Access Network Transport

Standards Overview

July 2019 Q1/15 Meeting

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Access Network Transport is an ITU-T Project dealing with studies and Recommendations on the Access Network.

Access Network Transport Standards Overview

Issue 32, July 2019

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| Revision Status Report: Major Updates of Version 32, July 2019 |
| 1. Sections 3, 5, 6 and 7 have been entirely reviewed and reworked to comply with ITU-T G.902 2. Annex 2.1, Standards related to ANT Technologies    * Historical standards and standards not directly related to ANT Technologies have been deleted.    * HFC DOCSIS standards from ETSI and SCTE have been added and Recommendations from ITU-T SG9 on HFC have been reviewed and updated.    * ETSI standards have been reviewed and updated.    * ITU-T G.989.2, G.989.3 Amd.2, G.9807.2 Amd.1, G.993.2, G.993.5, G.994.1,  G. 998.2, G.998.4, G.999.1 and G.9701 have been updated.    * ITU-T G. 984.4 has been transferred in Annex 2.2.    * ITU-T G.9803 and G. Suppl. 66 have been added. 3. Annex 2.2, Standards related to broadband ANT Infrastructure Elements (incl. maintenance and operation)    * Historical standards and standards not directly related to ANT Infrastructure Elements have been deleted.    * CENELEC Technical Report CLC/TR 50682 has been added    * ETSI standards on Energy Management have been reviewed and updated.    * ITU-T G. 988 Amd.1, G.996.2, G.997.1 and G.997.2 have been updated.    * ITU-T G. Suppl. 45 and 49 have been added.    * ITU-T G.651.1, L.109, L.314, G. Suppl 40 and 42 have been reviewed    * ITU-T L.163, L.1700 and L. Suppl 22 have been added 4. Annex 4, List of Abbreviations has been reviewed and reworked |

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**ACCESS NETWORK TRANSPORT STANDARDS OVERVIEW**

Issue 32, JULY 2019

# Introduction

In today's global communications world the traditional boundaries in network access between Telecommunication Network Operators, Private Network Providers, Satellite and Cable TV Networks and Information Technologies cease to exist.

Within the ITU-T, the study and development of Recommendations related to transport in the access network is being carried out in a number of different Study Groups, e.g. SG 9, 13, 15. Moreover, ITU-R and other standards bodies, forums and consortia are also active in this area.

Recognizing that without a strong coordination effort there is the danger of duplication of work as well as the development of incompatible and non-interoperable standards, the WTSC 96 designated Study Group 15 as **Lead Study Group** on **Access Network Transport (ANT) - reaffirmed at the WTSA-16 -** with the mandate to

1. study the appropriate core Questions (Question 1, 2 and 4/15)
2. define and maintain an overall (standards) framework, in collaboration with other SGs and standards bodies
3. coordinate, assign and prioritize the studies done by the Study Groups (recognizing their mandates) to ensure the development of consistent, complete and timely Recommendations.

Study Group 15 entrusted WP 1/15 (Network Access), under Question 1/15, with the task to manage and carry out the Lead Study Group activities on Access Network Transport.

# 1. Scope

This document defines an ANT on the background of the Recs. G.902 and GII Y.100 series and provides an overview of the existing ANT related standards released and/or prepared by the ITU and other standardization bodies.

The main purpose ofthe **ANT Standards Overview** is to identify

- Which standards exist

- Lack of standards

- Duplication and/or overlap

- Market needs

- Priorities.

Topics/standards under study/development are identified in the **ANT Standards Work Plan.**

The presentation of the standards overview consists of two matrixes identifying key elements of the access network transport technologies and a listing of the various standards organizations and their standards identified, including their titles and publication dates.

# 2. References

ITU-T Recommendation G.902 (11/1995) : Framework Recommendation on functional access networks (AN) – Architecture and functions, access types, management and service node aspects  
  
ETSI EG 202 306 V1.2.1 (1998-05): Transmission and Multiplexing (TM); Access networks for residential customers  
  
ITU-T G Suppl. 50 (09/2011): Overview of digital subscriber line Recommendations  
  
ITU-T Recommendations Y.100 series on Global Information Infrastructure (GII)  
  
ANT Standards Work Plan (Issue 31)

# 3. General Access Network architecture

The basic documents for the following definitions are ITU-T G.902 and ETSI EG 202 306.

**Access Network Transport (ANT):**

Based on definitions specified in ITU-T Rec. G.902 the Access Network (AN) provides transport bearer capabilities for the provision of telecommunications services inside of the AN between a service node interface (SNI) providing customer access to a service node and each of the associated interfaces towards the Customer Premises Network(s) which are being grouped as user network interfaces (UNIs) . An Access Network implementation comprises transmission media and access network element (NE) entities.  
An Access Network is delimited by its interfaces. Users are connected via a User Network Interface (UNI) to the network. The AN is connected to the Service Node (SN) via the Service Node Interface (SNI) and to the Telecommunication Management Network (TMN) via a Q3 interface.  
Figure 1 “ General Access Network architecture and boundaries” shows the AN with the UNI, SNI and Q3 interface as the boundaries to other network entities.



Figure 1 “ General Access Network architecture and boundaries” (extracted from ITU-T G.902)

An Access Network element can be configured and managed through a Q3 interface that may be implemented at the Q reference point. This Q reference point is the access point for management information, configuration control, performance monitoring and maintenance as defined in ITU-T Rec. M.3010.

In principle there are no restrictions on the types and number of SNIs and UNIs that an Access Network may implement. The Access Network does not interpret (user) signaling and does not include Customer Premises Networks and/or terminal equipment respectively.

# 4. Abbreviations

The list of ANT related abbreviations is included into the Annex 4.

# 5. Access Network functional groups

The ANT functions as definitions specified in the ITU-T Rec. G.902 are divided into 5 groups:

1. User port functions
2. Service port functions
3. Core functions
4. Transport functions
5. AN-system management functions

Figure 2 gives an example of one AN functional architecture and how each of the functional groups are interconnected.  
  


Figure 2 “ Example of functional architecture of an Access Network” (extracted from ITU-T G.902)

Figure 3 shows an example of the layers that are processed in each functional group based on the example given in Figure 2.



Figure 3 “ Layered structure of an Access Network based on G.902 ”  
 (extracted from ITU-T I.414)

* **User port function (UPF):** This function adapts the specific UNI requirements into the core and system management functions.
* **Service port function (SPF):** This function adapts the specific SNI requirements into the core and system management functions.
* **Core function (CF):** This function adapts the individual User Port or Service Port bearer requirements into common transport bearers. The core function can be distributed in the AN.
* **Transport function (TF):** This function provides the network connections for the common bearers between different locations and the media adaptation.
* **AN system management function (AN-SMF):** AN System Management function coordinates operations and maintenance of the User Port function, Service Port function, Core function and Transport function within the AN. It coordinates time critical management and operation requirements for the allocated user ports with the Service Node via the SNI. It communicates with the TMN via the Q3 interface for the purpose of being monitored and/or controlled.

**Functions of Access Network Transport (ANT):**

The Transport Function (TF) provides the paths for the transport of common bearers between different locations in the Access Network (AN) and the media adaptation for the relevant transmission media used.

Examples of transport functions are:

1. multiplexing function,
2. cross connect function including grooming, on demand connection and configuration,
3. management functions,
4. physical media function.

# 6. Reference configuration for ITU-T G.99x-series Recommendations

As described in ITU-T G Suppl. 50, there are two generic reference configurations used to relate the ITU-T G.99x-series Recommendations for DSL systems. First reference configuration is based on the reference configuration used for the N-ISDN in ITU-T I.410 and described in figure 4 below. The other reference configuration is a protocol reference configuration to provide a view of the ITU-T G.99x-series Recommendations from the protocol architecture point of view.

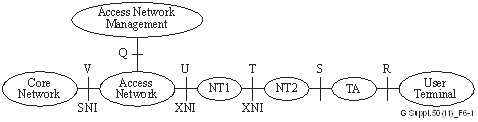


Figure 4 “ A reference configuration for a generic ITU-T G.99x system”   
(extracted from ITU-T G Suppl. 50)

This reference configuration identifies the reference points in the context of Access Network (AN). The generic reference configuration consists of seven elements:

1) Core network.

2) Access network.

3) Network termination 1 (NT1).

4) Network termination 2 (NT2).

5) Terminal adapter (TA).

6) User terminal.

7) Access network management.

Core network and access networks are separated at the V reference point – which serves as Service Node Interface (SNI). The access network and the access network management elements are separated at the Q reference point. The NT1 makes a physical connection to the access network at the U reference point, and provides service presentation to a customer on a logical or physical interface at the T reference point. An NT2 connects to the network at the T reference point, may connect to multiple user terminals on S reference point interfaces. The NT2 may be integrated with an NT1 to form an NT1/2. The NT term is used for generic network termination for various services. For some services it could be part of the access network, and for others not. The U and T reference points serve as Access Network Interfaces (XNI). The Access Network Interface (XNI) is the interface between the access network and the user premises, and therefore also serves as User Network Interface (UNI).  
A TA adapts the transport protocol to the specific requirements of a user terminal.

Note: The NT term is used for generic Network Termination for various services. For some services/configurations, the NT might be property of the customer and therefore integrated in the CPN; nevertheless it terminates the Access Network from a functional/physical point of view.

# Access Network Transport interfaces

##### Examples of Service Node Interfaces (SNIs)

##### SNI is defined as the interface that includes the following conditions:

##### interconnection between the access network and the service node,

##### described by a well-known standard,

##### includes a physical layer aspect.

Example of SNIs, physical interfaces and services that can be supported by the physical interfaces are shown in Table 7-1.

| Table 7-1 – Examples of SNIs and services | | |
| --- | --- | --- |
| SNI | Physical interface | Service |
| 1 GigE [IEEE 802.3] | 1000BASE | Ethernet |
| 10 GigE [IEEE 802.3] | 10GBASE | Ethernet |
| 40 GigE [IEEE 802.3] | 40GBASE | Ethernet |
| 100 GigE [IEEE 802.3] | 100GBASE | Ethernet |
| [ITU-T G.8261]  [ITU-T G.8262] | - | SyncE |
| [ITU-T G.964] and  [ITU-T G.965] | V5.1 and V5.2 | POTS, basic ISDN |
| [ITU-T G.967.1] and  [ITU-T G.967.2] | VB5.1 and VB5.2 | B- ISDN |
| [ITU-T G.703] | PDH, STM-1e | DS3, E1, E3, STM-1, DS1, DS0 |
| [ITU-T G.957] | STM-1,4,16,64 | E1, E3, DS1, DS3, GFP, E4,  STM-n, DS0 |
| [ATIS 0600107] | PDH | DS0, DS1, DS3 |
| SDH/SONET | SDH/SONET | OC3-OC192 , STM1-STM64 |
| OTN [ITU-T G.872] and  [ITU-T G.709] | OTN | OTU1, OTU2, OTU3 |
| CPRI/OBSAI (Open Base Station Architecture Initiative) |  |  |

##### Examples of User Network Interfaces (UNIs)

##### As defined in the ITU-T I.112, the User Network Interface (UNI) is the interface between the terminal equipment and a network termination at which interface the access protocols apply.

A UNI is defined as the interface that includes the following conditions:

* interconnection between the access network and the customer;
* described by a well-known standard;
* includes a physical layer aspect.

Examples of UNIs, physical interfaces and connectivity to be provided are shown in Table 7.2

| Table 7.2 – Examples of UNI and connectivity service | | |
| --- | --- | --- |
| UNI | Physical interface | Connectivity service |
| 10 Mbit/s/100 Mbit/s/1 Gbit/s Ethernet [IEEE 802.3] | 10/100/1000BASE | Ethernet |
| MoCA 2.0 | – | MoCA 2.0 |
| 1 Gbit/s fibre UNI | – | Ethernet |
| 10 Gbit/s fibre UNI | 10BASE | Ethernet |
| [ITU-T G.8261];  [ITU-T G.8262] | – | Synchronous Ethernet |
| [b‑ITU-T Q.552] | – | POTS |
| ISDN [ITU-T I.430] | – | ISDN |
| V.35 | – | – |
| G.hn [ITU-T G.9960] and [ITU-T 9961] | G.hn | G.hn |
| VDSL2 [ITU-T G.993.2], ADSL2+ [ITU‑T G.992.5] | xDSL | xDSL (e.g. FTTB, FTTC, FTTCab) |
| G.fast [ITU-T G.9701] | G.fast | G.fast ( FTTdp) |
| [ITU-T G.703] | PDH | DS3, E1, E3 |
| [b‑ATIS 0900102] and [b‑ATIS 0600107] | PDH | T1, DS0, DS1, DS3 |
| SDH/SONET |  | OC3 – OC192, STM1- STM64 |
| OTN [ITU-T G.709],  [ITU-T G.872] |  | OTU1, OTU2 |
| CPRI/OBSAI (Open Base Station Architecture Initiative) |  |  |
| 1PPS |  | Synchronizing interface |

##### Examples of Services

Services for residential subscribers, business customers, and mobile backhauling applications

| Service | |
| --- | --- |
| PSTN | VoIP |
| POTS |
| ISDN |
| TV (real-time) | IPTV |
| Digital TV broadcasting |
| Video | Digital video , video over IP |
| Leased line | T1, E1, E3, DS0, DS1, DS3 |
| High speed Internet access | Gigabit Ethernet [IEEE 802.3] |
| Ethernet data service | Ethernet service is mainly to transmit data such as IP, which includes VoIP, video streams coded by MPEG-2 or MPEG-4, and so on |
| L2 VPN services | Such as Ethernet services, with latest MEF Carrier Ethernet 2.0 extension, etc. (see [MEF 6.1]). |
| IP services | Such as L3 VPN and VoIP, etc. |
| Mobile backhaul | Accurate frequency/phase/time synchronization |
| Business applications | Ethernet services such as point-to-point, multipoint-to-multipoint and rooted-multipoint Ethernet virtual connection (EVC) services (also called E-Line, E-LAN and E-Tree, respectively). |

# 8. Access Network Transport technologies

Today’s Access Network Transport technologies enable the telecom and internet service providers to offer multi-services and applications (e.g. voice telephony, data, video, etc.) - including both legacy and emerging services - to a wide range of markets and customers, e.g. residential subscribers in SFUs (single family units) and MDUs (multi-dwelling units), businesses, public organizations like schools, hospitals, etc.. They may also be connected to other network infrastructures like for example base stations of mobile networks, security and monitoring networks and they may support wholesale and retail.  
 Today’s Access Network Transport types can be classified as below according to the transmission medium of the physical path and used technology:

1. Metallic Conductor Broadband Access
   1. Integrated services digital network (ISDN)
   2. Digital Subscriber Lines (DSL) Technologies
      * HDSL (High bit rate DSL) and SHDSL (Single-pair high-speed DSL)
      * ADSL (Asymmetric DSL), ADSL2 and ADSL2plus
      * VDSL (Very-high speed DSL), VDSL2 and VDSL2 Vectoring
      * G.fast (fast access to subscriber terminals) /FTTdp
   3. Ethernet over copper (EoC)
2. Fibre Optic Broadband Access
   1. Point-to-Point (PtP) Ethernet
   2. Passive Optical Network (PON)
      * Early PON Protocols: OAN and B-PON
      * Gigabit PON: G-PON and 1G-EPON
      * 10-Gibabit PON: XG-PON, XGS-PON and 10G-EPON
      * 40-Gigabit PON: NG-PON2
      * Higher-Speed PON and Multiple-wavelength PON (MW-PON)
   3. Hybrid Fibre Access Technologies
      * Radio Frequency over Glass Fibre-to-the-Home (RFoG)
      * Radio over Fibre (RoF)
      * RF-Video Overlay
      * Wireless – Fibre Access Networks
3. Hybrid Fibre Coax (HFC) Broadband Access
   1. DOCSIS (Data-Over-Cables Service Interface Specification) Network
   2. High Performance Networks over Coax (HiNoC)
   3. Ethernet Passive Optical Networks Protocol over Coax (EPoc)
   4. Radio Frequency over Glass Fibre-to-the-Home (RFoG)
   5. Radio over IP transmission
4. Fixed Wireless Access
5. Satellite
6. Power Line Communications (PLC)

Annex 1 depicts examples of deployment scenarios and references models of some major Access Network Transport technologies deployed today.

# 9. Overview of existing ANT standards

In order to classify the existing ANT standards, a matrix of ANT-related standards was developed from known public lists inputs from other ITU Study Groups, other standards development organizations (SDOs), Forums & consortia. The matrix is organized by Standards bodies alphabetically listed and then by standard numbers and titles. The current matrix is reported in Annex 2 and consists of two parts reported in Annex 2.1 and Annex 2.2.

The Annex 2.1 - Standards related to ANT Technologies – lists the ANT relevant standards by transmission medium and technology. Each standard is categorized by marking its type according to a code as below:  
General Aspects (Gen. Asp.) = General requirements, architecture and functions  
Medium: F= Fiber; C= Coax; P= Twisted pair; A= Wireless  
Technology: I= ISDN; D= DSL; G= G.fast; E= PtP; P= PON; H= HFC; W= Fixed Wireless Access and Satellite; L= PLC  
Additionally examples of deployment scenarios and references models of some major Access Network Transport technologies deployed today are shown in Annex 1.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Stds. Body** | **Number** | **Titles** | **Gen. Asp.** | **Medium** | | | | **Technology** | | | | | | | | **Public. Date** |
| F | **C** | **P** | A | I | **D** | **G** | **E** | **P** | **H** | **W** | **L** |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Sample format for standards matrix as in Annex 2.1**

The Annex 2.2 - Standards related to ANT Infrastructure Elements – lists the ANT relevant standards by transmission medium and infrastructure elements including operation and maintenance. Each standard is categorized by marking its type according to a code as below:  
General Aspects (Gen. Asp.) = General aspects on network infrastructure, design and management  
Medium: F= Fiber; C= Coax; P= Twisted pair; A= Wireless  
Infrastructure: N= Network engineering and infrastructure elements including node equipment and devices; E= Power supply and energy management; O= Operation and maintenance including network management; T = Testing; C= Conformance and interoperability; F = Optical cable technology;   
P = Copper cable technology; I = Cable installation technique

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Stds. Body** | **Number** | **Titles** | **Gen. Asp.** | **Medium** | | | | **Infrastructure** | | | | | | | | **Public. Date** |
| F | **C** | **P** | A | N | **E** | **O** | **T** | **C** | **F** | **P** | **I** |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Sample format for standards matrix as in Annex 2.2

The matrixes are updated through liaison to ITU-T, ITU-R, and standards organizations outside the ITU. It is planned to eventually replace this manual method for presenting the matrixes of standards with a web-based approach where a user could click on a portion of the ANT technologies and immediately obtain a list of relevant standards.

# Annex 1

**Examples of deployment scenarios and references models of   
Access Network Transport technologies**

### A1.1 Metallic Conductor Broadband Access

### A1.1.1 Access Digital Subscriber Line (DSL) technology Examples of ADSL2plus, VDSL2 and G.fast deployment

### 

### Figure 1.1 - Example of Access Network solutions using ADSL2plus, VDSL2 and G.fast technologies

### 

### VDSL2 supports FTTCab (fiber to the cabinet), FTTC (fiber to the curb) and FTTB (fiber to the building) types of deployment. G.fast supports FTTdp (fiber to the distribution point) and FTTB (fiber to the building) types of deployment.

### A1.1.2 Example of VDSL system reference model Figure 1.2 illustrates the ITU-T G.993.1 system VDSL reference model aligned with the reference configuration for ITU-T G.99x-series Recommendations described in Section 6..

### 

### Figure 1.2 - ITU-T G.993.1 system VDSL reference model and its alignment with the generic reference configuration (extracted from ITU-T G Suppl. 50)

The ITU-T G.993.1 system reference model shows the functional blocks necessary to illustrate a VDSL transmission system. With reference to the alignment with the generic reference configuration, the core network may contain the following functions:

– concentrator and/or switch;

– interface to the broadband and narrow-band network.

The VDSL access network consists of the following:

– VDSL Transceiver Unit-ONU (VTU-O);

– POTS splitter to separate the POTS and VDSL channels;

– copper loop plant.

The VDSL-NT1 may consist of the following functions:

– VDSL Transceiver Unit – Remote Terminal end (VTU-R);

– multiplexer/Demultiplexer;

– higher layer functions;

– interface to the user terminal or a home network.

The VDSL-NT2, the terminal adapter and the user terminal may share some or all of the NT1 functionalities.  
In ITU-T G.993.1, interfaces are defined at the V, U and T reference points namely U-O, U-R, V-O, and T-R interfaces.

A1.1.3 Example of G.fast application reference model  
Implementations complying with Recommendation ITU-T G.9701 for fast access to subscriber terminals (G.fast) are typically deployed in a fibre to the-distribution point (FTTdp) scenario. A FTTdp deployment may be a further evolution of a FTTx (e.g., FTTCab, FTTC and FTTB) deployment, taking the fibre deeper into the network, or it may be a FTTH deployment with a copper extension where installation of the fibre inside the customer premises is not possible. The optical distribution network that feeds the distribution point units (DPUs) may be based on point-to-multipoint (e.g., PON) or point-to-point (e.g., GbE) technologies.

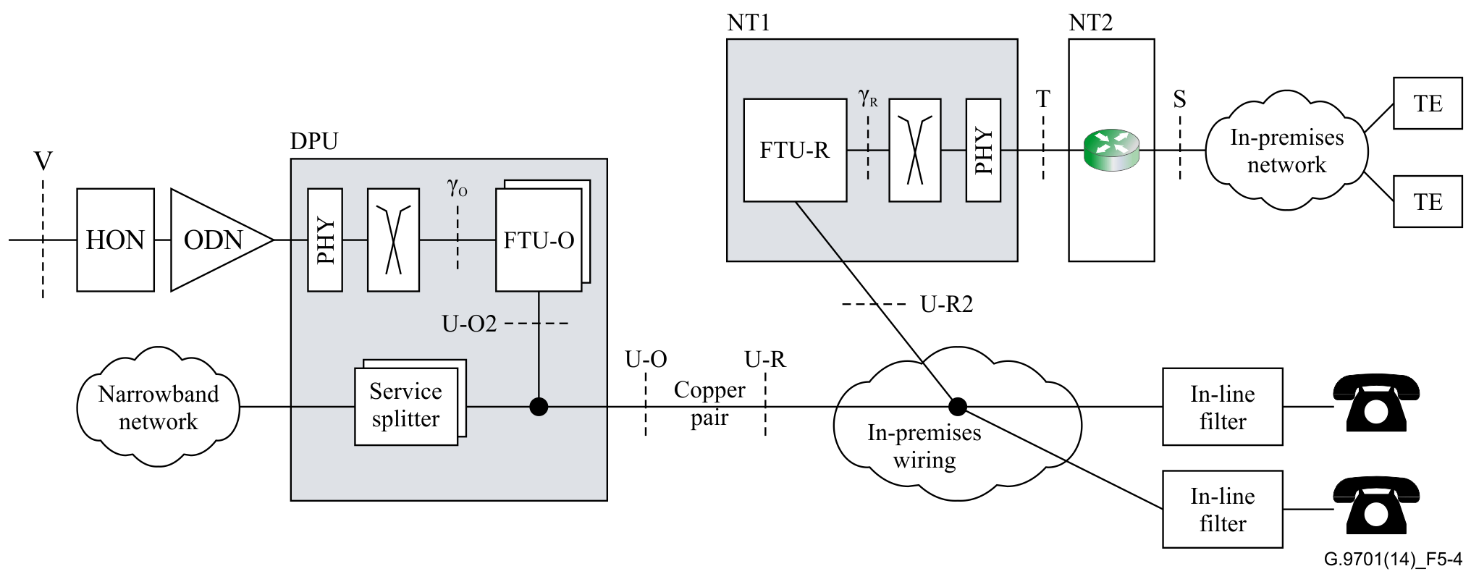


Figure 1.3 – Application reference model for FTTdp with POTS (extracted from ITU-T G.9701)

A key aspect of FTTdp deployment is the requirement that the customer should be able to self-install the equipment. Figure 1.3 provides an overview of the basic application reference model for customer self-install with POTS as the underlying narrowband service. Alternatively, the integrated services digital network (ISDN) may be used as the underlying narrowband service. This application model is very similar to the ITU-T G.993.2 generic application reference model for splitterless remote deployment. The DPU may contain one or multiple instantiations of the FTU-O and service splitter functionalities.

## 

## A1. 2. Fibre Optic Broadband Access

A1.2.1 Optical access network architecture

The optical section of a local access network system can be either active or passive and its architecture can be either point-to-point or point-to-multipoint. Figure 2.1 shows the considered architectures, which can be fibre to the home (FTTH), fibre to the cell site (FTTCell), fibre to the building/curb (FTTB/C), fibre to the cabinet (FTTCab), etc. The optical distribution network (ODN) is common to all the architectures shown in Figure 2.1; hence, the commonality of this system has the potential to generate large worldwide volumes.

## 

Figure 2.1 – Network architecture (extracted from ITU-T G.987.1)

NOTE – An ONU supporting FTTH has been commonly referred to as ONT (see [ITU-T G.987]).

The differences among these FTTx options are mainly due to the different services supported and the different locations of the ONUs rather than the ODN itself, so they can be treated as one. It must be noted that a single OLT optical interface might accommodate a combination of several scenarios described hereafter.

1) FTTB scenario

The FTTB scenario is divided into two scenarios, one for multi-dwelling units (MDU) and the other for businesses or mixed environments, multi-tenant units (MTUs). Each scenario has the following service categories:

1.1) FTTB for MDU-served residential users

* Asymmetric broadband services (e.g., IPTV, digital broadcast services, video on demand (VoD), file download, etc.).
* Symmetric broadband services (e.g., content broadcast, e-mail, file exchange, distance learning, telemedicine, online-games, etc.).
* POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation (providing a service that is almost the same as the legacy service).

1.2) FTTB for MTU-served business users

* Symmetric broadband services (e.g., group software, content broadcast, e-mail, file exchange, etc.).
* POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation (providing a service that is almost the same as the legacy service).
* Private line – The access network must be able to provide, in a flexible way, private-line services at several rates.

2) FTTCurb and FTTCab scenario

Within this scenario, the following service categories have been considered:

* Asymmetric broadband services (e.g., IPTV, digital broadcast services, VoD, file download, online-games, etc.).
* Symmetric broadband services (e.g., content broadcast, e-mail, file exchange, distance learning, telemedicine, etc.).
* POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation (providing a service that is almost the same as the legacy service).
* xDSL backhaul.

3) FTTH scenario

Within this scenario, the following service categories have been considered:

* Asymmetric broadband services (e.g., IPTV, digital broadcast services, VoD, file download, etc.).
* Symmetric broadband services (e.g., content broadcast, e-mail, file exchange, distance learning, telemedicine, online-games, etc.).
* POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation (providing a service that is almost the same as the legacy service).

4) FTTO scenario

Fibre to the office (FTTO) addresses business ONU dedicated to a small business customer. Within this scenario, the following service categories have been considered:

* Symmetric broadband services (e.g., group software, content broadcast, e-mail, file exchange, etc.).
* POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation (providing a service that is almost the same as the legacy service).
* Private line – The access network must be able to provide, in a flexible way, private line services at several rates.

5) FTTCell wireless scenario

Within this scenario, the ONU will be called a cell-site backhauling unit (CBU) and will have to offer connectivity to wireless base stations:

* Symmetric TDM services (e.g., 2G cell site backhaul);
* Symmetric/asymmetric packet-based broadband services (e.g., 3G/4G cell-site backhaul);
* Hot spots.

A1.2.2 Example of Access Network solutions using PON technology

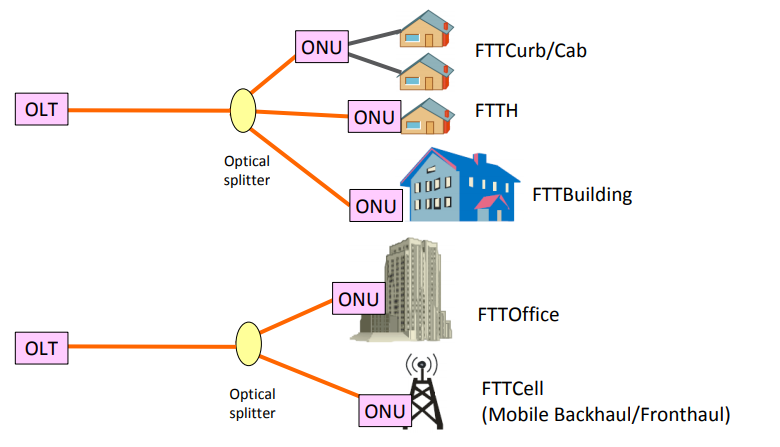


Figure 2.2 – A summary of some PON deployment scenarios

Figure 2.2 represents exemplary scenarios of PON applications

A1.2.3 Reference configuration: example of XG-PON (as in the ITU-T G.987.x series)

A high level and simple reference configuration of XG-PON is depicted in Figure A2-3, which shows a very similar high level reference configuration of B-PON as in the ITU-T G.983.x series and G-PON as in the ITU-T G.984.x series of Recommendations.

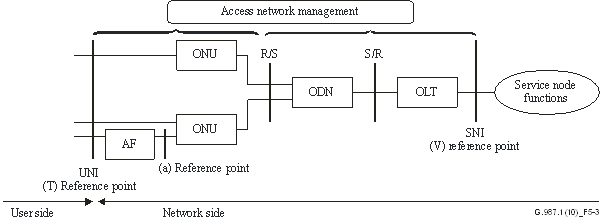


Figure 2.3 – High-level reference configuration of XG-PON (extracted from ITU-T G.987.1)

In addition to Figure 2.3, when XG-PON is deployed with an RF video overlay service, the ODN can use a WDM device or an optical coupler/splitter to combine PON and RF video signals.

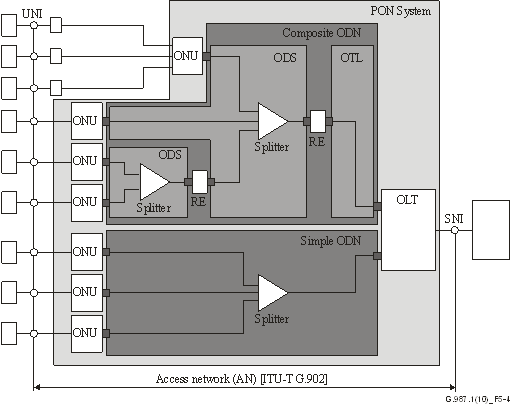


Figure 2.4 - Reference access network architecture (extracted from ITU-T G.987.1)

Figure 2.4 depicts the generic optical access network (OAN) reference architecture that applies to the XG-PON. It includes an OLT, ONUs and an optical distribution network between them. As shown in Figure 2.4, an XG-PON ODN can consist of a single passive optical distribution segment (ODS), or a group of passive ODSs interconnected with reach extenders (REs) [ITU T G.987].

A1.2.4 Reference configuration: example of NG-PON2 (as in the ITU-T G.989.x series)

1. Multi-wavelength PON system reference points

In a multiple wavelength passive optical network (PON) system, such as next generation passive optical network 2 (NG PON2), the optical line terminal (OLT) is conceptually composed of multiple OLT channel terminations (CTs) connected via a wavelength multiplexer (WM). The associated reference logical architecture and its reference points are presented in Figure 2.5.

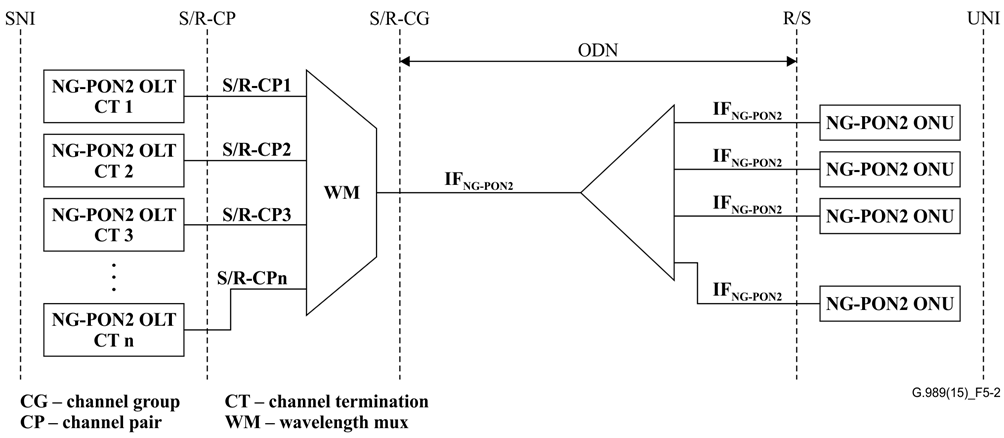


Figure 2.5- NG-PON2 reference logical architecture (extracted from ITU-T G.989)

1. Network reference architecture

Figure 2.6 depicts the functional optical access network architecture and reference points that apply to NG-PON2 systems with legacy systems coexistence. The ODN consists of the splitter and the coexistence element (WDM) and, optionally, reach extenders may also be used in the ODN.

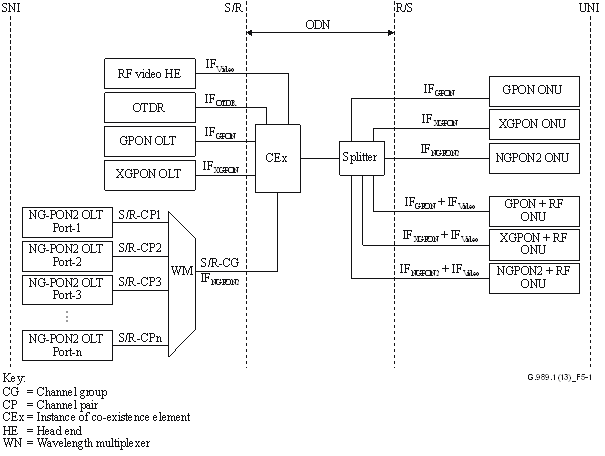


Figure 2.6 - Functional reference architecture and points for NG-PON2 system  
 coexistence with legacy systems (extracted from ITU-T G.989.1)

## A1.3 Hybrid Fibre Coax (HFC) Broadband Access

## A1.3.1 The DOCSIS network

## The elements that participate in the provisioning of DOCSIS services are shown in Figure 3.1:

## 

## Figure 3.1 – The DOCSIS network (extracted from ITU-T J.222.1)

The CM connects to the operator's HFC network and to a home network, bridging packets between them. Many CPE devices can connect to the CMs' LAN interfaces. CPE devices can be embedded with the CM in a single device, or they can be separate standalone devices, as shown in Figure ‎3.1.   
CPE devices may use IPv4, IPv6 or both forms of IP addressing. Examples of typical CPE devices are home routers, set-top devices, personal computers, etc.

The CMTS connects the operator's back office and core network with the HFC network. Its main function is to forward packets between these two domains, and between upstream and downstream channels on the HFC network.

## Service goals

As cable operators have widely deployed high-speed data services on cable television systems, the demand for bandwidth has increased. Additionally, networks have scaled to such a degree that IPv4 address constraints are becoming a burden on network operations. It is thus appropriate to add new features to the DOCSIS Recommendations for the purpose of increasing channel capacity, enhancing network security, expanding addressability of network elements, and deploying new service offerings.

The DOCSIS system allows transparent bidirectional transfer of Internet protocol (IP) traffic, between the cable system head-end and customer locations, over an all-coaxial or hybrid-fibre/coax (HFC) cable network. This is shown in simplified form in Figure 3.2.



Figure 3.2 – Transparent IP traffic through the data-over-cable system (extracted from ITU-T J.222.1)

1. Reference architecture

The reference architecture for data-over-cable services and interfaces is shown in Figure ‎3.3



Figure 3.3 – Data-over-cable reference architecture (extracted from ITU-T J.222.1)

## A1.3.2 High performance network over coax (HiNoC) connected with fibre to the building

Typical scenario for HiNoC operation-deployment

Cable operators around the world are interested in deploying triple-play services over cable television systems while supporting existing analogue or digital TV broadcasting services. Most triple-play services with video content require a very high-speed access network.

In high-density residential or office areas, FTTB and coax solutions have been introduced. A typical network scenario is shown in Figure 3.4. The FTTB + coax network can be realized by the PON system in the distribution network and the HiNoC system in a coaxial network. Services such as analogue or digital TV, VoIP, Internet access and interactive services can be transferred over the network.

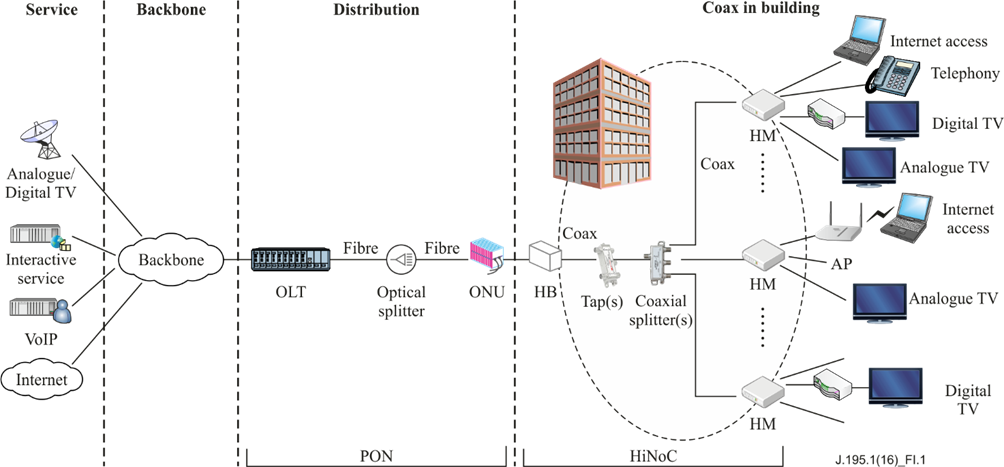


Figure 3.4 – FTTB + coax (extracted from ITU-T J.195.1)

## A1.4 Fixed Wireless Access

A1.4.1 Broadband Wireless Access (BWA) in the fixed service

1) Application and services

BWA systems operating in the fixed service should support a wide range of applications in use today and be extendable to support future services. The main user applications that can be foreseen today are as follows:

* Internet access (e.g. IP versions 4 and 6)
* LAN bridging and remote LAN access

The protocols could support bridged LAN service and remote LAN access capabilities.

* Videotelephony and videoconferencing
* Computer gaming
* Real-time video and audio
* Telemedicine; tele-education
* Telephony/voice services (e.g. VoIP)
* Voice-band modems and fax

The system could facilitate unicast, multicast, as well as broadcast services.

Fixed BWA systems can also be used to provide backhaul links for local area networks (LAN), metropolitan area networks (MAN), and cellular mobile networks, as well as synchronous digital hierarchy (SDH) rings.

2) Topology structures

There are four kinds of basic topology:

* A conventional point-to-point (P-P) topology where a station communicates directly with another station;
* A conventional point-to-multipoint (P-MP) topology where each subscriber unit (SU) communicates directly with a base station (BS);
* A multipoint-to-multipoint (MP-MP) with mesh network topology where SUs communicate with nearest neighbours and information is passed back through the mesh in a manner analogous to internet traffic;
* A combination of P-P, P-MP and MP-MP topology.

The main difference between the P-MP and MP-MP topology structures is that in the P-MP mode, traffic only occurs between BS and SUs while in the MP-MP topology traffic can occur directly between SUs and also can be routed further through other SUs. It should be noted that a P-P application may be used as an element link of P-MP or MP-MP topology, and that some backhaul links including mobile infrastructure may also use P-P application.

The above four topology structures, P-P, P-MP and MP-MP, or a combination structure of them, should be evaluated when being considered for implementation.

2.1) P-P deployment topology

In P-P systems, traffic is transmitted directly from one station to another. Uses for P-P systems also include backhaul links for LAN, MAN, and cellular mobile networks.

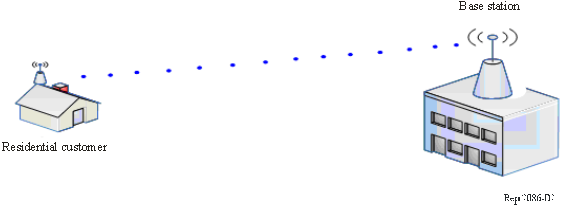


Figure 4.1 - Illustration of network deployment configuration based on P-P configuration  
 (extracted from ITU-R F.2086-1)

2.2) P-MP deployment topology

In P-MP systems, all data traffic (data, voice or multimedia) should go through the BS that shall serve as a radio resource supervisor.

Figure 4.2 shows an example deployment configuration. The BS can serve individual buildings, multiple subscribers in multiple buildings (using multiple radio links), or multiple subscribers in a single building by use of a single radio link and further in-building distribution systems. It shows the use of an optional repeater and route diversity in order to provide extended coverage and coverage in difficult areas. This does not imply the use of these features in all systems.

BWA base stations are deployed to form either contiguous cells or spot-type coverage.

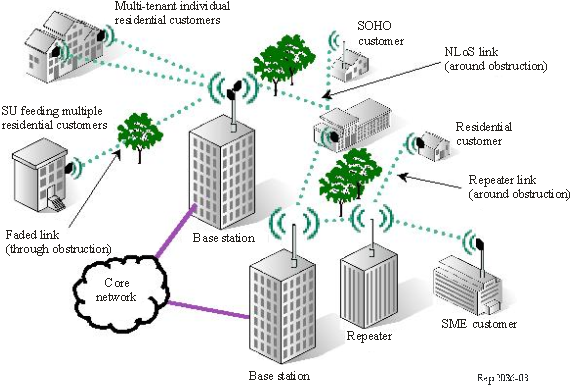


Figure 4.2 Illustration of network deployment configuration based on P-MP configuration  
(extracted from ITU-R F.2086-1)

2.3) MP-MP deployment topology

The system may support MP-MP with mesh network topology.

Figure 4.3 illustrates an example of MP-MP system with mesh network topology. The wireless mesh network consists of wireless nodes, which are either customer sites, relay nodes without originating/terminating traffic, or points of interface (PoI) to other networks such as ISP networks. The entire network shown in Figure 4.3 can be regarded as an MP-MP system. When at least one diversity route is available in the network, the system is specifically referred to as “an MP-MP system with mesh network topology” (see Recommendation ITU-R F.1704).

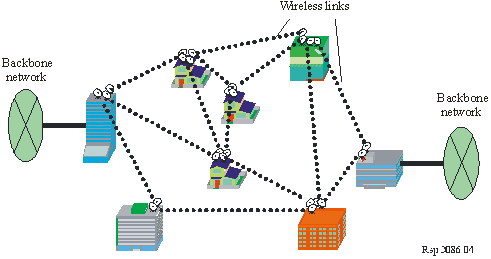


Figure 4.3 - Illustration of network deployment configuration based on MP-MP configuration  
(extracted from ITU-R F.2086-1)

2.4) Combination P-P, P-MP and MP-MP deployment topology

Figure 4.4 illustrates an example of mix topology. In this case, the wireless network may have both P MP and MP-MP links and the BS supporting its SU may be connected to the other networks via backbone network.

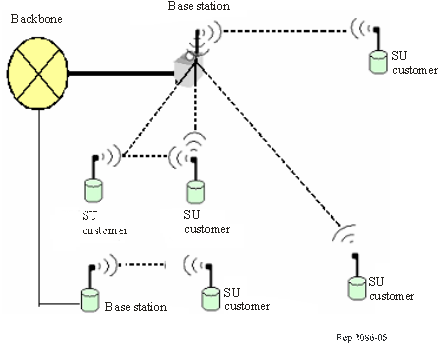


Figure 4.4 - Illustration of network deployment based on combination P-P, P-MP and MP-MP configuration (extracted from ITU-R F.2086-1)

## A1.5 Power Line Communications (PLC)

The Power Line Communications technology, also called Power Line Telecommunications (or PLT) enables the provision of telecommunications narrowband and broadband services over the power line. The Access Network PLC technology is designed to provide the services to the user’s home through the external electricity grid, while the In-home PLC technology is designed to provide the services within the user’s home.

Figure 5.1 depicts a typical Power Line Communications solution for the Access



# Annex 2 - ANT-Relevant Standards

## Annex 2.1 - Standards related to ANT Technologies

Some of the listed Documents, may not be not publicly available. Interested people may contact the person mentioned under the responsible standardization group in the list of contacts in Section 3.2 of the ANT Standards Work Plan.

| **Organization of ANT Relevant Standards by Transmission Medium and Technology**  **General Aspects (Gen. Asp.) =** General requirements, architecture and functions **Medium:** **F**= Fiber; **C**= Coax; **P**= Twisted pair; **A**= Wireless **Technology: I**= ISDN; **D**= DSL; **G**= G.fast; **E**= PtP; **P**= PON, **H**= HFC, **W**= Fixed Wireless Access and Satellite, **L**= PLC |
| --- |

| **Stds** | **Number** | **Title** | **Gen.**  **Asp.** | **Medium** | | | | | | | | **Technology** | | | | | | | | | | | | | | | | **Public. Date** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Body** |  |  |  | **F** | | **C** | | **P** | | **A** | | **I** | | **D** | | **G** | | **E** | | **P** | | **H** | | **W** | | **L** | |  | |
| ANSI/ SCTE | ANSI/SCTE 22-1 2012 | Data-Over-Cable Service Interface Specification DOCSIS 1.0 Radio Frequency Interface (RFI) |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2012 | |
| ANSI/ SCTE | ANSI/SCTE 22-2  2012 | Data-Over-Cable Service Interface Specification DOCSIS 1.0 Baseline Privacy Interface (BPI) |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2012 | |
| ANSI/ SCTE | ANSI/SCTE 22-3 2012 | Data-Over-Cable Service Interface Specification DOCSIS 1.0 Operations Support System Interface (OSSI) |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2012 | |
| SCTE | SCTE 23-1 2017 | DOCSIS 1.1 Part 1: Radio Frequency Interface |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2017 | |
| ANSI/  SCTE | ANSI/SCTE 23-2 2017 | DOCSIS 1.1 Part 2: Baseline Privacy Plus Interface |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2017 | |
| ANSI/  SCTE | ANSI/SCTE 23-3 2017 | DOCSIS 1.1 Part 3: Operations Support System Interface |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2017 | |
| ANSI/  SCTE | ANSI/SCTE 79-1 2016 | DOCSIS 2.0 Part 1: Radio Frequency Interface |  |  | | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ANSI/  SCTE | | ANSI/SCTE 79-2 2016 | DOCSIS 2.0 Part 2: Operations Support System Interface |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ANSI/  SCTE | | ANSI/SCTE 79-3 2017 | DOCSIS 2.0 + IPv6 Cable Modem Standard |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2017 | |
| ANSI/  SCTE | | ANSI/SCTE 135-1 2018 | DOCSIS 3.0 Part 1: Physical Layer Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2018 | |
| SCTE | | SCTE 135-2 2019 | DOCSIS 3.0 Part 2: MAC and Upper Layer Protocols |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2019 | |
| ANSI/  SCTE | | ANSI/SCTE 135-03 2019 | DOCSIS 3.0 Part 3: Security Services |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2019 | |
| ANSI/  SCTE | | ANSI/SCTE 135-4 2019 | DOCSIS 3.0 Part 4: Operations Support Systems Interface |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2019 | |
| ANSI/  SCTE | | ANSI/SCTE 135-5 2017 | DOCSIS 3.0 Part 5: Cable Modem To Customer Premise Equipment Interface |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2017 | |
| ANSI/  SCTE | | ANSI/SCTE 174 2018 | Radio Frequency over Glass Fiber-to-the-Home (RFoG) Specification Extension |  | X | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2018 | |
| ANSI/  SCTE | | ANSI/SCTE 220-1 2016 | DOCSIS 3.1 Part 1: Physical Layer Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ANSI/  SCTE | | ANSI/SCTE 220-2 2016 | DOCSIS 3.1 Part 2: MAC and Upper Layer Protocols Interface |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ANSI/  SCTE | | ANSI/SCTE 220-3 2016 | DOCSIS 3.1 Part 3: Cable Modem Operations Support  System Interface-Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ANSI/  SCTE | | ANSI/SCTE 220-4 2016 | DOCSIS 3.1 Part 4: CCAP Operations Support System  Interface Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ANSI/  SCTE | | ANSI/SCTE 220-5 2016 | DOCSIS 3.1 Part 5: Security Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 2016 | |
| ATIS | | 0600413 | Network to Customer Installation Interfaces – Asymmetric Digital Subscriber Line (ADSL) Metallic Interface |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | March 2009 | |
| ATIS | | 0600417 | Spectrum Management for Loop Transmission Systems |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | September 2003 | |
| ATIS | | 0600418 | High bit rate Digital Subscriber Line – 2nd Generation (HDSL2/HDSL4), Issue 2 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | June 2004 | |
| ATIS | | 0600422 | Single-Pair High-Speed Digital Subscriber Line (SHDSL) Transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | October 2001 | |
| ATIS | | 0600423 | Asymmetric Digital Subscriber Line (ADSL) Transceivers Based on ITU-T Recommendation G.992.1 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | December 2001 | |
| ATIS | | 0600424 | Interface Between Networks and Customer Installation Very-high-bit-rate Digital Subscriber Lines (VDSL) Metallic Interface (DMT based) |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | June 2004 | |
| ATIS | | 0600427.01 | ATM-Based Multi-Pair Bonding |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | November 2004 | |
| ATIS | | 0600427.02 | Ethernet-based Multi-Pair Bonding |  |  |  | | X | |  | |  | | X | |  | |  | | |  | |  |  | |  | | January 2005 | |
| ATIS | | 0600427.03 | Multi-Pair Bonding Using Time-Division Inverse Multiplexing |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | September 2004 | |
| ATIS | | 0600601 | Integrated Services Digital Network (ISDN)- Basic Access Interface for Use on Metallic Loops for Application on the Network Side of the NT (Layer 1 Specification). |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | June 1999 | |
| ATIS | | 0900007 | Dynamic Spectrum Management Technical Report | X |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | November 2012 | |
| ATIS | | T1.TR.28 | High-Bit-Rate Digital Subscriber Line (HDSL) | X |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | February  1994 | |
| BBF | | TR-xxx | Published BBF Technical Reports can be found at:  <https://www.broadband-forum.org/standards-and-software/technical-specifications/technical-reports> | X | X | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | |  | |
| ETSI | | EG 202 306 | Transmission and Multiplexing (TM); Access networks for residential customers | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | V 1.2.1  (1998-05) | |
| ETSI | | TR 101 689-2 | Transmission and Multiplexing (TM); Terms and definitions in transport networks; Part 2: Access networks | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | V1.1.1 (2000-06) | |
| ETSI | | TS 101 135 | Transmission and Multiplexing (TM); High bit-rate Digital Subscriber Line (HDSL) transmission system on metallic local lines; HDSL core specification and applications for combined ISDN-BA and2 048 kbit/s transmission |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | V1.5.3 (2000-09) | |
| ETSI | | TR 101 177 | Broadband Radio Access Networks (BRAN); Requirements and architectures for broadband and fixed radio access networks (HIPERACCESS) | X |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.1.1  (1998-05) | |
| ETSI | | TR 101 173 | Broadband Radio Access Networks (BRAN); Inventory of broadband radio technologies and techniques | X |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.1.1  (1998-05) | |
| ETSI | | TS 101 272 | Transmission and Multiplexing (TM);  Optical Access Networks (OANs) for evolving services; ATM Passive Optical Networks (PONs) and the transport of ATM over digital subscriber lines |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | V1.1.1  (1998-06) | |
| ETSI | | EN 302 217-3 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 3: Equipment operating in frequency bands where both frequency coordinated or uncoordinated deployment might be applied; Harmonized EN covering the essential requirements of article 3.2 of R&TTE Directive |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V2.2.1 (2014-04) | |
| ETSI | | EN 302 217-2-2 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Digital systems operating in frequency bands where frequency co-ordination is applied; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V2.2.1 (2014-04) | |
| ETSI | | EN 302 326-2 | Fixed Radio Systems; Multipoint Equipment and Antennas; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for Digital Multipoint Radio Equipment |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.2.2  (2007-06) | |
| ETSI | | ETS 300 681 | Transmission and Multiplexing (TM); Optical Distribution Network (ODN) for Optical Access Network (OAN) |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | Edition 1  (1997-06) | |
| ETSI | | TR 101 036-1 | Fixed Radio Systems; Generic wordings for standards on DFRS (Digital Fixed Radio Systems) characteristics; Part 1: General aspects and point-to-point equipment parameters |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.3.1 (2002-08) | |
| ETSI | | TR 101 274 | Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in the access network; Overview of different access techniques |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.1.1  (1998-06) | |
| ETSI | | TS 101 270-1 | Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very High Speed Digital Subscriber Line (VDSL); Part 1: Functional requirements |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | V1.4.1  (2005-10) | |
| ETSI | | TS 101 270-2 | Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very High Speed Digital Subscriber Line (VDSL); Part 2: Transceiver specification |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | V1.2.1  (2003-07) | |
| ETSI | | TS 101 271 | Access, Terminals, Transmission and Multiplexing (ATTM); Access transmission systems on metallic access cables; Very High Speed digital subscriber line system (VDSL2) [Recommendation ITU-T G.993.2 modified] |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | V.1.2.1  (2013-08) | |
| ETSI | | TS 101 388 | Access Terminals Transmission and Multiplexing (ATTM); Access transmission systems on metallic access cables; Asymmetric Digital Subscriber Line (ADSL) - European specific requirements [ITU-T Recommendation G.992.1 modified] |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | V1.4.1  (2007-08) | |
| ETSI | | TS 101 524 | Access, Terminals, Transmission and Multiplexing (ATTM); Access transmission system on metallic access cables; Symmetrical single pair high bit rate Digital Subscriber Line (SDSL); [ITU-T Recommendation G.991.2 (2005), modified] |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | V1.5.1 (2010-08) | |
| ETSI | | TS 101 974 | Transmission and Multiplexing (TM);  Digital Radio Relay Systems (DRRS);  Radio specific SDH functionalities for transmission of sub-STM-0 |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.1.1  (2001-08) | |
| ETSI | | TR 101 853 | Fixed Radio Systems; Point-to-point and Point-to-multipoint equipment; Rules for the co-existence of point-to-point and point-to-multipoint systems using different access methods in the same frequency band |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | V1.1.1  (2000-10) | |
| ETSI | | TS 102 973 | Access Terminals, Transmission and Multiplexing (ATTM); Network Termination (NT) in Next Generation Network architectures | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | V1.1.1  (2008-09) | |
| ETSI | | TR 102 881 | Access, Terminals, Transmission and Multiplexing (ATTM); Cable Network Handbook | X |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1 (2010-06) | |
| ETSI | | EN 300 429 | Digital Video Broadcasting (DVB);  Framing structure, channel coding and modulation  for cable systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.2.1 (1998-04) | |
| ETSI | | ES 201 488-1 | Access and Terminals (AT); Data Over Cable Systems;  Part 1: General |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.2.2  (2003-10) | |
| ETSI | | ES 201 488-2 | Access and Terminals (AT); Data Over Cable Systems;  Part 2: Radio Frequency Interface Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.2.2 (2003-10) | |
| ETSI | | ES 201 488-3 | Access and Terminals (AT); Data Over Cable Systems;  Part 3: Baseline Privacy Plus Interface Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.2.2 (2003-10) | |
| ETSI | | ES 202 488-1 | Access and Terminals (AT); Second Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 1: General |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1 (2003-09) | |
| ETSI | | ES 202 488-2 | Access and Terminals (AT); Second Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 2: Radio frequency interface specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1 (2003-09) | |
| ETSI | | ES 202 488-3 | Access and Terminals (AT); Second Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 3: Baseline privacy plus interface specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2003-09) | |
| ETSI | | EN 302 878-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for  Interactive Cable Television Services - IP Cable Modems; Part 1: General; DOCSIS 3.0 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2011-11) | |
| ETSI | | EN 302 878-2 | Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for  Interactive Cable Television Services - IP Cable Modems; Part 2: Physical Layer; DOCSIS 3.0 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2011-11) | |
| ETSI | | EN 302 878-3 | Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 3: Downstream Radio Frequency Interface; DOCSIS 3.0 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2011-11) | |
| ETSI | | EN 302 878-4 | Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 4: MAC and Upper Layer Protocols; DOCSIS 3.0 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2011-11) | |
| ETSI | | EN 302 878-5 | Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 5: Security Services; DOCSIS 3.0 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2011-11) | |
| ETSI | | ES 203 312 | Integrated broadband cable telecommunication networks (CABLE); Cabinet DOCSIS (C-DOCSIS) System Specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2015-03) | |
| ETSI | | ES 203 311-1 | Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 1: General; DOCSIS® 3.1 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1 (2019-05) | |
| ETSI | | ES 203 311-2 | Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 2: Physical layer; DOCSIS® 3.1 [ANSI/SCTE 220-1 2016] |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2019-05) | |
| ETSI | | ES 203 311-3 | Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 3: MAC and upper layer protocols interface; DOCSIS® 3.1 [ANSI/SCTE 220-2 2016] |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2019-05) | |
| ETSI | | ES 203 311-4 | Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 4: Cable modem operations support system interface; DOCSIS® 3.1 [ANSI/SCTE 220-3 2016] |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2019-05) | |
| ETSI | | ES 203 311-5 | Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 5: Converged cable access platform operations support system interface; DOCSIS® 3.1 [ANSI/SCTE 220-4 2016] |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2019-05) | |
| ETSI | | ES 203 311-6 | Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 6: Security; DOCSIS® 3.1 [ANSI/SCTE 220-5 2016] |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2019-05) | |
| ETSI | | ES 203 386 | Integrated broadband cable telecommunication networks (CABLE); Embedded Router |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | V1.1.1  (2017-08) | |
| IEEE | | 802.3-2018 2BASE-TL | Physical Layer specification up to 5.696 Mb/s point to point link over single copper wire pair - IEEE Std 802.3, Clause 61 and Clause 63 |  |  |  | | X | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 08/2018 | |
| IEEE | | 802.3-2018 10PASS-TS | Physical Layer specification up to 100 Mb/s point to point link over single copper wire pair – IEEE Std 802.3, Clause 61 and 62 |  |  |  | | X | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 08/2018 | |
| IEEE | | 802.3-2018 100BASE-LX1 and  100BASE-BX10 | Physical Layer specification for point-to-point 100 Mb/s Ethernet links over single-mode optical fiber - IEEE Std 802.3, Clause 56, Clause 58 and Clause 66 |  | X |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 08/2018 | |
| IEEE | | 802.3-2018 1000BASE-LX10 and  1000BASE-BX10 | Physical Layer specification for point-to-point 1 Gb/s Ethernet links over single-mode optical fiber and multimode optical fiber- IEEE Std 802.3, Clause 56, Clause 59 and Clause 66 |  | X |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 08/2018 | |
| IEEE | | 802.3-2018 1000BASE-PX | Physical Layer specification for point-to-multipoint 1 Gb/s connections over Ethernet-based passive optical networks (1G-EPON) - IEEE Std 802.3, Clause 56, Clause 60, Clause 64 and Clause 65 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 08/2018 | |
| IEEE | | 802.3-2018 10GBASE-PR and  10/1GBASE-PRX | Physical Layer specification for point-to-multipoint 10 Gb/s connections over Ethernet-based passive optical networks (10G-EPON) - IEEE Std 802.3, Clause 56, Clause 75, Clause 76 and Clause 77 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 08/2018 | |
| IEEE | | 802.3-2018 10GPASS-XR (EPoC) | Physical Layer Specifications and Management Parameters for Ethernet Passive Optical Networks Protocol over Coax (EPoC) – IEEE Std 802.3, Clause 100, Clause 101, Clause 102 and Clause 103 |  | X | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 08/2018 | |
| IEEE | | 802.16-2017 | IEEE Standard for Air Interface for Broadband Wireless Access Systems |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 03/2018 | |
| IEEE | | 802.16.1-2012 | IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 09/2012 | |
| IEEE | | 802.16.1a-2013 | IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems --Amendment 2: Higher Reliability Networks |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 06/2013 | |
| IEEE | | 802.16.1b-2012 | IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems Amendment 1: Enhancements to Support Machine-to-Machine Applications |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 10/2012 | |
| ISO/ IEC | | 12139-1 | Information technology — Telecommunications and information exchange between systems — Power Line Communication(PLC) – High speed PLC Media Access Control(MAC) and Physical Layer(PHY) | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | X | | May 2009 | |
| ITU-R | | BT.2400 (draft) | Draft new Report ITU-R BT.[GLOBAL PLATFORM] - Usage scenarios, requirements and technical elements of a global platform for the broadcasting service | X | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2017 | |
| ITU-R | | F.757-3 | Basic system requirements and performance objectives for fixed wireless access using mobile-derived technologies offering basic telephony service and data communication service | X |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 02/03 | |
| ITU-R | | F.757-4 | Basic system requirements and performance objectives for fixed wireless access using mobile | X |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 04/2011 | |
| ITU-R | | F.1332-1 | Radio-frequency signal transport through optical fibres | X | X |  | |  | |  | |  | |  | |  | |  | |  | |  | | X | |  | | 05/99 | |
| ITU-R | | F.1399-1 | Vocabulary of terms for wireless access | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/01 | |
| ITU-R | | F.1400 | Performance and availability objectives for FWA to PSTN | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/99 | |
| ITU-R | | F.1401-1 | Considerations for the identification of possible frequency bands for fixed wireless access and related sharing studies. |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 01/04 | |
| ITU-R | | F.1402 | Frequency sharing criteria between land mobile wireless access systems and FWA using the same equipment type as mobile wireless access system |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/1999 | |
| ITU-R | | F.1490-1 | Generic requirements for fixed wireless access (FWA) systems | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 09/2007 | |
| ITU-R | | F.1499 | Radio transmission systems for fixed broadband wireless access (BWA) based on cable modem standard |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/00 | |
| ITU-R | | F.1500 | Preferred characteristics of systems in the fixed service using high altitude platforms operating in the bands 47.2‑47.5 GHz and 47.9-48.2 GHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/2000 | |
| ITU-R | | F.1569 | Technical and operational characteristics for the fixed service using high altitude platform stations in the band 27.5-28.5 and 31.0-31.3 GHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/02 | |
| ITU-R | | F.1704 | Characteristics of multipoint-to-multipoint fixed wireless systems with meshed network topology operating in frequency bands above about 17 GHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 01/05 | |
| ITU-R | | F.1763-1 | Radio interface standards for broadband wireless access systems in the fixed service operating below 66 GHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02/2014 | |
| ITU-R | | F.2058 (Report) | Design techniques applicable to broadband fixed wireless access systems conveying Internet protocol packets or asynchronous transfer mode cells |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2006 | |
| ITU-R | | F.2086-1 (Report) | Technical and operational requirements for broadband wireless access in the fixed service | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2010 | |
| ITU-R | | F.2106-1 (Report) | Fixed Service applications using free-space optical links | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2010 | |
| ITU-R | | F.2107-1 (Report) | Characteristics and applications of fixed wireless systems operating in the 57 GHz to 130 GHz bands |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2012 | |
| ITU-R | | F.2060 (Report) | Fixed Service use in the IMT-2000 transport network | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2005 | |
| ITU-R | | F.2106-1 (Report) | Fixed Service applications using free-space optical links | X |  |  | |  | |  | |  | |  | |  | |  | | |  | |  | X | |  | | 2010 | |
| ITU-R | | F.2107-1 (Report) | Characteristics and applications of fixed wireless systems operating in the 57 GHz to 130 GHz bands |  |  |  | |  | |  | |  | |  | |  | |  | | |  | |  | X | |  | | 2012 | |
| ITU‑R | | [M.687-2](http://www.itu.int/rec/R-REC-M.687/en) | International Mobile Telecommunications-2000 (IMT-2000) | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02-1997 | |
| ITU‑R | | [M.818-2](http://www.itu.int/rec/R-REC-M.818/en) | Satellite operation within IMT‑2000 | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 06-2003 | |
| ITU-R | | [M.819-2](http://www.itu.int/rec/R-REC-M.819/en) | International Mobile Telecommunications-2000  (IMT-2000) for developing countries | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02-1997 | |
| ITU‑R | | [M.1036-](http://www.itu.int/rec/R-REC-M.1036/en)4 | Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications-2000 (IMT-2000) in the bands  806-960 MHz, 1 710-2 025 MHz, 2 110-2 200 MHz and 2 500-2 690 MHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 03/2012 | |
| ITU‑R | | [M.1073](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1073).2 | Digital cellular land mobile telecommunication systems | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | June 2005 | |
| ITU-R | | [M.1079-2](http://www.itu.int/rec/R-REC-M.1079/en) | Performance and quality of service requirements for International Mobile Telecommunications-2000  (IMT-2000) | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 06-2003 | |
| ITU‑R | | [M.1167](http://www.itu.int/rec/R-REC-M.1167/en) | Framework for the satellite component of International Mobile Telecommunications-2000 (IMT-2000) | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 10-1995 | |
| ITU‑R | | [M.1224](http://www.itu.int/rec/R-REC-M.1224/en)-1 | Vocabulary of terms for IMT-2000 | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 03/2012 | |
| ITU‑R | | [M.1225](http://www.itu.int/rec/R-REC-M.1225/en) | Guidelines for evaluation of radio transmission technologies for IMT-2000 | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02-1997 | |
| ITU‑R | | [M.1311](http://www.itu.int/rec/R-REC-M.1311/en) | Framework for modularity and radio commonality within IMT-2000 | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 10-1997 | |
| ITU‑R | | [M.1390](http://www.itu.int/rec/R-REC-M.1390/en) | Methodology for the Calculation of IMT‑2000 Terrestrial Spectrum Requirements |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 01-1999 | |
| ITU‑R | | [M.1391-1](http://www.itu.int/rec/R-REC-M.1391/en) | Methodology for the Calculation of IMT‑2000 Satellite Spectrum Requirements |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 03-2006 | |
| ITU‑R | | [M.1034-1](http://www.itu.int/rec/R-REC-M.1034/en) | Requirements for the radio interfaces for IMT-2000 | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02-1997 | |
| ITU‑R | | [M.1450](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1450)-5 | Characteristics of broadband RLANs | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 04/2014 | |
| ITU‑R | | [M.1454](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1454) | E.i.r.p. density limit and operational restrictions for RLANs or other wireless access transmitters in order to ensure the protection of feeder links of NGSO systems in the MSS in the frequency band 5 150-5 250 MHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2000 | |
| ITU-R | | M.1457-12 | Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000) |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02/2015  Supersedes M.1457-11 (02/2013) | |
| ITU-R | | M.1579-2 | Global circulation of IMT-2000 terrestrial terminals |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 01/2015  Supersedes  M.1579-1 (03/2012) | |
| ITU‑R | | [M.1651](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1651) | A method for assessing the required spectrum for broadband NWA systems including RLANs using the 5 GHz band |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2003 | |
| ITU‑R | | [M.1652](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1652)-1 | Dynamic Frequency Selection (DFS) in Wireless Access Systems (WAS) including Radio Local Area Networks (RLAN) for the purpose of protecting the radio determination service in the 5 GHz band |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 05/2011 | |
| ITU‑R | | [M.1653](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1653) | Operational and deployment requirements for WAS including RLANs in the MS to facilitate sharing between these systems and systems in the EESS (active) and the SRS (active) in the band 5 470-5 570 MHz within the 5 460‑5 725 MHz range |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2003 | |
| ITU-R | | [M.1768](http://www.itu.int/rec/R-REC-M.1768/en) | Methodology for calculation of spectrum requirements for the future development of the terrestrial component of IMT-2000 and systems beyond IMT-2000 |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 03-2006 | |
| ITU‑R | | [M.1797](http://www.itu.int/rec/R-REC-M.1797/en) | Vocabulary of terms for the land mobile service | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2007 | |
| ITU‑R | | [M.1801](http://www.itu.int/rec/R-REC-M.1801/en)-2 | Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 02/2013 | |
| ITU‑R | | M.1850-2 | Detailed specifications of the radio interfaces for the satellite component of International Mobile Telecommunications-2000 (IMT-2000). |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 10/2014 | |
| ITU-R | | [M.2003](http://www.itu.int/rec/R-REC-M.2003-1-201501-I/en)-1 | Multiple Gigabit Wireless Systems | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 01/2015 | |
| ITU-R | | M.2012-2 | Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced) |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 09/2015 Supersedes M.2012-1 (02/2014) | |
| ITU‑R | | [M.2023](http://www.itu.int/pub/R-REP-M.2023/en) (Report) | Spectrum Requirements for IMT‑2000 | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2000 | |
| ITU‑R | | [M.2034](http://www.itu.int/itudoc/itu-r/publica/rep/m/2034.html) (Report) | Impact of radar detection requirements of dynamic frequency selection on 5 GHz wireless access system receivers |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2003 | |
| ITU-R | | M.2047-0 | Detailed specifications of the satellite radio interfaces of International Mobile Telecommunications-Advanced (IMT-Advanced) |  |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 12/2013 | |
| ITU-R | | [M.2074](http://www.itu.int/pub/R-REP-M/en) (Report) | Radio aspects for the terrestrial component of IMT-2000 and systems beyond IMT-2000(ex-[Doc. 8/115(Rev.1](http://www.itu.int/md/R03-SG08-C-0115/e))) | X |  |  | |  | | X | |  | |  | |  | |  | | |  | |  | X | |  | | 2006 | |
| ITU-R | | S.579 | Availability objectives for a hypothetical reference circuit and a hypothetical reference digital path when used for telephony using pulse code modulation, or as part of an integrated services digital network hypothetical reference connection, in the fixed satellite service |  |  |  | |  | | X | | X | |  | |  | |  | |  | |  | | X | |  | | 2001 | |
| ITU-R | | S.614 | Allowable error performance for a hypothetical reference digital path in the fixed-satellite service operating below 15 GHz when forming part of an international connection in an integrated services digital network |  |  |  | |  | | X | | X | |  | |  | |  | |  | |  | | X | |  | | 1994 | |
| ITU-R | | S.1062 | Allowable error performance for a hypothetical reference digital path operating at or above the primary rate |  |  |  | |  | | X | | X | |  | |  | |  | |  | |  | | X | |  | | 1999 | |
| ITU-R | | S.1420 | Performance for broadband integrated services digital network asynchronous transfer mode via satellite |  |  |  | |  | | X | | X | |  | |  | |  | |  | |  | | X | |  | | 1999 | |
| ITU-R | | S.1424 | Availability objectives for a hypothetical reference digital path when used for the transmission of B-ISDN asynchronous transfer mode in the fixed-satellite service by geostationary orbit satellite systems using frequencies below 15 GHz |  |  |  | |  | | X | | X | |  | |  | |  | |  | |  | | X | |  | | 2000 | |
| ITU-R | | S.1521 | Allowable error performance for a hypothetical reference digital path based on synchronous digital hierarchy |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 2001 | |
| ITU-R | | S.1711 | Performance enhancements of transmission control protocol (TCP) over satellite networks |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 2005 | |
| ITU-R | | S.1782 | Possibilities for global broadband Internet access by fixed-satellite service systems – 2007 | X |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 01/2007 | |
| ITU-R | | S.1806 | Availability objectives for hypothetical reference digital paths in the fixed-satellite service operating below 15 GHz – 2008 |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 08/2008 | |
| ITU-R | | S.1878 | Multi-carrier based transmission techniques for satellite systems – 2010 |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 12/2010 | |
| ITU-R | | S.1897 | Cross-layer QoS provisioning in IP-based hybrid satellite-terrestrial networks – 201 |  |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 01/2012 | |
| ITU-R | | http://www.itu.int/oth/R0A06000001/en | Guide to the use of ITU-R texts related to the land mobile service | X |  |  | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 2011 | |
| ITU‑T | | G.805 | General transport network architecture | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 03/2000 | |
| ITU‑T | | G.902 | Framework Recommendation on functional access networks (AN) - Architecture and functions, access types, management and service node aspects | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 11/1995 | |
| ITU-T | | Technical paper (12/2011) | Wireline broadband access networks and home networking | X | X |  | | X | |  | |  | | X | |  | | X | | X | |  | |  | |  | | 12/2011 | |
| ITU-T | | G Suppl. 39  (02/2016) | Optical system design and engineering considerations | X | X |  | |  | |  | |  | |  | |  | | X | | X | |  | |  | |  | | 02/2016 | |
| ITU‑T | | G.981 (01/1994) | PDH optical line systems for the local network |  | X |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 01/1994 | |
| ITU‑T | | G.982 (11/1996) | Optical access networks to support services up to the ISDN primary rate or equivalent bit rates |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 11/1996 | |
| ITU‑T | | G.983.1 (01/2005) | Broadband optical access system based on Passive Optical Networks (PON) |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 01/2005  Erratum 1  03/2006 | |
| ITU‑T | | G.983.1 (2005)  Amendment 1 | Broadband optical access systems based on Passive Optical Networks (PON)  Amendment 1: PICS for OLT and ONU |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 05/2005 | |
| ITU-T | | G.983.3 (03/2001) | A broadband optical access system with increased service capability by wavelength allocation |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2001 | |
| ITU-T | | G.983.3 (2001) Amendment 1 | A broadband optical access system with increased  service capability by wavelength allocation  Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 06/ 2002 | |
| ITU-T | | G.983.3 (2001) Amendment 2 | A broadband optical access system with increased  service capability by wavelength allocation  Amendment 2 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 07/ 2005 | |
| ITU-T | | G.983.4 (11/2001) | A broadband optical access system with increased service capability using dynamic bandwidth assignment |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 11/2001  Corrigendum1  01/2005 | |
| ITU-T | | G.983.4 (2001)  Amendment 1 | A broadband optical access system with increased service capability using dynamic bandwidth assignment  Amendment 1: New Annex A – Performance  monitoring parameters |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 12/2003 | |
| ITU-T | | G.983.5 (01/2002) | A Broadband Optical Access System with Enhanced Survivability |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 01/2002 | |
| ITU-T | | G.984.1 (03/2008) | Gigabit-capable passive optical networks (GPON): General characteristics |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2008 | |
| ITU-T | | G.984.1 (2008)  Amendment 1 | Gigabit-capable passive optical networks (GPON): General characteristics  Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 10/2009 | |
| ITU-T | | G.984.1 (2008)  Amendment 2 | Gigabit-capable passive optical networks (GPON): General characteristics  Amendment 2 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 04/2012 | |
| ITU-T | | G.984.2 (03/2003) | Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2003 | |
| ITU-T | | G.984.2 (2003)  Amendment 1 | Gigabit-capable Passive Optical Networks  (G-PON): 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 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 02/2006 | |
| ITU-T | | G.984.2 (2003)  Amendment 2 | Gigabit-capable Passive Optical Networks  (G-PON): Physical Media Dependent (PMD) layer  specification  Amendment 2 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2008 | |
| ITU-T | | G.984.3 (01/2014) | Gigabit-capable Passive Optical Networks (GPON): Transmission convergence layer specification |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 01/2014  Supersedes Ed. 1 - 02/2004, Ed. 2- 03/2008 and all related amendments | |
| ITU-T | | G.984.5 (05/2014) | Gigabit-capable Passive Optical Networks (G-PON): Enhancement band |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 05/2014  Supersedes Ed.1- 09/2007 and Amd.1-10/2009 | |
| ITU-T | | G.984.5 (05/2014) Amendment 1 | Gigabit-capable Passive Optical Networks (G-PON): Enhancement band  Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 05/2018 | |
| ITU-T | | G.984.6 (03/2008) | Gigabit-capable passive optical networks  (GPON): Reach extension |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2008 | |
| ITU-T | | G.984.6 (2008)  Amendment 1 | Gigabit-capable passive optical networks (GPON):  Reach extension  Amendment 1: Wavelength-converting, continuous mode, and 1:N-protected range extenders |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 11/2009 | |
| ITU-T | | G.984.6 (2008)  Amendment 2 | Gigabit-capable passive optical networks (G-PON):  Reach extension  Amendment 2 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 05/2012 | |
| ITU-T | | G.984.7 (07/2010) | Gigabit-capable passive optical networks (GPON): Long reach |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 07/2010 | |
| ITU-T | | G.985 (03/2003) | 100 Mbit/s point-to-point Ethernet based optical  access system |  | X |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 03/2003  Corrigendum1 01/2005 | |
| ITU-T | | G.985 (2003)  Amendment 1 | 100 Mbit/s point-to-point Ethernet based optical  access system  Amendment 1: Silent start function of optical  network terminals |  | X |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 01/2009 | |
| ITU-T | | G.986 (01/2010) | 1 Gbit/s point-to-point Ethernet-based optical  access system |  | X |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | |  | | 01/2010 | |
| ITU-T | | G.987 (06/2012) | 10-Gigabit-capable passive optical network  (XG-PON) systems: Definitions, abbreviations  and acronyms |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 06/2012 | |
| ITU-T | | G.987.1 (03/2016) | 10-Gigabit-capable passive optical networks  (XG-PON): General requirements |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2016  Supersedes  Ed.1 - 01/2010  and Amd.1 - 04/2012 | |
| ITU-T | | G.987.2 (02/2016) | 10-Gigabit-capable passive optical networks  (XG-PON): Physical media dependent (PMD)  layer specification |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 02/2016  Superseded Amd.1 – 02/2012  and Ed.2 -10/2010 and Ed.1 - 01/2010 | |
| ITU-T | | G.987.2 (2016) Amendment 1 | 10-Gigabit-capable passive optical networks  (XG-PON): Physical media dependent (PMD)  layer specification  Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 08/2017 | |
| ITU-T | | G.987.3 (01/2014) | 10-Gigabit-capable passive optical networks (XG-PON): Transmission convergence (TC) layer specification |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 01/2014  Supersedes  Ed. 1- 10/2010 and Amd.1 - 06/2012 | |
| ITU-T | | G.987.4 (06/2012) | 10 Gigabit-capable passive optical networks  (XG-PON): Reach extension |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 06/2012 | |
| ITU-T | | G Suppl. 48 (06/2010) | 10-Gigabit-capable passive optical networks: Interface between media access control with serializer/deserializer and physical medium dependent sublayers |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 06/2010 | |
| ITU-T | | G.989 (10/2015) | 40-Gigabit-capable passive optical network (NG PON2): Definitions, abbreviations and acronyms |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 10/2015 | |
| ITU-T | | G.989.1 (03/2013) | 40-Gigabit-capable passive optical networks  (NG-PON2): General requirements |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 03/2013 | |
| ITU-T | | G.989.1 (2013) Amendment 1 | 40-Gigabit-capable passive optical networks (NG-PON2): General requirements: Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 08/2015 | |
| ITU-T | | G.989.2 (02/2019) | 40-Gigabit-capable passive optical networks 2 (NG-PON2): Physical media dependent (PMD) layer specification |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 02/2019 | |
| ITU-T | | G.989.3 (10/2015) | 40-Gigabit-capable passive optical networks (NG PON2): Transmission Convergence Layer Specification |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 10/2015 | |
| ITU-T | | G.989.3 (2015)  Amendment 1 | 40-Gigabit-capable passive optical networks (NG PON2): Transmission Convergence Layer Specification Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 11/2016 | |
| ITU-T | | G.989.3 (2015)  Amendment 2 | 40-Gigabit-capable passive optical networks (NG PON2): Transmission Convergence Layer Specification Amendment 2 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 11/2018 | |
| ITU-T | | G Suppl. 63 (02/2018) (ex G.sup.TCadapt) | ITU-T G.989.3 TC layer operating in ITU T G.987.3 or ITU-T G.9807.1 TC layer mode |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 02/2018 | |
| ITU-T | | G Suppl. 64 (02/2018)  (ex G.sup.HSP) | PON transmission technologies above 10 Gb/s per wavelength |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 02/2018 | |
| ITU-T | | G. Suppl. 66 (10/2018) | 5G wireless fronthaul requirements in a passive optical network context | X | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 10/2018 | |
| ITU-T | | G Suppl. 50 (09/2011) | Overview of digital subscriber line Recommendations | X |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 09/2011 | |
| ITU‑T | | G.991.1 (10/1998) | High bit rate Digital Subscriber Line (HDSL) transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 10/1998 | |
| ITU‑T | | G.991.2 (12/2003) | Single-pair high-speed digital subscriber line (SHDSL) transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 12/2003  Erratum 1  04/2005 | |
| ITU‑T | | G.991.2 (2003)  Amendment 1 | Single-pair high-speed digital subscriber line (SHDSL) transceivers  Amendment 1 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 07/2004 | |
| ITU‑T | | G.991.2 (2003)  Amendment 2 | Single-pair high-speed digital subscriber line (SHDSL) transceivers  Amendment 2 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 02/2005  Erratum 1  11/2005 | |
| ITU‑T | | G.991.2 (2003)  Amendment 3 | Single-pair high-speed digital subscriber line (SHDSL) transceivers  Amendment 3 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 09/2005 | |
| ITU‑T | | G.992.1 (07/1999) | Asymmetric digital subscriber line (ADSL) transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 07/1999  Corrigendum1 11/2001  Corrigendum2  07/2002 | |
| ITU‑T | | G.992.1 (1999) Amendment 1 | Asymmetric digital subscriber line (ADSL) transceivers  Amendment 1: Revised Annex C, new Annex I  and new Appendix V |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 03/2003  Corrigendum1  12/2003 | |
| ITU‑T | | G.992.1 (10/2000) Annex H | Asymmetric digital subscriber line (ADSL) transceivers  Annex H: Specific requirements for a  synchronized symmetrical DSL (SSDSL) system  operating in the same cable binder as ISDN as  defined in ITU-T G.961 Appendix III |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 10/2000 | |
| ITU‑T | | G.992.2 (07/1999) | Splitterless asymmetric digital subscriber line (ADSL) transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 07/1999  Corrigendum1  07/2002 | |
| ITU‑T | | G.992.2 (1999)  Amendment 1 | Splitterless asymmetric digital subscriber line (ADSL) transceivers  Amendment 1: Revised Annex C |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 03/2003 | |
| ITU‑T | | G.992.2 (1999)  Amendment 2 | Splitterless asymmetric digital subscriber line (ADSL) transceivers  Amendment 2: New Appendix IV – Example  overlapped PSD masks for use in a TCM-ISDN  crosstalk environment |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 10/2003 | |
| ITU-T | | G.992.3 (04/2009) | Asymmetric digital subscriber line transceivers 2 (ADSL2) |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 04/2009  Corrigendum1  11/2009  Corrigendum2  06/2011  Corrigendum3  08/2013 | |
| ITU-T | | G.992.3 (2009)  Amendment 1 | Asymmetric digital subscriber line transceivers 2  (ADSL2)  Amendment 1: Channel initialization policies |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 03/2010 | |
| ITU-T | | G.992.3 (2009)  Amendment 2 | Asymmetric digital subscriber line transceivers 2  (ADSL2)  Amendment 2: Retrain on eoc protocol timeout |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 07/2010 | |
| ITU-T | | G.992.3 (2009)  Amendment 3 | Asymmetric digital subscriber line transceivers 2  (ADSL2)  Amendment 3: Scale factor for downstream  transmitter referred virtual noise, and corrigenda |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 11/2010 | |
| ITU-T | | G.992.3 (2009)  Amendment 4 | Asymmetric digital subscriber line transceivers 2  (ADSL2)  Amendment 4 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 10/2011 | |
| ITU-T | | G.992.3 (2009)  Amendment 5 | Asymmetric digital subscriber line transceivers 2  (ADSL2)  Amendment 5: Accuracy of test parameters |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 10/2012 | |
| ITU‑T | | G.992.4 (07/2002) | Splitterless asymmetric digital subscriber line  transceivers 2 (splitterless ADSL2) |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 07/2002 | |
| ITU-T | | G.992.5 (01/2009) | Asymmetric digital subscriber line 2 transceivers (ADSL2)– Extended bandwidth ADSL2 (ADSL2plus) |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 01/2009  Corrigendum1  11/2010 | |
| ITU-T | | G.993.1 (06/2004) | Very high speed digital subscriber line transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 06/2004 | |
| ITU-T | | G.993.2 (02/2019) | Very high speed digital subscriber line transceivers 2 (VDSL2) |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 02/2019  Supersedes previous version 2015 | |
| ITU-T | | G.993.5 (02/2019) | Self-FEXT cancellation (vectoring) for use with  VDSL2 transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 02/2019  Supersedes previous version 2015 | |
| ITU‑T | | G.994.1 (11/2018) | Handshake procedures for digital subscriber line transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 11/2018 Supersedes previous version 2017 | |
| ITU-T | | G.998.1 (01/2005) | ATM-based multi-pair bonding |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 01/2005 | |
| ITU-T | | G.998.1(2005)  Amendment 1 | ATM-based multi-pair bonding  Amendment 1 |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 08/2013 | |
| ITU-T | | G.998.2 (11/2018) | ATM-based multi-pair bonding |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 11/2018 Supersedes previous version 2005 | |
| ITU-T | | G.998.3 (01/2005) | Multi-pair bonding using time-division inverse  multiplexing |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 01/2005  Erratum 1  08/2005 | |
| ITU-T | | G.998.3 (2005)  Amendment 1 | Multi-pair bonding using time-division inverse  multiplexing  Amendment 1 – Intentional temporary shutdown  of some bonded lines |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 08/2013 | |
| ITU-T | | G.998.4 (11/2018) | Improved impulse noise protection for DSL  Transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 11/2018 | |
| ITU-T | | G.999.1 (03/2019) | Interface between the link layer and the physical  layer for digital subscriber line (DSL)  transceivers |  |  |  | | X | |  | |  | | X | |  | |  | |  | |  | |  | |  | | 03/2019 | |
| ITU-T | | G.9700 (04/2014) | Fast access to subscriber terminals (G.fast) – Power spectral density specification |  |  | X | | X | |  | |  | |  | | X | |  | |  | |  | |  | |  | | 04/2014 | |
| ITU-T | | G.9700 (2014) Amendment 1 | Fast access to subscriber terminals (G.fast) - Power spectral density specification: Amendment 1 |  |  | X | | X | |  | |  | |  | | X | |  | |  | |  | |  | |  | | 09/2016 | |
| ITU-T | | G.9700 (2014) Amendment 2 | Fast access to subscriber terminals (G.fast) - Power spectral density specification: Amendment 2 |  |  | X | | X | |  | |  | |  | | X | |  | |  | |  | |  | |  | | 06/2017 | |
| ITU-T | | G.9701 (03/2019) | Fast Access to Subscriber Terminals (G.fast) - Physical layer specification |  |  | X | | X | |  | |  | |  | | X | |  | |  | |  | |  | |  | | 03/2019  Supersedes  previous version 2014 | |
| ITU-T | | G.9802 (04/2015) | Multiple Wavelength Passive Optical Networks (MW-PON) |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 04/2015 | |
| ITU-T | | G.9802 (2015) Amendment 1 | Control aspects of multiple wavelength passive optical networks: Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 08/2015 | |
| ITU-T | | G.9803 (11/2018) | Radio over fibre systems | X | X |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 11/2018 | |
| ITU-T | | G.9807.1 (06/2016) | 10-Gigabit-capable symmetric passive optical network (XGS-PON) |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 06/2016  Erratum 1 (03/17) | |
| ITU-T | | G.9807.1 (2016)  Amendment 1 | 10-Gigabit-capable symmetric passive optical network (XGS-PON)  Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 10/2017 | |
| ITU-T | | G.9807.2 (08/2017) | 10 Gigabit-capable passive optical networks (XG(S)-PON): Reach extension |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 08/2017 | |
| ITU-T | | G.9807.2 (2017) Amendment 1 | 10 Gigabit-capable passive optical networks (XG(S)-PON): Reach extension – Amendment 1 |  | X |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 11/2018 | |
| ITU-T | | G Suppl.55 (ex G Suppl.RoF) (07/2015) | Radio-over-fiber (RoF) technologies and their applications |  | X |  | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 07/2015 | |
| ITU‑T | | I.120 (03/1993) | Integrated services digital networks (ISDNs) |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 03/1993 | |
| ITU‑T | | I.121 (04/1991) | Broadband aspects of ISDN |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 04/1991 | |
| ITU‑T | | I.210 (03/1993) | Principles of telecommunication services supported by an ISDN and the means to describe them |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 03/1993 | |
| ITU‑T | | I.432.1 | B-ISDN user-network interface physical layer specification – general characteristics |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 02/1999 | |
| ITU‑T | | I.432.2 | B-ISDN UNI Physical layer specification for 155 520 kbit/s and 622 080 kbit/s |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 02/1999 | |
| ITU‑T | | I.432.3 | B-ISDN UNI Physical layer specification for 1 544 kbit/s and 2 048 kbit/. |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 02/1999 | |
| ITU‑T | | I.432.4 | B-ISDN UNI Physical layer specification for 51 840 kbit/s |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 02/1999 | |
| ITU‑T | | I.432.5 | B-ISDN UNI Physical layer specification for 25 600 kbit/s |  |  |  | | X | |  | | X | |  | |  | |  | |  | |  | |  | |  | | 06/1997 | |
| ITU-T | | J-1 (01/2019) | Terms, definitions and acronyms for television and sound transmission and integrated broadband cable networks | X |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 01/2019 | |
| ITU-T | | J.2 (09/1999) | Guidelines on the use of some ITU-T Recommendations in the J series |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 09/1999 | |
| ITU-T | | J.83 | Digital multi-programme systems for television, sound and data services for cable distribution | X |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 12/2007 | |
| ITU-T | | J.84 | Distribution of digital multi-programme signals for television, sound and data services through SMATV |  |  | X | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 03/2001 | |
| ITU-T | | J.87 | Use of hybrid cable television links for the secondary distribution of television into the user’s premises |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2001 | |
| ITU-T | | J.93 | Requirements for conditional access in the secondary distribution of digital television on cable television systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/1998 | |
| ITU-T | | J.110 (04/1997) | Basic principles for a worldwide common family of systems for the provision of interactive television services |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 04/1997 | |
| ITU-T | | J.111 (03/1998) | Network independent protocols for interactive systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/1998 | |
| ITU-T | | J.112 | Transmission systems for interactive cable television services |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/1998 | |
| ITU-T | | J.112 Annex A | Digital Video Broadcasting: DVB interaction channel for Cable TV (CATV) distribution systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2001 | |
| ITU-T | | J.112 Annex B | Data-over-cable service interface specifications: Radio-frequency interface specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2004 | |
| ITU-T | | J.112  Annex C | Data-over-cable service interface specifications: Radio-frequency interface specification using QAM technique |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 02/2002 | |
| ITU-T | | J.118 | Access systems for interactive services in SMATV |  |  | X | |  | | X | |  | |  | |  | |  | |  | |  | | X | |  | | 05/2000 | |
| ITU-T | | J.122 | Second Generation Transmission Systems for Interactive Cable Television Services – IP Cable Modems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 12/2007 | |
| ITU-T | | J.125 | Link privacy for cable modem implementations |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 12/2007 | |
| ITU-T | | J.126 | Embedded Cable Modem device specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 12/2007 | |
| ITU-T | | J.160 | Architectural framework for the delivery of time-critical services over cable television networks using cable modems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/2005 | |
| ITU-T | | J.184 | Digital Broadband Delivery System:  Out Of Band Transport |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2001 | |
| ITU-T | | J.185 | Transmission equipment for transferring multi-channel television signals over optical access networks by frequency modulation conversion |  | X | X | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 06/2012 | |
| ITU-T | | J.186 | Transmission equipment for multi-channel television signals over optical access networks by sub-carrier multiplexing (SCM) |  | X | X | |  | |  | |  | |  | |  | |  | | X | |  | |  | |  | | 6/2008 | |
| ITU-T | | J.195.1  (J.HiNoC-req) | Functional requirements for high speed transmission over coaxial networks connected with fibre to the building |  | X | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2016 Supersedes Ed.1 03/2013 | |
| ITU -T | | J.195.2  (J.HiNoC-phy) | Physical layer specification for high speed transmission over coaxial networks |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 10/2014 | |
| ITU-T | | J.195.3  (J.HiNoC-mac) | Medium Access Control layer specification for high speed transmission over coaxial networks |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 10/2014 | |
| ITU-T | | J.196.1  (J.HiNoC2-req) | Functional requirements for second-generation HiNoC |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2016 | |
| ITU-T | | J.196.2  (J.HiNoC2-phy) | Physical layer specification of second generation HiNoC |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 10/2016 | |
| ITU-T | | J.196.3 (J.HiNoC2-mac) | Media Access Control (MAC) layer specification of second generation HiNoC |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 10/2016 | |
| ITU-T | | J.210 | Downstream RF Interface for Cable Modem Termination Systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/2006 | |
| ITU-T | | J.211 | Timing Interface for Cable Modem Termination Systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/2006 | |
| ITU-T | | J.212 | Downstream External PHY Interface for Modular Cable Modem Termination Systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/2006 | |
| ITU-T | | J.214 (07/2007) | Cable modem TDM emulation interface |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 07/2007 | |
| ITU-T | | J.218 (07/2007) | Cable modem IPv4 and IPv6 eRouter specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 07/2007 | |
| ITU-T | | J.222.0 | Third-generation transmission systems for interactive cable television services – IP cable modems: Overview |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 12/2007 | |
| ITU-T | | J.222.1 | Third-generation transmission systems for interactive cable television services – IP cable modems: Physical layer specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 07/2007 | |
| ITU-T | | J.222.2 | Third-generation transmission systems for interactive cable television services – IP cable modems: MAC and Upper Layer protocols |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 07/2007 | |
| ITU-T | | J.222.3 | Third-generation transmission systems for interactive cable television services – IP cable modems: Security services |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/2007 | |
| ITU-T | | J.223.1 | Functional requirements for Cabinet DOCSIS (C-DOCSIS) |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2016 | |
| ITU-T | | J.223.2 | Cabinet DOCSIS (C-DOCSIS) system specification |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 10/2016 | |
| ITU-T | | J.381 | Requirements for advanced digital cable transmission technologies |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 09/ 2012 | |
| ITU-T | | J.382 | Advanced digital downstream transmission systems for television, sound and data services for cable distribution |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2018 | |
| ITU-T | | J.1106 (07/2017) | Requirement for radio over IP transmission system |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 07/2017 | |
| ITU-T | | J.1107 (03/2018) | Architecture and specification for radio over IP transmission systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 03/2018 | |
| ITU-T | | J.1108 (01/2019) | Transmission specification for radio over IP transmission systems |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 01/2019 | |
| ITU-T | | J.1109 (01/2019) | Requirement for in-band full-duplex in a HFC based network |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 01/2019 | |
| ITU-T | | J Suppl. 1 (11/1998) | Example of linking options between annexes of ITU-T Recommendation J.112 and annexes of ITU-T Recommendation J.83 |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/1998 | |
| ITU-T | | J Suppl. 2 (11/1998) | Guidelines for the implementation of annex A of Recommendation J.112, "Transmission systems for interactive cable television services" – Example of digital video broadcasting (DVB) interaction channel for cable television distribution |  |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/1998 | |
| ITU-T | | J Suppl. 3 (11/1998) | Guidelines for the implementation of Recommendation J.111 "Network independent protocols" – Example of digital video broadcasting (DVB) systems for interactive services | X |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 11/1998 | |
| ITU-T | | J Suppl. 5 (09/1999) | Guidelines on the use of some ITU-T Recommendations in the J series | X |  | X | |  | |  | |  | |  | |  | |  | |  | | X | |  | |  | | 09/1999 | |
| ITU‑T | | Y.100 | General overview of the Global Information  Infrastructure standards development | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 06/1998 | |
| ITU‑T | | Y.110 | Global Information Infrastructure principles and  framework architecture | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 06/1998 | |
| ITU‑T | | Y.120 | Global Information Infrastructure scenario  methodology | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 06/1998  Corrigendum1  11/2000 | |
| ITU‑T | | Y.120  Annex A | Global information infrastructure scenario  methodology  Annex A: Examples of use | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 02/1999 | |
| ITU-T | | Y.1001 (11/2000) | IP Framework – A framework for convergence of telecommunications network and IP network technologies | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 11/2000 | |
| ITU-T | | Y.1231 (11/2000) | IP access network architecture | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 11/2000 | |
| ITU-T | | Y.2001 | General overview of NGN | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 12/2004 | |
| ITU-T | | Y.2002 | Overview of ubiquitous networking and of its support in NGN | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 10/2009 | |
| ITU-T | | Y.2011 | General principles and general reference model for Next Generation Networks | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 10/2004 | |
| ITU-T | | Y.2012 | Functional requirements and architecture of next generation networks | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 04/2010 | |
| ITU-T | | Y.2091 (03/2011) | Terms and definitions for next generation networks | X |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | 03/2011 | |

**Annex 2.2 - Standards related to ANT Infrastructure Elements**

Some of the listed Documents may not be publicly available. Interested people may contact the person mentioned under the responsible standardization group in the list of contacts in Section 3.1 of the ANT Standards Work Plan.

**Organization of ANT Relevant Standards by Transmission Medium and Infrastructure Elements  
 incl. Operation and Maintenance**

**General Aspects (Gen. Asp.)** = General aspects on network infrastructure, design and management  
**Medium:** **F**= Fiber; **C**= Coax; **P**= Twisted pair; **A**= Wireless  
**Infrastructure**: **N**= Network engineering and infrastructure elements including node equipment and devices; **E=** Power supply and energy management; **O**= Operation and maintenance including network management; **T** = Testing; **C**= Conformance and interoperability; **F** = Optical cable technology; **P** = Copper cable technology; **I** = Cable installation technique

|  | **Number** | **Title** | **Gen. Asp.** | **Medium** | | | | | **Infrastructure** | | | | | | | | | | **Public. Date** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Body** |  |  |  | **F** | | **C** | **P** | **A** | **N** | **E** | **O** | **T** | **C** | | | **F** | **P** | **I** |  |
| ANSI/ SCTE | ANSI/SCTE 96 2013 | Cable Telecommunications Testing Guidelines | X |  | | X |  |  |  |  |  | X |  | | |  |  |  | 2013 |
| BBF | TR-xxx | Published BBF Technical Reports can be found at:  <https://www.broadband-forum.org/standards-and-software/technical-specifications/technical-reports> | X | X | | X | X | X | X | X | X | X | X | | |  |  |  |  |
| Cenelec | CLC/TR 50510 | Fibre optic access to end-user – A guideline to building of FTTX fibre optic network | X | X | |  |  |  | X | X |  |  |  | | | X |  | X | May 2012 |
| Cenelec | CLC/TR 50682 | Consideration on the use of OTDRs to measure return loss of single-mode optical fibre connection |  | X | |  |  |  |  |  |  | X |  | | |  |  |  | June 2018 |
| ETSI | TS 102 566 | Access, Terminals, Transmission and Multiplexing (ATTM) Common Requirements for Automated Distribution Frames (ADF) at Street Cabinet | X |  | |  | X |  | X |  | X |  |  | | |  |  |  | V1.1.1  (2007-09) |
| ETSI | EN 302 099 | Environmental Engineering (EE);  Powering of equipment in access network | X |  | |  |  |  | X | X |  |  |  | | |  |  |  | V2.1.1 (2014-08) |
| ETSI | ES 202 874-1 | Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 1: Functional Requirements | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2012-05) |
| ETSI | TS 102 874-3 | Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 3: CPS Type 1 implementation details | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2012-03) |
| ETSI | TS 102 874-4 | Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 4: CPS Type 2.b implementation details | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2012-03) |
| ETSI | TS 102 874-5 | Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 5: CPS Type 2.c implementation details | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2012-03) |
| ETSI | TS 102 874-6 | Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 6: CPS Type 2.d implementation details | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2012-02) |
| ETSI | TS 105 174-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 1: Overview, common and generic aspects | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2014-09) |
| ETSI | TS 110 174-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Sustainable Digital Multiservice Cities (SDMC); Broadband Deployment and Energy Management; Part 1: Overview, common and generic aspects of societal and technical pillars for sustainability | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2018-12) |
| ETSI | TS 105 174-2 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 2: ICT sites | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2017-01) |
| ETSI | TR 105 174-2-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 2: Network sites; Sub-part 1: Operator sites | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2009-10) |
| ETSI | TS 110 174-2-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Sustainable Digital Multiservice Cities; Broadband Deployment and Energy Management; Part 2: Multiservice Networking Infrastructure and Associated Street Furniture; Sub-part 1: General requirements | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1 (2018-11) |
| ETSI | TS 105 174-2-2 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 2: Network sites; Sub-part 2: Data centres | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2009-10) |
| ETSI | TR 105 174-4 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 4: Access networks | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2009-10) |
| ETSI | TS 105 174-4-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 4: Access Networks; Sub-part 1: Fixed access networks (excluding cable) | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2015-09) |
| ETSI | TR 105 174-5-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 5: Customer network infrastructures; Sub-part 1: Homes (single-tenant) | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2009-10) |
| ETSI | TR 105 174-5-2 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 5: Customer network infrastructures; Sub-part 2: Office premises (single-tenant) | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2009-10) |
| ETSI | TS 105 174-5-4 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 5: Customer network infrastructures; Sub-part 4: Data centres (customer) | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2009-10) |
| ETSI | TS 105 174-7-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 7: Digital multiservice cities; Sub-part 1: Multiservice Street Furnitures | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2017-06) |
| ETSI | EN 305 200-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 1: General requirements | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2018-07) |
| ETSI | EN 305 200-2-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 2: Specific requirements; Sub-part 1: ICT Sites | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1 (2018-02) |
| ETSI | EN 305 200-2-2 | Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 2: Specific requirements; Sub-part 2: Fixed broadband access networks | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2018-08) |
| ETSI | EN 305 200-2-3 | Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 2: Specific requirements; Sub-part 3: Mobile broadband access networks | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1 (2018-06) |
| ETSI | EN 305 200-3-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 3: ICT Sites; Sub-part 1: DCEM | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2018-02) |
| ETSI | EN 305 200-4-4 | Integrated broadband cable telecommunication networks (CABLE); Energy management; Operational infrastructures; Global KPIs; Part 4: Design assessments; Sub-part 4: Cable Access Networks | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.1.1  (2018-04) |
| ETSI | ES 205 200-2-1 | Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures; Part 2: Specific requirements; Sub-part 1: Data centres | X |  | |  |  |  |  | X | X |  |  | | |  |  |  | V1.2.1  (2014-03) |
| ETSI | EN 301 217-2 | V interfaces at the digital Service Node (SN); Interfaces at the VB5.2 reference point for the support of broadband or combined narrowband and broadband Access Networks (Ans); Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification |  |  | |  | X |  |  |  |  |  | X | | |  |  |  | V1.1.3 (1999-09) |
| ETSI | EN 302 326-3 | Fixed Radio Systems; Multipoint Equipment and Antennas; Part 3: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for Multipoint Radio Antennas |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | V1.3.1 (02/2008) |
| ETSI | EN 301 754 | Telecommunications Management Network (TMN); Management interfaces associated with the VB5.2 reference point | X |  | |  | X |  |  |  | X |  |  | | |  |  |  | V1.1.1 (2001-09) |
| ETSI | ETR 240 | Transmission and Multiplexing (TM); Optical Access Networks (OANs); Operations and Maintenance (OAM) of OANs | X | X | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1 (1996-04) |
| ETSI | ES 203 069 | Access, Terminals, Transmission and Multiplexing (ATTM); Remote management of CPE over broadband networks; CPE WAN Management Protocol (CWMP) | X |  | |  |  |  |  |  | X |  |  | | |  |  |  | V1.2.1  (2011-09) |
| ETSI | ETR 240 | Transmission and Multiplexing (TM); Operations and maintenance of Optical Access Networks | X | X | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1  (1996-04) |
| ETSI | ETS 300 150 | Transmission and Multiplexing (TM) ; Protocol suites for Q interfaces for management of transmission systems | X |  | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1  (1992-11) |
| ETSI | ETS 300 376‑1 | Q3 interface at the Access Network (AN) for configuration management of V5 interfaces and associated user ports; Part 1: Q3 interface specification | X |  | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1  (1994-12) |
| ETSI | ETS 300 377‑1 | Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification | X |  | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1  (1994-12) |
| ETSI | ETS 300 378‑1 | Q3 interface at the Access Network (AN) for fault and performance management of V5 interfaces and associated user ports; Part 1: Q3 interface specification | X |  | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1  (1995-11) |
| ETSI | ETS 300 379‑1 | Q3 interface at the Local Exchange (LE) for fault and performance management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification | X |  | |  |  |  |  |  | X |  |  | | |  |  |  | Edition 1  (1995-11) |
| ETSI | TS 100 783 | Transmission and Multiplexing (TM); Passive optical components; Fibre optic fusion splices for single-mode optical fibre transmission systems for indoor and outdoor applications; Common requirements and conformance testing |  | X | |  |  |  | X |  |  | X |  | | | X |  | X | V1.2.1 (2004-08) |
| ETSI | TS 101 263 | Transmission and Multiplexing (TM); Passive optical components; Fibre optic mechanical splices for single-mode optical fibre communications systems for indoor and outdoor applications; Common requirements and conformance testing |  | X | |  |  |  | X |  |  | X |  | | | X |  | X | V1.2.1 (2004-07) |
| ETSI | ES 201 792 | Transmission and Multiplexing (TM); Passive optical components; Fibre optic patchcords for single mode optical fibre communication systems; Common requirements and conformance testing |  | X | |  |  |  | X |  |  | X |  | | | X |  |  | V1.1.1  (2000-08) |
| ETSI | ES 201 286 | Transmission and Multiplexing ™; Passive optical components; Connector-type optical fixed attenuators for single-mode optical fibre communications systems; Common requirements and conformance testing |  | X | |  |  |  | X |  |  | X |  | | | X |  |  | V1.1.1  (1999-06) |
| ETSI | ES 202 319 | Transmission and Multiplexing (TM); Passive optical components and cables; Optical fibre cables to be used for patchcord applications for single-mode optical fibre communication systems; Common requirements and conformance testing |  | X | |  |  |  | X |  |  | X |  | | | X |  |  | V1.1.1  (2004-06) |
| ETSI | ETS 300 644 | Transmission and Multiplexing (TM); Optical fibre cables for indoor applications |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | Edition 1  (1997-06) |
| ETSI | TS 101 573 | Access, Terminals, Transmission and Multiplexing (ATTM); General engineering of optical building cabling | X | X | |  |  |  | X |  |  |  |  | | | X |  | X | V1.1.1  (2012-09) |
| ETSI | TS 102 872 | Transmission and Multiplexing (ATTM); Copper External Network Testing Interface |  |  | |  | X |  |  |  | X | X |  | | |  |  |  | V1.1.1  (2010-07) |
| ETSI | TS 102 873 | Transmission and Multiplexing (ATTM); Optical External Network Testing |  | X | |  |  |  |  |  | X | X |  | | |  |  |  | V1.1.1  (2010-10) |
| ETSI | TS 101 548 | Access, Terminals, Transmission and Multiplexing (ATTM); European Requirements for Reverse Powering  of Remote Access Equipment | X |  | |  |  |  |  | X |  |  |  | | |  |  |  | V2.1.1 (2016-09) |
| ETSI | TS 101 548-1 | Access, Terminals, Transmission and Multiplexing (ATTM); European Requirements for Reverse Powering of Remote Access Equipment; Part 1: Twisted pair networks | X |  | |  |  |  |  | X |  |  |  | | |  |  |  | V2.2.1 (2018-06) |
| ICEA | S-84-608-2017 | Telecommunications Cable Filled, Polyolfin Insulated, Copper Conductor Technical Requirements |  |  | |  | X |  |  |  |  |  |  | | |  | X |  | January 1, 2017 |
| ICEA | S-85-625-2016 | Telecommunications Cable, Aircore Polyolefin Insulated, Copper Conductor Technical Requirements |  |  | |  | X |  |  |  |  |  |  | | |  | X |  | March 8, 2016 |
| ICEA | S-86-634-2001 | Buried Telecommunications Wire Filled, Polyolefin Insulated, Copper Conductor Technical Requirements |  |  | |  | X |  |  |  |  |  |  | | |  | X |  | January 1, 2011 |
| IEC | TR 62691 Edition 2.0 | Optical fibre cables – Guidelines to the installation of optical fibre cables |  | X | |  |  |  | X |  |  |  |  | | | X |  | X | 06/2016 |
| IEC | TR 62901  Edition 1.0 | Guidance for the selection of drop cables |  | X | |  |  |  | X |  |  |  |  | | | X |  | X | 03/2016 |
| IEEE | 802.16.2-2004 | IEEE Recommended Practice for Local and Metropolitan Area Networks Coexistence of Fixed Broadband Wireless Access Systems | X |  | |  |  | X | X |  | X |  |  | | |  |  |  | 03/2004  Reaffirmed: 03/2010 |
| IEEE | 1904.1-2017 | IEEE Standard for Service Interoperability in Ethernet Passive Optical Networks (SIEPON) |  | X | |  |  |  |  |  | X |  | X | | |  |  |  | 07/2017 |
| ITU-R | F.1400 | Performance and availability objectives for FWA to PSTN |  |  | |  |  | X | X |  | X |  |  | | |  |  |  | 05/99 |
| ITU-R | F.1569 | Technical and operational characteristics for the fixed service using high altitude platform stations in the band 27.5-28.5 and 31.0-31.3 GHz |  |  | |  |  | X | X |  | X |  |  | | |  |  |  | 05/02 |
| ITU-R | F.2058 (Report) | Design techniques applicable to broadband fixed wireless access systems conveying Internet protocol packets or asynchronous transfer mode cells |  |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2006 |
| ITU-R | F.2086-1 (Report) | Technical and operational requirements for broadband wireless access in the fixed service | X |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2010 |
| ITU-R | F.2106-1 (Report) | Fixed Service applications using free-space optical links | X |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2010 |
| ITU-R | F.2107-1 (Report) | Characteristics and applications of fixed wireless systems operating in the 57 GHz to 130 GHz bands |  |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2012 |
| ITU-R | F.2060 (Report) | Fixed Service use in the IMT-2000 transport network | X |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2005 |
| ITU-R | F.2106-1 (Report) | Fixed Service applications using free-space optical links | X |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2010 |
| ITU-R | F.2107-1 (Report) | Characteristics and applications of fixed wireless systems operating in the 57 GHz to 130 GHz bands |  |  | |  |  | X | X |  | X |  |  | | |  |  |  | 2012 |
| ITU‑R | [M.818-2](http://www.itu.int/rec/R-REC-M.818/en) | Satellite operation within IMT‑2000 | X |  | |  |  | X | X |  | X |  |  | | |  |  |  | 06-2003 |
| ITU‑R | [M.1036-](http://www.itu.int/rec/R-REC-M.1036/en)4 | Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications-2000 (IMT-2000) in the bands  806-960 MHz, 1 710-2 025 MHz, 2 110-2 200 MHz and 2 500-2 690 MHz |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | 03/2012 |
| ITU-R | [M.1079-2](http://www.itu.int/rec/R-REC-M.1079/en) | Performance and quality of service requirements for International Mobile Telecommunications-2000  (IMT-2000) |  |  | |  |  | X | X |  | X |  |  | | |  |  |  | 06-2003 |
| ITU‑R | [M.1225](http://www.itu.int/rec/R-REC-M.1225/en) | Guidelines for evaluation of radio transmission technologies for IMT-2000 | X |  | |  |  | X | X |  |  |  |  | | |  |  |  | 02-1997 |
| ITU‑R | [M.1390](http://www.itu.int/rec/R-REC-M.1390/en) | Methodology for the Calculation of IMT‑2000 Terrestrial Spectrum Requirements |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | 01-1999 |
| ITU‑R | [M.1391-1](http://www.itu.int/rec/R-REC-M.1391/en) | Methodology for the Calculation of IMT‑2000 Satellite Spectrum Requirements |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | 03-2006 |
| ITU‑R | [M.1454](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1454) | E.i.r.p. density limit and operational restrictions for RLANs or other wireless access transmitters in order to ensure the protection of feeder links of NGSO systems in the MSS in the frequency band 5 150-5 250 MHz |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | 2000 |
| ITU‑R | [M.1651](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1651) | A method for assessing the required spectrum for broadband NWA systems including RLANs using the 5 GHz band |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | 2003 |
| ITU‑R | [M.1653](http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=R-REC-M.1653) | Operational and deployment requirements for WAS including RLANs in the MS to facilitate sharing between these systems and systems in the EESS (active) and the SRS (active) in the band 5 470-5 570 MHz within the 5 460‑5 725 MHz range |  | |  |  |  | X | X |  | X |  |  | | |  |  |  | 2003 |
| ITU-R | [M.1768](http://www.itu.int/rec/R-REC-M.1768/en) | Methodology for calculation of spectrum requirements for the future development of the terrestrial component of IMT-2000 and systems beyond IMT-2000 |  |  | |  |  | X | X |  |  |  |  | | |  |  |  | 03-2006 |
| ITU-T | G.107 (06/2015) | The E-model: a computational model for use in transmission planning | X |  | |  |  |  | X |  |  |  |  | | |  |  |  | 06/2015 |
| ITU-T | G.108 (09/1999) | Application of the E-model: A planning guide | X |  | |  |  |  | X |  |  |  |  | | |  |  |  | 09/1999  Erratum 1 12/2000 |
| ITU-T | G.108 (1999)  Amendment 1 | Application of the E-model: A planning guide Amendment 1: New Appendix I - The relationship between and interaction of talker echo and absolute delay |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 09/2003 |
| ITU-T | G.108 (1999)  Amendment 2 | Application of the E-model: A planning guide Amendment 2: New Appendix II - Planning examples regarding delay in packet-based networks |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 03/2004 |
| ITU-T | G.108.1 | Guidance for assessing conversational speech transmission quality effects not covered by the E-model |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 05/2000 |
| ITU-T | G.108.2 (03/2007) | Transmission planning aspects of echo cancellers |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 03/2007 |
| ITU-T | G.108.2 (2007)  Amendment 1 | Transmission planning aspects of echo cancellers  Amendment 1: New Appendix III - Guidance for using echo cancellers to prevent low-level echo |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 10/2007 |
| ITU-T | G.109 (1999) | Definitions of categories of speech transmission quality | X |  | |  |  |  | X |  |  |  |  | | |  |  |  | 09/1999 |
| ITU-T | G.109 (1999)  Amendment 1 | Definitions of categories of speech transmission quality  Amendment1: New Appendix I – The E-model-based quality contours for predicting speech transmission quality and user satisfaction from time-varying transmission impairments | X |  | |  |  |  | X |  |  |  |  | | |  |  |  | 01/2007 |
| ITU‑T | G.114 (05/2003) | One-way transmission time |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 05/2003 |
| ITU‑T | G.114 (2003)  Amendment 1 | One-way transmission time  Amendment 1 |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 09/2003 |
| ITU‑T | G.114 (2003)  Amendment 2 | One-way transmission time  Amendment 2: New Appendix III – Delay variation on unshared access lines |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 11/2009 |
| ITU‑T | G.131 | Talker echo and its control |  |  | |  |  |  | X |  |  |  |  | | |  |  |  | 11/2003 |
| ITU‑T | G.174 | Transmission Performance Objectives for Terrestrial Digital Wireless Systems Using Portable Terminals to Access the PSTN |  |  | |  |  |  | X |  | X |  |  | | |  |  |  | 06/1994 |
| ITU‑T | G.601 | Terminology for cables | X | X | | X | X |  | X |  |  |  |  | | | X | X |  | 11/1988 |
| ITU‑T | G.602 | Reliability and availability of analogue cable transmission systems and associated equipments |  |  | |  | X |  | X |  | X |  |  | | |  |  |  | 11/1988 |
| ITU‑T | G.611 | Characteristics of symmetric cable pairs for analogue transmission |  |  | |  | X |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU‑T | G.612 | Characteristics of symmetric cable pairs designed for the transmission of systems with bit rates of the order of 6 to 34 Mbit/s |  |  | |  | X |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU‑T | G.613 | Characteristics of symmetric cable pairs usable wholly for the transmission of digital systems with a bit rate of up to 2 Mbit/s |  |  | |  | X |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU‑T | G.614 | Characteristics of symmetric pair star-quad cables designed earlier for analogue transmission systems and being used now for digital system transmission at bit rates of 6 to 34 Mbit/s |  |  | |  | X |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU‑T | G.621 | Characteristics of 0.7/2.9 mm coaxial cable pairs |  |  | | X |  |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU‑T | G.622 | Characteristics of 1.2/4.4 mm coaxial cable pairs |  |  | | X |  |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU‑T | G.623 | Characteristics of 2.6/9.5 mm coaxial cable pairs |  |  | | X |  |  | X |  |  |  |  | | |  | X |  | 11/1988 |
| ITU-T | Technical report (2015) | Technical Report on Optical fibres, cables and systems | X | X | |  |  |  | X |  |  |  |  | | | X |  |  | 2015 |
| ITU-T | G Suppl. 59 (02/2018) | Guidance on optical fibre and cable reliability | X | X | |  |  |  | X |  |  |  |  | | | X |  |  | 02/2018 |
| ITU‑T | G.650.1 (03/2018) | Definitions and test methods for linear, deterministic attributes of single-mode fibre and cable | X | X | |  |  |  | X |  |  | X |  | | | X |  |  | 03/2018 |
| ITU‑T | G.650.2 (08/2015) | Definitions and test methods for statistical and non-linear related attributes of single mode fibre and cable | X | X | |  |  |  | X |  |  | X |  | | | X |  |  | 08/2015 |
| ITU‑T | G.650.3 (08/2017) | Test methods for installed single-mode optical  fibre cable links | X | X | |  |  |  | X |  |  | X |  | | | X |  |  | 08/2017 |
| ITU‑T | G.651.1 (11/2018) | Characteristics of a 50/125 µm multimode graded index optical fibre cable for the optical access network |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 11/2018 |
| ITU‑T | G.652 (11/2016) | Characteristics of a single-mode optical fibre and cable |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 11/2016  Supersedes  11/2009 |
| ITU‑T | G.657 (11/2016) | Characteristics of a bending-loss insensitive single-mode optical fibre and cable for the access network |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 11/2016  Supersedes  10/2012 |
| ITU-T | G.671 (02/2012) | Transmission characteristics of optical components and subsystems | X | X | |  |  |  | X |  |  |  |  | | |  |  |  | 02/2012 |
| ITU‑T | G.772 | Protected monitoring points provided on digital transmission systems |  |  | |  |  |  | X |  |  | X |  | | |  |  |  | 03/1993 |
| ITU‑T | G.773 | Protocol suites for Q-interfaces for management of transmission systems |  |  | |  |  |  | X |  |  | X |  | | |  |  |  | 03/1993 |
| ITU‑T | G.902 | Framework Recommendation on functional access networks (AN) - Architecture and functions, access types, management and service node aspects | X |  | |  |  |  | X |  | X |  |  | | |  |  |  | 11/1995 |
| ITU-T | G Suppl. 39 (02/2016) | Optical system design and engineering considerations | X | X | |  |  |  | X |  |  |  |  | | |  |  |  | 02/2016 |
| ITU-T | G Suppl. 40 (10/2018) | Optical fibre and cable Recommendations and standards guideline | X | X | |  |  |  |  |  |  |  |  | | | X |  |  | 10/2018 |
| ITU-T | G Suppl. 42 (10/2018) | Guide on the use of the ITU-T Recommendations related to optical fibres and systems technology | X | X | |  |  |  | X |  |  |  |  | | | X |  |  | (10/2018) |
| ITU‑T | G.911 | Parameters and calculation methodologies for reliability and availability of fibre optic systems |  | X | |  |  |  | X |  | X |  |  | | |  |  |  | 04/ 1997 |
| ITU-T | G.983.2 (07/2005) | ONT management and control interface specification for B-PON |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 07/2005  Erratum 1  06/2006 |
| ITU-T | G.983.2 (2005)  Amendment 1 | ONT management and control interface specification for B-PON  Amendment 1: Omnibus improvements for OMCI |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 03/2006 |
| ITU-T | G.983.2 (2005)  Amendment 2 | ONT management and control interface specification for B-PON  Amendment 2 |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 01/2007 |
| ITU-T | G.Imp983.2 (02/2006) | Implementers’ Guide for ITU-T Rec. G.983.2 (07/2005)  ONT management and control interface specification for B-PON |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 02/2006 |
| ITU-T | G.984.4 (02/2008) | Gigabit-capable  Passive Optical Networks (GPON): ONT management and control interface specification |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 02/2008  Erratum 08/2009  Corrigendum1  03/2010 |
| ITU-T | G.984.4 (2008)  Amendment 1 | Gigabit-capable  Passive Optical Networks (GPON): ONT management and control interface specification  Amendment 1 |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 06/2009 |
| ITU-T | G.984.4 (2008)  Amendment 2 | Gigabit-capable passive optical networks (G-PON):  ONT management and control interface specification  Amendment 2: Changes and extensions to the  OMCI, editorial clarifications and corrections |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 11/2009 |
| ITU-T | G.984.4 (2008)  Amendment 3 | Gigabit-capable passive optical networks (G-PON):  ONT management and control interface specification  Amendment 3: Clarification of scope of application |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 07/2010 |
| ITU-T | G.Imp.984.4  (10/1999) | Implementers’ Guide for Recommendation ITU-T G.984.4  Second Revision |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 10/2009 |
| ITU-T | G.988 (11/2017) | ONU management and control interface (OMCI)  specification |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 11/2017 |
| ITU-T | G.988 (2017) Amendment 1 | ONU management and control interface (OMCI)  Specification - Amendment 1 |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 11/2018 |
| ITU-T | G Suppl. 44 (06/2007) | Test plan to verify B-PON interoperability |  | X | |  |  |  |  |  |  | X | X | | |  |  |  | 06/2007 |
| ITU-T | G. Suppl. 45  (05/2009) | GPON power conservation |  | X | |  |  |  |  | X |  |  |  | | |  |  |  | 05/2009 |
| ITU-T | G Suppl. 46 (05/2009) | G-PON interoperability test plan between optical line terminations and optical network units |  | X | |  |  |  |  |  |  | X | X | | |  |  |  | 05/2009 |
| ITU-T | G. Suppl. 49 (02/2011) | Rogue optical network unit (ONU) considerations |  | X | |  |  |  |  |  | X |  |  | | |  |  |  | 02/2011 |
| ITU-T | G. Suppl. 51 (06/2017) | Passive optical network protection consideration |  | X | |  |  |  | X | X |  |  |  | | |  |  |  | 06/2017 |
| ITU-T | G.995.2 (08/2015) | Enhanced common mode limits and measurement methods for customers premises equipment operating on copper pairs |  |  | |  | X |  |  |  |  | X |  | | |  |  |  | 08/2015 |
| ITU-T | G.996.1 | Test procedures for digital subscriber line (DSL)  transceivers |  |  | |  | X |  |  |  |  | X |  | | |  |  |  | 02/2001  Erratum 1  01/2003 |
| ITU-T | G.996.1  Amendment 1 | Test procedures for digital subscriber line (DSL)  transceivers  Amendment 1: New Annex B |  |  | |  | X |  |  |  |  | X |  | | |  |  |  | 03/2003 |
| ITU-T | G.996.2 (11/2018) | Single-ended line testing for digital subscriber lines (DSL) |  |  | |  | X |  |  |  |  | X |  | | |  |  |  | 11/2018 Supersedes previous version 2009 |
| ITU-T | G.997.1 (02/2019) | Physical layer management for digital subscriber line transceivers |  |  | |  | X |  | X |  | X |  |  | | |  |  |  | 02/2019 Supersedes previous version 2016 and 2018 |
| ITU-T | G.997.2 (03/2019) | Physical layer management for G.fast transceivers |  |  | | X | X |  | X |  | X |  |  | | |  |  |  | 03/2019 Supersedes previous version 2015 |
| ITU-T | G.Supp.62 (02/2018) | Gfast Certification |  |  | | X | X |  |  |  |  |  | X | | |  |  |  | 02/2018 |
| ITU‑T | G.8011.1/Y.1307 (11/2016) | Ethernet service characteristics | X |  | |  |  |  | X |  | X |  |  | | |  |  |  | 11/2016 |
| ITU‑T | G.8012/Y.1308 (08/2004) | Ethernet UNI And Ethernet Over Transport NNI | X |  | |  |  |  | X |  | X |  |  | | |  |  |  | 08/2004 |
| ITU‑T | G.8012/Y.1308 (2004)  Amendment 1 | Ethernet UNI And Ethernet Over Transport NNI  Amendment 1 | X |  | |  |  |  | X |  | X |  |  | | |  |  |  | 05/2006 |
| ITU‑T | G.8012/Y.1308 (2004)  Amendment 2 | Ethernet UNI And Ethernet Over Transport NNI  Amendment 2 | X |  | |  |  |  | X |  | X |  |  | | |  |  |  | 11/2016 |
| ITU-T | G.9801(08/2013) | Ethernet passive optical networks using OMCI |  | X | |  |  |  |  |  | X |  | X | | |  |  |  | 08/2013 |
| ITU-T | G.9801 Impl. Guide  (ex G.epon) (12/2014) | Conformance and interoperability test plans for OMCI-EPON |  | X | |  |  |  |  |  | X |  | X | | |  |  |  | 12/2014 |
| ITU-T | H.610 | Full-Service VDSL - System architecture and customer premises equipment |  |  | |  | X |  | X |  | X |  |  | | |  |  |  | 07/2003 |
| ITU-T | H.611 | Full-Service VDSL - Operations, Administration Maintenance & Provision aspects |  |  | |  | X |  | X |  | X |  |  | | |  |  |  | 07/2003 |
| ITU-T | K.23 (11/1988) | Types of induced noise and description of noise voltage parameters for ISDN basic user networks |  |  | |  | X |  | X |  |  |  |  | | |  |  |  | 11/1988 |
| ITU-T | K.27 (03/2015) | Bonding configurations and earthing inside a telecommunication building  Q4/5 states that this is valid for UNI and NNI |  |  | |  |  |  | X |  | X |  |  | | |  |  | X | 03/2015 |
| ITU-T | K.34 (07/2003) | Classification of electromagnetic environmental conditions for telecommunications equipment - Fast transient and radio frequency phenomena |  |  | |  |  |  | X |  | X |  |  | | |  |  |  | 07/2003 |
| ITU-T | K.35 (05/1996) | Bonding configurations and earthing at remote electronic sites |  |  | |  |  |  | X |  | X |  |  | | |  |  | X | 05/1996 |
| ITU-T | K.38 (10/1996) | Radiated emission test procedure for physically large systems |  |  | |  |  |  | X |  |  | X |  | | |  |  |  | 10/1996 |
| ITU-T | K.43(07/2009) | Immunity requirements for telecommunication equipment |  |  | |  |  |  | X |  | X |  |  | | |  |  |  | 07/2009 |
| ITU-T | K 47 (05/2012) | Protection of telecommunication lines against direct lightning flashes |  |  | |  |  |  | X |  | X |  |  | | |  |  | X | 05/2012 |
| ITU-T | K.50 (12/2016) | Safe limits for operating voltages and currents of telecommunication systems powered over the network |  |  | |  |  |  | X | X | X |  |  | | |  |  |  | 12/2016 |
| ITU-T | K.51(06/2016) | Safety criteria for telecommunication equipment |  |  | |  |  |  | X |  | X |  |  | | |  |  |  | 06/2016 |
| ITU-T | K.48 (09/2006) | EMC requirements for telecommunication equipment - Product family Recommendation |  |  | |  |  |  | X |  | X |  |  | | |  |  |  | 09/2006 |
| ITU-T | K.20 (07/2017) | Resistibility of telecommunication equipment installed in a telecommunication centre to overvoltages and overcurrents |  |  | |  |  |  | X | X | X |  |  | | |  |  |  | 07/2017 |
| ITU-T | K.45 (12/2016) | Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents |  |  | |  |  |  | X | X | X |  |  | | |  |  |  | 12/2016 |
| ITU-T | K.73 (04/2008) | Shielding and bonding for cables between buildings |  | X | | X | X |  | X |  | X |  |  | | | X | X | X | 04/2008 |
| ITU-T | K 188 (12/2016) | Requirements for lightning protection of fibre to the distribution point equipment |  | X | |  |  |  | X |  | X |  |  | | | X |  | X | 12/2016 |
| ITU-T | Technical report TR-GLSR (2018) | Guide on the use of ITU-T L-series Recommendations related to optical technologies for outside plant | X | X | | X | X |  | X |  |  |  |  | | | X | X | X | 2018 |
| ITU-T | L.19 (05/2010) | Multi-pair copper nework cable supporting shared multiple services such as POTS, ISDN and xDSL |  |  | |  | X |  | X |  |  |  |  | | |  | X |  | 05/2010 |
| ITU-T | L.71 (01/2008) | Design, construction, and installation of network cables for broadband access including metallic networks connected to optical fibre networks | X |  | |  |  |  | X |  |  |  |  | | |  |  |  | 01/2008 |
| ITU-T | L.75 (05/2008) | Test, acceptance and maintenance methods of copper subscriber pairs |  |  | |  | X |  | X |  | X | X |  | | |  | X |  | 05/2008 |
| ITU-T | L.76 (05/2008) | Copper loop requirements for various technologies including indoor and structured cabling |  |  | |  | X |  | X |  |  |  |  | | |  | X |  | 05/2008 |
| ITU-T | L.100/L10 (08/2015) | Optical fibre cables for duct and tunnel application |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 08/2015 |
| ITU-T | L.101/L.43 (08/2015) | Optical fibre cables for buried application |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 08/2015 |
| ITU-T | L.102/L.26 (08/2015) | Optical fibre cables for aerial application |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 08/2015 |
| ITU-T | L.103 (04/2016) | Optical fibre cables for indoor applications |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 04/2016  Supersedes L.59 |
| ITU-T | L.104/L.67  (10/20006) | Small count optical fibre cables for indoor applications |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 10/2006 |
| ITU-T | L.105/L.87 (07/2010) | Optical fibre cables for drop applications |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 07/2010 |
| ITU-T | L.106/L.58  (03/2004) | Optical fibre cables: Special needs for access networks |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 03/2004 |
| ITU-T | L.107/L.78  (05/2008) | Optical fibre cable construction for sewer duct applications |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 05/2008 |
| ITU-T | L.107/L.78 (2008)  Amendment 1 | Optical fibre cable construction for sewer duct applications  Amendement 1 |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 06/2010 |
| ITU-T | L.108(03/2018) | Optical fibre cable elements for microduct blowing-installation application |  | X | |  |  |  | X |  |  |  |  | | | X |  |  | 03/2018 |
| ITU-T | L.109/L.60 (11/2018) | Construction of optical/metallic hybrid cables |  | X | | X | X |  | X |  |  |  | |  | | X | X |  | 11/2018 |
| ITU-T | L.110 (08/2017) | Optical fibre cables for direct surface application |  | X | |  |  |  | X |  |  |  | |  | | X |  |  | 08/2017 |
| ITU-T | L.150/L.35 (10/1998) | Installation of optical fibre cables in the access network |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 10/ 1998 |
| ITU-T | L.150/L.35 (1998)  Amendment 1 | Installation of optical fibre cables in the access network  Amendment 1 |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 11/2007 |
| ITU-T | L.151/L.34 (10/1998) | Installation of Optical Fibre Ground Wire (OPGW) cable |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 10/1998 |
| ITU-T | L.152/L.38 (09/1999) | Use of trenchless techniques for the construction of underground infrastructures for telecommunication cable installation |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 09/1999 |
| ITU-T | L.153/L.48 (03/2003) | Mini-trench installation technique |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 03/2003 |
| ITU-T | L.154/L.49 (03/2003) | Micro-trench installation technique |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 03/2003 |
| ITU-T | L.155 (11/2016) | Low impact trenching technique for FTTx networks |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 11/2016 |
| ITU-T | L.156 (03/2018) | Air-assisted installation of optical fibre cables |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 03/2018 |
| ITU-T | L.157/L.61 (07/2004) | Optical fibre cable installation by floating technique |  | X | |  |  |  | X |  |  |  |  | | | X |  | X | 07/2004 |
| ITU-T | L.158/L.56 (05/2003) | Installation of optical fibre cables along railways |  | X | |  |  |  | X |  |  |  |  | | | X |  | X | 05/2003 |
| ITU-T | L.159/L.77  (05/2008) | Installation of cables in sewer ducts |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 05/2008 |
| ITU-T | L.160/L.82 (07/2010) | Optical cabling shared with multiple operators in buildings |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 07/2010 |
| ITU-T | L.160/L.82 (2010)  Amendment 1 | Optical cabling shared with multiple operators in buildings  Amendment 1 |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 12/2014 |
| ITU-T | L.161/L.46 (10/2000) | Protection of telecommunication cables and plant from biological attack |  | X | | X | X |  | X |  |  |  | | |  | X | X | X | 10/2000 |
| ITU-T | L.162 (11/2016) | Microduct technology and its applications |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 11/2016 |
| ITU-T | L.163 (11/2018) | Criteria for optical cable installation with minimal existing infrastructure |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 11/2018 |
| ITU-T | L.200/L.51 (04/2003) | Passive node elements for fibre optic networks – General principles and definitions for characterization and performance evaluation |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 04/2003 |
| ITU-T | L.201/L.13 (04/2003) | Performance requirements for passive optical nodes: Sealed closures for outdoor environments |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 04/2003 |
| ITU-T | L.202/L.50  (07/2010) | Requirements for passive optical nodes: Optical distribution frames for central office environments |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 07/2010 |
| ITU-T | L.203/L.44 (10/2000) | Electric power supply for equipment installed as outside plant |  |  | |  |  |  | X | X |  |  | | |  |  |  |  | 10/2000 |
| ITU-T | L.204/L.70 (11/2007) | Managing active electronics in the outside plant |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 11/2007 |
| ITU-T | L.205/L.11 (11/1988) | Joint use of tunnels by pipelines and telecommunication cables, and the standardization of underground duct plans |  |  | |  |  |  | X |  | X |  | | |  | X | X | X | 11/1988 |
| ITU-T | L.206 (08/2017) | Requirements for passive optical nodes – Outdoor optical cross-connect cabinet |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 08/2017 |
| ITU-T | L.207 (03/2018) | Passive node elements with automated ID tag detection |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 03/2018 |
| ITU-T | L.250/L.90 (02/2012) | Optical access network topologies for broadband services | X | X | |  |  |  | X |  |  |  | | |  |  |  |  | 02/2012 |
| ITU-T | L.251/L.72  (01/2008) | Databases for optical access network infrastructure |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 01/2008 |
| ITU-T | L.252/L.86  (07/2010) | Considerations on the installation site of branching components in passive optical networks for fibre to the home |  | X | |  |  |  | X |  |  |  | | |  |  |  |  | 07/2010 |
| ITU-T | L.253/L.47 (10/2000) | Access facilities using hybrid fibre/copper networks |  | X | | X | X |  | X |  |  |  | | |  |  |  |  | 10/2000 |
| ITU-T | L.254/L.62  (09/2004) | Practical aspects of unbundling services by multiple operators in copper access networks |  |  | |  | X |  | X |  |  |  |  | | |  |  |  | 09/2004 |
| ITU-T | L.255/L.17 (06/1995) | Implementation of connecting customers into the public switched telephone network (PSTN) via optical fibres |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 06/1995  Appendix 02/1997 |
| ITU-T | L.256/L.45 (10/2000) | Minimizing the effect on the environment from the outside plant in telecommunication networks | X |  | |  |  |  | X |  |  |  | | |  |  |  |  | 10/2000 |
| ITU-T | L.257/L.39 (05/2000) | Investigation of the soil before using trenchless techniques |  |  | |  |  |  | X |  |  |  | | |  |  |  | X | 05/2000 |
| ITU-T | L.258/L.63 (10/2004) | Safety procedures for outdoor installations |  |  | |  |  |  | X |  |  |  |  | | |  |  | X | 10/2004 |
| ITU-T | L.259/L.73 (04/2008) | Methods for inspecting and repairing underground plastic ducts |  |  | |  |  |  | X |  | X |  |  | | |  |  | X | 04/2008 |
| ITU-T | L.260/L.84 (07/2010) | Fast mapping of underground networks |  |  | |  |  |  | X |  | X |  | | |  |  |  | X | 07/2010 |
| ITU-T | L.261/L.89 (02/2012) | Design of suspension wires, telecommunication poles and guy-lines for optical access networks |  | X | |  |  |  | X |  |  |  | | |  | X |  | X | 02/2012 |
| ITU-T | L.262/L.94 (01/2015) | Use of global navigation satellite systems to create a referenced network map |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 01/2015 |
| ITU-T | L.300/L.25 (01/2015) | Optical fibre cable network maintenance |  | X | |  |  |  | X |  | X |  | | |  | X |  |  | 01/2015 |
| ITU-T | L.301/L.41 (05/2000) | Maintenance wavelength on fibres carrying signals |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 05/2000 |
| ITU-T | L.302/L.40  (10/2000) | Optical fibre outside plant maintenance support, monitoring and testing system |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 10/2000 |
| ITU-T | L.310 (04/2016) | Optical fibre maintenance depending on topologies of access networks |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 04/2016 |
| ITU-T | L.311/L.93 (05/2014) | Optical fibre cable maintenance support, monitoring and testing systems for optical fibre trunk networks |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 05/2014 |
| ITU-T | L.312/L.68 (10/2007) | Optical fibre cable maintenance support, monitoring and testing system for optical fibre cable networks carrying high total optical power |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 10/2007 |
| ITU-T | L.313/L.66 (05/2007) | Optical fibre cable maintenance criteria for in-service fibre testing in access networks |  | X | |  |  |  | X |  | X | X | | |  |  |  |  | 05/2007 |
| ITU-T | L.314 (11/2018) | Optical fibre identification for the maintenance of optical access networks |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 11/2018 |
| ITU-T | L.315 (03/2018) | Water detection in underground closures for the maintenance of optical fibre cable networks with optical monitoring system |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 03/2018 |
| ITU-T | L.340/L.74 (04/2008) | Maintenance of cable tunnels |  | X | | X | X |  | X |  | X |  | | |  | X | X |  | 04/2008 |
| ITU-T | L.341/L.88 (07/2010) | Management of poles carrying overhead telecommunication lines |  | X | | X | X |  | X |  | X |  | | |  | X | X |  | 07/2010 |
| ITU-T | L.360/L.80 (05/2008) | Operations support system requirements for infrastructure and network elements management using ID technology |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 05/2008 |
| ITU.T | L.361/L.64 (10/2012) | ID tag requirements for infrastructure and network elements management |  |  | |  |  |  | X |  | X |  |  | | |  |  |  | 10/2012 |
| ITU-T | L.362/L.69 (06/2007) | Personal digital assistant requirements and relevant data structure for infrastructure and network elements management |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 06/2007 |
| ITU-T | L.390/L92 (10/2012) | Disaster management for outside plant facilities |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 10/2012 |
| ITU-T | L.391/L.81 (11/2009) | Monitoring systems for outside plant facilities |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 11/2009 |
| ITU-T | L.392 (04/2016) | Disaster management for improving network resilience and recovery with movable and deployable information and communication technology (ICT) resource units |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 04/2016 |
| ITU-T | L.400/L.12 (03/2008) | Optical fibre splices |  | X | |  |  |  | X |  |  |  | | |  |  |  | X | 03/2008 |
| ITU-T | L.401/L.31 (10/1996) | Optical fibre attenuators |  | X | |  |  |  | X |  |  |  | | |  |  |  | X | 10/1996 |
| ITU-T | L.402/L.36 (01/2015) | Single mode fibre optic connectors |  | X | |  |  |  | X |  |  |  | | |  |  |  | X | 01/2015 |
| ITU-T | L.403/L.37 (02/2007) | Fibre optic (non-wavelength selective) branching devices |  | X | |  |  |  | X |  |  |  | | |  |  |  | X | 02/2007 |
| ITU-T | L.404 (08/2017) | Field mountable single-mode optical fibre connectors |  | X | |  |  |  | X |  |  |  | | |  |  |  | X | 08/2017 |
| ITU-T | L.430/L.28 (10/2002) | External additional protection for marinized terrestrial cables |  |  | |  |  |  | X |  |  |  | | |  | X |  | X | (10/2002) |
| ITU-T | L.431/L.29 (01/2002) | As-laid report and maintenance/repair log for marinized terrestrial cable installation |  |  | |  |  |  | X |  | X |  | | |  | X |  | X | (01/2002) |
| ITU-T | L.432/L.30 (11/2007) | Markers on marinized terrestrial cables |  |  | |  |  |  | X |  | X |  | | |  | X |  | X | (11/2007) |
| ITU-T | L.433/L.54 (02/2004) | Splice closure for marinized terrestrial cables (MTC) |  |  | |  |  |  | X |  |  |  | | |  | X |  | X | (02/2004) |
| ITU-T | L.434/L.55 (11/2003) | Digital database for marine cables and pipelines |  |  | |  |  |  | X |  | X |  | | |  | X |  | X | (11/2003) |
| ITU-T | L.1700 (06/2016) | Requirements and framework for low-cost sustainable telecommunications infrastructure for rural communications in developing countries | X |  | |  |  |  | X |  |  |  | | |  |  |  |  | 06/2016 |
| ITU-T | L Suppl. 22 (04/2016) | ITU-T L.1700 - Low-cost sustainable telecommunication for rural communications in developing countries using fibre optic cable | X |  | |  |  |  | X |  |  |  | | |  |  |  |  | 04/2016 |
| ITU-T | L Suppl. 35 (06/2017) | Framework of disaster management for network resilience and recovery |  |  | |  |  |  | X |  | X |  | | |  |  |  |  | 06/2017) |
| ITU-T | Q.833.1 (01/2001) | ADSL network element management – CMIP model |  |  | |  | X |  | X |  | X |  | | |  |  |  |  | 01/2001 |
| ITU-T | Q.834.1 (06/2004) | ATM-PON requirements and managed entities for the network and network element views |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 06/2004 |
| ITU-T | Q.834.2 (04/2001) | ATM-PON requirements and managed entities for the network view |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 04/2001 |
| ITU-T | Q.834.3 (06/2004) | A UML description for management interface requirements for Broadband Passive Optical Networks |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 06/2004 |
| ITU-T | Q.834.4 (07/2003) | A CORBA interface specifications for Broadband Passive Optical Networks based on UML interface requirements |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 07/2003  Corrigendum 1 Jan. 2004  January 2004 |
| ITU-T | Q.834.4 (2003)  Amd.1 (01/2004) | A CORBA interface specifications for Broadband Passive Optical Networks based on UML interface requirements |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 01/2004 |
| ITU-T | Q.838.1 (10/2004) | Requirements and analysis for the management interface of Ethernet passive optical networks (EPON) |  | X | |  |  |  | X |  | X |  | | |  |  |  |  | 10/2004 |

# Annex 3

# Rearrangement of the list of standards Annex 2

Work on a web-based ANT Standards Overview in order to make the huge Standardization List in ANNEX 2 more manageable and to concentrate on the major approved documents related to Access Network Transport is in progress. A pilot web-based “ANT Roadmap” has been realized using a new taxonomy for the approved Standards and Recommendations related to the Fiber Optic Broadband Access and extended with those related to Metallic Conductor Broadband Access. The taxonomy used for these ANT technologies is as below:

1. Access Network Architecture and Functions
2. Fibre Optic Broadband Access

2.1 General on optical system design

2.2 Point-to-Point (PtP)

2.3 Passive Optical Network (PON)

* Early PON Protocols: OAN and B-PON
* Gigabit PON: G-PON and 1G-EPON
* 10-Gibabit PON: XG-PON, XGS-PON and 10G-EPON
* 40-Gigabit PON: NG-PON2
* Higher Speed PON and Multiple-wavelength PON (MW-PON)
* ONU Management and Control Interfaces (OMCI) and other ONU considerations
* Protection and system power saving considerations
* Conformance and Interoperability for PON systems

2.4 Hybrid Fibre Access Technologies

* Radio Frequency over Glass Fibre-to-the-Home (RFoG)
* Radio over Fibre (RoF)
* RF-Video Overlay
* Wireless – Fiber Access Networks

1. Metallic Conductor Broadband Access

3.1 Integrated services digital network (ISDN)

3.2 Digital Subscriber Lines (DSL) Technologies

* Overview DSL systems
* HDSL (High bit rate DSL)
* SHDSL (Single-pair high-speed DSL)
* ADSL (Asymmetric DSL)
* ADLS2 (Asymmetric DSL2) and ADLS2plus
* VDSL (Very-high speed DSL)
* VDSL2 (Very-high speed DSL2)
* VDSL2 Vectoring (Very-high speed DSL2 Vectoring)
* G.fast (fast access to subscriber terminal)

3.3 DSL techniques

* Spectrum management
* Handshake
* Physical layer management for transceivers
* Link layer /Physical layer interface
* Multi-pair bonding
* Impulse noise protection
* Reverse Powering
* Test procedures for DSL systems
* Conformance and Interoperability for DSL systems

3.4 Ethernet over copper (EoC)

4. Hybrid Fibre Coax (HFC) Broadband Access

4.1 General on Cable Networks

4.2 DOCSIS® (Data Over cable Service Interface Specification)

* DOCSIS 1.0 and 1.1
* DOCSIS 2.0
* DOCSIS 3.0
* DOCSIS 3.1
* Cable Modem

4.3 High Performance Networks over Coax (HiNoC)

4.4 Ethernet Passive Optical Networks Protocol over Coax (EPoC)

4.5 Radio Frequency over Glass Fiber-to-the-Home (RFoG)

4.6 Radio over IP transmission (RoIP)

4.7 Test Procedures for Cable Networks  
  
The current status of web-based ANT Standards Overview can be seen at [Access Network Transport Standards Overview](https://www.itu.int/net4/ITU-T/landscape#?topic=0.105&workgroup=1&searchValue=&page=1&sort=Revelance).

Next objective is to extend the web-based “ANT Standards Overview” with the approved Standards and Recommendations related to “Wireline Access Network Infrastructure” and “Fixed Wireless Access”.

# Annex 4

# List of Abbreviations

|  |  |
| --- | --- |
| ADSL | Asymmetric Digital Subscriber Line |
| AF | Access Bearer Handling Function |
| AN | Access Network |
| ANSI | American National Standards Institute |
| AN-SMF | Access Network System Management Function |
| ANT | Access Network Transport |
| ANT RM | Access Network Transport Reference Model |
| ANT SMF | Access Network Transport System Management Function |
| AP | Access Point |
| ATIS | Alliance for Telecommunications Industry Solutions |
| ATM | Asynchronous Transfer Mode |
| B-ISDN | Broadband ISDN |
| BBF | Broadband Forum |
| BRAN | Broadband Radio Access Networks |
| BS | Base Station |
| BSC | Base Station Controller |
| BSS | Base Station System |
| BTS | Base Transceiver Station (for wireless systems) |
| BWA | Broadband Wireless Access |
| CATV | Cable Television |
| CDMA | Code Division Multiple Access |
| CENELEC | European Committee for Electrotechnical Standardization |
| CF | Core Function |
| CL | Circuit Layer |
| CM | Cable Modem |
| CMTS | DOCSIS Cable Modem Terminating Systems |
| CN | Core Network |
| CO | Central Office |
| CPE | Customer Premises Equipment |
| CPN | Customer Premises Network |
| CPRI | Common Public Radio Interface |
| CSU | Channel Service Unit |
| CTB | Customer Termination Box |
| DLL | Data Link Layer |
| DMT | Discrete Multi Tone modulation |
| DN | Distribution Node |
| DOCSIS | Data Over cable Service Interface Specification |
| DPU | Distribution Point Unit |
| DSL | Digital Subscriber Line |
| DSP | Digital Signal Processing |
| DS1 | Digital Signal level 1 |
| DVB | Digital Video Broadcasting |
| EIA/TIA | Electronic Industry Alliance/Telecommunications Industry Association |
| EFM | Ethernet in the First Mile |
| EPON | Ethernet Passive Optical Network |
| EoC | Ethernet over copper |
| ETSI | European Telecommunications Standard Institute |
| EVC | Ethernet Virtual Connection Ethernet Virtual Circuit |
| fast | fast access to subscriber terminals |
| FDB | Fibre Distribution Box |
| FDD | Frequency Division Duplex |
| FDM | Frequency-Division Multiplexing |
| FDMA | Frequency Division Multiple Access |
| FEC | Forward Error Correction |
| FEXT | Far End crosstalk |
| FITH | Fibre in the Home |
| FITL | Fibre in the Loop |
| FSAN | Full Service Access Networks Group |
| FTTB | Fibre to the Building |
| FTTC | Fibre to the Curb |
| FTTCab | Fibre to the Cabinet |
| FTTCell | Fibre to the Cell site |
| FTTdp | Fibre to the Distribution point |
| FTTH | Fibre to the Home |
| FTTN | Fibre to the Node |
| FTTO | Fibre to the Office |
| FTTP | Fibre to the Premise |
| FTTx | Generic term for all of the fibre to the x above |
| FWA | Fixed Wireless Access |
| GII | Global Information Infrastructure |
| GSM | Global System for Mobile Communications |
| HB | HiNoC Bridge |
| HDSL | High bit rate Digital Subscriber Line |
| HFC | Hybrid Fiber Coax |
| HiNoC | High Performance Networks over Coax |
| HM | HiNoC Modem |
| HN (hn) | Home Network |
| HNT | Home Network Transport |
| HON | High Order Node |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMT | International Mobile Telecommunications |
| IEC | International Electrotechnical Commission |
| IL | Insertion Loss |
| IP | Internet Protocol |
| IPTV | Television over Internet Protocol |
| ISDN | Integrated Services Digital Network |
| ISDN-BA | ISDN basic access |
| ISO | International Organization for Standardization |
| ISP | Internet Service Provider |
| ITU-D | International Telecommunication Union – Telecommunication Development Sector |
| ITU-R | International Telecommunication Union – Radiocommunication Sector |
| ITU-T | International Telecommunication Union - Telecommunication Standardization Sector |
| LAN | Local Area Network |
| LE | Local Exchange |
| LT | Line Termination |
| LTB | Line Termination Box |
| LTU | Line Termination Unit |
| MAC | Medium Access Control |
| MDU | Multi-Dwelling Units |
| MoCA | Multimedia over Coax Alliance |
| MPEG | Motion Picture Experts Group video compression standard |
| MWA | Mobile Wireless Access |
| MW-PON | Multiple-Wavelength Passive Optical Network |
| N-ISDN | Narrowband ISDN |
| NE | Network Element |
| NE | Network Element layer |
| NEF | Network Element Function |
| NEFANT | Network Element Function ANT |
| NEFSN | Network Element Function SN |
| NEXT | Near End crosstalk |
| NGA | Next Generation Access Network |
| NGN | Next Generation Network |
| NMS | Network Management System |
| NT  (NTU) | Network Terminating Unit  Network Termination  Network Termination Unit |
| NT1 | Network Termination 1 |
| NT2 | Network Termination 2 |
| OAM (OA&M) | Operation, Administration and Maintenance, Operation and Maintenance (used in ISDN related Recs.) |
| OAM&P | Operations, Administration, Maintenance and Provisioning |
| OAN | Optical Access Networks |
| OBSAI | Open Base Station Architecture Initiative |
| ODF | Optical Distribution Frame |
| ODN | Optical Distribution Network |
| OLT | Optical Line Termination |
| OMCI | ONU Management and Control Interfaces |
| ON | Optical Network |
| ONE | Optical Network Element |
| ONT | Open Network Terminal |
| ONU | Optical Network Unit |
| OTN | Optical Transport Network |
| P2MP | Point-to-Multi-Point (communication, connection, configuration) |
| P2P (PtP) | Point-to-Point (communication, connection, configuration) |
| PDH | Plesiochronous Digital Hierarchy |
| PHY | Physical Layer |
| PLC | Power Line Communications |
| PLCP | Physical Level Convergence Procedure |
| PMD | Physical Media Dependent sublayer |
| PMS-TC | Physical Media Specific – Transmission Convergence sublayer |
| PON | Passive Optical Network |
| POP | Point of Presence |
| POTS | Plain Old Telephone Service |
| PSD | Power Spectral Density |
| PSTN | Public Switched Telephone Network |
| PTT | Postal, Telephone and Telegraph |
| Q | Interface Reference point |
| QAM | Quadrature Amplitude Modulation |
| QoS | Quality of Service |
| QPSK | Quadrature Phase Shift Keying |
| RAN | Radio Access Network |
| RF | Radio Frequency |
| RFI | Radio Frequency Interference |
| RoF | Radio over Fibre RoF |
| RfoG | Radio Frequency over Glass Fiber-to-the-Home |
| RITL | Radio in the Loop |
| RLL | Radio Local Loop |
| RT | Remote Terminal |
| SCTE | Society of Cable Telecommunications Engineers |
| SDH | Synchronous Digital Hierarchy |
| SHDSL | Single-pair High-speed Digital Subscriber Line  Symmetrical High bit rate Digital Subscriber Line |
| SDO | Standards Development Organization |
| SIEPON | Standard for Service Interoperability in Ethernet Passive Optical Networks |
| SFU | Single Family Unit |
| SMATV | Satellite Master Antenna TeleVision |
| SN | Service Node |
| SNI | Service Node Interface |
| SN-SMF | Service Node System Management Function |
| SOHO | Small Office Home Office |
| SONET | Synchronous Optical Network |
| SPF | Service Port Function |
| STM | Synchronous Transfer Mode |
| STP | Shielded Twisted Pair |
| STU | Set Top Unit |
| T1/E1 | Primary rate transmission system |
| TA | Terminal Adapter |
| TC | Transmission Convergence sublayer |
| TCM | Time-Compression Multiplexing |
| TCP | Transmission Control Protocol |
| TDM | Time Division Multiplex |
| TDMA | Time Division Multiple Access |
| TE | Terminal Equipment |
| TF | Transport Function |
| TM  (TML) | Transmission Media Layer |
| TMN | Telecommunications Management Network |
| TP | Path Layer |
| UMTS | Universal Mobile Telecommunications System |
| UNI | User Network Interface |
| UPF | User Port Function |
| UTP | Unshielded Twisted Pair |
| VDSL | Very high speed Digital Subscriber Line  Very high bit rate Digital Subscriber Line |
| VoIP | Voice over Internet Protocol |
| VPN | Virtual Private Network |
| WBS | Wireless Base Station |
| WDM | Wavelength Division Multiplexing |
| WL | Wireless Loop |
| WLL | Wireless Local Loop |
| WM | Wavelength Multiplexer |
| xDSL | Any of the various types of Digital Subscriber Line systems  Generic term for all the different Digital Subscriber Line systems |
| XNI | Access Network Interface  Customer to Network Interface |

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