

Titolo documento: All. 3 - xPON interface requirements for external ONTs and internal ONTs in optical CPEs in TIM FTTH deployment


Emesso da:	Process Owner:	Stato: in Vigore	Codice documento	Versione 1	Data di pubblicazione 26/07/2022
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All. 3 - xPON interface requirements for external ONTs and internal ONTs in optical CPEs in TIM FTTH deployment

Gestione	Funzione	Riferimento
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VERIFICATO		
APPROVATO		

Il presente documento è stato redatto in coerenza con:

- Codice Etico e di Condotta del Gruppo Telecom Italia
- Modello Organizzativo 231 del Gruppo Telecom Italia
- Policy “Definizione” e Formalizzazione di Policy, Procedure ed Istruzioni Operative di Gruppo e di Business Process Management
- Sviluppo dell’Identità Organizzativa - I nuovi Valori di Telecom Italia


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REGISTRO DELLE MODIFICHE

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1. INTRODUCTION

The document provides a list of Requests and Questions that an FTTH ONT, either external, or located in a Layer 3 OLO CPE, MUST fulfil, to be theoretically compliant and interoperable with the FTTH TIM equipment (OLT).

OLO MUST provide, before the validation test campaign performed by TIM, the answers list to these requirements document, which represent, hence, the interop basic level at which the OLO ONT or ONT or optical CPE interface MUST satisfy, and that will be analysed.

ONT or ONT or optical CPE suppliers, of course, MUST provide answers list regarding chapters related to their products (i.e., GPON or XGS-PON, specific Service Model), according to the descriptions reported in § 2.

As an output of this process, TIM reserve the right to not proceed to validation campaign if critical requirements fulfilment lacks will come out from the answers analysis, until they will be solved by the OLO.

1.1 ADOPTED CONVENTIONS

All the requirements will be indicated with the codification “**R_N**”, where:

- **R** stands for the requirement
- **N** is a progressive integer number that represents a unique ID for the requirement

All the questions will be indicated with the codification “**Q_N**”, where:

- **Q** stands for question
- **N** is a progressive integer number that represents a unique ID for the question


1.2 ANSWER METHOD TO REQUIREMENTS AND QUESTIONS

All the answers MUST refer to the compliance of optical xPON equipment interface to the specific requirement/question on the following date: **reception date of this document**.

If there is no compliance to a specific requirement/question at the date above, ONT or optical CPE supplier MUST indicate the availability date choosing among one of these possibilities:

- **Yes:** requirement/question already available at the **reception date of this document**
- **No:** requirement/question not available at the **reception date of this document**

ONT or optical CPE supplier MUST always specify in the answers the limitations and the maximum performance of their system whether the request is satisfied or not satisfied

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2. DESCRIPTION OF THE REFERENCE SCENARIO

This document is organized on three main sections of requirements/questions:


- first section refers to general behaviour of ONT or optical CPE
- second section refers to technology fulfilments for GPON and XGS-PON interface
- third section refers the Service Models requirements/questions, regardless technology, for which the ONT or optical CPE interface will be tested during the validation phase.

ONT or optical CPE supplier MUST provide answers for the technology and all Service Models that will be tested, according to the agreement occurred with the OAO.

Take note that the official Telecom Italia documents that describe the services that can be implemented on the ONT or optical CPE are the following (see [12]):

- “Offerta di Riferimento di Telecom Italia – Servizio Bitstream NGA”
- “Offerta di Riferimento di Telecom Italia – Servizio VULA”

A landscape of all Service Models is depicted in the document [1] “All_1 – TIM FTTH deployment Service Models for external ONTs and internal ONTs in optical CPEs”.

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3. SECTION 1 – ONT OR OPTICAL CPE GENERAL BEHAVIOUR

3.1 XPON INTEROPERABILITY

- R_1 The ONT or optical CPE interface **MUST** be fully interoperable with all OLTs and HW listed in the following Table 1. **In this table the actual OLT HW/SW situation is represented, and it will be modified in future if new OLT/Line Cards will be adopted for TIM FTTH deployment.** I.e., in future also the MPM module, on new Line Cards, could be used for providing legacy GPON services, and so new validation against this technology could occur.

Note: Validation tests of the xPON ONT or optical CPE interface will be performed against all the OLT/xPON Line Cards HW/SW indicated below, for the specific involved technology (GPON or XGS-PON). For GPON validation, please refer to blue cells, while for XGS-PON to green ones.


OLT Name	Supplier	SW Main Release	LT Boards / Used optical modules	TIM OLT xPON technology used in tests (today)
MA5600T	HUAWEI	V800R018	H806GPFD 16*GPON	GPON
MA5800	HUAWEI	V100R020	H902GPHF 16*GPON	GPON
			H902FLHF 16*GPON/MPM	XGS-PON
iSAM7360 FX	NOKIA	V6.2	FGLT-B 16*GPON	GPON
			FGLT-D 16*GPON	GPON
			FWLT-C 16*GPON/MPM	XGS-PON

Table 1 – OLT/ xPON Line Cards list adopted for validation tests

3.2 ONT OR OPTICAL CPE OPTICAL INTERFACE GENERAL REQUIREMENTS

The ONT or optical CPE providers **MUST** propose only one device per questionnaire and all the answers to the requirements and questions **MUST** be referred to the chosen device to be tested.

- Q_1 Specify the name of the ONT or optical CPE device (only one) and the Part Number
- Q_2 Provide detailed information about ONT or optical CPE interface optical chipset (vendor/model)
- Q_3 Provide a datasheet of the ONT or optical CPE reporting HW and SW information: functionalities list, ONT or optical CPE picture, size, connectors, LED, buttons, driver and SW versions, etc.
- R_2 The ONT or optical CPE **MUST** supply clearly the xPON Serial Number (in ASCII hexadecimal format). This SN will be used for the ONT interface authentication with OLT.
- R_3 All ONT or optical CPE GPON Functionalities parameters **MUST** be configurable via OMCI management

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Q_4 Indicate the maximum number of User VLAN required by the Service Model adopted by the OAO (this number will be addressed in the following requirements with “NUM_VLAN” term)

R_4 The GPON ONT or optical CPE interface MUST be able to provide to the OLT via OMCI MEs, the following parameters needed for assurance processes:

- Equipment ID
- Vendor ID
- Serial Number
- SW version number (active SW version)
- Equipment version number (HW version)
- Passive SW version of the ONT or optical CPE (optional)


R_5 The external ONT or optical CPE MUST indicate xPON connection status and SHOULD indicate optical LOS alarm. For example, it SHOULD have at least one LED for representing the connection status with the following behaviour:

- OFF when the xPON port is not connected to optical fibers or does not receive optical signals Fiber
- GREEN FLASHING when xPON optical interface is in one of the states O2, O3, O4 (see [4] par. 10.2.2) and is not authenticated yet.
- GREEN FIXED when the xPON optical interface is ranged and the S/N has been authenticated by OLT (state O5)

In case optical LOS alarm is present, provide detail about its behaviour. For example, it SHOULD have at least one LED for representing the LOS status with the following behaviour:

- OFF, in case of optical power normal
- ON FIXED, in case of LOS/LOF alarms

Q_5 Provide the list of all LEDs available on the ONT or optical CPE and a detailed description of the behaviour of each LED

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4. SECTION 2 – XPON TECHNOLOGY REQUIREMENTS

4.1 GPON ONT OR OPTICAL CPE INTERFACE FUNCTIONALITIES

R_6 The GPON ONT or optical CPE interface **MUST** be compliant with the most updated versions of the ITU-T G.984.x Recommendations [2], [3], [4], [5], [6], and with [7], and their amendments.

R_7 The GPON ONT or optical CPE interface **MUST** support a line rate of 2.488 Gbit/s downstream and 1.244 Gbit/s upstream

R_8 The GPON ONT or optical CPE interface **MUST** be able to cope with an ODN compliant with the requirements defined in [3]; in particular, it is required that the GPON system supports the following ODN attenuation range class:

- Class C+: 17-32 dB (Table V.2 [3] Amendment 2)

Note: consider that the Class C+ minimum DS sensitivity on the ONT or optical CPE interface receiver (-30 dBm) can be obtained with a B+ transceiver using DS FEC enabled.

R_9 The GPON ONT or optical CPE interface transmitter **SHOULD** use the narrow wavelength band option (1300-1320nm) or **MUST** use at least the reduced wavelength band option (1290-1330nm), as defined in [6] Table 1. This functionality is required for facilitating coexistence with new PON technologies.

R_10 The GPON ONT or optical CPE interface **MUST** support a fibre logical split ratio of up to 1:64 as specified in paragraph 6.2 of [4]

Q_6 Indicate if the GPON ONT or optical CPE interface supports optical power levelling in the upstream direction


R_11 The GPON ONT or optical CPE interface TC layer **MUST** be compliant with the requirements defined in [4]

R_12 The GPON ONT or optical CPE ONT **MUST** support the Non-Status Reporting or the Status Reporting mode in accordance with [4]; please indicate the reporting mechanism used on the device.


R_13 The GPON ONT or optical CPE interface **MUST** support a GTC that is composed by a “Framing Sublayer” and an “Adaptation Sublayer” in accordance with [4]

R_14 The GPON ONT or optical CPE interface **MUST** support the mapping of GEM frames into GTC payload (and inversely extracts GEM frames from GTC payload) in accordance with [4]

R_15 The GPON ONT or optical CPE interface **MUST** support the mapping of Ethernet frames into GEM frames (and inversely extracts Ethernet frames from GEM frames) in accordance with [4]

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- R_16 The GPON ONT or optical CPE interface MUST support DBA functionality to optimize upstream bandwidth allocation
- R_17 The GPON ONT or optical CPE interface MUST support the T-CONT utilization as defined in [4]
- R_18 The GPON ONT or optical CPE interface MUST support T-CONT Type 3 and 4
- R_19 The GPON ONT or optical CPE interface MUST support the encryption mechanism (128bit AES) in Counter Mode and the related Key Exchange mechanism defined in [4]
- R_20 Referring to Encryption mechanism, GPON ONT or optical CPE interface MUST not prevent a key refresh time less than or equal to 15 minutes as provided by the OLT.
- R_21 The GPON ONT or optical CPE interface MUST support data transport using FEC, as specified in [4] in the downstream direction
- R_22 The GPON ONT or optical CPE interface MUST support data transport using FEC, as specified in [4] in the upstream direction
- R_23 The GPON ONT or optical CPE interface MUST support the “embedded OAM”, “PLOAM” and “OMCI” management information channels
- R_24 The GPON ONT or optical CPE interface MUST be able to perform physical layer measurements to support Optical Layer Supervision, as specified in Annex B of [3]. In particular all the following transceiver parameters, as defined in Table B.1 of [3] MUST be monitored continuously in real-time, with the defined resolution, accuracy and repeatability, without significant degradation of the normal service transmission, and provided to the OLT:
- Transceiver temperature
 - Transceiver voltage
 - Laser bias current
 - ONT transmit power
 - ONT receive power
- R_25 The GPON system MUST support the ONT activation method based on the preconfiguration of the ONT serial number in accordance with [4]
- R_26 The GPON system MUST support the ONT activation method based on the auto-discovery of the ONT serial number in accordance with [4]
- R_27 The default value of the Managed Entity called “Upstream transmit power threshold” defined in the ONT MIB ([7] par.9.2.1 – ANI-G) MUST be set to the equivalent value of “+5.5 dBm”
- R_28 The ONT MUST support at least 17 GEM ports (this number could be reduced if the Service Model utilized foresees a number of User VLAN smaller than 4).

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R_29 The ONT MUST support at least 5 T-CONTs (this number could be reduced if the Service Model utilized foresees a number of User VLAN smaller than 4).

R_30 The ONT MUST be able to bind to each T-CONT at least 4 GEM ports

4.2 XGS-PON ONT OR OPTICAL CPE INTERFACE FUNCTIONALITIES

R_31 The XGS-PON ONT or optical CPE interface MUST be compliant with the most updated versions of the [8] and [7]

R_32 The XGS-PON ONT or optical CPE interface MUST support a symmetrical line rate of 9.95328 Gbit/s (downstream and upstream)

R_33 The XGS-PON ONT or optical CPE interface MUST be compliant with the requirements defined for class C+ (used in an MPM module on OLT equipment) in particular:

- ODN attenuation range: 17-32 dB (Table 6.1 of [9])
- ONU XGS-PON minimum sensitivity: -28 dBm (Table B.9.3 of [8])
- ONU XGS-PON power Tx range (min/max): +4/+9 dBm (Table B.9.4 of [8])

R_34 The XGS-PON ONT or optical CPE interface MUST support a fibre logical split ratio of at least of 1:64, as specified in paragraph A.8.5 of [8]

R_35 The XGS-PON ONT or optical CPE interface TC layer MUST be compliant with the requirements defined in the Annex C of [8]

R_36 The XGS-PON ONT or optical CPE ONT MUST support the Non-Status Reporting or the Status Reporting mode in accordance with A.9.3 of [8]; please indicate the reporting mechanism used on the device.

R_37 The XGS-PON ONT or optical CPE interface MUST support a XGTC that is composed by a “Framing Sublayer” and an “Adaptation Sublayer” in accordance with Annex C of [8]

R_38 The XGS-PON ONT or optical CPE interface MUST support the mapping of XGEM frames into XGTC payload (and inversely extracts XGEM frames from XGTC payload) in accordance with Annex C of [8]

R_39 The XGS-PON ONT or optical CPE interface MUST support the mapping of Ethernet frames into XGEM frames (and inversely extracts Ethernet frames from XGEM frames) in accordance with Annex C of [8]


R_40 The XGS-PON ONT or optical CPE interface MUST support DBA functionality to optimize upstream bandwidth allocation

R_41 The XGS-PON system MUST support the T-CONT utilization as defined in Annex C of [8]

R_42 The XGS-PON ONT or optical CPE interface MUST support T-CONT Type 3 and 4

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- R_43 The XGS-PON ONT or optical CPE interface MUST support the encryption mechanism (128bit AES) in Counter Mode and the related Key Exchange mechanism defined in Annex C of [8]
- R_44 Referring to Encryption mechanism, the XGS-PON ONT or optical CPE interface MUST not prevent a key refresh time less than or equal to 15 minutes as provided by the OLT
- R_45 The XGS-PON ONT or optical CPE interface MUST support data transport using FEC, as specified in Annex C of [8] in the downstream direction
- R_46 The XGS-PON ONT or optical CPE interface MUST support data transport using FEC, as specified in Annex C of [8] in the upstream direction
- R_47 The XGS-PON ONT or optical CPE interface MUST support the “embedded OAM”, “PLOAM” and “OMCI” management information channels
- R_48 The XGS-PON ONT or optical CPE interface MUST be able to perform physical layer measurements to support Optical Layer Supervision, as specified in Appendix B.II of [8]. In particular, all following transceiver parameters defined in Table B.II.1 of [8] MUST be monitored continuously in real-time, with the defined resolution, accuracy and repeatability, without significant degradation of the normal service transmission, and provided to the OLT:
- Transceiver temperature
 - Transceiver voltage
 - Laser bias current
 - ONT transmit power
 - ONT receive power
- R_49 The XGS-PON ONT or optical CPE interface MUST support the ONT activation method based on the preconfiguration of the ONT serial number in accordance with [8]
- R_50 The XGS-PON ONT or optical CPE interface MUST support the ONT activation method based on the auto-discovery of the ONT serial number in accordance with [8]
- R_51 The XGS-PON ONT or optical CPE interface MUST support at least 17 XGEM ports (this number could be reduced if the Service Model utilized foresees a number of User VLAN smaller than 4).
- R_52 The XGS-PON ONT or optical CPE interface MUST support at least 5 T-CONTs (this number could be reduced if the Service Model utilized foresees a number of User VLAN smaller than 4).
- R_53 The XGS-PON ONT or optical CPE interface MUST be able to bind to each T-CONT at least 4 XGEM ports

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5. SECTION 3 - SERVICE MODELS REQUIREMENTS

5.1 L2 BRIDGING FUNCTIONALITIES


- R_54 The xPON ONT or optical CPE interface MUST support VLAN with 802.1q tagged frames containing priority-tagged information as defined in IEEE 802.1p method
- R_55 The xPON ONT or optical CPE interface MUST support VLAN Id able to assume values from 1 to 4095, using the entire field (12 bit) dedicated to it
- R_56 The xPON ONT or optical CPE interface MUST NOT learn MAC addresses to determine how to forward Ethernet Frames as required by [11]
- R_57 The support of many different VLANs on the same xPON ONT or optical CPE ONT MUST guarantee the traffic's segregation between them (unicast, multicast and broadcast traffic): in no case the traffic received on a VLAN (included the case of implicit VLAN on the LAN) MUST be forwarded to another VLAN
- R_58 In whatever condition the xPON ONT or optical CPE ONT works, it MUST allow the transmission of Ethernet frames with an MTU (included the 802.1q tag) of at least of 2048 Bytes.
- Q_7 Indicate the MTU permitted by the xPON ONT or optical CPE ONT
- R_59 All Bridging Functionalities parameters MUST be configurable via OMCI protocol

WAN Side:

- R_60 The xPON ONT or optical CPE interface MUST carry Ethernet frames at layer 2 in trunking way according to the [10] standard
- R_61 According to Q_4 the xPON ONT or optical CPE interface MUST support a minimum of concurrent active VLANs at least equal to NUM_VLAN.
- R_62 The xPON ONT or optical CPE ONT MUST discard the incoming traffic from the WAN with unknown or without VLAN Id.

LAN Side:

- R_63 According to Q_4 the xPON ONT or optical CPE ONT UNI interface MUST support a minimum of concurrent active VLANs at least equal to NUM_VLAN.
- R_64 The xPON ONT or optical CPE interface MUST discard traffic coming from the UNI interface with unknown VLAN id
- R_65 The xPON ONT or optical CPE ONT interface, on configuration basis, MUST discard or manage traffic coming from the UNI interface with no VLAN TAG (untagged)

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- R_66 The xPON ONT or optical CPE interface **MUST** forward any kind of packet/protocol from the UNI VLAN to the WAN VLAN (and vice versa). Then the xPON ONT or optical CPE interface **MUST** forward transparently: Broadcast, Multicast, Unicast Unknown, IGMP, ARP, PPPoE, DHCP, IPoE, PIM, BGP and so on
- R_67 Each VLAN created on the UNI side **MUST** be associated one-to-one with a VLAN on xPON side. The VLAN identifiers on the UNI and xPON side could be different; in this case the “VLAN translation” functionality is required to be mandatory
- R_68 The xPON ONT or optical CPE interface **MUST NOT** alter any VLAN TAGs beyond the outer one, and **MUST** treat any additional TAGs as part of the payload (in TIM language this service is called “triple TAG”, because the OLT will manage three VLAN TAGs stacked)
- R_69 In case of using Untagged traffic on the UNI side, it **MUST** be associated one-to-one with a VLAN on xPON side; in this case the “VLAN TAG added” functionality is required to be mandatory

5.2 QOS FUNCTIONALITIES COMMON TO BOTH MONOCOS AND MULTICOS VLANS

The WAN QoS functionalities described in the following specifications **MUST** be available for the upstream and downstream data flow.

- Q_8 Provide detailed information about the QoS architecture of the xPON ONT or optical CPE interface (including classification, marking, policing, scheduling mechanisms)
- R_70 The xPON ONT or optical CPE interface **MUST** manage at least 4 separate priority queues, implemented before each congestion point. In particular: downstream before frames are sent to the UNI ports; upstream before frames are sent to the Transmission Container (T-CONT) logical port
- R_71 The xPON ONT or optical CPE interface **MUST** use the CoS (VLAN tag priority or IEEE.802.1p method) field to distinguish in downstream between different classes of service and to direct traffic to the appropriate queue of the UNI port.
- For Tagged traffic the xPON ONT or optical CPE interface **MUST** distinguish the different classes of service by taking into account the CoS field of the outer VLAN.
 - For Untagged traffic the xPON ONT or optical CPE interface **MUST** distinguish the different classes of service by taking into account the CoS field before removing the TAG.
- R_72 The xPON ONT or optical CPE interface **MUST** use the GEM port-id field to distinguish between different classes of service and to direct traffic to the appropriate queue of the Transmission Container (T-CONT) logical ports.
- R_73 In xPON ONT or optical CPE interface, the mapping between CoS values and classes of service (queues) **MUST** be configurable with no restrictions, i.e., it **MUST** be possible to direct any two different CoS values, even non-adjacent, to the same queue

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R_74 In xPON ONT or optical CPE interface, at each congestion point (T-CONTs and UNI port) it MUST be possible to apply a Strict Priority (SP) scheduling mechanism to at least 2 queues

R_75 In xPON ONT or optical CPE interface, at each congestion (T-CONTs and Ethernet ports) point it MUST be possible to apply a Weighted Fair Queuing (WFQ) (or similar) scheduling mechanism to at least 2 queues. The weights MUST be configurable. Following the queuing and scheduling architecture as used by FTTH TIM deployment:

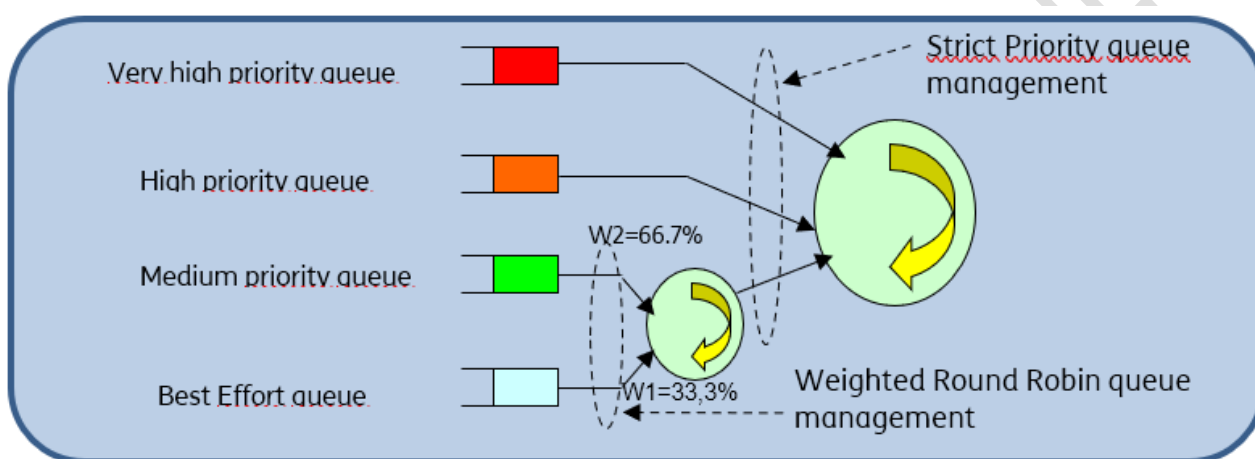


Figure 1 – scheduling example for QoS management

CoS values	Queue type	Queue tipology	Service Type
0, 1	Best Effort	WRR (33 %)	Low priority service (e.g. Internet)
2, 4	Medium priority	WRR (67%)	Medium priority service (e.g. business)
3, 6, 7	High priority	SP	High priority service (e.g. Video)
5	Very High priority	SP	Very High priority service (e.g. VoIP)


Table 1 – CoS <> queue relationship

R_76 In xPON ONT or optical CPE interface, all QoS parameters MUST be configurable via OMCI protocol (e.g. WFQ/WRR queue weights, Priority Queues, CoS,..)

5.3 QOS FUNCTIONALITIES REFERRED TO MONOCOS VLANS

In this paragraph the requirements refer to the following Services:

- BitStream → VLAN mono Cos 0 or 1 (single or double tag)
- BitStream → VLAN mono Cos 3 or 5 (single or double tag)

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R_77 The xPON ONT or optical CPE interface MUST be able to direct user aggregated traffic¹ from UNI ports to the appropriate GEM port ID by using the VLAN ID (Mapping mode based on VLAN ID). [VLAN/SVLAN MonoCoS Scenario]

R_78 Referring to R_77 (Mapping mode based on VLAN ID), in the xPON ONT or optical CPE interface, each GEM port MUST be able to aggregate at least 1 traffic flow with different VLAN IDs.

R_79 In the xPON ONT or optical CPE interface, for each VLAN it MUST be possible to remark the traffic according to 802.1p field. The xPON ONT or optical CPE interface MUST be able to receive untagged upstream frames and to add a tag with configurable CoS value

R_80 The xPON ONT or optical CPE interface MUST be able to receive single-tagged upstream frames and to overwrite the [IEEE.802.1p] field with a configurable CoS value

5.4 QOS FUNCTIONALITIES REFERRED TO MULTICOS VLANS

In this paragraph the requirements refer to the following Services:

- BitStream → VLAN Multi Cos (single or double tag)
- VULA → VLAN Multi Cos (double tag)

R_81 The xPON ONT or optical CPE interface MUST be able to direct user aggregated traffic² from UNI ports to the appropriate GEM port ID by using the pair VLAN ID and CoS (up to three CoS values) (Mapping mode based on VLAN and CoS) [VLAN/SVLAN MultiCoS Scenario]

R_82 Referring to R_81 (Mapping mode based on VLAN and CoS), each GEM port MUST be able to aggregate at least 3 traffic flows with different pairs of VLAN ID and CoS (up to three CoS values).

R_83 In the xPON ONT or optical CPE interface, For each VLAN it MUST be possible to forward the traffic without any change to 802.1p field


R_84 The xPON ONT or optical CPE interface MUST be able to receive single-tagged upstream frames and not to change the [IEEE.802.1p] field

5.5 MULTICAST FUNCTIONALITIES


R_85 All Multicast parameters MUST be configurable via OMCI management

¹ Aggregated traffic means the traffic coming from more LAN ports that satisfies the rule of same VLAN ID

² Aggregated traffic means the traffic coming from more LAN ports that satisfies the rule of same VLAN ID and CoS values


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- R_86 The xPON ONT or optical CPE interface MUST support a range of at least 1024 multicast channels that MUST be stored in its internal memory via OMCI channel
- R_87 The xPON ONT or optical CPE interface MUST be able to forward to the LAN side at least 16 channels
- R_88 The xPON ONT or optical CPE interface MUST support IGMPv2 protocol
- R_89 The xPON ONT or optical CPE interface MUST support IGMP snooping functionality
- R_90 The xPON ONT or optical CPE interface MUST support in Upstream the forwarding of the IGMP packets to the OLT applying a VLAN translation ID (from Multicast User VLAN id on the UNI side to the Multicast VLAN id on the xPON side)

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6. LIST OF REFERENCES

Rif.	Titolo Documento	Codice Documento	Data emissione
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[2]	Gigabit-capable Passive Optical Networks (G-PON): General characteristics	ITU-T G.984.1 Amendment 1 Amendment 2	03/2008 10/2009 04/2012
[3]	Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification	ITU-T G.984.2	08/2019
[4]	Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification	ITU-T G.984.3 Amendment 1	01/2014 03/2020
[5]	Gigabit-capable Passive Optical Networks (G PON): ONT management and control interface	ITU-T G.984.4 Erratum 1 Amendment 1 Amendment 2 Corrigendum1 Amendment 3	02/2008 08/2009 06/2009 11/2009 03/2010 07/2010
[6]	Enhancement band for gigabit capable optical access networks	ITU-T G.984.5	02/2022
[7]	ONU management and control interface (OMCI) specification	ITU-T G.988 Amendment 1 Amendment 2 Amendment 3 Amendment 4 Amendment 5	11/2017 11/2018 08/2019 03/2020 09/2021 06/2022
[8]	10-Gigabit-capable symmetric passive optical network (XGS-PON)	ITU-T G.9807.1 Erratum 1 Amendment 1 Corrigendum 1 Amendment 2	06/2016 03/2017 10/2017 03/2020 10/2020
[9]	Coexistence of passive optical network systems	ITU-T G.9805.1	02/2022
[10]	IEEE Standard for Local and Metropolitan Area Networks-Bridges and Bridged Networks	IEEE 802.1q-2018	05/2018
[11]	Using GPON Access in the context of TR-101	BBF TR-156 Issue 3	11/2011
[12]	Offerta di Riferimento di Telecom Italia per i mercati VULA (3a) e Bitstream NGA (3b)	https://wdc.wholesale.telecomitalia.it/offerte-di-riferimento/	2022

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ANNEX 1. LIST OF ACRONYMS

Acronyms	Description
BP	Banda di Picco (Peak Bandwidth)
CBS	Committed Burst Size
CIR	Committed Information Rate
CO	Central Office
CoS	Class of Service
CPU	Central Processing Unit
C-VLAN	Customer-Virtual Local Area Network
DHCP	Dynamic Host Configuration Protocol
DS	Downstream
DSCP	Differentiated Services Code Point
EM	Element Manager
FEC	Forward Error Correction
FTTH	Fiber To The Home
GbE	Giga bit Ethernet
GPON	Giga Passive Optical Network
GUI	Graphic User Interface
I/F	Interface
IP	Internet Protocol
IpoE	Internet Protocol over Ethernet
LAN	Local Area Network
LCT	Local Craft Terminal
MAC	Media Access Control
ME	Managed Entity
MIB	Management Information Base
MPM	Multi PON Module (Aka “Combo”)
NB	Northbound
NE	Network Element
NFV	Network Functions Virtualisation
NGN2	New Generation Network 2

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NP	Network Provider
NT	Network Termination
NTP	Network Time Protocol
OAM	Operation, Administration and Maintenance
OAQ	Other Authorised Operatorolo
ODN	Optical Distribution Network
OLO	Other Licensed Operator
OLT	Optical Line Termination
OMCI	ONU/ONT Management and Control Interface
ONT	Optical Network Termination
ONU	Optical Network Unit
OPM	Optical Packet Metro
OS	Operating System
PIR	Peak Information Rate
PON	Passive Optical Network
QoS	Quality of Service
SFP	Small Form-Factor Pluggable
S/N	Serial Number
S-VLAN	Service Virtual Local Area Network
SW	Software
T-CONT	Traffic Container
TCP	Transmission Control Protocol
ToS	Type of Service
US	Upstream
VLAN	Virtual Local Area Network
VLAN-ID	Virtual Local Area Network Identification
VULA	Virtual Unbundled Local Access
WFQ	Weighted Fair Queuing
WRED	Weighted Random Early Discard
WRR	Weighed Round Robin
xPON	GPON/XGS-PON