

# ETSI TS 105 175-1 V1.1.1 (2010-01)

---

*Technical Specification*

## **Access, Terminals, Transmission and Multiplexing (ATTM); Plastic Optical Fibre System Specifications for 100 Mbit/s and 1 Gbit/s**

---

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

Full standard:  
<https://standards.iteh.ai/catalog/standards/sist/2af8eb54-ee99-4368-946e-e149bdd83422/etsi-ts-105-175-1-v1.1.1-2010-01>



---

Reference

DTS/ATTM-02008-1

---

Keywords

fibre, optical

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

**Important notice**

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:

[http://portal.etsi.org/chaicor/ETSI\\_support.asp](http://portal.etsi.org/chaicor/ETSI_support.asp)

---

**Copyright Notification**

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2010.  
All rights reserved.

**DECT**<sup>TM</sup>, **PLUGTESTS**<sup>TM</sup>, **UMTS**<sup>TM</sup>, **TIPHON**<sup>TM</sup>, the TIPHON logo and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.

**3GPP**<sup>TM</sup> is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**LTE**<sup>TM</sup> is a Trade Mark of ETSI currently being registered

for the benefit of its Members and of the 3GPP Organizational Partners.

**GSM**<sup>®</sup> and the GSM logo are Trade Marks registered and owned by the GSM Association.

# Contents

Intellectual Property Rights .....	4
Foreword.....	4
Introduction .....	4
1 Scope and Purpose .....	6
1.1 Scope .....	6
1.2 Requirements Notation.....	6
2 References .....	6
2.1 Normative references .....	7
2.2 Informative references.....	8
3 Definitions and abbreviations.....	8
3.1 Definitions .....	8
3.2 Abbreviations .....	8
4 Requirements for 100 Mbit/s System (Fast Ethernet) .....	9
4.1 Performances .....	9
4.2 Higher Level System Features.....	10
5 Requirements for 1 Gbit/s System.....	10
5.1 Performances .....	10
5.2 Higher Level System Features.....	11
6 Cable.....	11
7 Installation.....	11
8 Energy efficiency .....	12
9 Integrated Wall Plug.....	12
9.1 Interfaces - External sockets.....	12
9.2 Interfaces - Internal sockets.....	12
9.3 Wall socket plugs versions .....	13
9.4 Sustainability requirements .....	14
<b>Annex A (informative): Integrated Wall Plug Form Factor.....</b>	<b>15</b>
History .....	16

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://webapp.etsi.org/IPR/home.asp>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

---

## Introduction

Polymer Optical Fibres (POF) based on Poly-Methyl-Metha-Acrylate (PMMA) with step-index 1mm core diameter (referred to in the rest of the present document as POF) have gained interest in the recent years for their interesting properties compared to the better known glass optical fibres (GOF). The main advantages of POF when compared to GOF are:

- POF large core diameter (1mm) allows do-it-yourself installation and termination with common cutter and electrician-like low cost tools; besides PMMA material is a very inexpensive material.
- POF high diameter and numerical aperture makes bending loss sensitivity much lower than silica fibre (GOF).
- POF mechanical resilience and elasticity makes it possible to step on it and even tie it. Dust and water harm POF to a much smaller extent than GOF.
- The optical sources for POF are in the visible range, and the optical launch is usually non-collimated. POF optical sources are thus intrinsically eye-safe and easy to troubleshoot, as the signal can be seen by the naked eye.

For all these reasons, POF is potentially very interesting in several applications (industrial automation, automotive, home networking) where it shows key advantages to the more traditional copper cabling:

- Complete immunity to electromagnetic interference (EMI).
- Being POF an electrical insulator (like GOF), it can be laid down in power ducts. This apparently minor issue is seen as a key element by several European Telcos for in-house installation in brown-field areas.
- Lower weight (a fundamental issue in the automotive sector).

These native properties have to be balanced by some drawbacks: PMMA exhibits a strong attenuation (see Figure 1), minimum for visible light (0,15 dB/m to 0,20 dB/m at 650 nm, to be compared to 0,25 dB/km at 1 550 nm for silica single mode fibre), which limits the reach of the links to about hundred meters without bends.

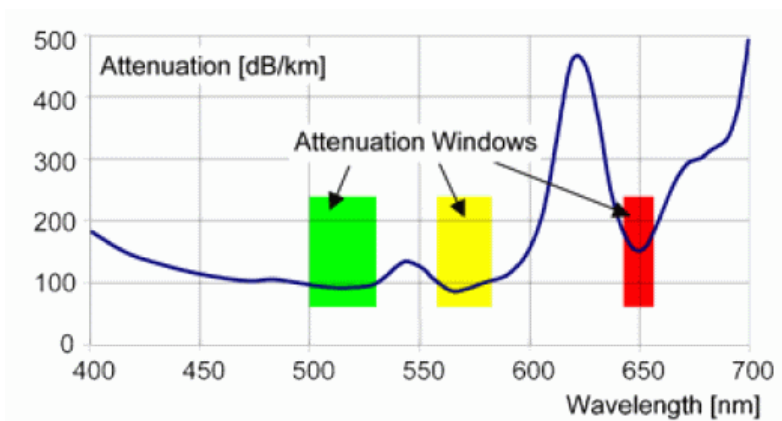


Figure 1: POF Attenuation

Besides, as next step in the evolution of Access Networks (see Figure 2), it is foreseen that higher bandwidth services will be delivered, either with active network elements built closer to the end-user (e.g. VDSL2 or Point-to-Point FTTH technology), or at the opposite end with active elements more distant from the end-user (e.g. GPON FTTH technology). The target for bandwidth delivered in home could be up to 1 Gbit/s in case of FTTH or up to 120 Mbit/s downstream and up to 50 Mbit/s upstream in case of VDSL2 technology.

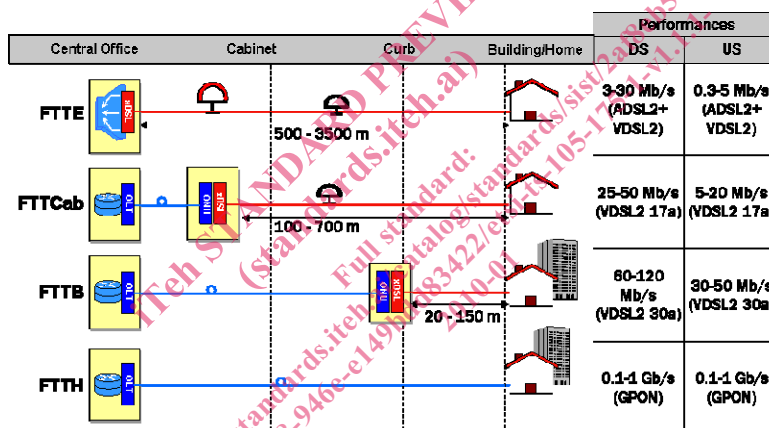


Figure 2: Evolution of Access Networks

The home network must not represent a bottleneck for the expected evolution for services such as the introduction of High Definition quality IPTV, multi-room/multi-vision configuration, using different channels seen in different rooms with up to 3 Set Top Boxes (STBs) and high quality video communication via the TV set. More in general, with the "Connected Home", several devices will be connected together: the home network can be used, for example, to share multimedia contents not necessarily delivered in real time by access network, but with the paradigm of "download and play" this content can be stored in a device inside the house and use it afterwards. Besides, this residential network must be easy, fast and cheap to deploy.

---

# 1 Scope and Purpose

## 1.1 Scope

The present document specifies the POF cabling system 100 Mbit/s and 1 Gbit/s for interoperability among different suppliers. The system comprises the active optical elements, the cables, connectors and wall plugs. A future step could be to achieve integration of POF interfaces into end user equipment.

## 1.2 Requirements Notation

If the present document is implemented, the key words "MUST" and "SHALL" as well as "REQUIRED" are to be interpreted as indicating a mandatory aspect of the present document. The keywords indicating a certain level of significance of a particular requirement that are used throughout the present document are summarized below.

**MUST:** This word or the adjective "REQUIRED" means that the item is an absolute requirement of the present document.

**MUST NOT:** This phrase means that the item is an absolute prohibition of the present document.

**SHOULD:** This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.

**SHOULD NOT:** This phrase means that there may exist valid reasons in particular circumstances when the listed behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.

**MAY:** This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

---

# 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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

## 2.1 Normative references

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

- [1] Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
- [2] IEEE 802.3: "Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Amendment: Physical Layer Specifications and Management Parameters for 10Gb/s Passive Optical Networks".
- [3] IEC 60825-1: "Safety of laser products - Part 1: Equipment classification and requirements".
- [4] DSL Forum Technical Report TR-126 (December 2006): "Triple-Play Services, Quality of Experience (QoE) Requirements".
- [5] DSL Forum Technical Report TR-069: "CPE WAN Management Protocol".
- [6] IEC 60793-1-47: "Optical fibres - Part 1-47: Measurement methods and test procedures - Macrobending loss".
- [7] IEC 60793-2-40: "Optical fibres - Part 2-40: Product specifications - Sectional specification for category A4 multimode fibres".
- [8] IEC 60794-2-40: "Optical fibre cables - Part 2-40: Indoor optical fibre cables - Family specification for A4 fibre cables".
- [9] IEC 60794-2-41 (Edition 1.0): "Optical fibre cables - Part 2-41: Indoor cables - Product specification for simplex and duplex buffered A4 fibres".
- [10] IEC 61754-2: "Fibre optic connector interfaces - Part 2: Type BFOC/2,5 connector family".
- [11] IEC 61754-22: "Fibre optic connector interfaces - Part 22: Type F-SMA connector family".
- [12] IEC 61754-24: "Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 24: Type SC-RJ connector family".
- [13] IEC 60332: "Tests on electric and optical fibre cables under fire conditions".
- [14] European Commission (18 November 2008) Version 3: "Code of Conduct on Energy Consumption of Broad Band Equipment".
- [15] IEC 60884-1: "Plugs and socket-outlets for household and similar purposes - Part 1: General requirements".
- [16] ISO/IEC 8802-3: "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications".
- [17] CENELEC EN 60950-1: "Information technology equipment - Safety - Part 1: General requirements".
- [18] ITU-T Recommendation K.21: "Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents".
- [19] CENELEC EN 60825-1: "Safety of laser products - Part 1: Equipment classification and requirements".
- [20] IEC 60068-2-27: "Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock".

- [21] ETSI EN 300 019-2-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests; Stationary use at weatherprotected locations".
- [22] IEC 60068-2-6: "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)".
- [23] IEC 60068-2-64: "Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance".
- [24] CENELEC EN 55022: "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement".
- [25] CENELEC EN 55024 - Information technology equipment - Immunity characteristics - Limits and methods of measurement.

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] IEEE 802.3u: "Local and Metropolitan Area Networks-Supplement - Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units and Repeater for 100Mb/s Operation, Type 100BASE-T (Clauses 21-30)".
- [i.2] IEEE 802.3z: "Media Access Control Parameters, Physical Layers, Repeater and Management Parameters for 1,000 Mb/s Operation, Supplement to Information Technology - Local and Metropolitan Area Networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".
- [i.3] IEC 61754-21: "Fibre optic connector interfaces - Part 21: Type SMI connector family for plastic optical fibre".
- [i.4] IEEE 802.3x: "IEEE Standards for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex Operation".
- [i.5] IEEE 802.1Q: "IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks".
- [i.6] IEEE 802.1p: "IEEE Standard for Local and Metropolitan Area Networks - Supplement to Media Access Control (MAC) Bridges: Traffic Class Expediting and Dynamic Multicast Filtering".
- [i.7] IEEE 802.1D: "IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges".

---

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**Triple Play Services:** scenario in which voice, video and data are all provided in a single access subscription

### 3.2 Abbreviations

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

ACS	Auto Configuration Server
CPE	Customer Premises Equipment
EMI	ElectroMagnetic Interference



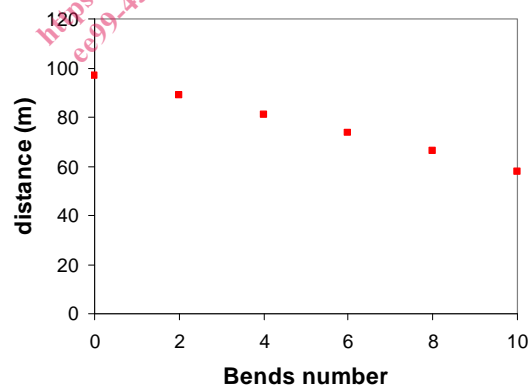
FTTH	Fiber To The Home
GOF	Glass Optical Fibre
GPON	Gigabit Passive Optical Network
HG	Home Gateway
IPTV	Internet Protocol Television
MTBF	Mean Time Between Failures
PMMA	Poly-Methyl-Metha-Acrlate
POF	Polymer Optical Fibres
PVC	PolyVinyl Chloride
QoE	Quality of Experience
QoS	Quality of Service
RoHS	Restriction of the Use of Certain Hazardous Substances
SC/RJ	Small Form Factor Connector/Registered Jack
SMI	Small Multimedia Interface
STB	Set Top Box
UTP5	Unshielded Twisted Pair (Category 5)
VAC	Volts Alternating Current
VDSL2	Very high bit-rate Digital Subscriber Line
VLAN	Virtual Local Area Network

## 4 Requirements for 100 Mbit/s System (Fast Ethernet)

### 4.1 Performances

Today on the market several suppliers offer PMMA POF media converter solutions at 100 Mbit/s. With such performance PMMA fibre may be used in the home to interconnect all devices usually communicating through Fast Ethernet interfaces for example the link between the home gateway and the STB. Below the requirement for 100 Mbit/s Systems.

- R1** The max Physical-Layer Data Rate **MUST** be 125 Mbit/s, compliant with IEEE 802.3u [i.1].
- R2** The system **SHOULD** be able to transmit over a distance up to 100 m. Figure 3 shows the maximum reachable distance vs. POF bends number.



**Figure 3: Maximum reachable distance vs. POF bends number**

- R3** Macrobend radius shall be  $\geq 25$  mm.
- R4** Macrobending loss shall be measured according to EN 60793-1-47 [6], method B.
- R5** The Bit Error Rate **MUST** be  $< 10^{-12}$ .
- R6** The system **MUST** work in Full Duplex. Today media converters are based on duplex services which are achieved by using duplex POF. However the availability of a duplex service over simplex POF systems needs to be investigated as ultimately they may provide practical advantages to end users.