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NICC Document

Active Line Access:
ALA UNI SPECIFICATION

NICC Standards Limited

Michael Faraday House,
Six Hills Way,
Stevenage
SG1 2AY

Tel.: +44(0) 20 7036 3636

Registered in England and Wales under number 6613589

Contents

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Foreword

This NICC Document (ND) has been produced by NICC DSL task group

Introduction

This document specifies the User-Network Interfaces (UNI) options for Ethernet Active Line Access (ALA)[1] networks. Two categories of UNI are discussed: Ethernet based interfaces, and also 'wires-only' interfaces.

For the Ethernet based UNI type, the ALA Provider supplies the equipment terminating the ALA physical network medium in the customer environment (e.g. VDSL2 modem or GPON ONU), and offers Ethernet presentation to the ALA User. This UNI uses reference point A1 as defined in the ALA architecture [33].

For a wires-only type UNI, the interface describes the demarcation between the ALA Provider domain and ALA User domain, whereby the ALA User provides the equipment that terminates the ALA physical network medium in the customer environment. This UNI uses reference point A2 as defined in the ALA architecture [33]. The option of a wires-only UNI is included in this specification to meet the requirement for "Flexible choice of CPE" which is one of Ofcom's five key ALA attributes.

The arrangement described above assumes that in the case of a wires-only UNI, there is only one ALA User per UNI. Multiple ALA Users per wires-only UNI requires transparent forwarding of additional ALA Users' services through the CPE, as described in the architecture document [33].

For the purposes of this document, the term "VDSL2 modem" refers to VDSL2 equipment that an ALA user connects to the VDSL2-UNI.

[1] For context, see NICC ND 1644 "Architecture for Ethernet Interconnect & Ethernet ALA"

1 Scope

The present document sets out the requirements for Ethernet, VDSL2, and GPON type User Network Interfaces for Ethernet ALA networks.

2 References

For the particular version of a document applicable to this release see ND1610 [1].

NOTE: While any hyperlinks included in this clause were valid at the time of publication NICC cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] NICC ND1610 Next Generation Networks, Release Definition

[2] ITU Recommendation G.993.2, Very high speed subscriber line transceivers 2 (VDSL2)

[3] ITU Recommendation G.997.1, Physical Layer Management for Digital Subscriber Line (DSL) Transceivers

[4] ITU Recommendation G.994.1, Handshake procedures for digital subscriber line transceivers

[5] ITU-T Recommendation G.998.4, Improved impulse noise protection for DSL transceivers

[6] ETSI TS101271 v1.1.1, Access Terminals Transmission and Multiplexing (TM); Access transmission system on metallic pairs; Very High Speed digital subscriber line system (VDSL2)

[7] NICC Specification of the Access Network Frequency Plan applicable to transmission systems connected to the BT Access Network issue 5, ND1602

[8] NICC Specification of the Access Network Frequency Plan applicable to transmission systems connected to the KCH Access Network issue 3, ND1604

[9] Broadband Forum (BBF) Technical Report, VDS2 Performance Test Plan, TR-114i2

[10] Broadband Forum (BBF) Technical Report, VDSL2 Functionality Test Plan, TR-115i2

[11] Broadband Forum (BBF) Technical Report, TR-138, Accuracy tests for test parameters

[12] NICC ND1030 Ethernet ALA Service Definition, 2010.

[13] Broadband Forum (BBF) Technical Report: "Migration to Ethernet-Based DSL Aggregation," TR-101, Issue 1, April 2006.

[14] ITU Recommendation G.984.1 Gigabit-capable Passive Optical Networks (GPON): General characteristics

[15] ITU Recommendation G.984.2 Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification

[16] ITU Recommendation G.984.3 Gigabit-capable Passive Optical Networks (GPON): Transmission convergence layer specification

[17] ITU Recommendation G.984.4 Gigabit-capable Passive Optical Networks (GPON): ONT management and control interface specification

[18] ITU Recommendation G.984.2 Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification Amendment 1: New Appendix III – Industry best practice for 2.488 Gbit/s downstream, 1.244 Gbit/s upstream G-PON

[19] IEC 825-1, International Electrotechnical Commission (IEC) Standard, Safety of Laser Products Part 1.

[20] Broadband Forum (BBF) Technical Report: "Using GPON Access in the context of TR-101," TR-156, Issue 1, December 2008.

[21] Broadband Forum (BBF) Technical Report: "CPE WAN Management Protocol", TR-069 Amendment 2, December 2007.

[22] Broadband Forum (BBF) Technical Report: "Framework for TR-069 Enabled PON Devices", TR-142 Issue 2, February 2010.

[23] IEEE 802.3, Standards for Local Area Networks: CSMA/CD Access Method.

[24] NICC ND1642 Requirements for Ethernet Interconnect and Ethernet ALA, 2010.

[25] IEEE 802.3u, Standards for Local and Metropolitan Area Networks, Supplement: Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units and Repeater for 100 Mbit/s Operations Type 100Base-T.

[26] IEEE 802.3x, Standards for Local and Metropolitan Area Networks, Specification for 802.3 Full Duplex.

[27] IEEE 802.3z, IEEE Standards for Gigabit Ethernet in the LAN/WAN, 1998.

[28] IEEE 802.1d, Media Access Control (MAC) Bridges.

[29] IEEE 802.1s, Virtual Bridged Local Area Networks, Amendment 3: Multiple Spanning Trees

[30] IEEE 802.1w, Media Access Control (MAC) Bridges, Rapid Reconfiguration

[31] IEEE 802.1q, Recommendations for Virtual LANs.

[32] IEEE 802.3ab, 1000Base-T

[33] NICC ND1644 Architecture for Ethernet Active Line Access

[34] NICC ND1436, VDSL2 Test procedures for the UK, May 2015 [expected date]

[35] NICC ND1417, Management architecture for ALA

[36] ETSI TS 101 952-1, Access network xDSL splitters for European Deployment, Part 1: Generic specification of xDSL over POTS splitters

[37] ETSI TS 101 952-3, Access network xDSL splitters for European deployment, Part 3: Generic specification of static distributed filters for xDSL over POTS

[38] BT Suppliers' Information Note 351, Technical characteristics of the single analogue line interface

[39] NICC ND1649, Active Line Access NICC B2B L2C ALA Interface Standard

[40] NICC ND1651, Active Line Access B2B Lead-to-Cash (L2C) XML standard

[41] Broadband Forum (BBF) Technical Report: "GPON ONU Conformance Test Plan", ID-247 issue 2, January 2013

[42] Broadband Forum (BBF) Technical Report: "G-PON interoperability test plan", TR-255, February 2013

[43] ITU-T Recommendation G.992.5, "Asymmetrical digital subscriber line transceivers 2 (ADSL2) – Extended bandwidth (ADSL2plus)"

2.2 Informative references

[i.1] SR 001 262 (V2.0.0): "ETSI drafting rules Section 23:- Verbal Forms For The Expression of Provisions"

3 Definitions and abbreviations

3.1 Definitions

The key words "shall", "shall not", "must", "must not", "should", "should not", "may", "need not", "can" and "cannot" in this document are to be interpreted as defined in the ETSI Drafting Rules [i.1].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ADSL2 Asymmetric Digital Subscriber Line (2nd Generation)

ADSL2+	ADSL2 with extended bandwidth
AELEM	Alternative Electrical Length Estimation Method
ALA	Active Line Access
ANFP	Access Network Frequency Plan
AUC	ALA User Connection
CPE	Customer Premises Equipment
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
ELE-M1	Electrical Length Estimation Method 1
ETSI	European Technical Standards Institute
GPON	Gigabit Passive Optical Network
MDI/MDIX	Medium Dependent Interface/MDI crossover
MEG	Maintenance Entity Group
MTU	Maximum Transmit Unit
NTE	Network Terminating Equipment
OAM	Operations Administration and Maintenance
OLT	Optical Line Terminal
OMCI	ONT Management Control Interface
ONT	Optical Network Terminal
ONU	Optical Network Unit
PSD	Power Spectral Density
PSTN	Public Switched Telephone Network
SC/APC	Standard Connect / Angled Physical Contact
SFP	Small Form Package
SRA	Seamless Rate Adaptation
UNI	User Network Interface
UPS	Uninterruptable Power Supply
VDSL2	Very high-speed Digital Subscriber Line
VLAN	Virtual Local Area Network

4 UNI SPECIFICATION FOR ETHERNET

4.1 Physical Interface and Installation Topology

This UNI applies in the situation where the ALA Provider provides the NTE that terminates the ALA access transmission system (VDSL2, GPON etc.) and presents the ALA service via an Ethernet LAN port [23] on the NTE.

The ALA NTE shall present two, and may support more than two, physical Ethernet ports to the end-user to support multiple ALA services.

The Ethernet UNI shall be presented as a 10/100/1000BaseT electrical interface (supporting auto-negotiation and MDI/MDIX auto-sensing) on an RJ45 physical socket in accordance with IEEE 802.3 [23], [32] in full duplex mode. The ALA User or end-user can connect their CPE to the ALA Ethernet UNI via an RJ-45 connector [25], [26].

The Ethernet UNI may also be presented via an SFP transceiver slot to enable connection via a Gigabit Ethernet optical interface (as per IEEE 802.3z [27]) to augment the mandatory electrical interface.

The ALA NTE presenting the Ethernet UNI shall not require line-powering. The ALA NTE presenting the Ethernet UNI should provide visual indications: when the unit is powered on, and when the Ethernet physical port(s) state is active (link-up).

4.2 OAM Functionality

As part of service provisioning the ALA provider may offer the extended AUC MEG, this permits ALA Users to monitor the connectivity, frame delay and loss for the AUC. See the service definition [12].

4.3 Ethernet Service Presentation

The Ethernet Maximum Transmit Unit (MTU) frame size shall be a minimum of 1600 bytes (excluding pre-amble and Inter-Frame Gap).

ALA supports transparent layer 2 services, as defined in the service definition [12]. The ALA Provider will define layer 2 frame transparency at the UNI as part of their service description. The Ethernet UNI shall be able to present and accept the following frames formats:

- Untagged
- single-tagged (IEEE 802.1q)
- double-tagged (IEEE 802.1ad) frames
- IEEE 802.1p VLAN priority markings

To enable connectivity of multiple AUCs via a single NTE, an AUC may be presented on a dedicated physical port, or alternatively a physical port may be used to present multiple AUCs differentiated by VLAN-ID (in which case VLAN-aware equipment will need to be attached to the port). The ALA NTE presenting the Ethernet UNI shall be capable of simultaneously supporting both unicast and multicast in accordance with the NICC Ethernet ALA Service Definition [12].

5 UNI SPECIFICATION FOR VDSL2 WIRES-ONLY

5.1 Physical Interface and Installation Topology

Filters are required to separate the ALA VDSL2 frequencies from any voice-band frequencies used for telephony in the twisted-pair bearer. The filtering may be done in one of two different ways:

- Via a single master splitter fitted at the master socket (usually an NTE5). This may be in the form of a centralised splitter. This approach not only separates the high frequency VDSL2 signals from voice-band signals, it also splits out the VDSL2 signals from the legacy premises wiring so that they can be connected to the VDSL2 modem over separate higher quality cabling. Centralised splitters shall comply with the requirements of ETSI Specification TS 101 952-1 [36].
- Via distributed microfilters (also called in-line filters) installed in every extension socket being used for communications equipment in the premises. Distributed splitters shall comply with the requirements of ETSI Specification TS 101 952-3 [37].

It should be noted that microfilters are likely to result in inferior transmission performance compared to the centralised splitter approach for two reasons:

- As noted above, when using a centralised splitter the connection from the splitter to the modem can be made via high quality cabling. In the microfilter scenario it is more likely the DSL signals will encounter 'tree and branch' or 'star' wiring topologies, and lower quality cabling used for telephone extension sockets
- In the case where microfilters have been installed incorrectly, or not on every extension socket, the modem may see impedance changes on the line due to on-/off-hook activity, or incorrectly measure loop frequency response due to signal reflections from unterminated extensions

The physical interface for connection of the filtering devices is the standard PSTN socket as described in BT SIN 351 [38] or as otherwise published by the provider of the network termination.

5.2 Transmission and Signalling Layer

5.2.1 DSL transmission layer general requirements

5.2.1.1 VDSL2

The VDSL2 modem shall comply with the mandatory requirements of ITU G.993.2 and associated ITU and ETSI VDSL2 standards [2]-[6].

5.2.1.2 Handshake

The modem shall support operating with cabinet based VDSL2. This involves supporting tone-sets A43 and A43C (as defined in G.994.1 Amendment 1), plus downstream PSD shaping and upstream power back-off as defined in G.997.1 and G.993.2.

5.2.1.3 Bandplan

The modem shall support operation as per the current UK ANFP documents [7], [8] which specify use of VDSL2 bandplan 998ADE17 (Asymmetric Downstream Extension, 17MHz), including use of upstream band U0 (25 – 138 KHz).

5.2.1.4 Bitswap

The VDSL2 modem shall support bitswapping.

5.2.1.5 SRA

The VDSL2 modem shall support Seamless Rate Adaptation.

5.2.2 Retransmission

The VDSL2 modem shall support DSL layer retransmission as specified in G998.4 [4]. Equipment should be tested as described in TR-114i2 Annex-E.

5.2.3 Upstream PSD calculation

The VDSL2 modem must support an algorithm that calculates the upstream transmit PSD correctly, regardless of the quality of installation. A suitable algorithm to ensure this requirement is met is the optional ELE-M1 (also known as AELEM) as detailed in G.993.2 [2] – VDSL2 wires-only equipment shall support ELE-M1.
As mentioned above (section 2.1), where microfilters are used, in-home wiring could distort the frequency response of the transmission channel. Such distortions could lead an algorithm that is not compliant to ELE-M1 to incorrectly estimate the upstream electrical distance to the DSLAM, and hence, incorrectly select the upstream transmit PSD.

5.2.4 Vectoring

The VDSL2 modem shall be vector ready (as defined in G993.5). Modems not supporting either of these modes may fail to synchronise with vectored DSLAMs. In addition, the VDSL2 modem shall support concurrent operation of retransmission, vectoring and SRA in each direction.

5.2.5 Virtual noise

The VDSL2 modem should support virtual noise.

5.2.6 Monitoring diagnostics and test

Parameters specified in G997.1 and G993.2 for reporting inventory information, and performance and operational monitoring information shall be supported by equipment connecting to the UNI. To support remote diagnostics and test for lines, loop diagnostics specified in G993.2 and G997.1 shall be supported. Diagnostics shall meet the accuracy requirements described in TR-138 [11].

5.2.7 Modem test procedures

The VDSL2 modem shall meet the requirements of NICC document ND1436 [34]. This document describes test procedures, and lists references to the relevant Broadband Forum technical reports [9]-[10] and ITU standards [2]-[5].

5.2.8 ADSL2+ Fall-back

Requirements and test procedures for ADSL2+ fall-back operation are defined in Annex B of NICC document ND1436 [34].

5.3 OAM Functionality

The wires-only ALA VDSL2 UNI shall be capable of transporting Ethernet OAM as specified in the NICC Ethernet ALA Service Definition [12]. In order to be able to use OAM functionality

across the UNI, the ALA User's CPE needs to support the OAM functionality requirements of section 7.3.1 in Broadband Forum TR-101 [13].

5.4 Ethernet Service Presentation

In order to be able to use the multicast service, the terminating modem equipment connected to the UNI (reference point A2 as defined in the ALA architecture [33]) needs to support both unicast and multicast in accordance with the NICC ALA Service Definition [12].
If VLAN tagging is required by the ALA Provider to identify AUCs at the VDSL2-UNI, the VLAN-IDs shall be configured on the VDSL2 modem. This may be achieved by:

- Using a default AUC numbering scheme for all equipment connecting at the VDSL2-UNI
- The ALA User specifies via the L2C interface the VLAN-IDs to be used at the UNI during the order process. This can be done explicitly in the XML or implicitly as part of the product definition. The ALA Management documents ND1417 [35], ND1649 [39], ND1651 [40] describe this mechanism

6 UNI SPECIFICATION FOR GPON WIRES-ONLY

6.1 Physical Interface and Installation Topology

The physical connector shall be SC/APC (Standard Connect / Angled Physical Contact). The SC/APC connector virtually eliminates all back reflection even from an unterminated connector.

6.2 Transmission and Signalling Layer

The GPON optical transmission system shall comply with ITU GPON standards [14]

6.3 OAM Functionality

The wires-only ALA GPON UNI shall be capable of transporting Ethernet OAM as specified in the NICC Ethernet ALA Service Definition [12].

6.4 Ethernet Service Presentation

In order to be able to use the multicast service, the terminating ONT equipment connected to the UNI (reference point A2 as defined in the ALA architecture [33]) needs to support both unicast and multicast in accordance with the NICC ALA Service Definition [12].

6.5 Management

The ALA User will need a management system operating at a higher-layer than the native GPON OMCI management protocol [17] since the ONT used in a wires-only deployment will need to be configured by the OLT of the ALA Provider, which will not be directly accessible to the ALA User. The ALA User's management system will need to communicate the physical layer and Ethernet layer setup requirements to the ALA Provider to configure the ONT, and may also implement alternative management techniques such as TR-69 to allow direct control of parameters not configured via OMCI. The demarcation between the use of OMCI and ALA User's management system shall be via a virtual UNI within the equipment as described in Broadband Forum TR-142 issue 2 [22].

6.6 Battery Back-Up

ALA does not require that active equipment in the customer premises is provided with a UPS facility. Other services deployed over ALA may require such a facility, but this is outside of the scope of ALA.

6.7 Interoperability

GPON interoperability specifications and certifications are developed by the Broadband Forum. A GPON ONU Conformance Certification program is in place [41]. The Broadband Forum is also developing a multivendor OLT and ONU interoperability test program [42]. The ONT provided by

the ALA user should pass the multivendor OLT and ONU interoperability test program – this requires the ONT to have been tested by an independent test lab for compliance to specification.

History

Document History		
Version	**Date**	**Milestone**
1.1.1	23/12/10	Approved version
1.2.1	14/03/13	Second published issue
1.3.1	09/09/15	Third published issue to reflect revised ND1436.