

Recommendation

ITU-T G.972 (08/2024)

SERIES G: Transmission systems and media, digital systems and networks

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

Definition of terms relevant to optical fibre submarine cable systems

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Recommendation ITU-T G.972

Definition of terms relevant to optical fibre submarine cable systems

Summary

Recommendation ITU-T G.972 applies to optical fibre submarine cable systems. The purpose of this Recommendation is to provide definitions of terms relevant to optical fibre submarine cable systems, including terms relevant to system configuration, system aspects, terminal equipment, optical submarine repeaters and branching units, optical fibre submarine cable, manufacturing and installation, and the maintenance of the submarine portion. Appendix I is the alphabetical list of terms defined in this Recommendation.

In this latest version, terms and definitions introduced by new Recommendations ITU-T G.9730.1 and ITU-T G.9730.2 are added. All the terms that the definitions that were for further study have been added as well.

History*

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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.

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Recommendation ITU-T G.972

Definition of terms relevant to optical fibre submarine cable systems

1 Scope

The purpose of this Recommendation is to provide definitions of terms relevant to optical fibre submarine cable systems.

A small number of terms defined in this Recommendation are associated with definitions in [ITU-T G.601], [ITU-T G.602] and [ITU-T G.701]. References to these definitions are given in parenthesis as an aid to ensure consistency between the different Recommendations in the event of future amendments.

Figure 1 of [ITU-T G.971] 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 of [ITU-T G.971], 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. Letters in brackets in the definitions of this Recommendation refer to the above figure.

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 stand-alone document, the status of a Recommendation.

- [ITU-T G.601] Recommendation ITU-T G.601 (1988), *Terminology for cables*.
- [ITU-T G.602] Recommendation ITU-T G.602 (1988), *Reliability and availability of analogue cable transmission systems and associated equipments*.
- [ITU-T G.652] Recommendation ITU-T G.652 (2024), *Characteristics of a single-mode optical fibre and cable*.
- [ITU-T G.653] Recommendation ITU-T G.653 (2010), *Characteristics of a dispersion-shifted, single-mode optical fibre and cable*.
- [ITU-T G.654] Recommendation ITU-T G.654 (2024), *Characteristics of a cut-off shifted, single-mode optical fibre and cable*.
- [ITU-T G.655] Recommendation ITU-T G.655 (2009), *Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable*.
- [ITU-T G.656] Recommendation ITU-T G.656 (2010), *Characteristics of a fibre and cable with non-zero dispersion for wideband optical transport*.
- [ITU-T G.661] Recommendation ITU-T G.661 (2007), *Definitions and test methods for the relevant generic parameters of optical amplifier devices and subsystems*.
- [ITU-T G.701] Recommendation ITU-T G.701 (1993), *Vocabulary of digital transmission and multiplexing, and pulse code modulation (PCM) terms*.

- [ITU-T G.870] Recommendation ITU-T G.870/Y.1352 (2016), *Terms and definitions for optical transport networks*.
- [ITU-T G.872] Recommendation ITU-T G.872 (2019), *Architecture of optical transport networks*.
- [ITU-T G.957] Recommendation ITU-T G.957 (2006), *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*.
- [ITU-T G.971] Recommendation ITU-T G.971 (2024), *General features of optical fibre submarine cable systems*.
- [ITU-T G.976] Recommendation ITU-T G.976 (2014), *Test methods applicable to optical fibre submarine cable systems*.
- [ITU-T G.977] Recommendation ITU-T G.977 (2015), *Characteristics of optically amplified optical fibre submarine cable systems*.
- [ITU-T G.977.1] Recommendation ITU-T G.977.1 (2020), *Transverse compatible DWDM applications for repeatered optical fibre submarine cable systems*.
- [ITU-T G.979] Recommendation ITU-T G.979 (2016), *Characteristics of monitoring systems for optical submarine cable systems*.
- [ITU-T G.9730.1] Recommendation ITU-T G.9730.1 (2024), *Dedicated scientific sensing submarine cable system*.
- [ITU-T G.9730.2] Recommendation ITU-T G.9730.2 (2024), *Scientific monitoring and reliable telecommunication submarine cable systems*.

3 Definitions

This Recommendation defines the following terms:

3.1 Terms relevant to elements of system configuration

1001 optical fibre submarine cable system: A set of equipment designed to permit the interconnection of two or more terminal stations.

The optical fibre submarine cable system is usually composed of terminal equipment (terminal transmission equipment, power feeding equipment, maintenance controller, etc.), and submersible equipment (cable, repeater(s), branching unit(s), etc.).

1002 optical fibre submarine cable link: A link which interconnects two terminal stations using a single optical fibre submarine cable system or an integrated system using system portions supplied by different suppliers.

1003 optical fibre submarine cable network: A network which interconnects three or more terminal stations using a single optical fibre submarine cable system or an integrated system made of system portions supplied by different suppliers.

1004 land portion: The portion between the system interface in the terminal station (A), and the beach joint or landing point (B) when it exists. It includes the optical fibre land cable, land repeaters, land joints and the system terminal equipment.

1005 submarine portion: The portion of the system laying on the seabed, between the beach joints or landing points (B), which includes the optical fibre submarine cable and the submarine equipment (e.g., optical submarine repeater(s), optical submarine branching unit(s) and optical submarine cable jointing box(es)).

1006 beach joint: The cable joint made between the optical fibre submarine cable and the optical fibre land cable.

1007 terminal station: The telecommunication station usually located in the vicinity of the landing point and housing the optical fibre submarine cable system terminal equipment and that of associated terrestrial systems.

1008 terminal station equipment (TSE): The TSE comprises the system terminal equipment (STE) and the ancillary equipment used for the operation of the optical fibre submarine cable system.

1009 system terminal equipment (STE): The STE comprises all equipments specific to a given optical fibre submarine cable system.

1010 terminal transmission equipment (TTE): The equipment terminating the optical submarine transmission line at the optical interface and connected to the system interface. The TTE may have multiple signal sources with channel multiplexer/demultiplexer. For interoperable submarine cable systems, TTE is treated as the terminal portion, and terminates the interoperable cable section.

1011 supervisory system: The whole of equipment and sub-assemblies commonly providing one or more of the following functions:

- monitoring the performance of the submarine equipment and sub-assemblies;
- monitoring the performance of the system terminal equipment;
- monitoring the end-to-end performance of the digital line sections;
- enabling fault location inside the submarine plant, to within one repeater section, where possible;
- controlling redundancy switching, if provided inside the submarine portion;
- providing interfaces to other management facilities.

1012 maintenance controller: A computer with an interface to the supervision and remote maintenance equipment, which is commonly used during the supervision and remote maintenance activity for the equipment in the submarine portion. It is also used for terminal transmission equipment (TTE) maintenance purposes.

1013 power feeding equipment (PFE): The equipment providing, through a power conductor in the optical fibre submarine cable, a stabilized constant electrical current for powering optical submarine repeaters and/or optical submarine branching units.

1014 cable terminating equipment (CTE): The equipment providing the interface between the optical fibre from the terminal transmission equipment (TTE) and the optical fibre cable, and the interface between the power feeding line from the power feeding equipment (PFE) and the power feeding conductor from the optical fibre cable.

NOTE – The CTE is usually part of the PFE.

1015 power feed earth: The earth provided to establish the return path of the repeater power feeding current circuit.

1016 power feed earth electrode cable: The cable installed between the power feed earth and the power feeding equipment (PFE).

1017 optical fibre station cable: The optical fibre cable installed inside the cable station.

1018 optical fibre land cable: The optical fibre cable installed between the cable terminating equipment (CTE) and the beach joint.

1019 optical fibre submarine cable: The submarine cable using optical fibres as transmission line.

1020 optical submarine repeater: (Related to definition 1001 provided in [ITU-T G.601]) An equipment essentially including one or more regenerators or amplifiers and associated devices, in the submarine portion.

1021 bipolar repeater: An optical submarine repeater which can be powered by a power feeding current flowing in either direction.

1022 branching unit (BU): An equipment connecting more than two optical fibre submarine cable sections.

NOTE – Applications for the optical submarine branching may include the following additional functions:

- optical signal path switching;
- signal regeneration or amplification;
- power path switching.

1023 undersea branching multiplexer (UBM): A branching unit that separates lower level digital signals from incoming optical line signals and recombines them differently in outgoing optical line signals.

1024 integration specification: A set of specifications established to permit the interconnection of two or more optical fibre submarine cable systems designed by different suppliers.

1025 integration line optical interface: The optical interface between fractions of the submarine cable sections provided by different suppliers.

1026 shallow water: Water depths down to a given limit, corresponding to the depths of fishing activity, or more generally of marine activity, creating a risk of cable fault.

NOTE – The limit of shallow water is of the order of 1000 metres.

1027 deep water: Water depths exceeding the limit of shallow water.

1028 elementary cable section: The whole length of optical fibre cable between two pieces of equipment (repeaters, branching units or terminal transmission equipment).

1029 repeatered submarine cable: An electrically powered underwater optical fibre cable, designed for repeatered applications, and suitable for shallow and deep water use, which has been extensively tested to show it can be installed and repaired *in situ*, even in the worst weather conditions, without any impairment of optical, electrical or mechanical performance or reliability.

NOTE – For appropriate test methods, please refer to [ITU-T G.976].

1030 repeaterless submarine cable: An underwater optical fibre cable, designed for unrepeatered applications, and suitable for shallow and deep water use, which has been extensively tested to show it can be installed and repaired *in situ*, even in the worst weather conditions, without any impairment of optical, electrical or mechanical performance or reliability.

NOTE 1 – For appropriate test methods, please refer to [ITU-T G.976].

NOTE 2 – The term "repeaterless" is also known as "unrepeatered" or "non-repeatered".

1031 marinized terrestrial cable (MTC): An underwater optical fibre cable construction based on a conventional multi-fibre terrestrial cable core protected to withstand the marine environment, designed for unrepeatered applications and tested for use in non-aggressive shallow waters with varying repair capability.

NOTE 1 – Sometimes known in Europe as an "underwater" cable.

NOTE 2 – Appropriate test methods are under study.

1032 single wavelength system (SWS): A bidirectional optical system that carries on only one line optical channel (LOC).

1033 wavelength division multiplexing (WDM): An aggregate of several line optical channels (LOCs) to be carried through part or the whole of the submarine line on the same line fibre.

1034 wavelength division multiplexing system (WDMS): A bidirectional optical system that carries on several line optical channels (LOCs).

- 1035 dense wavelength division multiplexing (DWDM):** An aggregate of a large number of line optical channels (LOCs) to be carried through part or the whole of the submarine line on the same line fibre.
- 1036 dense wavelength division multiplexing system (DWDMs):** A bidirectional optical system that carries on a large number of line optical channels (LOCs).
- 1037 gain equalizer:** Gain equalizer is the means used to adapt the submerged plant gain profile characteristics suitable for transmission.
- 1038 tilt equalizer:** Tilt equalizer is the means for wavelength division multiplexing system (WDMS) to provide the equalization of the residual gain/wavelength tilt which accumulates when the signal is transmitted through a chain of submerged repeaters.
- 1039 slope equalizer:** Slope equalizer is the means for wavelength division multiplexing system (WDMS) to provide the equalization of the residual gain/wavelength slope which accumulates when the signal is transmitted through a chain of submerged repeaters.
- 1040 shunt fault:** A shunt fault is a current leakage path between the power conductor and the sea water without a break in the power conductor.
- 1041 remote optically pumped amplifier (ROPA):** An optical fibre amplifier (OFA) consisting of a section of erbium doped fibre that is activated by a pump beam sent from the terminal station.
- 1042 distributed Raman amplifier (DRA):** An optical fibre amplifier (OFA) using the transmission fibre as an amplifier medium that is pumped from the terminal station. The gain is obtained all along the fibre (therefore distributed) using the Raman properties of the fibre until sufficient pump power is available.
- 1043 Raman gain coefficient:** The Raman gain coefficient quantifies the change in the intensity of the Raman-scattered light per unit length and per unit pump power within the fibre.
- 1044 elementary cable:** A series of elementary cable sections.
- 1045 single-fibre type elementary cable:** Elementary cable consisting of a single type of optical fibre.
- 1046 hybrid-fibre type elementary cable:** Elementary cable consisting of more than one type of optical fibre.
- 1047 cut-off shifted single-mode fibre (CSF):** Loss-minimized and cut-off shifted single-mode optical fibre, specified in [ITU-T G.654].
- 1048 dispersion compensating single-mode fibre (DCF):** Single-mode optical fibre with large negative chromatic dispersion value.
- 1049 dispersion shifted single-mode fibre (DSF):** Zero-dispersion wavelength shifted single-mode optical fibre, specified in [ITU-T G.653].
- 1050 large effective area single-mode fibre (LEF):** Single-mode optical fibre with enlarged effective area.
- 1051 negative dispersion single-mode fibre (NDF):** Single-mode optical fibre with negative chromatic dispersion value in the signal wavelength region.
- 1052 non-zero dispersion shifted single-mode fibre (NZDSF):** Zero-dispersion wavelength shifted single-mode optical fibre, but it has some non-zero chromatic dispersion value in the wavelength region of 1530 to 1565 nm, specified in [ITU-T G.655].
- 1053 positive dispersion single-mode fibre (PDF):** Single-mode optical fibre with positive chromatic dispersion value in the signal wavelength region.