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**SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS**

Digital transmission systems – Digital sections and digital
line system – Optical line systems for local and access
networks

**Optical access networks to support services up
to the ISDN primary rate or equivalent bit rates**

ITU-T Recommendation G.982

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION G.982

OPTICAL ACCESS NETWORKS TO SUPPORT SERVICES UP TO THE ISDN PRIMARY RATE OR EQUIVALENT BIT RATES

Summary

This Recommendation deals with the characteristics of an Optical Access Network (OAN) with the capability of transporting interactive services over the Optical Distribution Network (ODN) based on point-to-multipoint configuration using passive optical branching components.

The Recommendation considers an OAN for both business and residential customer service requirements based on 64 kbit/s bearer capabilities up to and including ISDN primary rate services.

Source

ITU-T Recommendation G.982 was prepared by ITU-T Study Group 15 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 8th of November 1996.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation G.982**OPTICAL ACCESS NETWORKS TO SUPPORT SERVICES UP TO THE
ISDN PRIMARY RATE OR EQUIVALENT BIT RATES***(Geneva, 1996)***1 Scope**

This Recommendation is intended to describe flexible access networks using optical fibre technology. The intention is to provide for the services of today and also the basis for the future service requirements.

This Recommendation describes the characteristics of an Optical Access Network (OAN) with the capability of transporting interactive services based on 64 kbit/s bearer capabilities between the user-network interface and the network-network interface. The Recommendation considers an OAN for both business and residential customer service requirements up to and including ISDN primary rate services carried over a passive split optical network. Distributive services (e.g. cable TV) are not considered in this Recommendation.

The OAN described in this Recommendation should enable the network operator to provide a flexible upgrade to meet future customer requirements, in particular in the area of the Optical Distribution Network (ODN). The ODN considered is based on the point-to-multipoint tree and branch option.

This Recommendation is based on the Time Division Multiple Access (TDMA) protocol; however, other protocols are not precluded. Systems using both one and two fibres are described. Although examples are quoted, it is not the intention of this Recommendation to preclude further innovation.

The use of optical amplifiers is not excluded within the scope of this Recommendation.

2 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; all 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.

- [1] ITU-T Recommendation G.652 (1993), *Characteristics of a single-mode optical fibre cable*.
- [2] ITU-T Recommendation G.803 (1993), *Architecture of transport networks based on the Synchronous Digital Hierarchy (SDH)*.
- [3] ITU-T Recommendation G.902 (1995), *Framework Recommendation on functional access networks – Architecture and functions, access types, management and service node aspects*.
- [4] ITU-T Recommendation G.955 (1996), *Digital line systems based on the 1544 kbit/s and the 2048 kbit/s hierarchy on optical fibre cables*.
- [5] ITU-T Recommendation G.957 (1995), *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*.

- [6] ITU-T Recommendation G.964 (1994), *V-interfaces at the digital Local Exchange (LE) – V5.1-interface (based on 2048 kbit/s) for the support of Access Network (AN)*.
- [7] ITU-T Recommendation G.671 (1996), *Transmission characteristics of passive optical components*.
- [8] ITU-T Recommendation M.3010 (1996), *Principles for a telecommunication management network*.
- [9] ITU-T Recommendation G.653 (1997), *Characteristics of a dispersion-shifted single-mode optical fibre cable*.
- [10] ITU-T Recommendation G.662 (1995), *Generic characteristics of optical fibre amplifier devices and sub-systems*.

3 Abbreviations

This Recommendation uses the following abbreviations:

AF	Adaptation Function
AU	Adaptation Unit
FTTB	Fibre-To-The-Building
FTTC	Fibre-To-The-Curb
FTTH	Fibre-To-The-Home
FTTO	Fibre-To-The-Office
ISDN	Integrated Services Digital Network
MCS	Monte Carlo Simulation
OA	Optical Amplifier
OAM	Operation, Administration and Maintenance
OAN	Optical Access Network
ODN	Optical Distribution Network
OLT	Optical Line Terminal
ONU	Optical Network Unit
OS	Operation System
OTDR	Optical Time Domain Reflectometer
SCM	Sub-Carrier Multiplexing
SCMA	Sub-Carrier Multiple Access
SDH	Synchronous Digital Hierarchy
SDM	Space Division Multiplexing
SNI	Service Node Interface
SPF	Service Port Function
TCM	Time Compression Multiplexing
TDMA	Time Division Multiple Access

TU	Tributary Unit
UNI	User Network Interface
UPF	User Port Function
WDM	Wavelength Division Multiplexing

4 Definitions

This Recommendation defines the following terms:

4.1 passive optical access link: The whole of transmission means between a given network interface (V) and a single user interface (T). The concept of passive optical access link is used in order to allow a functional and procedural description and a definition of the network requirements. The user side and the network side of the access link are not identical and, therefore, the access link is not symmetrical.

4.2 adaptation unit (AU): An AU provides adaptation functions between the Optical Network Unit (ONU) and the user side.

4.3 duplex working: Bidirectional communication using a different wavelength for each direction of transmission over a single fibre.

4.4 duplex working: Bidirectional communication using the same wavelength for both directions of transmission over a single fibre.

4.5 differential fibre distance: The difference of distance between the nearest and furthest ONU from the OLT.

4.6 logical reach: The logical reach is defined as the maximum length that can be achieved for a particular transmission system independent of optical budget.

4.7 mean signal transfer delay: The average upstream and downstream values between reference points "V" and "T": a given value is determined by measuring round-trip delay, then dividing by 2.

4.8 OAN: The set of access links sharing the same network-side interfaces and supported by optical access transmission systems. The OAN may include a number of ODNs connected to the same OLT.

4.9 ODN: An ODN provides the optical transmission means from the OLT towards the users, and vice versa. It utilizes passive optical components.

4.10 OLT: An OLT provides the network-side interface of the OAN, and is connected to one or more ODNs.

4.11 ONU: An ONU provides (directly or remotely) the user-side interface of the OAN, and is connected to the ODN.

4.12 service port function: The Service Port Function (SPF) adapts the requirements defined for a specific SNI to the common bearers handling and selects the relevant information for treatment in the AN system management function.

4.13 space division multiplexing: Bidirectional multiplexing using different fibres for upstream and downstream signals.

4.14 sub-carrier multiplexing: Multiplexing multiple electrical frequencies onto a single fibre at a single wavelength to provide an individual frequency to each multipoint-to-point path.