port. The ATMF–25.6 4B5B block code causes multiple bit errors for each corrupted bit. Hence cells in which error(s) are detected in the header are silently discarded.
<b>Cell Rate Decoupling</b>	For the ATMF–25.6 interface, cell rate decoupling is achieved by inserting/detecting the start-of-cell command bytes in the cell stream; hence there is no need to generate or process idle or unassigned cells. However, if either idle or unassigned cells occur at the receive side, they are silently discarded.
<b>Quality of Service Support</b>	Identical to description of ATM Layer User Plane at the U interface.
<b>Loop-backs</b>	There are no loop-backs at the T/S interface.

## 12. ANNEX 3 - MODEM SUPPLIER COMPATIBILITY CHECKLIST DECLARATION.

The following is a list of functional items associated with the operations and procedures of the 3<sup>rd</sup> party vendor ATU-R and Alcatel ATU-C equipment. To ensure inter-operability, one must support and enable the modem (ie. modem shall be configured into the below conditions prior to product release) to the following items listed below:

<b>Functionality Base Level</b>	
<b>Inter-op</b>	
<b>Transport Capacity</b>	
Single Latency Mode	Yes
Dual Latency Downstream	Yes
Dual Latency Upstream	Yes
AS0 (32 kbit/s - 6.144 Mbit/s)	Yes
LS0 (32 kbit/s - 640 kbit/s)	Yes
<b>Functional Characteristics</b>	
ATM TC Functions	Yes
Superframe support (with CRC)	Yes
Full Overhead Framing	Yes
Sync Byte Support (other than "No Action" - Full OH Only)	Yes
Fast Path (Data Buffer) Support	Yes
Interleaved Path (Data Buffer) Support	Yes
Scrambler/Descrambler	Yes
Fwd Error Correction	Yes
Tone Ordering	Yes
Trellis Coding	Yes
<b>Functionality Base Level Interop</b>	
<b>Operation and Maintenance</b>	
EOC Message Set	Yes
EOC Protocol States	Yes
Generation (ATU-R) / Reception (ATU-C) of Dying Gasp	Yes
In-Service Monitoring and Surveillance (Indicator Bits)	Yes
<b>Initialisation</b>	
Support for Retrain State	Yes
Support for Resync State	Yes
Loop Timing (ATU-R) / (ATU-C Sends C-ACT4)	Yes
Expanded Exchange Sequence (Rate Adaptation)	Yes
<b>On-line Adaptation and Reconfiguration</b>	
Dynamic Rate Adaptation (Annex K)	Yes
AOC Message Set	Yes
AOC Protocol	Yes
Bit Swapping (required in both upstream & downstream directions)	Yes
<b>Management and Service Provisioning</b>	
Manual Configuration of ATM Information	Yes

.....  
(Signature of declarant)

.....  
(Full name of declarant)

.....  
(Position held in the manufacturing or importing organisation)

.....  
(Date of declaration)

.....  
(CPE type and model number)

"The Declarant warrants that he or she is authorised to make this Declaration on behalf of the manufacturer named above."

IP1149, Issue 6.

## 13. ANNEX 4 - IP TEST SUITES AND CLIENT SOFTWARE.

All times are based on tests using a client PC configuration of:

- 2.02 GHz P4 processor,
- 256 Megabytes of RAM,
- WinXP.

### Test Types:

#### 1. IP Connectivity Testing

The above IP test requires that the ATU-R under investigation be configured with a specific IP address

#### 2. Throughput Testing

These tests will demonstrate the throughput capabilities of the ATU- under investigation.

#### 3. ATUR- R Mode of Operation Testing

These will test the different possible modes of operations that the ATU-R can operate under. These will include PPPoE, PPPoA, DHCP.

### 13.1 IP Connectivity Testing

In performing IP test suites, there are common tests that should be performed prior to connection set-up.

The requirements for the following tests are: No loss of packets and an average round time of less than 100 ms.

#### IP connectivity tests, should be broken down into the following:

- LAN/PC to ATU-R LAN interface connectivity.
- LAN/PC to ATU-R WAN interface connectivity (WAN static IP ONLY).
- LAN/PC to Remote WAN Interface (Server) Connectivity.

#### 13.1.1 LAN/PC to ATU-R LAN Interface Connectivity

Ping from the LAN/PC to ATU-R LAN interface with 32 200 byte frames

eg. ping XXX.XXX.XXX.XXX -n 32 -l 200, where XXX.XXX.XXX.XXX is the IP address of the ATU-R under test's LAN interface.

Repeat with 1000 byte frames.

### 13.1.2 LAN/PC to ATU-R WAN Interface Connectivity

Connect the ATU-R to the ATU-C in Fast mode and establish a PPPoE/A session.

Ping from the LAN/PC to the ATU-R WAN Interface with 32 200 byte frames

eg. ping XXX.XXX.XXX.XXX -n 32 -l 200, where XXX.XXX.XXX.XXX is the IP address of the modem under test's WAN interface.

Repeat with 1000 byte frames.

### 13.1.3 LAN/PC to Remote WAN Interface (Server) Connectivity

Connect the ATU-R to the ATU-C in Fast mode and establish a PPPoE/A session.

Ping from the LAN/PC to the server with 32 200 byte frames

eg. ping XXX.XXX.XXX.XXX -n 32 -l 200, where XXX.XXX.XXX.XXX is the IP address of the remote server.

Repeat with 1000 byte frames.

Connect the ATU-R in Interleave mode and repeat.

## 13.2 Throughput Testing

### 13.2.1 Throughput Testing Using PPPoE

Connect the ATU-R under test using a Null loop to the ATU-C and allow to synchronise and establish a PPPoE session.

Log on to the **FTP** server and download and upload the following files.

Ensure that the speed of the transfer is within the required limit.

Tests are performed on each type of port of the ATU-R.

#### Fast Mode (FTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	1	3	2	1
5 Mbyte	10	24	11	9
10 Mbyte	18	53	22	21
Upload				
10 Mbyte	170	174	133	134

### Interleaved Mode (FTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	3	5	4	3
5 Mbyte	26	45	27	23
10 Mbyte	52	85	56	50
<b>Upload</b>				
10 Mbyte	197	175	134	136

Log off from the **FTP** server and log on to the **HTTP** server and download the following files. Ensure that the speed of the transfer is within the required limit.

### Fast Mode (HTTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	2	3	2	2
5 Mbyte	11	27	10	10
10 Mbyte	20	51	22	21

### Interleaved Mode (HTTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	3	5	3	3
5 Mbyte	28	41	26	25
10 Mbyte	47	83	51	43

These times have been calculated from the measured times of the SpeedTouch Home 530 (Ethernet), SpeedTouch 530 (USB) or SpeedTouch 570 (Wireless).

### 13.2.2 Throughput Testing Using PPPoA

Connect the ATU-R under test using a Null loop to the ATU-C and allow to synchronise and establish a PPPoA session.

Log on to the **FTP** server and download and upload the following files. Ensure that the speed of the transfer is within the required limit. Each type of port of the ATU-R shall be tested.

#### Fast Mode (FTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	1	3	2	1
5 Mbyte	7	21	11	7
10 Mbyte	14	43	21	14
<b>Upload</b>				
10 Mbyte	177	169	133	133

#### Interleaved Mode (FTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	2	4	2	3
5 Mbyte	21	40	27	27
10 Mbyte	41	77	57	52
<b>Upload</b>				
10 Mbyte	201	170	133	134

Log off from the **FTP** server and log on to the **HTTP** server and download the following files. Ensure that the speed of the transfer is within the required limit.

### Fast Mode (HTTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	2	3	2	2
5 Mbyte	7	21	10	8
10 Mbyte	14	40	20	14

### Interleaved Mode (HTTP)

Download	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
0.5 Mbyte	2	4	3	3
5 Mbyte	11	39	28	26
10 Mbyte	27	71	49	44

## 13.3 MTU Size Rate Testing

### 13.3.1 MTU Size Rate Using PPPoE

Connect the ATU-R under test using a Null loop to the ATU-C and allow to synchronise and establish a PPPoE session.

Set the FTP server's MaxMTU to the appropriate size.

Log on to the **FTP** server and download a 10 Megabyte file. Ensure that the speed of the transfer is within the required limit for each MTU size. Each type of port of the ATU-R shall be tested.

### Fast Mode (FTP)

MaxMTU	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
100 bytes	88	205	165	88
296 bytes	36	99	67	36
576 bytes	27	78	36	27
1500 bytes	20	51	22	20



### Interleaved Mode (FTP)

MaxMTU	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
100 bytes	208	353	269	223
296 bytes	113	186	115	105
576 bytes	87	128	75	67
1500 bytes	52	84	54	53

### 13.3.2 MTU Size Rate Using PPPoA

Connect the ATU-R under test using a Null loop to the ATU-C and allow to synchronise and establish a PPPoA session.

Set the FTP server's MaxMTU to the appropriate size.

Log on to the **FTP** server and download a 10 Megabyte file. Ensure that the speed of the transfer is within the required limit for each MTU size. Each type of port of the ATU-R shall be tested.

### Fast Mode (FTP)

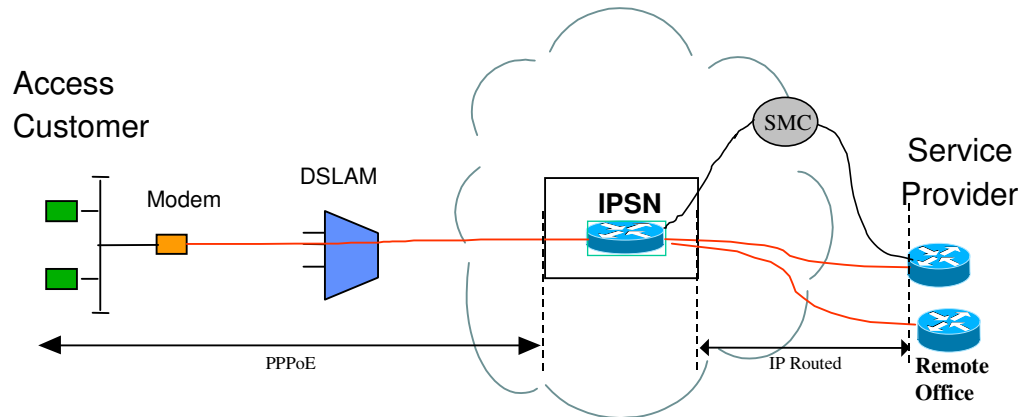
MaxMTU	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
100 bytes	76	122	185	73
296 bytes	27	58	69	27
576 bytes	16	56	36	16
1500 bytes	14	42	22	14

### Interleaved Mode (FTP)

MaxMTU	Max. Time Allowed (seconds)			
	Ethernet	USB	Wireless	NIC
100 bytes	171	255	266	204
296 bytes	98	133	122	88
576 bytes	55	107	70	60
1500 bytes	32	70	53	54

## 13.4 ATU-R (ADSL Modem) Operating Modes

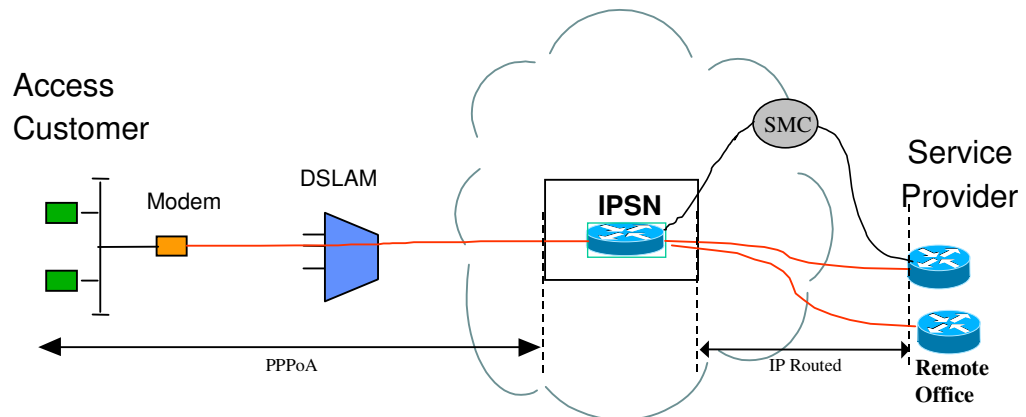
### 13.4.1 Bridged Mode - Using PPPoE



In this configuration, the ATU-R (ADSL modem) IP functionality must comply with:

- RFC 1483-B - Multi-Protocol Encapsulation over AAL5

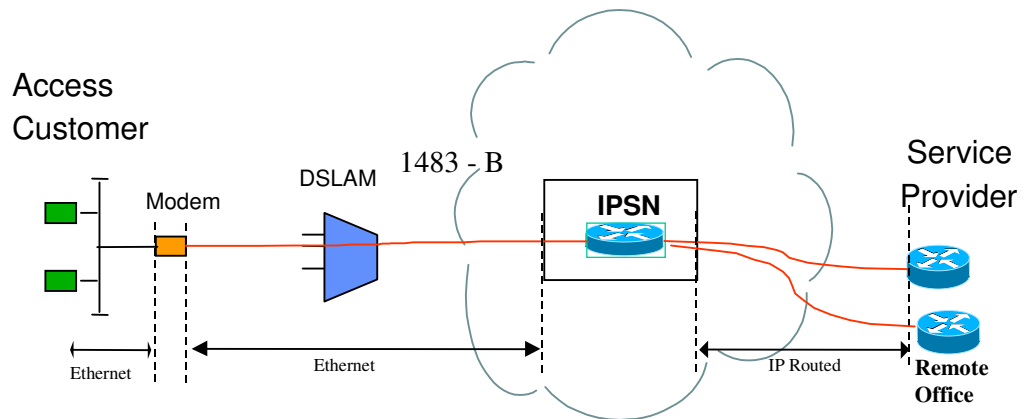
### 13.4.2 Bridged Mode - Using PPPoA



In this configuration, the ATU-R (ADSL modem) IP functionality must comply with:

- RFC 1483-B - PPP Encapsulation Protocols

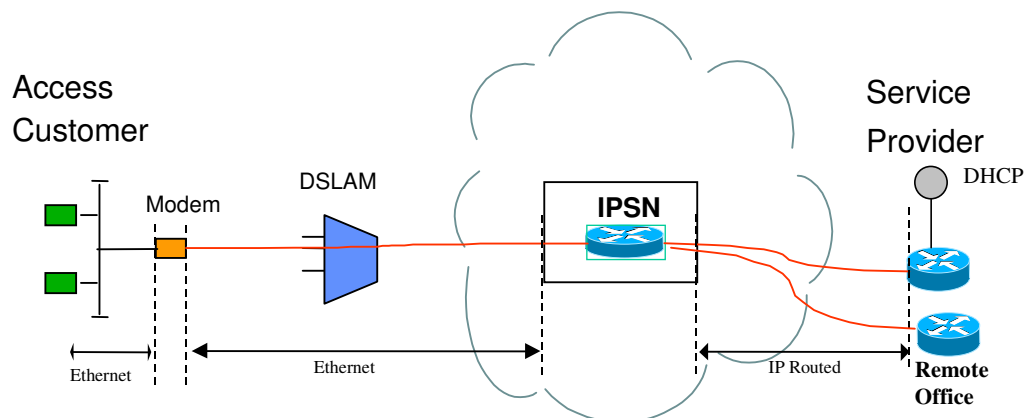
### 13.4.3 Bridged Mode - Using Static IP Addressing Scheme



In this configuration, the ATU-R (ADSL modem) IP functionality must comply with:

- RFC 1483-B - Multi-Protocol Encapsulation over AAL5

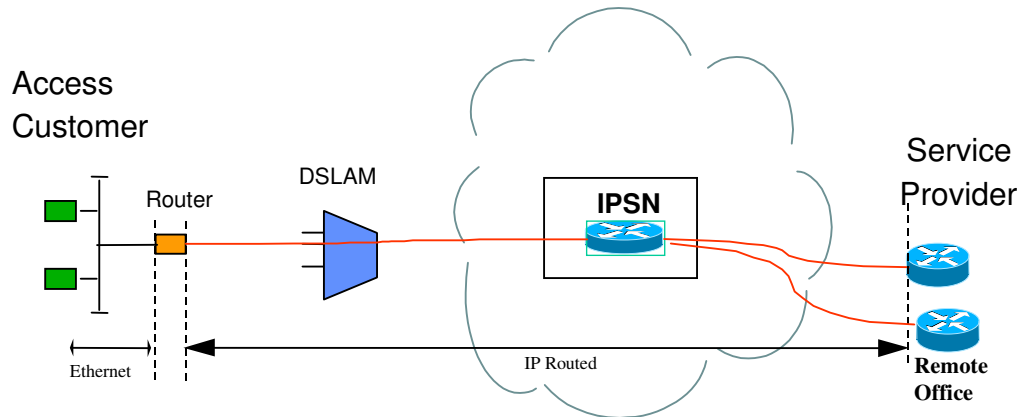
### 13.4.4 Bridged Mode - Using Static IP Addressing Scheme with DHCP Relay



In this configuration, the ATU-R (ADSL modem) IP functionality must comply with:

- RFC 1483-B - Multi-Protocol Encapsulation over AAL5

### 13.4.5 Routed Mode - Using Static IP Addressing Scheme

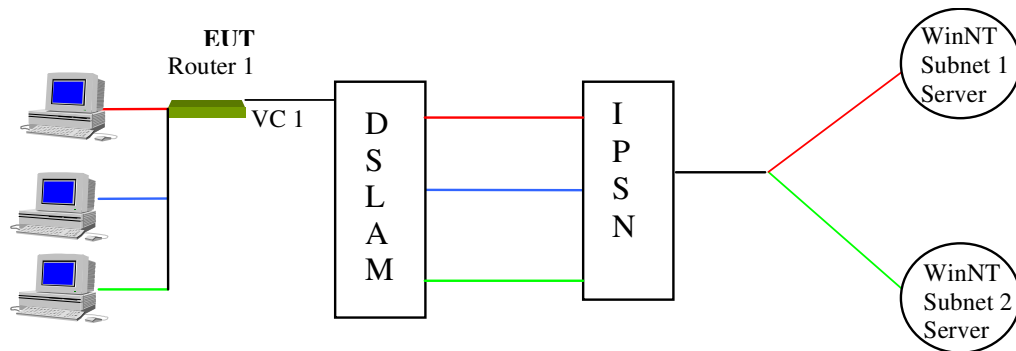


In this configuration, the ATU-R (ADSL modem) IP functionality must comply with:

- RFC 1483-R - Multi-Protocol Encapsulation over AAL5

Additionally, the following tests should be conducted:

Separate applications from the common site to separate end-user subnet services will need to be launched. Example of the testing scenario is shown below:



The above ADSL end user, should be able to successfully connect to any services available on the remote subnets.

## 13.5 Client Software

Client software shall be tested in consultation with the relevant functionality that is described in the RFC (Request For Comment). The main aim is to ensure that the software is completely compatible with the Telstra Network. Refer to Nortel documentation.

### **13.5.1 Client Software Inter-operability Requirements for Connection to the Telstra Network**

- Although independent testing is required confirming the correct operation of this software, Telstra may be consulted in special circumstances where difficulty is encountered.
- Client software shall connect directly upon the first logon to the "[username@domain](#)" service. In order to determine compliance, the system shall be tested consecutively a minimum of 20 times without failure. The system shall log on without failure or excess delay on all attempts.
- Client software shall not intermittently drop out of service, once connected to the service provider unless the link is non-operational. A minimum test period of 4 Hours shall be undertaken to ensure that the software is compliant.
- Client software shall not cause any software failures of host PC.
- Client software shall not alter any PC configuration unnecessarily upon installation.

### **13.5.2 Client Software - PPPoE Bridge Connection**

Under this type of configuration, the following should be adhered to:

- RFC 1334 - PPP Authentication Protocols
- RFC 1661 - Point to Point Protocol
- RFC 2516 - A Method of Transmitting PPP over Ethernet
- RFC 1994 - CHAP

### **13.5.3 Client Software - PPPoA Bridge Connection**

Under this type of configuration, the following should be adhered to:

- RFC 1334 - PPP Authentication Protocols
- RFC 2364 - PPP over AAL5

**14. ANNEX 5 - DECLARATION OF CONFORMITY AND COMPLIANCE**

**DECLARATION OF COMFORMANCE & COMPLIANCE TO  
TELSTRA ADSL DOCUMENT (IP 1149 - Issue 6) STATEMENT**

I/We.....

*(Name of manufacturer, importer or agent)*

of.....

*(Address of manufacturer, importer or agent)*

Australian Company Number (ACN).....

Australian Registered Business Number.....

ACA Supplier code Number.....

*(If applicable)*

declare that the following customer equipment or client software:

.....

*(Name, Type, Firmware and Model numbers)*

to which this declaration relates complies with all applicable standards.

Applicable standards, selected are:

.....

.....

*(Details of applicable standards, including number, title and date of publication)*

.....  
*(Signature of declarant)*

"The Declarant warrants that he or she is authorised to make this Declaration on behalf of the manufacturer named above."

.....  
*(Full name of declarant)*

.....  
*(Position held in the manufacturing or importing organisation)*

.....  
*(Date of declaration)*

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**End of Document**