



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.42

(05/2003)

SERIES L: CONSTRUCTION, INSTALLATION AND
PROTECTION OF CABLES AND OTHER ELEMENTS OF
OUTSIDE PLANT

Extending optical fibre solutions into the access network

ITU-T Recommendation L.42

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Extending optical fibre solutions into the access network

Summary

This Recommendation describes the optical access network to be used in the design and construction of fibre to the home (FTTH). It deals mainly with access network architectures, and the upgrading of optical networks to optical access networks.

Source

ITU-T Recommendation L.42 was approved on 14 May 2003 by ITU-T Study Group 6 (2001-2004) under the ITU-T Recommendation A.8 procedure.

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1 Introduction

Progress on multimedia technologies has led to the active development of many kinds of broadband services such as data and video communication using access networks. It is important that high-speed broadband networks be developed to provide such services economically. In order to provide these services in a timely way, it is necessary to construct fibre to the home (FTTH) optical access networks immediately, efficiently and cost-effectively. To achieve this, the network design must take construction, maintenance and operation into account. Here, an optical access network is defined as a network of optical fibres that extend from a carrier's central office into individual homes, apartment houses and business offices for FTTH.

2 Scope

This Recommendation deals mainly with access network architectures and the ability to upgrade optical networks, which are the most important items in terms of designing and constructing optical access networks. Moreover, this Recommendation describes the optical transmission performance, the maintenance system and power supply required for the design and construction of an optical access network for FTTH.

3 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [1] ITU-T Recommendation G.652 (2003), *Characteristics of a single-mode optical fibre cable*.
- [2] ITU-T Recommendation G.662 (1998), *Generic characteristics of optical amplifier devices and subsystems*.
- [3] ITU-T Recommendation G.664 (2003), *Optical safety procedures and requirements for optical transport systems*.
- [4] ITU-T Recommendation G.671 (2002), *Transmission characteristics of optical components and subsystems*.
- [5] ITU-T Recommendation G.694.1 (2002), *Spectral grids for WDM applications: DWDM frequency grid*.
- [6] ITU-T Recommendation G.694.2 (2003), *Spectral grids for WDM applications: CWDM wavelength grid*.
- [7] ITU-T Recommendation G.982 (1996), *Optical access networks to support services up to the ISDN primary rate or equivalent bit rates*.
- [8] ITU-T Recommendation G.983.1 (1998), *Broadband optical access systems based on passive optical networks (PON)*.

- [9] ITU-T Recommendation G.983.2 (2002), *ONT management and control interface specification for B-PON*.
- [10] ITU-T Recommendation G.983.3 (2001), *A broadband optical access system with increased service capability by wavelength allocation*.
- [11] ITU-T Recommendation G.983.4 (2001), *A broadband optical access system with increased service capability using dynamic bandwidth assignment (DBA)*.
- [12] ITU-T Recommendation G.983.5 (2002), *A broadband optical access system with enhanced survivability*.
- [13] ITU-T Recommendation G.983.6 (2002), *ONT management and control interface specifications for B-PON system with protection features*.
- [14] ITU-T Recommendation G.983.7 (2001), *ONT management and control interface specification for dynamic bandwidth assignment (DBA) B-PON system*.
- [15] ITU-T Recommendation G.983.8 (2003), *B-PON-OMCI support for IP, ISDN, video, VLAN tagging, VC cross-connections and other select functions*.
- [16] ITU-T Recommendation G.984.1 (2003), *Gigabit-capable Passive Optical Networks (GPON): General characteristics*.
- [17] ITU-T Recommendation K.51 (2000), *Safety criteria for telecommunication equipment*.
- [18] ITU-T Recommendation L.10 (2002), *Optical fibre cables for duct and tunnel application*.
- [19] ITU-T Recommendation L.12 (2000), *Optical fibre joints*.
- [20] ITU-T Recommendation L.13 (2003), *Performance requirements for passive optical nodes: Sealed closures for outdoor environments*.
- [21] ITU-T Recommendation L.15 (1993), *Optical local distribution networks – Factors to be considered for their construction*.
- [22] ITU-T Recommendation L.26 (2002), *Optical fibre cables for aerial application*.
- [23] ITU-T Recommendation L.31 (1996), *Optical fibre attenuators*.
- [24] ITU-T Recommendation L.36 (1998), *Single mode fibre optic connectors*.
- [25] ITU-T Recommendation L.37 (1998), *Fibre optic (non-wavelength selective) branching devices*.
- [26] ITU-T Recommendation L.40 (2000), *Optical fibre outside plant maintenance support, monitoring and testing system*.
- [27] ITU-T Recommendation L.41 (2000), *Maintenance wavelength on fibres carrying signals*.
- [28] ITU-T Recommendation L.43 (2002), *Optical fibre cables for buried application*.
- [29] ITU-T Recommendation L.44 (2000), *Electric power supply for equipment installed as outside plant*.
- [30] ITU-T Recommendation L.50 (Draft), *Requirements for passive optical nodes: Optical distribution frames for central office environments*.
- [31] ITU-T Recommendation L.51 (2003), *Passive node elements for fibre optic networks – General principles and definitions for characterization and performance evaluation*.
- [32] ITU-T Recommendation L.53 (2003), *Optical fibre maintenance criteria for access networks*.

- [33] IEC 60825 (2001), *Safety of laser products*.
[34] IEC 60950 (2001), *Information technology equipment – Safety*.

4 Terms and definitions

For the purpose of this Recommendation, the definitions given in ITU-T Recs G.652, G.662, G.664, G.671, G.694.1, G.694.2, G.982, G.983.1 to G.983.8, G.984.1, K.51, L.13, L.26 and L.51 apply.

5 Abbreviations

This Recommendation uses the following abbreviations:

CATV	Cable Television
CWDM	Coarse Wavelength Division Multiplexing
DWDM	Dense Wavelength Division Multiplexing
FTTH	Fibre to the Home
OLT	Optical Line Terminal
ONU	Optical Network Unit
WDM	Wavelength Division Multiplexing

6 Features of access network architecture

In order to select or design an optical access network for FTTH, telecommunication companies should mainly consider:

- 1) scalability (number of terminated fibres, total fibre length of network, etc.);
- 2) survivability (security, supervisory system, etc.);
- 3) functionality (bit rate, transmission distance, etc.);
- 4) construction and maintenance costs;
- 5) upgrading the optical network (increase transmission capacity, increase transmission length, increase number of customers including future demand).

When designing or constructing an optical access network, telecommunication companies should select and use one or more of the following architectures, based on the optical access network requirements in each region.

6.1 Point-to-point network

The basic configuration for a point-to-point network is shown in Figure 1. This distributes one or more fibres individually from an OLT in a central office to an ONU in buildings, apartment houses or residential premises. Therefore, a large number of fibres are installed and distributed from a central office to customers. This configuration has low optical loss and provides the maximum distance between central offices and customers. Moreover, this may be suitable for customers requiring large bandwidth and/or high security.