INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.17

Appendix I

(02/97)

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

Implementation of connecting customers into the public switched telephone network (PSTN) via optical fibres

Appendix I: Examples of possible applications

ITU-T Recommendation L.17 – Appendix I

(Previously CCITT Recommendation)

ITU-T L-SERIES RECOMMENDATIONS

CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION L.17

IMPLEMENTATION OF CONNECTING CUSTOMERS INTO THE PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) VIA OPTICAL FIBRES

APPENDIX I

Examples of possible applications

Source

Appendix I to ITU-T Recommendation L.17 was prepared by ITU-T Study Group 6 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 7th of February 1997.

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.

NOTES

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

2. The status of annexes and appendices attached to the Series L Recommendations should be interpreted as follows:

– an *annex* to a Recommendation forms an integral part of the Recommendation;

– an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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(Geneva, 1997)

Introduction

Many countries are studying systems and network configurations to provide access for customers over optical fibres. These studies need to take into account not only the initial costs for providing services, but the ongoing costs of operation and the efficiency of maintenance. Also the future cost of shifting to broadband services must be considered.

All studies show that economies can be achieved by the sharing of the OLT (Optical Line Termination) by the use of optical splitters. Beyond this, strategies vary widely for cost efficient solutions from the Japanese approach of locating the splitters in the exchange (central office) to the UK implementation of a modular plant system optimised for use in the access network.

I.1 Japanese culture [1]

By a comparison of network configurations of point-to-point and point-to-multipoint, taking into account the total cost – the initial cost, the cost of shifting to broadband services in the future (cost of transferring to single star, that is, point-to-point) and the running and maintenance costs, it is concluded that the most economic network is when the optical splitters are located in the exchange and the external cable configuration is point-to-point, see Figure I.1.

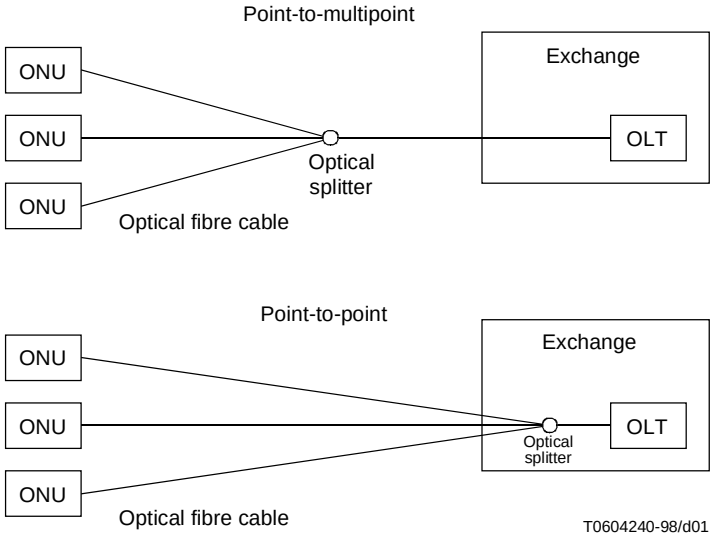

Figure I.1/L.17 – Network configurations

It is considered important not only to reduce the cost of optical fibre cables, especially high fibre count cables, by developing new technology but also to reduce the optical loss and make installation work more efficient in the networks (by minimising the number of jointing points through long length cabling).

By the use of computer control at a central point:

– Maintenance operations can be made more efficient by the more speedy and accurate location of faults.

– A flexible assignment function can be implemented to redistribute the traffic in optical fibres in accordance with fluctuating demand.

– Efficient transference of fibres can be implemented to allow re-routing of the cables.

I.2 UK culture [2], [3], and [4]

With the introduction of optical fibre into the access network and the need to improve the quality of service offered to customers whilst minimising network costs, a new infrastructure philosophy has been developed within the UK resulting in a new architecture. This achieves:

– flexibility by adopting a modular approach to all components in the system;

– resilience by the ability to provide complete redundant or back-up paths to those who require 24-hour operation by using a feeder ring structure;

– reliability by understanding which are the critical parameters of the system and specifying components with the most dependable performance;

– upgradeability by ensuring the components capable of working at both 1300 nm and 1550 nm windows;

– low maintenance by the modular approach and the reliability criteria.

The basis of the modular system consists of a linear array or stack of splice trays which are of two types:

– a *single circuit tray* which fulfils the functions of identification, storage, connection, inspection and re-connection on a single fibre or pair of fibres. The single circuit tray allows network configuration and reconfiguration without disturbance to other circuits which may be carrying traffic. Provision is also made for non-intrusive optical circuit diagnosis when an individual tray is opened by only exposing limited fibre for testing.

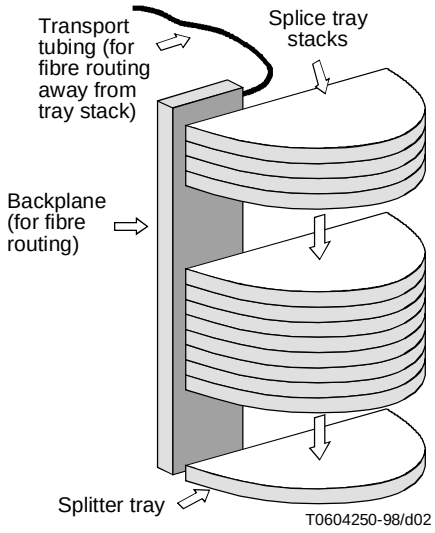

Figure I.2/L.17 – Stack principle

– a *single element tray* which fulfils the functions of identification, storage, connection and re-connection of a multiplicity of fibres, for example, splicing together two units each of eight fibres commonly encountered in a loose-tube type cable. The linear array may be used with point-to-point configurations or with PON systems. In the latter case 1 × N or 2 × N way optical splitters or Wavelength Division Multiplexing (WDM) devices can be incorporated.

The use of trays and arrays provides the craft person with a familiar system at all points in the network and allows for considerable factory preconfiguration, thereby minimising field configuration, testing and reconfiguration time. The overall system provides for dense fibre/cable management whilst preserving defined minimum bend radii for the fibres.

In the exchange, arrays are (pre-)assembled into telecommunication standard rack frames. They can also be installed in the cable chamber joint units.

In the external network, arrays are (pre-)assembled into enclosures which can be hermetically sealed and installed in manholes. The cable configuration in the external network for a feeder ring or spine is typically a 96-fibre cable with eight fibres per loose tube plus a copper quad for field telephony or order wiring. Typically one tube is used per primary node allowing up to twelve nodes in a feeder.

Blown fibre may be used between the primary nodes and the customer's premises allowing rapid just-in-time installation.

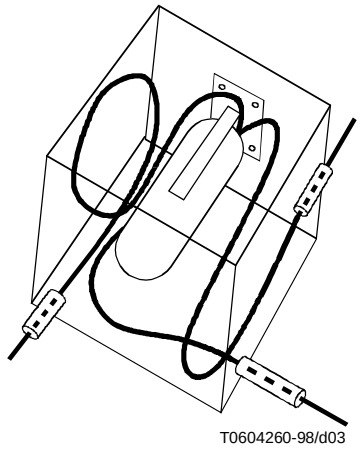

Figure I.3/L.17 – Manhole enclosure

At the customers' premises, arrays are (pre-)assembled into appropriately styled enclosures and outlets suitable for installation within domestic and commercial buildings of all types. The overall system allows for the appropriate procedures necessary for transition between external and internal plant, for example gas blocking.

For maintenance purposes, an out-of-band test signal can be injected via the exchange equipment with the power level being interrogated at any single circuit tray. Apertures are provided in the trays that allow interrogation at both sides of the splice. By this means the relative attenuation may be assessed at any reconfigurable point in the network and a footprint obtained for maintenance purposes.

References

[1] NTT, Japan: The configuration of optical access network, COM 6-44, January 1995.

[2] Pirelli Cables, UK: Plant for connection of customers to the Public Switched Telecommunication Network (PSTN) via optical fibres, COM 6-37, January 1995.

[3] BICC, UK: Modular optical plant items implementing proposals in draft Recommendation L.imp, COM 6-42, January 1995.

[4] HALE (P. G.), BREWER (D. A.), Pirelli Cables UK, PEACOCK (J.), BELL (P.), BT, UK: Modular optical plant for the access network: a practical solution, *Proc. EFOC & N (Technology and infrastructure)*, pp.158-161, 1995.

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