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

Digital sections and digital line system – Optical fibre
submarine cable systems

General features of optical fibre submarine cable systems

Recommendation ITU-T G.971



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Recommendation ITU-T G.971

General features of optical fibre submarine cable systems

Summary

Recommendation ITU-T G.971 applies to optical fibre submarine cable systems. The purpose of this Recommendation is to identify the main features of optical fibre submarine cable systems, and to provide generic information on relevant Recommendations in the field of optical fibre submarine cable systems. A common implementation relevant to all the optical fibre submarine cable systems is described in Annex A. Specific information relevant to each optical fibre submarine cable systems is included in annexes of other Recommendations. The updated data on cable ships and submersible equipment of various countries are also described in Appendix I.

In this latest version, relationship among Recommendations relevant to optical fibre submarine cable systems found in section 7 is amended to take into account three groups of "General", "Components or Functions" and "System Requirements".

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Keywords

Cable ship, optical fibre submarine cable systems, submersible equipment.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 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 ITU-T G.971

General features of optical fibre submarine cable systems

1 Scope

This Recommendation applies to optical fibre submarine cable systems.

The purpose of this Recommendation is to identify the main features of optical fibre submarine cable systems, and to provide generic information on relevant Recommendations in the field of optical fibre submarine cable systems. Annex A contains common implementation aspects of all optical submarine cable systems. Appendix I contains data on cable ships and submersible equipments of various countries.

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; 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 standalone document, the status of a Recommendation.

- [ITU-T G.821] Recommendation ITU-T G.821 (2002), *Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an Integrated Services Digital Network.*
- [ITU-T G.826] Recommendation ITU-T G.826 (2002), *End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections.*
- [ITU-T G.828] Recommendation ITU-T G.828 (2000), *Error performance parameters and objectives for international, constant bit-rate synchronous digital paths.*
- [ITU-T G.8201] Recommendation ITU-T G.8201 (2011), *Error performance parameters and objectives for multi-operator international paths within optical transport networks.*
- [ITU-T G.972] Recommendation ITU-T G.972 (2016), *Definition of terms relevant to optical fibre submarine cable systems.*
- [ITU-T G.973] Recommendation ITU-T G.973 (2016), *Characteristics of repeaterless optical fibre submarine cable systems.*
- [ITU-T G.973.1] Recommendation ITU-T G.973.1 (2009), *Longitudinally compatible DWDM applications for repeaterless optical fibre submarine cable systems.*
- [ITU-T G.973.2] Recommendation ITU-T G.973.2 (2011), *Multichannel DWDM applications with single channel optical interfaces for repeaterless optical fibre submarine cable systems.*

- [ITU-T G.974] Recommendation ITU-T G.974 (2007), *Characteristics of regenerative optical fibre submarine cable systems*.
- [ITU-T G.977] Recommendation ITU-T G.977 (2015), *Characteristics of optically amplified optical fibre submarine cable systems*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the terms defined in [ITU-T G.972].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

BAS	Burial Assessment Survey
BOL	Beginning of Life
BU	Branching Unit
CPT	Cone Penetrometer Testing
CTE	Cable Terminating Equipment
DP-system	Dynamic Positioning-system
DWDM	Dense Wavelength Division Multiplexing
PFE	Power Feeding Equipment
PLGR	Pre-Lay Grapnel Run
ROV	Remotely Operated Vehicle
SCARAB	Submersible Craft Assisting Repair and Burial
SWL	Safe Working Load
TSE	Terminal Station Equipment
TTE	Terminal Transmission Equipment

5 Conventions

None.

6 Features of optical fibre submarine cable systems

An optical fibre submarine cable system has specific technical features:

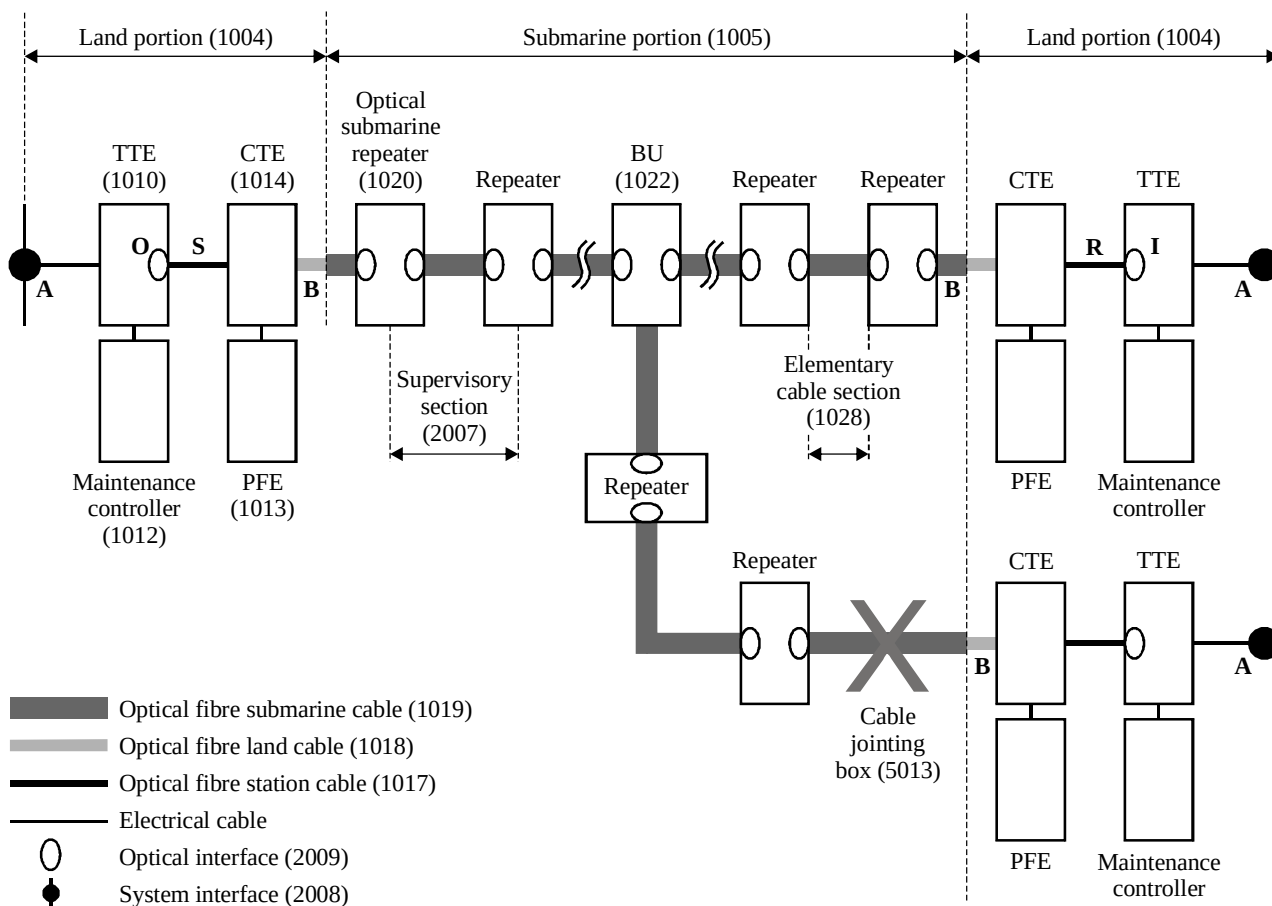
- a) A submarine cable system should have a long lifetime and be highly reliable. The main reason for this is that the construction and maintenance of a link is long and expensive because of the difficulty in accessing a submerged plant. Moreover, most submarine links are of strategic importance in the transmission network – the interruption of a link usually results in significant loss of traffic and revenue.

- b) A submarine cable system should possess mechanical characteristics which enable it:
 - 1) to be installed accurately with correct slack and with due attention to safety considerations on the seabed – deep water installations can reach up to 8,000 metres. (In general, submarine cable systems shall be installed, buried or inspected by specially designed cable ships and submerged equipment. Detailed information of such cable ships and submerged equipment (i.e., ploughs, ROVs, etc.) is contained in Appendix I);
 - 2) to resist environmental conditions on the sea bottom at the installation depth, particularly hydrostatic pressure, temperatures, abrasion, corrosion and marine life;
 - 3) to be adequately protected (i.e., by armouring or burying) against aggression, due for example to trawlers or anchors;
 - 4) to survive recovery from such a depth, and subsequent repair and relay, with due safety considerations.
- c) The material characteristics of a submarine cable system should enable the optical fibre:
 - 1) to achieve its desired reliability over its design lifetime;
 - 2) to tolerate stated loss and aging mechanisms, especially bending, strain, hydrogen, stress, corrosion and radiation.
- d) The transmission quality of a submarine cable system should follow, as a minimum [ITU-T G.821] or [ITU-T G.826] or [ITU-T G.828] or [ITU-T G.8201].

Figure 1 shows the basic concept of optical fibre submarine cable systems and boundaries. Optical submarine repeaters or optical submarine branching units could be included, depending on each system requirement.

In Figure 1, "A" denotes the system interfaces at the terminal station (where the system can be interfaced to terrestrial digital links or to other submarine cable systems), and "B" denotes beach joints or landing points. Numbers in brackets in the figure refer to [ITU-T G.972].

Figure 1: Basic concept of optical fibre submarine cable systems and boundaries.



NOTE 1 – A denotes system interface.

NOTE 2 – B denotes landing points or beach joints (1006).

NOTE 3 – X denotes cable jointing box (5013).

NOTE 4 – Number in brackets relate to [ITU-T G.972].

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Figure 1 – Example of optical fibre submarine cable systems

7 Relationship among Recommendations relevant to optical fibre submarine cable systems

Relationships among the various Recommendations pertaining to optical fibre submarine cable systems are shown in the flow chart presented in Figure 2. Recommendations relevant to optical fibre submarine cable systems can be categorized into three groups. The first group covers general aspects on optical fibre submarine cable systems. This category is composed of [ITU-T G.971], [ITU-T G.972] and [b-ITU-T G.Sup.41]. These documents respectively describe general features, definitions and design guidelines for optical fibre submarine systems. The second group deals with the components or functions used in optical fibre submarine systems. This category is composed of [b-ITU-T G.975], [b-ITU-T G.975.1], [b-ITU-T G.976], [b-ITU-T G.978] and [b-ITU-T G.979]. These documents describe forward error correction, advanced forward error correction, test methods, optical fibre cables and characteristics of monitoring systems relevant to optical fibre submarine systems. The final group describes system requirements. This category contains [ITU-T G.973], [ITU-T G.973.1], [ITU-T G.973.2], [ITU-T G.974] and [ITU-T G.977]. Respectively, these Recommendations consider: the repeaterless, longitudinal compatible repeaterless, single channel interface based repeaterless, regenerative and optically amplified submarine systems.