



PON Interface / Config Specification

Vrije Modemkeuze

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Disclaimer

When a new version of this specification is published it supersedes all previous versions of this specification. Users are advised to regularly check for updates on this specification.

DELTA Fiber Nederland reserves the right to deviate from this specification, in certain geographical areas for technical tests and network development purposes.

DELTA Fiber Nederland does not take any responsibility for the correctness of the reference values included in this specification.

This interface specification implements the following (in Dutch):

- Besluit van 12 december 2016, houdende regels inzake eindapparaten ter implementatie van richtlijn 2008/63/EG (Besluit eindapparaten).
- ACM Beleidsregel handhaving besluit randapparaten (bepaling van het netwerkaansluitpunt en de vrije keuze van eindapparaten) – Staatscourant nr. 26456, 27 juli 2021.
- Nota van bevindingen – Beleidsregel handhaving besluit eindapparaten (bepaling van het netwerkaansluitpunt en de vrije keuze van eindapparaten) – Zaaknr. ACM/19/036305/ Documentnr. ACM/UIT/558420.

and is intended for fiber modem device manufacturers. The declaration of conformity with this interface specification is the sole responsibility of the manufacturer.

The interface specification does not apply under abnormal operating conditions such as:

- operating conditions arising as a result of operating services other than XGS-PON over the dedicated fiber interface.
- operating conditions arising as a result of a fault, maintenance and construction work or to minimize the extend of interruption of service.
- operating conditions arising as a result of force majeure or third-party interference.
- operating conditions arising as a result of test signal injection governed by regulation.
- In case of non-compliance of a network user's installation or non-compliance of equipment with the relevant standards or non-compliance with the technical requirements for connection, established either by this interface specification or the public authorities including the relevant limits for electromagnetic compatibility.

The characteristics given in this interface specification are intended to be used to derive and specify requirements for equipment such as fiber cables and fiber modems to connect them to the dedicated fiber interface or Ethernet interface. The values in this interface specification take precedence over requirements in equipment product standards and installation standards.

This interface specification may be changed at any time and may break backward compatibility with previous versions. Manufacturers are required to provide regular software updates. This interface specification may be superseded in total or in part by the terms of a contract between the individual network user and DELTA Fiber Nederland.



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Information for individual customers regarding the use of own fiber modems on the DELTA Fiber networks is available at:

<https://www.delta.nl/klantenservice/vrije-modemkeuze/>

<https://www.caiway.nl/klantenservice/vrije-modemkeuze/>



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Conventions

Throughout this document, key words need to be interpreted in accordance with:

“MUST, SHALL”	This word means that the item is an absolute requirement of this specification.
“MUST NOT”	This phrase means that the item is an absolute prohibition of this specification.
“SHOULD”	This word means that there MAY exist valid reasons in particular circumstances to ignore this item, but the full implications SHOULD be understood and the case carefully weighed before choosing a different course.
“SHOULD NOT”	This phrase means that there may exist valid reasons in particular circumstances when the list 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 means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example, another vendor may omit the same item.

References

[1] ATTEMA FTU, Datasheet article nr AT29100 AT12372,
<https://assets.attema.com/media/15/15140/Datasheet%20FTU%20DeltaFiber%20NL%20AT12372%20V1.0.pdf>

[2] BBF.247 GPON ONU Certification
<https://www.broadband-forum.org/testing-and-certification-programs/bbf-247-gpon-onu-certification>

[3] G.988 ONU management and control interface
<https://www.itu.int/rec/T-REC-G.988/en>

[4] G.9807.1: 10-Gigabit-capable symmetric passive optical network (XGS-PON)
<https://www.itu.int/rec/T-REC-G.9807.1/en>



[5] Ethernet Based Broadband Aggregation

https://www.broadband-forum.org/download/TR-101_Issue-2.pdf

[6] Using GPON Access in the Context of TR-101

https://www.broadband-forum.org/download/TR-156_Issue-3.pdf

[7] Abstract Test Plan for GPON ONU Conformance

https://www.broadband-forum.org/download/TR-247_ATP-247.pdf

[8] GPON Interoperability Test Plan

<https://www.broadband-forum.org/download/TR-255.pdf>

[9] <https://datatracker.ietf.org/doc/html/rfc2131> DHCPv4

[10] <https://datatracker.ietf.org/doc/html/rfc8415> DHCPv6

[11] <https://ieeexplore.ieee.org/document/7374647> "IEEE Standard for Local and metropolitan area networks--Bridges and Bridged Networks--Corrigendum 1: Technical and editorial corrections," in *IEEE Std 802.1Q-2014/Cor 1-2015 (Corrigendum to IEEE Std 802.1Q-2014)*, vol., no., pp.1-122, 12 Jan. 2016, doi: 10.1109/IEEESTD.2016.7374647.

[12] <https://datatracker.ietf.org/doc/html/rfc4638> Accommodating a Maximum Transit Unit/Maximum Receive Unit (MTU/MRU)

[13] <https://datatracker.ietf.org/doc/html/rfc7084> Basic requirements for IPv6 Customer Edge Routers

[14] <https://datatracker.ietf.org/doc/html/rfc2464> Transmission of IPv6 packets over Ethernet networks

[15] <https://datatracker.ietf.org/doc/html/rfc4862> IPv6 Stateless Address Autoconfiguration



1. Scope

This document describes the basic requirements for the Delta Fiber network to be met by XGSPON ONT modem equipment of the retail customer for using data, IPTV, voice services at the “fixed network termination point” (vaste network aansluitpunt) as described in the “ACM Beleidsregel Handhaving Besluit Eindapparaten”.

The document covers the basic physical requirements as well as XGSPON protocol requirements for using Internet Protocol services (IP) over the XGSPON Fiber Network. Additionally, the requirements for the service settings are also covered.

These requirements may change from time to time to reflect changes in the network. Anyone using this specification should therefore regularly consult the website of DELTA Fiber Nederland to look for the latest version of this document.

Any device that is connected to the network that is in violation of this specification can be refused access to the network.

DELTA fiber will not perform or facilitate software updates for the XGSPON ONT/RG. The XGSPON ONT/RG's MUST NOT accept new firmware/software unless it has been digitally signed by the original manufacturer of the ONT/RG modem. Alteration of the software itself MUST NOT be possible in any other way.

2. Definitions and Abbreviations

ACM	Autoriteit Consument & Markt
ACS	Auto-Configuration Server
BBF	Broadband Forum
CPE	Customer Premise Equipment
DHCP	Dynamic Host Configuration Protocol
DS	Downstream
dBm	decibel per milliwatt
E2E	End-to-end
FTU	Fiber termination unit
GPON	Gigabit Passive Optical Network
HSI	High Speed Internet
IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPTV	Internet Protocol
ITU	International Telecommunication Union
L3	Internet Protocol TeleVision
LAN	Local Area Network
MRU	Maximum Receive Unit
MTU	Maximum Transmission Unit
OLT	Optical Line Termination
OMCI	ONT Management Control Interface
ONT	Optical Network Terminal
ONU	Optical Network Unit
PON	Passive Optical Network
QoS	Quality of Service
RF	Radio Frequency
RG	Residential Gateway
SC/APC	Standard Connector/ Angled Physical Contact
TR	Transmission Request
UP	Upstream
VLAN	Virtual Local Area Network
VoIP	Voice over Internet Protocol
XGSPON	10 Gigabit Symmetrical Passive Optical Network



3. General

The PON ONT/RG modem MUST be connected to the outlet of the Attema FTU with a simplex single mode (9/125 μm) fiber patch cable between the PON ONT/RG modem and the Attema FTU with a SC/APC connector at the side of the FTU and a suitable fiber patch assembly for the Attema FTU [1].

The patch fiber assembly is available for modem manufacturers at:

Attema BV
Afdeling Verkoop binnendienst
+31(0)183 650 650

PON is a shared media, so connecting an off-the-market ONT to the PON may impact the customer and other customers in the area if that model ONT doesn't follow the relevant ITU standards. If the impact to other customers is not resolved DFN reserves the right to temporary disconnect the fiber to disrupting PON ONT/RG modem's.



4. Network PON Requirement

Third party PON ONT/RG modem MUST comply to the standards as defined in the following chapters.

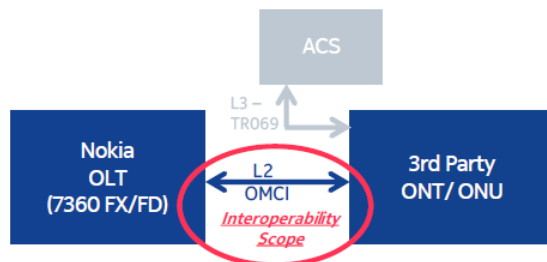
Standards

- Use of a SC/APC connector at the FTU with fiber patch assembly [1]
- The PON ONT/RG modem MUST be certified with the BBF.247 certification[2].
- ITU-T G.988 (OMCI) compliant [3]
- ITU-T G.9807.1 XGS-PON standards compliant [4]:
 - 4 dBm ~ 9 dBm launch power; -28 dBm ~ -9 dBm for receiving
 - Wavelength: 1260 nm–1280 nm upstream; 1575 nm–1580 nm downstream
 - 10 G burst mode upstream transmitter
 - 10 G downstream receiver
- ITU-T G.9807.1-compliant 10 GPON Encapsulation Method (XGEM) framing [4]
 - Flexible mapping between XGEM ports and T-CONT
 - Advanced Encryption Standard (AES) 128 (Downstream)
 - Forward error correction (FEC)
 - Interface identification Slot id = 1 (type Ethernet) / Port id = 1

Current ONT OMCI interoperability process

BBF Interoperability Focus is on data only ONTs within the scope of [4] BBF.247 GPON ONU Certification

Not supported are proprietary modem implementations and L3 functions like Wi-fi, RF-Video and Voice, which are also specific E2E service implementations per operator and for example steered in the modem by ACS management (TR-69).



Interoperability standards strictly followed
G.988 Appendix I & II (OMCI), TR-156, TR-247, TR-255

<https://www.broadband-forum.org/testing-and-certification-programs/bbf-247-gpon-onu-certification>

- GPON Interoperability is based on the compliance of GPON equipment (OLT, ONT) to the combination of G.988 Appendix I & II (OMCI) and TR-156 Issue 3 [6]
 - Broadband Forum TR-156 Issue 3 defines the division of functionality between OLT and ONU in a TR-101 [5] Ethernet architecture network
 - G.988 Appendix I & II define how to use the OMCI MIB to comply with TR-156 Issue 3
- Verified at the ONT using Broadband Forum TR-247 [7]
- TR-247 defines test plan for verification of ONU's compliance with TR-156 Issue 3
 - Used as the test plan for BBF.247 ONU certification
- Verified at a system level using Broadband Forum TR-255
 - The ONU used in TR-255 testing is assumed to be already certified so TR-255 also verifies OLT support of BBF.247 certified ONUs

Note:

The OLT and ONT configurations to be deployed must comply with TR-156 issue 3 and must strictly use TR-247 elements compliant to G.988. This is prerequisite for Layer 2 OLT-ONT interoperability testing. OMCI interoperability and ONT/ONU certification are only a subset of what is required for deploying reliable, maintainable networks as this is only focusing on layer 2 basic service testing. There is no certification for L3 defined (e.g. Voice Service, Integration with Video Middleware) and other advance Service testing (stress test, stability test, Performance Monitoring).

- BBF TR-247 defines test cases to verify conformance of ONU equipment functionality, and the implementation of the OMCI protocol by that equipment to Broadband Forum TR-156 Issue 3, and the related recommendations from Appendix I and II of G.988.
- The OLT and ONT configurations to be deployed must comply with TR-156 issue 3 and must strictly use TR-247 elements compliant to G.988.

5.XGSPON ONT Manual Configuration Settings

This chapter will describe the end users service ONT/RG settings which are minimal required to interface to the Delta's PON infrastructure.

The Third party PON ONT/RG modem must follow the defined service model of the operator, i.e. specific VLANs, p-bit values etc.

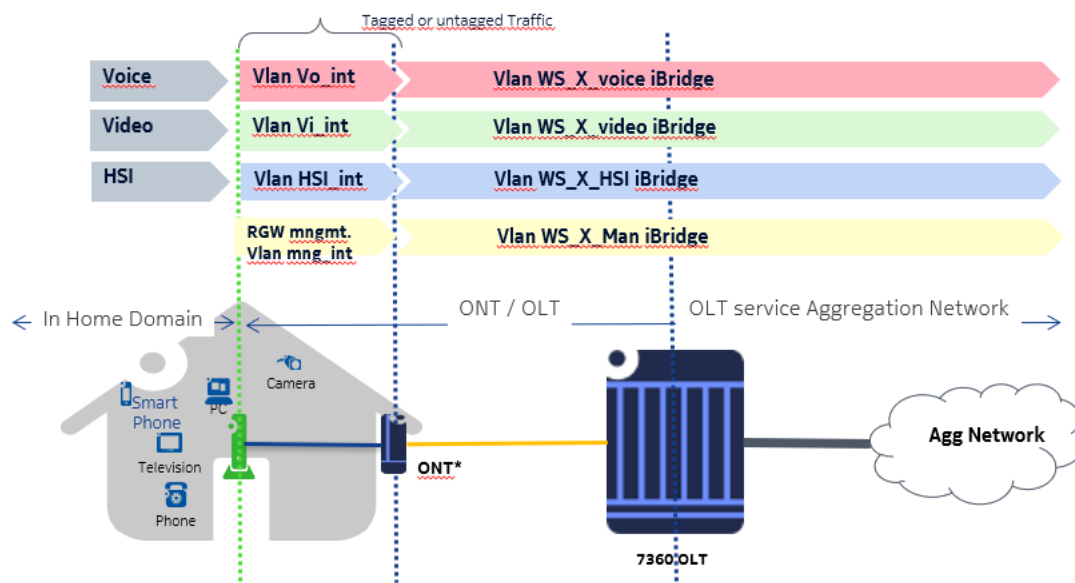
Depending on the end user subscription max three services can be deployed

- Internet
- IPTV
- Fixed Voice

There is no CPE management configuration done by Delta for 3rd party PON ONT/RG modem.

The end user is responsible for applying the correct setting as specified by Delta.

The 3rd party ONT/RG is not managed by Delta. The end user is responsible for using the latest validated ONT/RG software and the correct settings.



The picture above gives an overview about the translation of the VLAN service settings in the infrastructure.



IP-services

The PON ONT/RG modem MUST get an IPv4 address via DHCPv4 [9] and/or DHCPv6 [10] for every VLAN [11] that the customer is intending to use. MTU [12] size MUST be set to 1500. The QoS [11] settings SHOULD be set at the given value below to ensure the best quality.

Regarding IPv6 the basic IPv6 [13] requirements MUST be followed on the WAN side:

WLL-1: If the WAN interface supports Ethernet encapsulation, then the IPv6 CE router MUST support IPv6 over Ethernet [14]. => verwijzing van maken

WAA-3: The IPv6 CE router MUST support DHCPv6 [10] client behavior.

WAA-7: If the IPv6 CE router does not acquire a global IPv6 address(es) from DHCPv6, then it **SHOULD** create a global IPv6 address(es) from its delegated prefix(es) and configure those on one of its internal virtual network interfaces, unless configured to require a global IPv6 address on the WAN interface.

WPD-1: The IPv6 CE router MUST support DHCPv6 prefix delegation requesting router behavior as specified in [RFC3633] (Identity Association for Prefix Delegation (IA_PD) option).

Notes:

- The CPE is allowed to do a IA_NA request and will receive a unique IPv6 address, however we encourage not to use this. Instead we advice to only do an DHCP IPv6 IA_PD request
- We do not support DHCPv6 Rapid Commit
- As DELTA Fiber uses DHCPv6 security rules, it is required for the CPE to do DHCP renew messages to maintain usability of the delegated prefix. (IP Source guard)

The basic IPv6 process is:

The PON ONT/RG modem MUST use the SLAAC (Stateless Address AutoConfiguration) protocol [15] to start creating a unique Link Local Address. With the Link Local address it MUST start sending a type 135 Router Solicitation that request a Router Advertisement from the First Hop Router (Distribution Router). The M (Managed) flag in the Router Advertisement will trigger the CPE to request a managed IPV6 prefix via DHCPv6.

The ONT/RG MUST send the DHCPv6 request with the following options:

Prefix Delegation (Option 25, OPTION_IA_PD) = MUST

WAN Address (Option 3 ,OPTION_IA_NA) = COULD*

DNS Servers (Option 23, OPTION_DOMAIN_LIST) = SHOULD

* Delta Fiber advices to only do an IA_PD request and use a unique prefix from this /56 to configure on the CPE.

By default every connection will get a unique **IPv6 /56 prefix** assigned. This prefix is persistent and is bound to the customer subscription.



For security reasons, we recommend using a firewall on the ONT/RG, to filter out incoming Internet traffic that is not initiated from the LAN side.

IPv6 DNS Servers (in case of static configuration needed):

- 1 DNS server address: 2a02:f68:0:6e:6e73::1**
- 2 DNS server address: 2a02:f68:0:cf3:6e73::2**
- 3 DNS server address: 2a02:f68:0:cf4:6e73::3**

Internet Service

At least the Internet service must be set at the ONT/RG.

Internet	
Type	DHCPv4 and/or DHCPv6 (dual stack)
VLAN	100
MTU	1500
IP protocol version	IPv4 and/or IPv6 (dual stack)
QoS marking	0

IPTV Service

Applicable if the end-user has a subscription for this service.

IPTV	
Type	DHCPv4
VLAN	101
MTU	1500
IP protocol version	IPv4
IGMP proxy	min IGMPv2



Voice

Applicable if the end-user has a subscription for this service. Further information about the VoIP configuration and requirements can be found in the Voice documentation.

VoIP	
Type	DHCPv4
VLAN	102
MTU	1500
IP protocol version	IPv4
QoS marking	5



Routing

Routing from source customer LAN to VLAN100

Source LAN destination 62.45.57.36/32 to VLAN 100

Routing from source customer LAN to the following subnets needs to be routed through VLAN101

62.45.57.34/32
62.45.57.0/24
62.45.59.0/24
62.45.76.0/24
62.45.58.226/32
62.45.45.150/32
62.45.49.0/24
212.115.196.0/25
217.63.90.128/25
217.63.91.0/26
62.45.61.32/27
62.45.61.16/28
62.45.61.64/28
217.102.255.57/32



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