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(Formerly WT-066v4)

VoDSL Interoperability Test Plan

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Abstract:

Tests and requirements demonstrate interoperability of VoDSL equipment. The key items of voice functionality, fax and modem calls and voice quality are tested to demonstrate compliance with deployment-based requirements. This working text contains tests and requirements suitable for all markets.

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1 Revision History

Table 1: Revision History

Date (M/D/Y)	Version	Major Changes	Editor(s)
6/20-22/01	1.0	Initial creation per agreement in Oslo, based on contribution 2001.178. OpenVoB Implementation Guide and Test Plan	Paul Drew, MetaSwitch Joey Chou, Intel
8/30/01	2.0	Updates based on contributions 2001.267 and 2001.274	Paul Drew, MetaSwitch
11/27/01	3.0	OpenVoB contribution resulted from Callfests III and IV.	Joey Chou, Intel Paul Drew, MetaSwitch
3/7/02	4.0	Updates based on contributions 2002.029, 2002.030 and 2002.032	Paul Drew, MetaSwitch

2 Introduction

This document describes interoperability test cases required for VoDSL reference systems consisting of Voice Gateways and IADs complying with TR-039 Annex A [6]. This test plan is intended to cover all the supported protocol combinations between IWFs as specified by af-vmoa-0145 [2].

An IAD and a Voice Gateway 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. The term "compatible" is used to mean that there are no conflicting requirements that will prevent the VoDSL system from achieving interoperability.

This document uses several words to signify the specification requirements. This section defines these words as they should be interpreted. The key words "must", "must not", "required", "shall", "shall not", "should", "should not", "recommended", "may", and "optional" in this document are to be interpreted as described below.

- **Must** This word, or the terms "required" or "shall", mean that the definition is an absolute requirement of the specification.
- **Must Not** This phrase, or the phrase "shall not", mean that the definition is an absolute prohibition of the specification.
- **Should** This word, or the adjective "recommended", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- **Should Not** This phrase, or the phrase "not recommended" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
- **May** This word, or the adjective "optional", mean that an item is truly optional. One vendor may

choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation that does not include a particular option must be prepared to interoperate with another implementation that does include the option, though perhaps with reduced functionality. In the same vein, an implementation that does include a particular option must be prepared to interoperate with another implementation that does not include the option (except, of course, for the feature the option provides).

3 Scope

Section 6 identifies key requirements and options as defined in af-vmoa-0145.000 [2] and btd-vmoa-les-02.02 [21] that are critical to the promotion of the interoperability IAD—Voice Gateway. This guide provides explanatory text to assist the LES standard in areas where misinterpretation can occur.

This test plan consists of a test suite for verifying the IAD—Voice Gateway interoperability to provide Voice over AAL2 LES. The test suite shall verify the voice over AAL2 requirements as defined in TR-039 [6] from the DSL Forum.

This test plan covers the markets defined in TR-039, GR-303 and ETSI V5.x.

The IAD under test shall support the some or all of the following devices.

- Analog POTS phone
- Fax
- Voice-band Modem
- ISDN terminals

It is expected that CLASS (Customer Local Area Signaling Services) features, supported by a typical Class 5 switch, shall be available to derived lines provided by LES. As the CLASS features are normally implemented in the Class 5 Switch, LES is only responsible for the tunneling of the invocation and indication signaling (*e.g.*, hook-flash, DTMF tones, Caller ID), that are used to invoke the CLASS features. Therefore, this test plan will test a subset of the CLASS features that use hook-flash, DTMF tones, and Caller ID transmission.

This test plan will use the CP-IWF MIB as defined in af-vmoa-175.000 [1] to enable remote provisioning, by using SNMP messages to change different profiles and parameters, such as speech coding (*e.g.*, G.711, G.726), silence suppression, expansion scheme (*e.g.*, μ -law/A-law), Loop Start, DTMF / Pulse Dialing, VPI/VCI, and CID.

The voice over broadband connections between IAD and Voice Gateway will be PVC. SVC or SPVC is outside the scope of this test plan.

4 Acronyms

AAL2	ATM Adaptation Layer type 2
AAL5	ATM Adaptation Layer type 5
ADPCM	Adaptive Differential Pulse-Code Modulation
ADPCM-32	Adaptive Differential Pulse-Code Modulation (32 kbps)
AppID	Application ID
ATM	Asynchronous Transfer Mode
BLES	Broadband Loop Emulation Service
BRI	Basic Rate Interface (ISDN 2B+D)

CAS	Channel Associated Signaling
CCS	Common Channel Signaling
CID	Channel Identifier
CLASS	Customer Local Area Signaling Services
CO-IWF	Central Office – InterWorking Function
CP-IWF	Customer Premise – InterWorking Function
CRV	Call Reference Value
DS0	Digital Signal level 0 (64 kbps)
DS1	Digital Signal level 1 (1.544 Mbps)
DS3	Digital Signal level 3 (45 Mbps)
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
E1	2.048 Mbps
ELCP	Emulated Loop control Protocol
FAX	Facsimile
IAD	Integrated Access Device (DSL Modem)
ISDN	Integrated Services Digital Network
LES	Loop Emulation Service
MOS	Mean Opinion Score
OC3	Optical Carrier 3 (155.52 Mbps)
PCM	Pulse-Code Modulation
PCM-64	Pulse-Code Modulation (64 kbps)
PRI	Primary Rate Interface (ISDN 23B+D)
PSQM	Perceptual Speech Quality Measure
PSTN	Public Switched Telephone Network
SN	Service Node
TBD	To Be Determined; To Be Defined
VoATM	Voice Over ATM
VPI	Virtual Path Identifier
VCI	Virtual Channel Identifier
WAN	Wide Area Network

5 References

- [1] af-vmoa-175.000, October 2001, “Loop Emulation Service Using AAL2 CP-IWF MIB Addendum”
- [2] af-vmoa-0145.000, June 2000, ATM Forum, “Voice and Multimedia Over ATM – Loop Emulation Service Using AAL2”

- [3] ITU-T I.366.1, June 1998, “Segmentation and Reassembly Service Specific Convergence Sublayer for the AAL2”
- [4] ITU-T I.366.2, February 1999, “AAL2 Service Specific Convergence Sublayer for Trunking”
- [5] af-vtoa-0113.000, February 1999, “ATM Trunking using AAL2 for Narrowband Services”
- [6] DSL Forum, TR-039, Version 1.1, “Requirements for Voice over DSL”, March 2001
- [7] Telcordia Generic Requirements GR-303-CORE Issue 2, 1998, Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface
- [8] ETSI EN 300 324-1, 2000-04, V5.1 interface for the support of access network (AN) Part1: V5.1 interface specification
- [9] ETSI EN 300 347-1, 1999-12, V5.2 interface for the support of access network (AN) Part1: V5.2 interface specification
- [10] ETSI EG 201 900-1 V1.1.1 (2001-04) ETSI Guide: Narrowband Services over ATM; Loop Emulation Service (LES) using AAL2; Part 1: LES Interface specification [ATM Forum Specification af-vmoa-0145.000 (2000), modified]
- [11] ETSI EG 201 900-2 V1.1.1 (2001-04) ETSI Guide; Narrowband Services over ATM; Loop Emulation Service (LES) using AAL2; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification
- [12] ITU-T I.432.1, 1996, B-ISDN user-network – Physical layer specification: General characteristics
- [13] ITU-T I.432.2, 1996, B-ISDN user-network – Physical layer specification: 155 520 kbit/s and 622 080 kbit/s operation
- [14] ITU-T I.432.3, 1996, B-ISDN user-network – Physical layer specification: 1544 kbit/s and 2048 kbit/s operation
- [15] ITU-T I.432.4, 1996, B-ISDN user-network – Physical layer specification: 51 840 kbit/s operation
- [16] ITU-T I.432.5, 1997, B-ISDN user-network – Physical layer specification: 25 600 kbit/s operation
- [17] ITU-T G.168, April 1997, “Digital Network Echo Canceller”
- [18] ITU-T G.711, November 1988, “Pulse Code Modulation (PCM) of Voice Frequency”
- [19] ITU-T G.726, December 1990, “40, 32, 24, 16 Kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)”
- [20] DSL Forum, TR-036, Version 1.0, “Requirements for Voice over DSL”, August 28, 2000
- [21] btd-vmoa-les-02.02, February 2002, Baseline text for Loop Emulation Service Using AAL2 – Rev 1
- [22] IETF RFC 1213, Management Information Base for Network Management of TCP/IP-based Internets: MIB-II, Mar. 1991
- [23] IETF RFC 2863, The Interfaces Group MIB, June 2000

6 Implementation Guidelines

6.1 Overview

In preparation for interoperability test cycles, this section provides IAD and Voice Gateway vendors with implementation guidelines created to enable multi-vendor VoDSL interoperability among various IAD and voice gateway suppliers.

Interoperability testing between the IAD (CP-IWF) and voice gateway (CO-IWF) shall conform to

af-vmoa-0145.000 [2]. The intent of this section is to identify the specific functionality to be implemented based on the ATM Forum specification. In addition, it shall interpret parts of the specification which vendors view as requiring clarification.

The numbers in each header indicate the chapter numbers of af-vmoa-0145.000 [2] from which each implementation guideline is derived. PCM-64 and ADPCM-32 Codecs are defined in ITU-T recommendations G.711 [18] and G.726 [19] respectively.

6.2 IWF-IWF Communication (Ch 3.1)

An IAD shall be connected to a Voice Gateway via a single ATM VCC. The testing configuration will only provide support for PVCs.

6.3 ATM VCCs Carrying AAL2 Channels for the Support of LES (Ch 3.2)

Both the IAD and voice gateway shall only support ATM VCCs containing one or more AAL2 channels, each carrying bearer traffic and/or signaling traffic.

6.4 Application Identifier (Ch 4.1.1)

Both the IAD and Voice Gateway shall agree on a common Application Identifier as specified in section 4.1.1.

6.5 Channel Associated Signaling (CAS)

This section is only relevant to IADs and Voice Gateways that use Application Identifier Loop Emulation Service using CAS (POTS only) without ELCP (0x0000000A).

6.5.1 Signaling Between CO-IWF & CP-IWF for Analog Telephony (Ch 3.3.1)

Both the IAD and voice gateway shall support Channel Associated Signaling (CAS) as specified in section 5.1.1 of af-vmoa-0145.000 [2]. The mapping between analog line states and ABCD bit codewords shall be as defined in Telcordia GR-303-CORE tables 12-3 through 12-6.

Support for DTMF relay as defined in ITU I.366.2 [4] Annex K is not required when using PCM-64 and ADPCM-32 Codecs.

6.5.2 Assignment of AAL2 Channels (Ch 4.4)

For voice channels, the CID will be allocated sequentially starting with CID=16. Support for the common channel signaling channel (CID=8) is considered out of scope.

The CID to physical port (on the IAD) mapping will be sequential starting with the first port on the device. For example, the first port on the IAD (assumed to be physical port number 1) for voice telephony will be associated with CID 16, the next port will be associated with CID 17, and so on.

6.5.3 LES Using CAS Between CP-IWF and CO-IWF (Ch 5.1.1)

The IAD and Voice Gateway shall support signaling ABCD bits across the AAL2 channel utilizing the procedures defined in ITU I.366.2 Annex L. The IAD shall provide for filtering/debouncing of the ABCD bit changes.

The CP-IWF or CO-IWF shall suppress Type 3 CAS packet refreshes when the AAL2 channel is deactivated per section 5.1.1 of [21] and the line is in on-hook state.

This method is recommended to conserve usage of bandwidth in the local loop to improve resource availability for network devices thereby reducing the cost of deployment.

6.5.4 Implicit Channel Activation Procedure (Ch 5.3.2.1)

The IAD shall follow the channel activation and deactivation procedures outlined in section 5.3.2.1 of af-vmoa-0145.000 [2].

The AAL2 type 3 packet (signaling) shall be sent when a port line state transition is detected independently of the channel state.

6.6 Common Channel Signaling (CCS)

This section is relevant to IADs and Voice Gateways that use the following Application Identifiers:

- Loop Emulation Service using PSTN signaling (POTS only) without ELCP (0x0000000B)
- Loop Emulation Service using PSTN signaling (POTS only) with ELCP (0x0000000C)
- Loop Emulation Service using PSTN signaling in support of POTS and DSS1 in support of BRI with ELCP (0x00000011)

Note: The AppId "Loop Emulation Service using PSTN signalling in support of POTS, and DSS1 in support of BRI (without ELCP) (0x 00000010)" is not supported by this document (see section 6.16).

6.6.1 Signaling Between CO-IWF and CP-IWF for Analog Telephony (Ch 3.3.1)

Both the IAD and voice gateway shall support Common Channel Signaling (CCS) as specified in section 5.1.2 of af-vmoa-0145.000 [2].

At the CP-IWF, conversion of analog line states to and from the PSTN protocol messages shall be performed as specified in ETSI EN-300 324-1.

Support for DTMF relay as defined in ITU I.366.2 [4] Annex K is not required when using PCM-64 and ADPCM-32 Codecs.

6.6.2 Assignment of AAL2 Channels (Ch 4.4)

CID = 8 shall be used for transport of CCS messages.

If ELCP is not used:

For voice channels, the CID will be statically allocated, sequentially starting with CID=16.

The CID to physical port (on the IAD) mapping will be sequential starting with the first port on the device. For example, the first port on the IAD (assumed to be physical port number 1) for voice telephony will be associated with CID 16, the next port will be associated with CID 17, and so on.

If ELCP is used:

For voice channels the CID will be allocated dynamically on a call per call basis using the ELCP ALLOCATION message as defined in section 5.3.1.1 of af-vmoa-0145.000 [2].

6.6.3 LES using CCS Between CP-IWF and CO-IWF (Ch 5.1.2)

The transport of CCS messages shall be done using LAPV5 on top of the Service Specific Transmission Error Detection sublayer (SSTED) on top of the Segmentation and Reassembly Service Specific Common sublayer (SSSAR) as specified in ITU-T Rec. I.366.1.

CCS common procedures shall be compliant with section 5.4 of af-vmoa-0145.000 [2].

6.6.4 Channel Activation Procedure

If ELCP is not used, the IAD shall follow the channel activation and deactivation procedures outlined in section 5.3.2.1 of af-vmoa-0145.000 [2] (implicit activation).

If ELCP is used, the IAD shall follow the channel activation and deactivation procedures in a master/slave mode as defined in section 5.3.1.1.2 of af-vmoa-0145.000 [2] (explicit activation).

6.6.5 Control of PSTN User Ports

If ELCP is used IWFs shall control the activation and deactivation of the user ports by means of ELCP messages exchanged on the common signaling channel (CID=8) as defined in section 5.3.1.2 of af-vmoa-0145.000 [2].

6.7 ISDN BRI

This section is relevant to IADs and Voice Gateways that use the following Application Identifiers:

- Loop Emulation Service DSS1 in support of BRI (BRI only) with ELCP (0x0000000E)
- Loop Emulation Service using PSTN signaling in support of POTS and DSS1 in support of BRI with ELCP (0x00000011)

Note: The AppIds

- "Loop Emulation Service using DSS1 in support of BRI (BRI only) without ELCP (0x0000000D)",
- "Loop Emulation Service using PSTN signalling in support of POTS, and DSS1 in support of BRI (without ELCP) (0x 00000010)", and
- "Loop Emulation Service using CAS in support of POTS, and DSS1 in support of BRI (without ELCP) (0000000F)"

are not supported in this document (see section 6.16).

6.7.1 Signaling Between CO-IWF and CP-IWF for ISDN BRI (Ch 3.3.2)

Both the IAD and the Gateway shall support DSS1 message relay as specified in section 5.2.1 of af-vmoa-0145.000 [2].

6.7.2 Assignment of AAL2 Channels (Ch 4.4)

Each ISDN BRI user port can use up to three channels 2B+D.

CID allocation is made by the Gateway through the use of the ALLOCATION message as defined in section 5.3.1.1 and 5.4.4.3 of af-vmoa-0145.000 [2].

For D channel, the CID allocation shall be done by the Gateway during the startup procedure as defined in section 5.4.4.1 of af-vmoa-0145.000 [2].

For B channel, the CID allocation shall be done by the Gateway on a per call basis.

6.7.3 Channel Activation Procedure (Ch 5.3.1.1)

The IAD shall follow the channel activation and deactivation procedures in a master/slave mode as defined in section 5.3.1.1.2 of af-vmoa-0145.000 [2].

The Information Transfer Capability information element shall be supported.

6.7.4 Control of ISDN BRI User Port (Ch 5.3.1.2)

IWFs shall control the activation and deactivation of the user ports by means of ELCP messages exchanged on the common signaling channel (CID=8) as defined in section 5.3.1.2 of af-vmoa-0145.000 [2].

6.8 Types of Encoding Supported (Ch 3.4.1)

The testing shall be limited to the voice coding specified in ITU I.366.2 [4] Annex B (PCM-64) and optionally Annex E (ADPCM -32).

6.9 Selection and Changing of Encoding (Ch 3.4.2)

The voice coding profiles to be supported are defined in section 6.23 and 6.24. Among them, the support of ATM Forum predefined Profile 9 is mandatory, while all others are optional.

6.10 Idle Channel Suppression (Ch 3.5)

When ELCP is not used, the IAD and Voice Gateway must support idle channel suppression by following the channel activation and de-activation procedures outlined in section 5.3.2.1 of af-vmoa-0145.000 [2].

When ELCP is used, the IAD and Voice Gateway must support idle channel suppression by following the channel activation and de-activation procedures outlined in section 5.3.1.1 of af-vmoa-0145.000 [2].

6.11 Silence Detection and Removal (Ch 3.6)

The IAD and Voice Gateway may optionally support silence detection and removal. If silence suppression is supported, then profile 7 and 8 shall be supported. When silence detection and removal are provided, the procedures outlined in ITU I.366.2 and the Generic SID defined in the default profile of Annex A should be utilized for this.

6.12 Echo Cancellation (Ch 3.7)

The IAD should support echo cancellation to cancel echo generated at the near end of the call. Echo generated by the local hybrid within the CP-IWF must be cancelled.

The Voice Gateway is responsible for ensuring echo generated at the far end of the call is cancelled. If the Voice Gateway inserts an echo canceller into the call, this must support an echo tail of at least 32ms, and preferably 64ms.

In all cases, the echo cancellation must be as specified in the applicable ITU-T recommendation G.168 [14].

6.13 Modem/Fax Call Handling

The master/slave mode of handling Codec switch-over as described in af-vmoa-0145.000 [2] shall be used.

6.14 DTMF Signaling Transport (Ch 3.8)

DTMF tones shall be passed transparently between IAD and CO switch.

(Support for DTMF relay as defined in ITU I.366.2 [4] Annex K is not required when using PCM-64 and ADPCM-32 Codecs.)

6.15 Transport of Voiceband Data (Ch 3.9)

Modem or Fax tones are passed transparently, when PCM-64 or ADPCM-32 coding are used. However, upon the detection of Modem or Fax tone, the CO-IWF must automatically switch the coding to PCM-64 coding, and the CP-IWF operating in master/slave mode must use the procedures as defined in section 7.2.3.1 of af-vmoa-0145.000 [2] to insure both CO-IWF and CP-IWF use the same coding. The fax demodulation and remodulation (fax relay) as defined in section 8.1 of af-vmoa-0145.000 is not considered in this document.

6.16 Emulated Loop Control Protocol (Ch 5.3.1)

ELCP protocol shall be supported by CO-IWF in CCS applications, but is optional for CP-IWF functions for POTS support.

ELCP is not required for CAS applications for POTS support.

ELCP protocol may be used for POTS support.

ELCP protocol shall be used for ISDN support.

ELCP protocol shall be used for mixed configuration support, *i.e.*, both POTS and ISDN BRI on the same IAD.

ELCP messages shall be exchanged between the IWFs over the common channel signaling (AAL2 CID=8).

ELCP message coding and procedures shall be as defined in section 5.3.1.1 of af-vmoa-0145.000 [2] for ELCP channel allocation and 5.3.1.2 of af-vmoa-0145.000 [2] for ELCP user port control.

The information transfer capability information element shall be sent by the voice gateway to support the detection of voice only calls in the IAD.

If the CPE does not support this information element, it shall ignore it.

Transport of ELCP messages shall comply to the common CCS procedures defined in section 5.4 of af-vmoa-0145.000 [2].

System startup shall be as defined in section 5.4.4.1 of af-vmoa-0145.000 [2].

System restart shall be as defined in section 5.4.4.2 of af-vmoa-0145.000 [2].

6.17 User Port Control via the LES EOC (Ch 5.3.2.2)

Support for user port control via the LES embedded operations channel is considered within scope.

6.18 Support for ATM OAM Cells (Ch 6.1)

The IAD may optionally provide support for the OAM F5 loopback, the OAM F5 AIS and the OAM F5 RDI cells as specified in section 6.1 of [2]. The reply of the OAM F5 loopback cells is mandatory for both IAD and Voice Gateway, while the generation of the OAM F5 loopback cells is optional.

6.19 LES Embedded Operations Channel (Ch 6.2)

LES Embedded Operation Channel as specified in section 6.2 of [2] shall be supported.

6.20 Selection of Profile Entry (Ch 7.2.3)

The IAD and Voice Gateway shall use master/slave mode.

6.21 Packet Delay Variation (Ch 9.1)

The IAD and Voice Gateway shall handle packet delay variation up to 20ms as specified in section 9.1 of af-vmoa-0145.000 [2]. Appendix A-2 of TR-039 [6] from the DSL Forum should be used as the reference for packet delay variation incurred at different stage of voice packet processing and transmission. In addition, IAD and Voice Gateway shall follow the procedures described in section 9.2 of af-vmoa-0145.000 [2] to mitigate the effect caused by the packet delay variation.

6.22 Timing Considerations (Ch 9.2)

A CP-IWF should use the derived clock locked to either the xDSL physical layer or CO-IWF AAL2 packets timing source. If a CP-IWF decides to use the free-running clock, as the minimal, the clock should have Stratum 3 accuracy.

6.23 ATM Forum Predefined Profiles (Annex A)

The following profiles, defined in Annex A of af-vmoa-0145.000 [2] shall be supported:

- Profile 9: PCM-64 without silence
- Profile 10: PCM-64, ADPCM-32, without silence

The following profiles may be supported.

- Profile 7: PCM-64, ADPCM-32 and silence
- Profile 8: PCM-64 and silence
- Profile 11 - PCM-64, ADPCM -32, 40 octet packets, without silence
- Profile 12 - PCM-64, ADPCM -32, 40 octet packets, with silence

6.24 ITU-T Predefined Profile

The following profiles, defined in Annex P of I.366.2 [4] may be supported:

- Profile 1: PCM-64
- Profile 2: PCM-64 and silence
- Profile 3: ADPCM -32 and silence

6.25 Default AAL2 VCC Parameters (Appendix E)

For the GR-303 market, in the case POTS only without ELCP protocol the IAD may optionally support the default parameters defined in Appendix E of af-vmoa-0145.000 [2].

6.26 CP-IWF MIB

If an IAD supports the LES EOC it shall support the following procedures. For each MIB Group the implementation guide specifies three classes of managed objects, which describe the support required by the IAD.

- **Mandatory:** IADs are required to fully implement mandatory managed objects.
 - For a read-write field the IAD must accept any legal value that it supports and configure the appropriate underlying behavior. If an IAD does not support the value specified in an SNMP SET it shall return a SNMP return code of badValue (3). If an IAD is unable to change the configuration in its current state, for example there are active calls, it shall return a SNMP return code of genErr(5).
 - For example there are 3 mandatory read-write managed objects in *cpIwfAal2Profile* group which control the voice encoding profile; *aal2SscsProfileSource*, *aal2SscsPredefinedProfileIdentifier*, *aal2SscsIeeeOui*. The IAD must implement these as read-write managed objects and support the values that specify the supported profiles, e.g., ATM Forum Profile 9 and 10 plus any optional profiles supported. It must change the profile in use when this object is modified via an SNMP SET.
 - For a read-only field the IAD must return the correct value of the object being queried in an SNMP GET response.
- **Default value only:** IADs are required to implement default value only managed objects in the MIB
 - It needs only support the default value specified in the MIB definition. This implies that it is not a requirement to tie the MIB field to the appropriate underlying behavior. This only applies to read-write managed objects.
 - For a read-write field the IAD must accept the default value, but can return a SNMP return code of badValue (3) for any other value.
- **Optional:** IADs are not required to implement the managed objects listed as optional,
 - Optional test cases are provided to test these managed objects. Later CallFest may make these objects mandatory.
 - If an IAD receives a GET or SET for an optional field that it has not implemented it shall return a SNMP return code of noSuchName (2).

Any other managed objects that are described in the MIB definitions but are not listed in the implementation guide need not be implemented.

6.26.1 SNMP Agent

The IAD shall use SNMP as specified in RFC 1157 [22]. The community string is set to "LESEOC", the OCTET STRING value: "4C4553454F43".

6.26.2 Updating Parameters

Many of the parameters supported by the various MIB groups have an impact on the voice service provided, for example changing the PCM encoding. Bullet 5 (below) of section 3.1 of af-vmoa-0175.000 [1] addresses this point, but makes it an EMS implementation issue to ensure that such changes are not made which might affect existing calls.

- Configuration changes to physical user ports, the CP-IWF, AAL SSCS and AAL CPS layers can be made regardless of the object's operational state. It is the responsibility of the administrator to ensure that changes are not made which might affect existing calls, for example changing the voice encoding profile for a CP-IWF while calls are in progress.

Several different implementations are possible, to ensure that configuration changes do not affect calls, including:

- Set the CP-IWF admin status to shuttingDown and wait for all calls to end prior to making any configuration changes. This requires additional SNMP commands to change the *cpIwfAdminStatus* object.
- Implicitly set the CP-IWF status to shuttingDown at the CO-IWF, *i.e.*, disallow any further call attempts, and wait for all calls to end prior to making any configuration changes.
- Immediately drop all calls and then make the configuration changes.

The implementation guidelines and test plan do not assume any particular choice has been made to address this issue.

Similarly the implementation guidelines do not assume any particular choice has been made to address error cases if the CP-IWF receives attempts to change configuration which affect existing calls, but one implementation is to return an SNMP return code of genErr(5).

Note: The CP-IWF can not assume that the admin state will be set to down before any configuration changes are made, although this is one possible implementation.

6.26.3 System Group

The following managed objects as defined in System Group of MIB II in RFC1213 [22] shall be supported.

- **Mandatory Managed object:**
 - *sysUpTime*

6.26.4 Interfaces MIB

The following managed objects as defined in Interface MIB in RFC 2863 [23] shall be supported.

- **Mandatory Managed objects:**
 - *ifIndex*
 - *ifType*
 - *ifName*
 - *ifAdminStatus* (support for testing is optional)
 - *ifOperStatus*
 - *ifLastChange*

6.26.5 cplwf Group

The following managed objects as defined in cpIwf Group in CP-IWF MIB [1] shall be supported.

- **Mandatory Managed objects:**
 - *cpIwfVpi*

- *cpIwfVci*
 - *cpIwfEchoCancellationSupport*
 - *cpIwfNumPotsPorts* (only required for POTS support)
 - *cpIwfNumIsdnBriPorts* (only required for ISDN support)
 - *cpIwfTimingReference*
 - *cpIwfAdminStatus* (support for testing mode is optional)
 - *cpIwfOperStatus*
 - *cpIwfCurrentConfig*
 - *cpIwfTrapGeneration* (support for enabled is optional)
 - *cpIwfVendorName*
 - *cpIwfDeviceType*
 - *cpIwfHardwareVersion*
 - *cpIwfSoftwareVersion*
 - *cpIwfV5PSTNProtocolVariant* (only required for CCS support)
- **Default Value Only Managed objects:**
 - *cpIwfPotsPortEncodingSelectionMode* (masterSlave) (only required for POTS support)
 - *cpIwfIsdnBriPortEncodingSelectionMode* (masterSlave) (only required for ISDN support)
 - *cpIwfPlayoutBufferDepth* (20 milliseconds)
 - *cpIwfImpairmentInterval* (15 minutes)
 - *cpIwfImpairmentThreshold* (0)
 - *cpIwfMwdForRestart* (600 seconds)
 - *cpIwfEocBandwidth* (32000 bits per second)
 - *cpIwfElcpAndPstnChannelBandwidth* (64000) (only required for CCS and ISDN support)
 - **Optional Managed objects:**
 - *cpIwfRestart*
 - *cpIwfTestType*
 - *cpIwfTestResult*
 - *cpIwfTestResultText*

6.26.6 cplwfAal2Profile Group

The following managed objects as defined in *cpIwfAal2Profile* group in CP-IWF MIB [1] shall be supported.

- **Mandatory Managed objects:**
 - *aal2SscsPcmEncoding* It is only required to support the A-law or μ -law encoding used in the target market, μ -law in North America, A-law elsewhere)
 - *aal2SscsProfileSource*
 - *aal2SscsPredefinedProfileIdentifier*
 - *aal2SscsIeeeOui*
- **Default Value Only Managed objects:**
 - *aal2ApplicationIdentifier* ('0000000A'H)
 - *aal2CpsMaxMultiplexedChannels* (255)
 - *aal2CpsMaxSDULength* (45)
 - *aal2CpsCIDLowerLimit* (16)
 - *aal2CpsCIDUpperLimit* (223)
 - *aal2CpsOptimisation* (singleCpsPacketPerCpsPduNoOverlap)
 - *aal2CpsTimerCuValue* (0)
 - *aal2SscsFaxDemodulationTransport* (disabled)

- *aal2SscsDtmfDigitPacketTransport* (disabled)
- *aal2SscsMaxSsarSduLength* (1500)
- *aal2SscsSsSarAssemblyTimerValue* (2147483647)

6.26.7 cplwfPotsPortTable Group

The following managed objects as defined in *cpIwfPotsPortTable* group in CP-IWF MIB [1] shall be supported for supporting POTS

- **Mandatory Managed objects:**
 - *signalingMethod* (support for loop-start required, other values optional)
 - *potsPortLabel*
 - *potsPortNumber*
- **Default Value Only Managed objects:**
 - *potsPhysicalPort* (allocated from interfaces MIB ifindex)
 - *aal2ChannelId* (allocated sequentially from channel 16)

Note: The *potsPhysicalPort* field is populated by the IAD as per its implementation of the interfaces MIB. The EMS can not set the field to any other value, *i.e.*, field is pseudo read-only.

- **Optional Managed object:**
 - *potsPortTestType*

6.26.8 cplwfIsdnBriPortTable Group

The following managed objects as defined in *cpIwfIsdnBriPortTable* group in CP-IWF MIB [1] shall be supported for supporting ISDN BRI

- **Mandatory Managed objects:**
 - *isdnBriPortLabel*
 - *isdnBriPortNumber*
- **Default Value Only Managed objects:**
 - *cpIwfIsdnBriPhysicalPort* (allocated from interfaces MIB ifindex)
- **Optional Managed object:**
 - *isdnBriPortTestType*
 - *aal2ChannelIdD* (only supported when ELCP is not used)
 - *aal2ChannelIdB1* (only supported when ELCP is not used)
 - *aal2ChannelIdB2* (only supported when ELCP is not used)

6.26.9 cplwfPotsPortStatsTable

The IAD may optionally support *cpIwfPotsPortStatsTable*.

6.26.10 cplwfIsdnBriPortStatsTable

The IAD may optionally support *cpIwfIsdnBriPortStatsTable*.

6.26.11 cplwfAal2Stats Group

The IAD may optionally support *cpIwfAal2Stats* Group.

6.26.12 Traps

- *coldStart* trap: The IAD must send this trap when it is restarted, unless all generation of all traps has been disabled.
- *cpIwfInsufficientPhysicalBandwidth* trap: The IAD may optionally send this trap unless generation of traps has been disabled.
- *cpIwfExcessImpairment* trap: The IAD may optionally send this trap unless generation of traps has been disabled.

6.26.13 Traffic Shaping on the LES-EOC

Both the IAD and Voice Gateway shall limit the rate of cell transmissions on the LES-EOC to 100 cells per second as described in section 6.2.2 of [2].

6.26.14 Start-up Procedures

Both the IAD and Voice Gateway shall at least support the Basic Flow Without Port Blocking start-up procedure as described in section 7 and appendix A.1.2.3 of [1].

The MWD timer should be started when the IAD is powered-on.

The *coldStart* trap is sent when the MWD timer elapses, or when an activity is detected. Activity includes any line state changes and activity on the LES EOC, *e.g.*, a SNMP request from the CO-IWF. If an SNMP request is received across the LES EOC, the *coldStart* trap is sent before replying.

6.26.15 Test Procedures

The IAD may optionally support the following tests using the CP-IWF MIB

- IAD self-test
- Loopback test for a POTS port

If supported loopback testing shall be carried out according to the procedures described in Appendix A.4 of [1].

7 Test Configuration

Figure 1 shows the test configuration for the interoperability test of IADs and Voice Gateways. The SNI interface upstream from the Voice Gateway to the Service Node is not relevant to the test infrastructure. Thus, the Voice Gateway can interface to a CO switch via GR-303, V5.x, or to the PSTN via SS7 if the CO switch functions were implemented in the Voice Gateway. An IAD is connected to the Voice Gateway via the ATM Access network, which may consist of DSLAM and ATM switch. Analog POTS phones and ISDN terminals connected to the IAD are used to conduct the telephony test.

For Voice Gateways that require a separate CO switch, it can be either a simulator or a Class 5 or ISDN switch, which performs circuit-switched telephony functions.

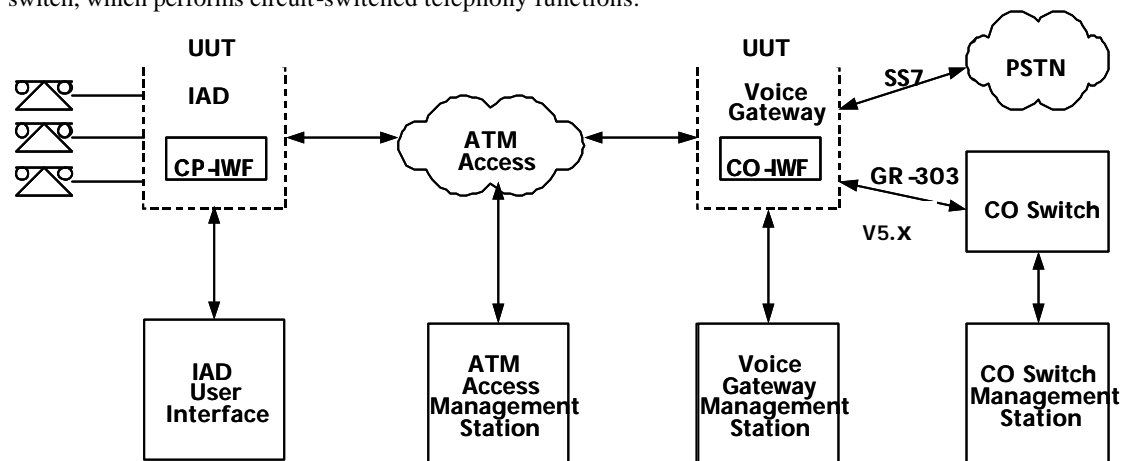


Figure 1: Interoperability Test Configuration

7.1 Physical Layer Interface

The physical layer interfaces between IAD, ATM, Access, Voice Gateway, and CO Switch shall comply with the following recommendations.

- IAD to ATM Access: ATM over ADSL recommendation as described in DSL Forum TR-017, ATM over SDSL, or ATM over T1, E1, DS-3, or OC-3.
- Voice Gateway to ATM Access: ITU-TI.432.x [8] – [12].
- Voice Gateway to CO Switch: DS1, DS3, or OC3 for GR-303, E1 for V5.x

7.2 Network Configuration

To provide voice over AAL2 LES, three Network Management functions are required to manage CO Switch (if present), Voice Gateway/ IAD, and ATM Access, respectively. As shown in Figure 1, each Network Management function is controlled by one management station. The description of the Network Management functions is listed in the following:

- CO Switch: When a new subscriber is added, CO Switch management function is responsible for the provisioning of the subscriber database in the CO Switch, and of Voice Gateway with parameters (*e.g.*, CRV (Call Reference Value) or L3 address, signaling methods).
- Voice Gateway / IAD: Voice Gateway management function is responsible for the management of CO-IWF and CP-IWF in Voice Gateway and IAD respectively. It provides

parameters, such as VPI/VCI of the bearer channel, speech coding (*e.g.*, G.711, G.726), silence suppression, expansion scheme (*e.g.*, μ -law/A-law).

- **ATM Access:** ATM Access management function is responsible for the management of ATM bearers that are used to tunnel the voice streaming, signaling, and management information. The management functions shall include, but not limited to, PVC provisioning, traffic descriptor provisioning.

According to the supported services, POTS or/and ISDN BRI, the test configuration, shall contain analog phones, modems, faxes, ISDN terminals, CO Switch or switch simulator, ATM Access and the appropriate network management equipment.

Vendors attending test events shall provide the IADs, Voice Gateways and the necessary management equipment.

7.3 Test Equipment

Figure 2 shows a diagram to describe test equipment and setup needed to conduct the interoperability test

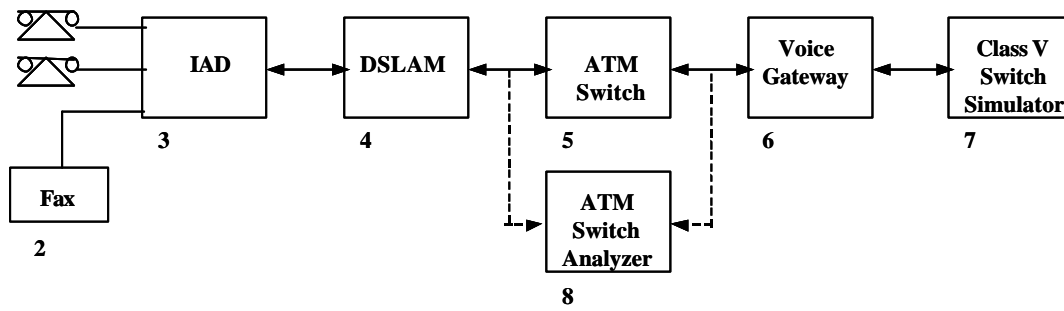


Figure 2: Test Diagram

However, Test participants should also provide some basic monitoring and control capabilities of their products under test to enable investigation of any faults during testing.

Table 2 lists the test equipment as identified in Figure 2 and additional equipment that are needed for the interoperability test.

Table 2: Test Equipment List

Test Equipment	Qualities
POTS Telephone (1)	10
ISDN terminals (phones/data/faxes)	10
Fax (2)	2
IAD (3)	
DSLAM (4)	2
ATM Switch (5)	1
Voice Gateway (6)	
Class 5 Switch Simulator (7)	1
ATM Protocol Analyzer (8)	1
PC with modem card	2
Voice Quality Measurement	2
IAD / Voice Gateway Debugging tools	

7.4 Test Description

Record the equipment tested.

Table 3: Voice gateway Features Table (Informative)

Make	
Model Number	
Software Version	

Table 4: CPE Features Table (Informative)

Make	
Model Name	
Software Version	

8 Test Cases

The test plan is composed of test groups that are intended to test each specific function or feature of the VoDSL applications. The first test group tests the basic telephony feature with minimal configuration on both Voice Gateway and IAD. Gradually, when a feature has passed the test cycle, then additional features, such as multiple phones, multiple IAD, provisioning, are added. Test groups will be used to test them accordingly.

Prior to the execution of any test groups as defined in this section, the following configurations should be performed in the CO Switch and ATM Access.

- CO Switch management function shall provision the CO switch subscriber database to activate the PSTN ports, the ISDN ports and IAD ISDN or PSTN ports. Mainly, the provision shall provide directory number, and signaling method.
- Voice Gateway management function shall provision the Voice Gateway by provide CRV or L3 address to IAD/ POTS number mapping and EF address to IAD/ISDN user port number mapping (as defined in figures C-2 and C-4 of af-vmoa-0145.000 [2]).
- Voice Gateway management function shall provide Voice Gateway the VPI/VCI of the VCC used for the voice streaming. Example: VPI/VCI = 0/40.
- ATM Access management function shall create a PVC connecting an IAD to the Voice Gateway.
- The AppId for the AAL2 PVC shall be mutually agreed between the IAD and VoiceGateway.
- The following AppId should be tested:
 - 0x000000A, Loop Emulation Service using CAS (POTS only) without ELCP.
 - 0x000000B, Loop Emulation Service using PSTN signaling (POTS only) without ELCP
 - 0x000000C, Loop Emulation Service using PSTN signaling (POTS only) with ELCP
 - 0x000000E, Loop Emulation Service using DSS1in support of BRI (BRI only) with ELCP
 - 0x0000011, Loop Emulation Service using PSTN signaling in support of POTS and DSS1in support of BRI with ELCP
- The PVC shall have a traffic descriptor sufficient to handle the voice and signaling traffic.

9 POTS Service Test Cases

9.1 Test Group 1: POTS Basic Telephony Test

This test group tests the basic telephony functions, such as call originating, call termination, distinctive ringing. This test suite assumes the minimal configuration. This test group requires one POTS port in the IAD. To simplify the test, there should not be any data traffic coming out of the IAD.

Depending on the type and capabilities of the IAD and the voice gateways provided by the vendors the following parameters have to be agreed and configured by the parties:

1. AAL2 PVC with VPI/VCI = 0/40 (IAD values),
2. AppId = 0xA or 0xB CID = 16, if ELCP is not supported
Appid = 0xC or 0x11, if ELCP is supported
3. ATM predefined profile = 9, (G.711, without silence compression)
4. PCM expansion scheme μ -law/A-law
5. AAL2 PVC traffic descriptor,
PCR = 955, SCR = 191, MBS = 16, CDVT = 20ms, for rtVBR
PCR = 191 cells/s CDVT = 20ms, for CBR
6. Loop start (GR-303 specific)

9.1.1 Test Case 1.1: Call Origination DTMF

The purpose of this test case is to verify whether an IAD phone can call a PSTN phone by using DTMF dialing.

Actions	Responses
1. The POTS phone goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Press the first DTMF digit	2. Verify that the dial tone disappears.
3. Dial the rest of the digits	3. Verify that call origination succeeds when ring back tone is heard or fails when busy tone is heard.
4. Test the voice communication	4. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
5. The POTS phone goes On-hook	5. Verify the call is released.

9.1.2 Test Case 1.2: Call Origination Dial Pulses

The purpose of this test case is to verify whether an IAD phone can call a PSTN phone by using pulse dialing.

Actions	Responses
1. The POTS phone goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the first digit	2. Verify that the dial tone disappears.
3. Dial the rest of the digits	3. Verify that call origination succeeds when ring back tone is heard or fails when busy tone is heard.
4. Test the voice communication.	4. Verify the talk path.
5. The POTS phone goes On-hook	5. Verify the call is released.

9.1.3 Test Case 1.3: Call Termination

The purpose of this test case is to verify that a PSTN phone can call an IAD phone.

Actions	Responses
1. Use a PSTN phone to call an IAD POTS phone	1. Verify that the IAD phone is rung properly.
2. IAD phone goes Off-hook	2. Verify ring trip.
3. Test the voice communication.	3. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
4. The POTS phone goes On-hook	4. Verify the call is released.

9.1.4 Test Case 1.4: Distinctive Ringing

The purpose of this test case is to verify that the IAD can play specific ringing pattern to indicate for instance that the incoming call is a long distance phone call.

Actions	Responses
1. Use a PSTN phone located in different calling domain to call an IAD POTS phone	1. Verify that the IAD phone is rung by a distinctive ringing pattern.
2. IAD phone goes Off-hook	2. Verify ring trip.
3. Test the voice communication.	3. Verify the talk path.
4. The POTS phone goes On-hook	4. Verify the call is released.

9.1.5 Test Case 1.5: Call Waiting

The purpose of this test case is to verify that Call-waiting tone can be heard by the IAD phone, and the hook-flash from IAD is able to trigger the call-waiting feature.

Actions	Responses
1. An IAD phone calls a PSTN phone A.	1. Verify the talk path between the IAD phone and PSTN phone A.
2. Another PSTN phone B calls the IAD phone	2. Verify that call-waiting tone is heard on the IAD phone.
3. IAD phone presses hook flash	3. Verify that the IAD phone can answer the call waiting and connect to phone B.
4. IAD phone presses hook flash again	4. Verify that the IAD phone can talk to phone A previously put on hold.
5. The IAD phone and PSTN phone A go On-hook	5. Verify the call is released, and the IAD phone is rung back.
6. Answer the IAD phone.	6. Verify the talk path between the IAD phone and PSTN phone B
7. The IAD phone and PSTN phone B go On-hook	7. Verify the call is released

9.1.6 Test Case 1.6: Caller ID

The purpose of this test case is to verify that the Caller ID and Caller Name can be transported over the AAL2 VCC.

Actions	Responses
1. An IAD phone is equipped with the caller ID display.	1.
2. A PSTN phone calls the IAD phone	2. Verify that caller's name and telephone number are shown on the caller ID display.
3. IAD phone goes Off-hook	3. Verify that the IAD phone can answer the call.
4. Test the voice communication.	4. Verify the talk path.
5. IAD phone goes On-hook	5. Verify the call is released.

9.1.7 Test Case 1.7: Call Parking

The purpose of this test case is to verify that a call can be parked by one IAD phone and retrieved by another IAD phone.

Actions	Responses
1. A PSTN phone calls a IAD phone	1. Verify the talk path.
2. IAD phone is answered	2.
3. IAD phone call is 'parked'	3. Verify that a proper special response tone is received by the IAD phone
4. Call is retrieved from another IAD phone that belongs to the same CENTREX group	4. Verify that the parked call can be retrieved.

Note: this is an optional test that requires Centrex support in the Class 5 switch or emulator.

9.1.8 Test Case 1.8: Ground Start Call Origination

The purpose of this test is to verify that a ground start port can originate a call. It repeats Test Case 1.1 using an IAD POTS port with ground start.

Note: not applicable for ETSI V5.x SNI.

9.1.9 Test Case 1.9: Ground Start Call Termination

The purpose of this test is to verify that a ground start port can terminate a call. It repeats Test Case 1.3 using an IAD POTS port with ground start.

Note: not applicable for ETSI V5.x SNI.

9.1.10 Test Case 1.10: Permanent Signaling Condition

The purpose of this test is to verify that permanent signaling condition is supported correctly, including AAL2 channel deactivation.

Actions	Responses
1. The IAD Phone goes Off-hook.	1. Verify that dial tone is received.
2. Wait until dial tone is removed.	2. Verify that ROH (howler) tone is played.
3. Wait until ROH tone removed.	3. Verify that the channel is deactivated.
4. The IAD Phone goes on-hook	4.
5. The AID Phone goes Off-hook.	5. Verify that dial tone is received.
6. Hang-up the IAD phone	6. Verify call is released.

9.1.11 Test Case 1.11: Network Failure– Layer 1

The purpose of this test is to verify that network failures at layer 1 are handled correctly.

Actions	Responses
1. An IAD phone goes Off-hook.	1. Verify that dial tone is received.
2. Call a PSTN phone	2. Verify that audible ringing is heard.
3. Answer the call at the PSTN phone	3. Verify that the ringing is removed and that voice communication occurs.
4. Disconnect wan cable from IAD	4. Verify call is lost
5. Hang-up both phones	5.
6. Reconnect wan cable to IAD and allow the layer 1 interface to synchronize.	6.
7. Repeat steps 1-3	7. Verify call is successful.
8. Hang-up both phones	8. Verify call is released.

9.1.12 Test Case 1.12: Network Failure– Layer 2

The purpose of this test is to verify that network failures at layer 2 are handled correctly.

Actions	Responses
1. An IAD phone goes Off-hook.	1. Verify that dial tone is received.
2. Call a PSTN phone	2. Verify that audible ringing is heard.
3. Answer the call at the PSTN phone	3. Verify that the ringing is removed and that voice communication occurs.
4. Put the PVC between the IAD and Voice Gateway in admin state down. Note: depending on the network this may be achieved using the ATM switch or DSLAM.	4. Verify call is lost
5. Hang-up both phones	5.
6. Put the PVC between the IAD and Voice Gateway in admin state up	6.
7. Repeat steps 1-3	7. Verify call is successful.
8. Hang-up both phones	8. Verify call is released.

9.1.13 Test Case 1.13: No Dial-tone

This test case verifies the behavior of the IAD if dial tone is not received from the Voice Gateway, including verifying that implicit channel activation has been implemented correctly.

Actions	Responses
1. At the voice gateway configure IAD port 1 such that the user port is blocked and hence the Class 5 switch does not send dial tone.	1.
2. An IAD phone goes Off-hook.	2. Verify that no dial tone is received and the IAD does not send any voice packets.
3. Wait 4 seconds	3. Verify that the IAD plays re-order tone. Note: re-order tone must not be played in case of ETSI V5.x SNL.

9.2 Test Group 2: Multiple POTS Ports on an IAD

This test suite tests the capability of an IAD to support multiple POTS lines. It reuses the test cases in Test Group 1 to test every single port. Since not all ports will be active at the same time, it is very common that an IAD is oversubscribed. An over-subscription test is included to test how the gateway behaves, when all ports are active at the same time. This test suite requires IAD to support more than 1 POTS port and one Voice Gateway. Successful execution of this suite requires that the Class 5 switch or simulator and Voice Gateway have a flexible means of matching user port & CRV or L3 address.

Depending on the type and capabilities of the IAD and the voice gateways provided by the vendors the following parameters have to be agreed and configured by the parties:

1. AAL2 PVC with VPI/VCI = 0/40 (IAD values),
2. AppId = 0xA or 0xB CID = 16, 17, 18, 19, if ELCP is not supported
Appid = 0xC or 0X11, if ELCP is supported
3. ATM predefined profile = 9, (G.711, without silence compression)
4. PCM expansion scheme μ -law/A-law.
5. AAL2 PVC traffic descriptor,
PCR = 3820, SCR = 764, MBS = 16, CDVT = 20ms, for rtVBR
PCR = 764 cells/s, CDVT = 20ms, for CBR
6. Loop start (GR -303 specific)

9.2.1 Test Case 2.1: POTS Lines Sequencing

This test case uses Test Case 1.1 and 1.3 to test each analog port sequentially to verify that calls can be initiated from each POTS line, and terminated on the correct POTS line.

9.2.2 Test Case 2.2: POTS lines Loading

This test case uses Test Case 1.1 and 1.3 to verify that all POTS lines can be active at the same time, there is no interference between the ports, and verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.

9.2.3 Test Case 2.4: IAD Phone to IAD Phone

This test case verifies that POTS line 1 can call POTS line 2 within the same IAD. Since the voice path travels through two LES hops, the voice quality should be measured to make sure packet latency does not cause voice degradation.

Actions	Responses
1. The POTS line 1 goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the first digit	2. Verify that the dial tone disappears.
3. Dial the rest of the digits for POTS line #2	3. Verify that call origination succeeds when ring back tone is heard on port # 1, while port #2 is rung.
4. Test the voice communication.	4. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
5. The POTS line 1 goes On-hook	5. Verify the call is released.

9.3 Test Group 3: Multiple IADs and Voice Gateway

This test suite contains test cases to verify voice over broadband applications in the multiple IAD and multiple Voice Gateway environments. It shall provide voice quality information as voice packet travel thought dual LES hops. This test suite requires two IAD and two Voice Gateways.

Depending on the type and capabilities of the IAD and the voice gateways provided by the same configuration as in test group 2 shall be pre-configured.

9.3.1 Test Case 3.1: Two IADs and one Voice Gateway

This test case verifies that one Voice Gateway can support multiple IADs. Port #1 of IAD #1 will call port #1 of IAD #2.

Actions	Responses
1. Port #1 of IAD #1 goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the first digit	2. Verify that the dial tone disappears.
3. Dial the rest of the digits for port #1 of IAD #2	3. Verify that call origination succeeds when ring back tone is heard on port # 1 of IAD #1, while port #1 of IAD #2 is rung.
4. Test the voice communication.	4. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
5. Both port #1 of IAD #1 and #2 go On-hook	5. Verify the call is released.

9.3.2 Test Case 3.2: Two IADs and two Voice Gateway

This test case verifies a call going through two IADs and two Voice Gateways. This test case reuses test case 3.1 with the following configuration.

- IAD #1 is connected to Voice Gateway #1
- IAD #2 is connected to Voice Gateway #2

9.4 Test Group 4: Manual Provisioning

This test suite contains test cases to verify that the IAD and Voice Gateway can support different profiles, coding schemes, and signaling. The configuration will be changed through manual provision in IAD and Voice Gateway.

9.4.1 Test Case 4.1: PVC Provisioning

Test case 4.1 uses different VPI/VCI to test that voice can be carried over different AAL2 channel. Both IAD and Voice Gateway will be provisioned manually to use VPI/VCI 1/32. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using profile 9.

9.4.2 Test Case 4.2: Profile 7 (PCM-64)

This test case is dependent on the optional support of profile 7.

Test case 4.2 tests the profile 7 using PCM-64 coding with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use profile 7, PCM-64 coding prior to the test. It will use UUI code points 0-7 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using PCM-64 coding with silence suppression.

9.4.3 Test Case 4.3: Profile 7 (ADPCM)

This test case is dependent on the optional support of profile 7.

Test case 4.3 tests the profile 7 using ADPCM-32 coding with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use profile 7, ADPCM coding prior to the test. It will use UUI code points 8-15 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using ADPCM coding with silence suppression.

9.4.4 Test Case 4.4: ATM Profile 8

Test case 4.4 tests the ATM profile 8 using PCM-64 coding with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 8, PCM-64 coding prior to the test. It will use UUI code points 0-15 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using PCM-64 coding with silence suppression.

9.4.5 Test Case 4.5: ATM Profile 10 (PCM-64)

Test case 4.5 tests the ATM profile 10 using PCM-64 coding without silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 10, PCM-64 coding prior to the test. It will use UUI code points 0-7 for voice packets. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using PCM-64 coding without silence suppression.

9.4.6 Test Case 4.6: ATM Profile 10 (ADPCM)

Test case 4.6 tests the ATM profile 10 using PCM-32 coding without silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 10, ADPCM coding prior to the test. It will use UUI code points 8-15 for voice packets. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using ADPCM coding without silence suppression.

9.4.7 Test Case 4.7: ATM Profile 11 (PCM-64)

Test case 4.7 tests the ATM profile 11 using PCM-64 coding and 40 octet packets without silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 11, PCM-64 coding prior to the test. It will use UUI code points 0-7 for voice packets. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using PCM-64 coding with silence suppression.

9.4.8 Test Case 4.8: ATM Profile 11 (ADPCM)

Test case 4.8 tests the ATM profile 11 using PCM-32 coding and 40 octet packets without silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 11, ADPCM coding prior to the test. It will use UUI code points 8-15 for voice packets. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using ADPCM coding with silence suppression.

9.4.9 Test Case 4.9: ATM Profile 12 (PCM-64)

Test case 4.9 tests the ATM profile 11 using PCM-64 coding and 40 octet packets with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 11, PCM-64 coding prior to the test. It will use UUI code points 0-7 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using PCM-64 coding with silence suppression.

9.4.10 Test Case 4.10: ATM Profile 12 (ADPCM)

Test case 4.10 tests the ATM profile 11 using PCM-32 coding and 40 octet packets with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ATM profile 11, ADPCM coding prior to the test. It will use UUI code points 8-15 for voice packets and code points 0-7 for SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using ADPCM coding with silence suppression.

9.4.11 Test Case 4.11: ITU P.1 Profile (PCM-64, 40 Octets)

Test case 4.11 tests the ITU P.1 profile using PCM-64 coding and 40 octet packets without silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ITU P.1 profile, PCM-64 coding prior to the test. It will use UUI code points 0-15 for voice packets. It uses test cases 1.1 and 1.3 to

verify that a call can be setup successfully using PCM-64 coding without silence suppression.

9.4.12 Test Case 4.12: ITU P.2 Profile (PCM64, 40 Octets)

Test case 4.12 tests the ITU P.2 profile using PCM-64 coding and 40 octet packets with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use ITU P.2 profile, PCM-64 coding prior to the test. It will use UUI code points 0-15 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using ADPCM coding with silence suppression.

9.5 Test Group 5: FAX and Voice-band Modem

This test suite contains test cases to verify that Fax and voice-band modem data can be transported over the AAL2 VCC without any degradation. Depending on the type and capabilities of the IAD and the voice gateways provided by the vendors the same configuration as for test group 2 shall be preconfigured. The ECM error correction feature of Fax machines, if available, should be disabled during the fax test. Modem compression, V.42bis shall be disabled during the modem test.

9.5.1 Test Case 5.1: Fax Test (IAD → PSTN)

This test case tests that a Fax machine connected to an IAD can send a fax to another Fax machine connected to the PSTN.

Actions	Responses
1. Fax phone on line 1 goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the Fax number on the PSTN	2. Verify that the IAD Fax rings and answers the call automatically.
3. Verify the Fax tone handshake completed successfully.	3.
4. Feed the Fax machine (IAD) a single standard text.	4. Verify the fax is received from the Fax machine connected to IAD correctly.
5. Fax phone on line 1 goes On-hook	5. Verify the call is released.

9.5.2 Test Case 5.2: Fax Test (PSTN → IAD)

This test case tests that a Fax machine connected to the PSTN can send a fax to another Fax machine connected to the IAD.

Actions	Responses
1. Fax phone connected to PSTN goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the Fax number of the IAD	2. Verify that the IAD Fax rings and answers the call automatically.
3. Verify the Fax tone handshake completed successfully.	3.
4. Feed the Fax machine (PSTN) a text page to send a fax.	4. Verify the fax is received from the Fax machine connected to IAD correctly.
5. Fax phone connected to PSTN goes On-hook	5. Verify the call is released.

9.5.3 Test Case 5.3: Fax Test (IAD → IAD)

This test case tests that a Fax machine connected to an IAD (port #1) can send a fax to another Fax machine connected to port #2.

Actions	Responses
1. Fax phone on line 1 goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the Fax number of line 2	2. Verify that the Fax connected to line 2 rings and answers the call automatically.
3. Verify the Fax tone handshake completed successfully.	3.
4. Feed the Fax machine (#1) a text page to send a fax.	4. Verify the fax is received from the Fax machine (#2) correctly.
5. Fax phone connected to PSTN goes On-hook	5. Verify the call is released.

9.5.4 Test Case 5.4: PC Fax Test (IAD → PSTN)

This test case tests that a PC Fax connected to an IAD can send a long fax document to another PC Fax connected to the PSTN.

Actions	Responses
1. PC Fax A on line 16 calls PC Fax B on the PSTN	1. Verify that PC Fax B rings and answers the call automatically.
2.	2. Verify the Fax tone handshake completed successfully and faxes connect at 14400 bps.
3. PC Fax A sends a long Fax document.	3. Verify PC Fax B receives the long Fax document correctly.
6. PC Fax A goes On-hook	4. Verify the call is released.

9.5.5 Test Case 5.5: PC Fax Test (PSTN → IAD)

This test case tests that a PC Fax connected to the PSTN can send a long fax document to another PC Fax connected to the IAD.

Actions	Responses
1. PC Fax B on the PSTN calls PC Fax A on IAD	1. Verify that PC Fax A rings and answers the call automatically. Verify the Fax tone handshake completed successfully and faxes connect at 14400 bps.
2. PC Fax B sends a long Fax document.	2. Verify PC Fax A receives the long Fax document correctly.
3. PC Fax B goes On-hook	3. Verify the call is released.

9.5.6 Test Case 5.6: PC Fax Test (IAD → IAD)

This test case tests that a PC Fax connected to an IAD (port #1) can send a long fax document to another PC Fax connected to port #2.

Actions	Responses
1. PC Fax A on line 1 calls PC Fax B on line 2.	1. Verify that PC Fax B rings and answers the call automatically. Verify the Fax tone handshake completed successfully and faxes connect at 14400 bps.
2. PC Fax A sends a long Fax document B.	2. Verify PC Fax B receives the long Fax document correctly.
3. PC Fax A goes On-hook	3. Verify the call is released.

9.5.7 Test Case 5.7: Modem Test (IAD → PSTN)

This test case tests that a V.34 modem connected to an IAD port can communicate another V.34 modem connected to a PSTN port. This test uses a terminal emulator application to control the modems.

Actions	Responses
1. IAD phone on port 1 calls another PSTN phone.	1. Verify that the modem connection is setup properly and is at least 26400bps
2. Type multiple sentences	2. Verify that they appear on the other side in a timely fashion
3. Send 1MB file transfer using zmodem	3. Verify file transfer is successful and no retries are observed with the terminal emulator application. Verify the throughput is at least 90% of the connection rate.
4. IAD phone releases the modem connection	4. Verify the connection is released successfully

9.5.8 Test Case 5.8: Modem Test (PSTN → IAD)

This test case tests that a V.34 modem connected to a PSTN port can communicate another V.34 modem connected to an IAD port. This test uses a terminal emulator application to control the modems.

Actions	Responses
1. PSTN phone calls an IAD phone.	1. Verify that the modem connection is setup properly.
2. Type multiple sentences.	2. Verify that they appear on the other side in a timely fashion.
3. Send 1MB file transfer using the zmodem file transfer protocol.	3. Verify file transfer is successful and no retries are observed with the terminal emulator application. Verify the throughput is at least 90% of the connection rate.
4. IAD phone releases the modem connection.	4. Verify the connection is released successfully.

9.5.9 Test Case 5.9: Modem Test (IAD → IAD)

This test case tests that a V.34 modem connected to an IAD on port 1 can communicate with another V.34 modem connected to the IAD port 2. This test uses a terminal emulator application to control the modems.

Actions	Responses
1. IAD phone on port 1 calls another IAD phone on port 2.	1. Verify that the modem connection is setup properly.
2. Type multiple sentences	2. Verify that they appear on the other side in a timely fashion.
3. Send 1MB file transfer using the zmodem file transfer protocol.	3. Verify file transfer is successful and no retries are observed with the terminal emulator application. Verify the throughput is at least 90% of the connection rate.
4. IAD phone releases the modem connection.	4. Verify the connection is released successfully.

9.5.10 Test Case 5.10: 23-Tone Test

This test case uses a Voice Quality Analyzer to execute a 23-tone test.

Note this test is supported by a Sage 935AT tester.

Actions	Responses
1. Execute 23 Tone test between IAD phone on port 1 and IAD phone on port 2	1. Verify Signal to Noise ratio is greater than 32dB
2. Execute 23 Tone test between IAD phone on port 1 and the PSTN	2. Verify Signal to Noise ratio is greater than 32dB

9.5.11 Test Case 5.11: Codec Switchover for Fax/Modem

This test case is intended to verify that the Codec should be switched to high bit-rate voice encoding (*i.e.*, G.711) when fax or voiceband data is transported. The voice channel should use a profile supporting G.711, G.726, with or without silence suppression. Prior to the test, CO-IWF should use G.726.

Note: If an IAD supports echo cancellation, and uses a profile with silence suppression, then both silence suppression and echo cancellation should be disabled when a 2100Hz Fax tone with phase reversal is detected.

Actions	Responses
1. Fax phone on line 1 goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Dial the Fax number of line 2	2. Verify that the Fax connected to line 2 rings and answers the call automatically. Verify both IAD and voice gateway should switch codec to G.711, <i>e.g.</i> , by checking UUI codepoint of the AAL2 bearer packets.
3. Feed the Fax machine (#1) a text page to send a fax.	3. Verify the fax is received from the Fax machine (#2) correctly.
4. Fax phone on line 1 goes On-hook	4. Verify the call is released.
5. Fax phone on line 1 goes Off-hook again	5. Verify the dial tone starting within 1 sec, and G.726 codec is used, <i>e.g.</i> , by checking UUI codepoint of the AAL2 bearer packets.
6. Dial the Fax number of line 2	6. Verify that the Fax connected to line 2 rings and answers the call automatically.
7. Fax phone on line 1 goes On-hook	7. Verify the call is released.

9.5.12 Test Case 5.12: Clipping

Use a voice quality analyzer to verifying that Clipping is not more than 10 ms.

Note: The PVIT test supported by the SAGE 935 AT is suitable.

9.5.13 Test Case 5.13: Idle Channel Suppression

This test case verifies that no bearer packet is transmitted when the channel is idle.

Actions	Responses
1. An IAD phone goes Off-hook.	1. Verify that dial tone is received.
2. Call a PSTN phone	2. Verify that audible ringing is heard.
3. Answer the call at the PSTN phone	3. Verify that the ringing is removed and that voice communication occurs.
4. Use an ATM Protocol Analyzer to monitor the AAL2 bearer packets.	4. Verify that voice bearer packets are transmitted over the channel associated with given by the CID.
5. IAD phone goes on-hook.	5. Verify the call is released.
6. Use an ATM Protocol Analyzer to monitor the AAL2 bearer packets.	6. Verify that no bearer packet is transmitted over the channel given by the CID.

9.5.14 Test Case 5.14: Silence Insertion Descriptor

This test case verifies that SID should be generated when silence is detected, and voice streaming should be generated when SID stops.

Actions	Responses
1. An IAD phone calls a PSTN phone.	1. Verify that the PSTN phone answers the call, and voice bearer packets are transmitted over the channel associated with the given CID.
2. Caller of the IAD phone stops talking	2.
3. Use an ATM Protocol Analyzer to monitor the AAL2 bearer packets.	3. Verify that generic SID packets are transmitted over the voice channel, and VG does not generate voice streaming.
4. Caller of the IAD phone starts talking	4.
5. Use an ATM Protocol Analyzer to monitor the AAL2 bearer packets.	5. Verify the generic SID packets are not transmitted, and VG should generate voice streaming.
6. IAD phone goes on-hook.	6. Verify the call is released.

10 ISDN BRI Service Test Cases

10.1 Test Group 6: ISDN BRI Basic Telephony Test

This test group tests the basic telephony functions, such as call originating, call termination, distinctive ringing. This test suite assumes the minimal configuration. This test group requires one ISDN BRI user port in the IAD equipped with ISDN phones. To simplify the test, there should neither be any data traffic coming out of the IAD nor data traffic on the D channel (except DSS1 signaling).

Depending on the type and capabilities of the IAD and the voice gateways provided by the vendors the following parameters have to be agreed and pre-configured by the parties:

- AAL2 PVC with VPI/VCI = 0/40 for the IAD side
- AppId = 0xE or 0x11
- ATM predefined profile = 9, (G.711, without silence compression)
- AAL2 PVC traffic descriptor,
 - VBRrt with PCR=1910 cells/s, SCR= 382 cells/s MBS=16 cells, CDVT =20 ms
 - or CBR with PCR =382 cells/s, CDVT = 20ms.

10.1.1 Test Case 6.1: Call Origination

The purpose of this test case is to verify whether an IAD ISDN phone can call an ISDN phone.

Actions	Responses
1. The ISDN phone goes Off-hook	1. Verify the dial tone starting within 1 sec.
2. Press the first digit	2. Verify that the dial tone disappears.
3. Dial the rest of the digits	3. Verify that call origination succeeds when ring back tone is heard or fails when busy tone is heard.
4. Test the voice communication	4. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
5. The ISDN phone goes On-hook	5. Verify the call is released.

10.1.2 Test Case 6.2: Call Termination

The purpose of this test case is to verify that an ISDN phone can call an IAD ISDN phone.

Actions	Responses
1. Use an ISDN phone to call an IAD ISDN phone	1. Verify that the IAD phone is rung properly.
2. IAD phone goes Off-hook	2. Verify ring trip.
3. Test the voice communication.	3. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
4. The ISDN phone goes On-hook	4. Verify the call is released.

10.1.3 Test Case 6.3: Call Origination on the 2nd B channel

The purpose of this test case is to verify whether a second phone call can be placed on the same ISDN user port using the second B channel with a second phone set connected on the same ISDN user port.

Actions	Responses
1. Establish a 1 st call from the IAD ISDN phone using test case 6.1	1. Verify the talk path
2. A second phone set on the same ISDN user port goes off-hook	2. Verify the dial tone starting
3. Dial the 1 st digit	3. Verify that the dial tone disappears
4. Dial the rest of the digits	4. Verify that call origination succeeds when ring back tone is heard or fails when busy tone is heard.
5. Test the voice communication on the two established calls	5. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.
6. One if the ISDN phone goes On-hook	6. Verify the concerned call is released and that the second call is still established.
7. The second ISDN phone goes on-hook	7. Verify the second call is released

10.1.4 Test Case 6.4: Call Waiting

The purpose of this test case is to verify that DSS1 messages are transmitted from/to the LE during conversation phase. The call waiting function is taken as example.

Actions	Responses
1. An IAD ISDN phone calls a ISDN phone	1. Verify the talk path.
2. Another ISDN phone calls the IAD ISDN phone	2. Verify that call-waiting tone is heard on the IAD phone.
3. IAD phone presses the Call Waiting key	3. Verify that the IAD phone can answer the call waiting.

10.2 Test Group 7: Multiple ISDN BRI User Ports on an IAD

This test suite tests the capability of an IAD to support multiple ISDN BRI user ports. It reuses the test cases in Test Group 6 to test every single port. This test suite requires IAD to support more than 1 ISDN BRI user port and one Voice Gateway.

Depending on the type and capabilities of the IAD and the voice gateways provided by the vendors the following parameters have to be agreed and pre-configured by the parties:

- AAL2 PVC with VPI/VCI = 0/40 for the IAD side
- AppId = 0xE or 0x11
- ATM predefined profile = 9, (G.711, without silence compression)
- AAL2 PVC traffic descriptor,
 - VBRrt with PCR=3820 cells/s, SCR= 764 cells/s MBS=16 cells, CDVT =20 ms
 - or CBR with PCR = 764 cells/s, CDVT = 20ms.
 This corresponds to 2 ISDN BRI user ports.

10.2.1 Test Case 7.1: ISDN BRI User Ports Sequencing

This test case uses Test Case 6.1 and 6.4 to test each ISDN BRI user port sequentially to verify that calls can be initiated from each ISDN BRI user port, and terminated on the correct ISDN BRI user port.

10.2.2 Test Case 7.2: ISDN BRI User Ports Loading

This test case uses Test Case 6.1 and 6.4 to verify that all ISDN BRI user ports can be active at the same time, there is no interference between the ports, and verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.

10.3 Test Group 8 Manual Provisioning

This test suite contains test cases to verify that the IAD and Voice Gateway can support different profiles, coding schemes, and signaling. The configuration will be changed through manual provision in IAD and Voice Gateway.

10.3.1 Test Case 8.1: PVC Provisioning

Test case 8.1 uses different VPI/VCI to test that voice can be carried over different AAL2 channel. Both IAD and Voice Gateway will be provisioned manually to use VPI/VCI 1/32. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using profile 9.

10.3.2 Test Case 8.2: Profile 7 (PCM-64)

This test case is dependent on the optional support of profile 7.

Test case 8.2 tests the profile 7 using PCM -64 coding with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use profile 7, PCM-64 coding prior to the test. It will use UI code points 0-7 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using PCM -64 coding with silence suppression.

10.3.3 Test Case 8.3: Profile 7 (ADPCM)

This test case is dependent on the optional support of profile 7.

Test case 8.3 tests the profile 7 using ADPCM-32 coding with silence suppression. Both IAD and Voice Gateway will be provisioned manually to use profile 7, ADPCM coding prior to the test. It will use UI code points 8-15 for voice packets and SID. It uses test cases 1.1 and 1.3 to verify that a call can be setup successfully using ADPCM coding with silence suppression.

10.4 Test Group 9: FAX and Voice-band Data

Same tests as in test group 5, using a B channel of the ISDN user port.

11 Test Group 10: OAM Testing

This test suite contains test cases to verify the use of OAM cells.

11.1 Test Case 10.1: F5 Loopback at IAD (ATM Switch)

The purpose of this test is to verify that the IAD replies to F5 loopback cells generated by the ATM Switch, DSLAM or ATM analyzer.

Actions	Responses
1. Initiate an F5 segment loopback test towards the IAD at either the ATM Switch, DSLAM or ATM analyzer.	1. Verify that IAD loops the F5 cells back again.

11.2 Test Case 10.2: F5 Loopback at VG (ATM Switch)

The purpose of this test is to verify that the Voice Gateway replies to F5 loopback cells generated by the ATM Switch, DSLAM or ATM analyzer.

Actions	Responses
1. Initiate an F5 segment loopback test towards the Voice Gateway at either the ATM Switch, DSLAM or ATM analyzer	1. Verify that the Voice Gateway loops the F5 cells back again.

11.3 Test Case 10.3: F5 Loopback at IAD

The purpose of this test is to verify that the IAD replies to F5 loopback cells generated by the Voice Gateway.

Actions	Responses
1. Initiate an F5 end-to-end loopback test at the Voice Gateway.	1. Verify that IAD loops the F5 cells back again.

Note: this requires the Voice Gateway to support generating OAM loopback cells and report the loopback test result.

11.4 Test Case 10.4: F5 Loopback at VG

The purpose of this test is to verify that the Voice Gateway replies to F5 loopback cells generated by the IAD.

Actions	Responses
1. Initiate an F5 end-to-end loopback test at the IAD.	1. Verify that the Voice Gateway loops the F5 cells back again.

Note: this requires the IAD to support generating OAM loopback cells and report the loopback test result.

12 Mixed POTS and ISDN BRI Test Cases

This test suite tests the capability of an IAD to support a mix of POTS user ports and ISDN BRI user ports. It reuses the test cases in Test Group 1 to test every single POTS port and the test cases in Test Group 6 to test every single ISDN user port.

Depending on the type and capabilities of the IAD and the voice gateways provided by the vendors the following parameters have to be agreed and pre-configured by the parties:

- AAL2 PVC with VPI/VCI = 0/40 for the IAD side
- AppId = 0x11
- ATM predefined profile = 9, (G.711, without silence compression)
- AAL2 PVC traffic descriptor,
 - VBRrt with PCR=2865 cells/s, SCR= 573 cells/s MBS=16 cells, CDVT =20 ms
 - or CBR with PCR = 573 cells/s, CDVT = 20ms.This corresponds to 1 POTS user port and 1 ISDN BRI user port.

12.1 Test Group 11: POTS Basic Telephony Test

Same tests as test group 1

12.2 Test Group 12: ISDN Basic Telephony Test

Same tests as test group 6

12.3 Test Group 13: ISDN <-> POTS Basic Telephony Test

Same tests as test group 6, except that one of the ISDN phones is replaced with a POTS phone to test calls between ISDN ports and POTS ports.

13 Test group 14: Provisioning Using LES-EOC

This test suite contains test cases to verify that use of the CP-IWF MIB over the LES-EOC.

Note: the testing is dependent upon how the Voice Gateway has implemented access to the LES EOC — this may be available to an SNMP agent, *e.g.*, HP OpenView, or just accessible via the Voice Gateway EMS.

13.1 Test Case 14.1: ColdStart Trap

The purpose of this test is to verify that the IAD sends a ColdStart trap at the start of day.

Step 2, 3, and 4 are optional.

Actions	Responses
1. Restart IAD	1. Verify that IAD sends <i>coldStart</i> after a random interval, between 0 and the default value of <i>cpIwfMwdForRestart</i> (600 seconds).
2. SET the value of <i>cpIwfMwdForRestart</i> to 6000 seconds.	2. Verify that the SNMP SET request is successful.
3. Restart IAD	3. Verify that IAD sends <i>coldStart</i> trap after a random interval, between 0 and 6000 seconds.
4. Repeat restarting IAD until a trap arrives after 600 seconds	4. Verify that the IAD is waiting a random time between 0 and 6000 seconds.

13.2 Test Case 14.2: System Group

The purpose of this test is to verify that the IAD supports the System Group as specified in the MIB-II specified in RFC1213 [22].

This test verifies the IAD support the following managed objects

- *sysUpTime*

Action	Response
1. GET the system group on the IAD	1. Verify that the IAD replies, including the <i>sysUpTime</i> .

13.3 Test Case 14.3: Control Oper State of POTS Ports

The purpose of this test is to verify that the IAD controls the state of the POTS ports using the interfaces MIB in RFC 2863 [23].

This test verifies the IAD support the following managed objects

- *ifAdminStatus*
- *ifOperStatus*

Actions	Responses
1. GET the <i>ifOperStatus</i> status of each POTS port in the IAD.	1. Verify that the IAD POTS port <i>ifOperStatus</i> is returned.
2. SET all the POTS ports to <i>ifAdminStatus</i> down.	2. Verify the SNMP SET is successful.
3. GET the <i>ifOperStatus</i> of each POTS port.	3. Verify that the IAD POTS port <i>ifOperStatus</i> is down.
4. Pick up a phone attached to each port.	4. Check no dial tone is received
5. SET all the POTS ports to <i>ifAdminStatus</i> up.	5. Verify the SNMP SET is successful.
6. GET the <i>ifOperStatus</i> of each POTS port.	6. Verify that the IAD POTS port <i>ifOperStatus</i> is up.
7. Pick up a phone attached to each port.	7. Check dial tone is received

13.4 Test Case 14.4: Interfaces MIB

The purpose of this test is to verify that the IAD implements the following objects in the interfaces MIB in RFC 2863 [23].

- *ifIndex*
- *ifType*
- *ifName*
- *ifLastChange*

Actions	Responses
1. GET the <i>ifIndex</i> , <i>ifType</i> , <i>ifName</i> and <i>ifLastChange</i> of the first POTS port in the IAD.	1. Verify that the IAD reports the following <ul style="list-style-type: none"> - <i>ifIndex</i> for POTS port 1 - <i>ifType</i> of voiceFXS (102) - <i>ifName</i> of <i>ifIndex.VPI.VCI</i> where <i>ifIndex</i> is for the WAN interface, VPI and VCI are as specified for the AAL2 PVC - <i>ifLastChange</i> Value of <i>sysUpTime</i> when port entered this admin state
2. Repeat the GET for all the remaining POTS ports	2. Verify that the IAD reports the correct information for each port.

13.5 Test Case 14.5: Control Oper state of IAD

The purpose of this test is to verify that the IAD controls the operational state of the IAD using the *cpIwf* MIB [1]. This test verifies the IAD support the following managed objects

- *cpIwfAdminStatus*
- *cpIwfOperStatus*

Actions	Responses
1. GET the <i>cpIwfOperStatus</i> of the IAD.	1. Verify that the IAD <i>cpIwfOperStatus</i> is returned.
2. Set up a call between port 1 and port 2.	2. Check call is active.
3. SET the <i>cpIwfAdminStatus</i> to down.	3. Verify that the IAD <i>cpIwfOperStatus</i> is down and the active call is cleared.
4. Pick up a phone attached to port 1.	4. Check no dial tone is received
5. SET the <i>cpIwfAdminStatus</i> to up.	5. Verify that the IAD <i>cpIwfOperStatus</i> is up.
6. Pick up a phone attached to port 1.	6. Check dial tone is received
7. Set up a call between port 1 and port 2.	7. Check call is active.
8. SET the <i>cpIwfAdminStatus</i> to shuttingDown.	8. Verify that the IAD <i>cpIwfOperStatus</i> remains up, and all calls are active.
9. Pick up port 3.	9. Verify no new calls can be made.
10. Hang up call between ports 1 and 2.	10. Verify that the IAD <i>cpIwfOperStatus</i> goes to down.
11. Pick up POTS ports 1, 2, 3, and 4.	11. Verify that no dial tone is received from any ports.

13.6 Test Case 14.6: *cpIwf* Parameters

The purpose of this test is to verify that it is possible to read and write various *cpIwf* parameters [1].

This test verifies the IAD supports the following managed objects

- *cpIwfVpi*
- *cpIwfVci*
- *cpIwfEchoCancellationSupport*
- *cpIwfNumPotsPorts*
- *cpIwfNumIsdnBriPorts*
- *cpIwfTimingReference*
- *cpIwfCurrentConfig*
- *cpIwfTrapGeneration*
- *cpIwfVendorName*
- *cpIwfDeviceType*
- *cpIwfHardwareVersion*
- *cpIwfSoftwareVersion*
- *cpIwfV5PSTNProtocolVariant*
- *cpIwfPotsPortEncodingSelectionMode* (masterSlave)
- *cpIwfIsdnBriPortEncodingSelectionMode* (masterSlave)
- *cpIwfPayoutBufferDepth* (20 milliseconds)
- *cpIwfImpairmentInterval* (15 minutes)
- *cpIwfImpairmentThreshold* (0)
- *cpIwfMwdForRestart* (600 seconds)
- *cpIwfEocBandwidth* (32000 bits per second)
- *cpIwfElcpAndPstnChannelBandwidth* (64000 bits per second)

Steps 6, 7, 10 and 11 are optional.

Actions	Responses
1. GET the following managed objects in the cpIwf group. - <i>cpIwfVpi</i> - <i>cpIwfVci</i> - <i>cpIwfEchoCancellationSupport</i> - <i>cpIwfNumPotsPorts</i> - <i>cpIwfTimingReference</i> - <i>cpIwfCurrentConfig</i> - <i>cpIwfVendorName</i> - <i>cpIwfDeviceType</i> - <i>cpIwfHardwareVersion</i> - <i>cpIwfSoftwareVersion</i>	1. Verify that the IAD reports the following - <i>cpIwfVpi</i> - VPI at IAD - <i>cpIwfVci</i> - VCI at IAD - <i>cpIwfEchoCancellationSupport</i> - 'yes' - <i>cpIwfNumPotsPorts</i> – number of POTS ports - <i>cpIwfTimingReference</i> – implementation dep - <i>cpIwfCurrentConfig</i> – integer - <i>cpIwfVendorName</i> – vendor name - <i>cpIwfDeviceType</i> – device model number - <i>cpIwfHardwareVersion</i> – hardware revision - <i>cpIwfSoftwareVersion</i> – software revision
2. SET the <i>cpIwfTrapGeneration</i> to disabled_all	2. Verify the SNMP SET is successful
3. Restart the IAD	3. Check that the IAD does not send a <i>coldStart</i> trap.
4. SET the <i>cpIwfTrapGeneration</i> to disabled_except_coldStart	4. Verify the SNMP SET is successful
5. Restart the IAD	5. Check that the IAD sends a <i>coldStart</i> trap.
6. SET the <i>cpIwfTrapGeneration</i> to enabled	6. Verify the SNMP SET is successful
7. Reduce the physical bandwidth on the DSL link to less than the bandwidth configured on the AAL2 VCC. This is done by configuring a DSL port on the DSLAM with a reduced bandwidth.	7. Check that the IAD sends an <i>cpIwfInsufficientPhysicalBandwidth</i> trap.
8. SET the following managed objects in the cpIwf group. - <i>cpIwfPotsPortEncodingSelectionMode</i> (masterSlave) - <i>cpIwfPayoutBufferDepth</i> (20 milliseconds) - <i>cpIwfImpairmentInterval</i> (15 minutes) - <i>cpIwfImpairmentThreshold</i> (0) - <i>cpIwfMwdForRestart</i> (600 seconds) - <i>cpIwfEocBandwidth</i> (32000 bits per second)	8. Verify the SNMP SET is successful.
9. GET the managed objects set in step 8.	9. Verify the SNMP GET returns the default values.
10. GET the following managed objects in the cpIwf group. - - <i>cpIwfIsdnBriPortEncodingSelectionMode</i> - <i>cpIwfElcpAndPstnChannelBandwidth</i> - <i>cpIwfNumIsdnBriPorts</i>	10. Verify the SNMP GET returns the default values.
11. SET the <i>cpIwfV5PSTNProtocolVariant</i> to 44 (UK) or other supported value for particular application.	11. Verify the SNMP SET is successful.

13.7 Test Case 14.7: AAL2 Parameters

The purpose of this test is to verify that it is possible to configure various AAL2 parameters [1]. There are no active calls when this test is started.

This test verifies the IAD supports the following managed objects

- *aal2SscsPcmEncoding*
- *aal2SscsProfileSource*
- *aal2SscsPredefinedProfileIdentifier*
- *aal2SscsIeeeOui*
- *aal2ApplicationIdentifier*
- *aal2CpsMaxMultiplexedChannels*
- *aal2CpsMaxSDULength*
- *aal2CpsCIDLowerLimit*
- *aal2CpsCIDUpperLimit*
- *aal2CpsOptimisation*
- *aal2CpsTimerCuValue*
- *aal2SscsFaxDemodulationTransport*
- *aal2SscsDtmfDigitPacketTransport*
- *aal2SscsMaxSsarSduLength*
- *aal2SscsSsarAssemblyTimerValue*

Steps 4, 5 and 6 are optional.

Actions	Responses
1. SET the PCM encoding to μ -law using the <i>aal2SscsPcmEncoding</i> object.	1. Verify the SNMP SET is successful.
2. Make a phone call from Port 1	2. Verify that μ -law PCM encoding is used.
3. Hang up call	3. verify call is ended.
4. SET the PCM encoding to A-law using the <i>aal2SscsPcmEncoding</i> object.	4. Verify the SNMP SET is successful.
5. Make a phone call from Port 1	5. Verify that A-law PCM encoding is used.
6. Hang up call	6. Verify call is ended.
7. SET the profile to ATM Profile 9 using - <i>aal2SscsProfileSource</i> (other) - <i>aal2SscsPredefinedProfileIdentifier</i> (9) - <i>aal2SscsIeeeOui</i> objects (00a03e)	7. Verify the SNMP SET is successful.
8. Make a phone call from Port 1	8. Verify that PCM encoding is used using profile 9.
9. SET the profile to ATM Profile 10 using the - <i>aal2SscsProfileSource</i> (other) - <i>aal2SscsPredefinedProfileIdentifier</i> (10) - <i>aal2SscsIeeeOui</i> objects (00a03e)	9. Verify the SNMP SET is successful.
10. Make a phone call from Port 1	10. Verify that ADPCM encoding is used using profile 10.
11. SET the following managed objects in the <i>cpIwfAal2Profile</i> group. - <i>aal2ApplicationIdentifier</i> ('0000000A'H) - <i>aal2CpsMaxMultiplexedChannels</i> (255) - <i>aal2CpsMaxSDULength</i> (45) - <i>aal2CpsCIDLowerLimit</i> (16) - <i>aal2CpsCIDUpperLimit</i> (223) - <i>aal2CpsOptimisation</i> (singleCpsPacketPerCpsPduNoOverlap) - <i>aal2CpsTimerCuValue</i> (0) - <i>aal2SscsFaxDemodulationTransport</i> (disabled) - <i>aal2SscsDtmfDigitPacketTransport</i> (disabled) - <i>aal2SscsMaxSsarSduLength</i> (1500) - <i>aal2SscsSsSarAssemblyTimerValue</i> (2147483647)	11. Verify the SNMP SET is successful.
12. GET the managed objects set in step 11	12. Verify the SNMP GET returns the default values.

13.8 Test Case 14.8: POTS Port Parameters

The purpose of this test is to verify that it is possible to configure various POTS port parameters [1]. There are no active calls when this test is started.

This test verifies the IAD supports the following managed objects

- *signalingMethod*
- *potsPortLabel*
- *potsPhysicalPort*
- *aal2ChannelId*

Steps 3 and 4 are optional.

Actions	Responses
1. SET the <i>signalingMethod</i> to loopStart for POTS port 1.	1. Verify the SNMP SET is successful.
2. Make a phone call from Port 1	2. Verify that loop start CAS signaling is used.
3. SET the <i>signalingMethod</i> to groundStart for POTS port 1.	3. Verify the SNMP SET is successful.
4. Make a phone call from Port 1	4. Verify that ground start CAS signaling is used.
5. SET the <i>potsPortLabel</i> for POTS port 1 to the configured directory number	5. Verify the SNMP SET is successful.
6. GET the <i>portPortLabel</i> for POTS port 1	6. Verify that the configured directory number is returned.
7. GET the <i>potsPhysicalPort</i> entry for POTS port 1.	7. Verify the <i>ifIndex</i> for port 1 is returned.
8. GET the <i>aal2ChannelId</i> for POTS port 1.	8. Verify this is channel 16.

13.9 Test Case 14.9: Restart IAD

The purpose of this test is to verify that the IAD can be restarted.

This test verifies the IAD supports the following managed objects

- *cpIwfRestart*

Actions	Responses
1. SET <i>cpIwfRestart</i> to warmStart	1. Verify that SNMP SET is successful, and the IAD performs a warm restart.
2. SET <i>cpIwfRestart</i> to coldStart,	2. Verify that SNMP SET is successful, and the IAD performs a cold restart.

13.10 Test Case 14.10: IAD Self-Test

The purpose of this test is to verify that the IAD can perform a self-test.

This test verifies the IAD supports the following managed objects

- *cpIwfAdminStatus*
- *cpIwfOperStatus*
- *cpIwfTestType*
- *cpIwfTestResult*

Actions	Responses
1. SET <i>cpIwfTestType</i> to selftest	1. Verify the SNMP SET is successful.
2. SET <i>cpIwfAdminStatus</i> to testing	2. Verify the SNMP SET is successful
3. GET <i>cpIwfOperStatus</i>	3. Verify that <i>cpIwfOperStatus</i> is testing.
4. GET <i>cpIwftestResult</i>	4. Verify test result from <i>cpIwftestResult</i> . If the result is inProgress, repeat step 4 until the final test result (e.g., failure or success) is returned.
5. GET <i>cpIwftestResultText</i>	5. Verify <i>cpIwftestResultText</i>
6. GET <i>cpIwfOperStatus</i>	6. Verify that <i>cpIwfOperStatus</i> is testing
7. Port 1 goes off-hook.	7. Verify that no dial tone is heard.
8. SET <i>cpIwfAdminStatus</i> to up	8. Verify the SNMP SET is successful.
9. GET <i>cpIwfOperStatus</i>	9. Verify that <i>cpIwfOperStatus</i> is up
10. Port 1 goes off-hook	10. Verify that dial tone is heard.

13.11 Test Case 14.11: POTS Port Loopback Testing

The purpose of this test is to verify that the IAD can perform POTS Port Loopback testing.

This test verifies the IAD supports the following managed objects

- *potsPortTestType*
- *ifAdminStatus*
- *ifOperStatus*

Actions	Responses
1. SET <i>potsPortTestType</i> to codecLoopback	1. Verify that the SNMP SET is successful.
2. SET <i>ifAdminStatus</i> to testing Perform a loopback test	2. Verify that the SNMP SET is successful.
3. GET <i>ifOperStatus</i>	3. Verify that the <i>ifOperStatus</i> is testing
4. CO-IWF perform a codec loopback test	4. CO-IWF verify that the codec loopback is successful.
5. SET <i>potsPortTestType</i> to aal2Loopback	5. Verify that the SNMP SET is successful.
6. CO-IWF perform a AAL2 loopback test	6. CO-IWF verify that the AAL2 loopback is successful
7. Port 1 goes off-hook.	7. Verify that no dial tone is heard
8. SET <i>ifAdminStatus</i> to up	8. Verify that the SNMP SET is successful.
9. SET <i>potsPortTestType</i> to none	9. Verify that the SNMP SET is successful.
10. Port 1 goes off-hook.	10. Verify that dial tone is heard.

13.12 Test Case 14.12: Statistics

The purpose of this test is to verify that the IAD supports POTS, ISDN and AAL2 statistics.

Actions	Responses
1. GET the AAL2 and POTS Port 1 statistics from the IAD	1. Verify that the statistics are returned successfully.
2. Make a phone call from Port 1	2. Verify that the call is successful.
3. GET the AAL2 and POTS Port 1 statistics from the IAD	3. Verify that the statistics are updated
4. GET the ISDN Port 1 statistics from the IAD	4. Verify that the statistics are returned successfully.
5. Make a phone call from ISDN Port 1	5. Verify that the call is successful.
6. GET the AAL2 and ISDN Port 1 statistics from the IAD	6. Verify that the statistics are updated

13.13 Test Case 14.13: Bandwidth Utilization

The purpose of this test is to verify that the using the LES EOC does not affect voice quality.

Note: This test relies on the ATM switch to perform traffic policing. The PVC is set to have enough bandwidth to handle n G.711 calls, where the IAD has n ports, plus 100 cells per second for the LES EOC. If the IAD or Voice Gateway exceeds the 100 cells per second on the LES EOC, the ATM switch will drop cells impacting the voice quality.

Actions	Responses
1. Setup a call between all the ports on the IAD using ATM Forum profile 9.	1. Verify that the calls are connected.
2. GET objects in the various MIB groups.	2. Verify that the IAD replies to the SNMP GETs
3. While the MIB queries are in progress test the voice communication	3. Verify the voice quality meets the MOS requirements using both a male and female voice as specified in Appendix A.

14 Test Validation

The preferred validation method is to simply manually inspect the test results during the test with both endpoint test application and monitoring equipment. Success is achieved when the corresponding test procedure has been completed and attained the specified success metric.

Some of the test cases are divided into sub-tests. It is expected that test participants complete the lowered numbered tests first, before proceeding to the next tests.

In general, for these test cases, test failure is understood to be any portion of the test procedure that could not be completed.

15 Test Case Matrices

15.1 POTS Test Cases

Table 5 is the Test Case Matrix that is used to record the results of POTS testing.

Table 5: POTS Test Case Matrix

Test Groups	Test Cases	Attempted	Passed/ Failed/ Not Applicable	Comments
1: Basic Telephony Test	1.1 Call Origination DTMF repeat 10x			
	1.2 Call Origination Dial pulses			
	1.3 Call Termination repeat 10x			
	1.4 Distinctive Ringing			
	1.5 Call Waiting			
	1.6 Call ID			
	1.7 Call Parking			
	1.8: Ground Start Call Origination			
	1.9: Ground Start Call Termination			
	1.10: Permanent Signaling Condition			
	1.11: Network Failure – Layer 1			
	1.12: Network Failure – Layer 2			
	1.13: No dial-tone			
2: Multiple POTS on an IAD	2.1 POTS lines Sequencing			
	2.2 POTS lines Loading			
	2.3 IAD phone to IAD phone			
3: Multiple IAD and Voice Gateway	3.1 Two IADs and one Voice Gateway			
	3.2 Two IADs and two Voice Gateways			
4: Manual Provisioning	4.1: PVC Provisioning			
	4.2: Profile 7 (PCM-64)			
	4.3: Profile 7 (ADPCM)			
	4.4: ATM Profile 8 (PCM-64)			
	4.5: ATM Profile 10 (PCM-64)			
	4.6: ATM Profile 10 (ADPCM)			
	4.7: ATM Profile 11 (PCM-64)			
	4.8: ATM Profile 11 (ADPCM)			
	4.9: ATM Profile 12 (PCM-64)			
	4.10: ATM Profile 12 (ADPCM)			
	4.11: ITU P.1 Profile (PCM-64)			
	4.12: ITU P.2 Profile (PCM-64)			
5. Fax and Voice Modem	5.1: Fax Test (IAD → PSTN)			
	5.2: Fax Test (PSTN → IAD)			
	5.3: Fax Test (IAD → IAD)			
	5.4: PC Fax Test (IAD → PSTN)			
	5.5: PC Fax Test (PSTN → IAD)			
	5.6: PC Fax Test (IAD → IAD)			
	5.7: Modem Test (IAD → PSTN)			
	5.8: Modem Test (PSTN → IAD)			
	5.9: Modem Test (IAD → IAD)			

Test Groups	Test Cases	Attempted	Passed/ Failed/ Not Applicable	Comments
	5.10: 23-tone test			
	5.11: Codec switchover for Fax/Modem			
	5.12: Clipping			
	5.13: Idle Channel Suppression			
	5.14: Silence Insertion Descriptor			

15.2 ISDN Test Cases

Table 6 is the Test Case Matrix that is used to record the results of ISDN BRI testing.

Table 6: ISDN BRI Test Case Matrix

Test Groups	Test Cases	Attempted	Passed/ Failed/ Not Applicable	Comments
6: Basic Telephony Test	6.1 Call Origination DTMF			
	6.2 Call Termination repeat 10x			
	6.3 Distinctive Ringing			
	6.4 Call Waiting			
	6.5 Call ID			
7: Multiple ISDN BRI user ports on an IAD	7.1 ISDN BRI user ports Sequencing			
	7.2 ISDN BRI user port Loading			
8: Manual Provisioning	8.1: PVC Provisioning			
	8.2: Profile 7 (PCM-64)			
	8.3: Profile 7 (ADPCM)			
9: Fax and Voice Modem	9.1: Fax Test (IAD → PSTN)			
	9.2: Fax Test (PSTN → IAD)			
	9.3: Fax Test (IAD → IAD)			
	9.4: Modem Test (IAD → PSTN)			
	9.5: Modem Test (PSTN → IAD)			
	9.6: Modem Test (IAD → IAD)			

15.3 OAM Testing

Table 7 is the Test Case Matrix that is used to record the results of OAM testing.

Table 7: OAM Test Case Matrix

Test Groups	Test Cases	Attempted	Passed/ Failed/ Not Applicable	Comments
10: OAM Test	10.1: F5 Loopback at IAD (ATM Switch)			
	10.2: F5 Loopback at VG (ATM Switch)			
	10.3: F5 Loopback at IAD			
	10.4: F5 Loopback at VG			

15.4 Mixed POTS and ISDN BRI Test Cases

Table 8 is the Test Case Matrix that is used to record the results of mixed POTS and ISDN BRI testing.

Table 8: Mixed POTS and ISDN BRI Test Case Matrix

Test Groups	Test Cases	Attempted	Passed/ Failed/ Not Applicable	Comments
11: POTS Basic Telephony Test	11.1 Call Origination DTMF			
	11.2 Call Termination repeat 10x			
	11.3 Distinctive Ringing			
	11.4 Call Waiting			
	11.5 Call ID			
	11.6 Call parking			
12: ISDN Basic Telephony Test	12.1 Call Origination DTMF			
	12.2 Call Termination repeat 10x			
	12.3 Distinctive Ringing			
	12.4 Call Waiting			
	12.5 Call ID			
13: ISDN <-> POTS Basic Telephony Test	13.1 Call Origination DTMF			
	13.2 Call Termination repeat 10x			
	13.3 Distinctive Ringing			
	13.4 Call Waiting			
	13.5 Call ID			

15.5 Provisioning using LES-EOC Test Cases

Table 9 is the Test Case Matrix that is used to record the results of provisioning using LES-EOC testing.

Table 9: Provisioning using LES-EOC Test Case Matrix

Test Groups	Test Cases	Attempted	Passed/ Failed/ Not Applicable	Comments
14: Provisioning using LES-EOC Test	14.1: ColdStart Trap			
	14.2: System Group			
	14.3: Control oper state of POTS ports			
	14.4: Interfaces MIB			
	14.5: Control oper state of IAD			
	14.6: cpIwf Parameters			
	14.7: AAL2 Parameters			
	14.8: POTS port parameters			
	14.9: Restart IAD			
	14.10: IAD Self-Test			
	14.11: POTS Port Loopback Testing			
	14.12: Statistics			
	14.13: Bandwidth Utilization			

Appendix A

Appendix A defines test steps and objectives for the voice quality tests executed in this plan.

A.1 Test Steps

There are various voice quality test units that can be used to measure the voice quality. The following describes suitable test steps for two widely available test units.

SAGE 935 AT

- Sage 935 AT SMOS test– one Sage unit is the director (test 76), the other the responder (test 77)

Malden DSLA

- Perform a PAMS test using the speech sample files at –20dB
For North American applications use the following speech sample files:
 - American IRS male onadrats
 - American IRS male starjust
 - American IRS male ratherna
 - American IRS male airjus
 - American IRS female onadrats
 - American IRS female starjust
 - American IRS female ratherna
 - American IRS female airjus
- For European applications use the following speech sample files
 - British IRS male onadrats
 - British IRS male starjust
 - British IRS male ratherna
 - British IRS male airjus
 - British IRS female onadrats
 - British IRS female starjust
 - British IRS female ratherna
 - British IRS female airjus
- Repeat for the PESQ test

A.2 Objectives

The following lists the objectives:

- G.711 Codec: MOS score > 4.12 for male and female voice
- G.726 Codec: MOS score > 3.8 for male and female voice