

Recommendation

ITU-T G.657 (08/2024)

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

Transmission media and optical systems characteristics –
Optical fibre cables

Characteristics of a bending-loss insensitive single-mode optical fibre and cable

ITU-T G-SERIES RECOMMENDATIONS
Transmission systems and media, digital systems and networks

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100-G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200-G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300-G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400-G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450-G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600-G.699
General	G.600-G.609
Symmetric cable pairs	G.610-G.619
Land coaxial cable pairs	G.620-G.629
Submarine cables	G.630-G.639
Free space optical systems	G.640-G.649
Optical fibre cables	G.650-G.659
Characteristics of optical components and subsystems	G.660-G.679
Characteristics of optical systems	G.680-G.699
DIGITAL TERMINAL EQUIPMENTS	G.700-G.799
DIGITAL NETWORKS	G.800-G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900-G.999
MULTIMEDIA QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000-G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000-G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000-G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000-G.8999
ACCESS NETWORKS	G.9000-G.9999

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

Recommendation ITU-T G.657

Characteristics of a bending-loss insensitive single-mode optical fibre and cable

Summary

Worldwide, technologies for general transport network and broadband access networks are advancing rapidly. Among these, the technology applying single-mode fibre provides for a high-capacity transmission medium which can answer the growing demand for high speed and broadband services.

The experience with the installation and operation of single-mode fibre and cable-based networks is huge and Recommendation ITU-T G.652, which describes its characteristics, has been adapted to this experience. Nevertheless, the specific use in an optical access network puts different demands on the fibre and cable which impacts its optimal performance characteristics. Differences with respect to the use in the general transport network are mainly due to the high-density network of distribution and drop cables in the access network. The limited space and the many manipulations ask for operator-friendly fibre performance and low bending sensitivity. In addition, the cabling in the crowded telecom offices where space is a limiting factor has to be improved accordingly. Yet, certain areas of the general transport and datacentre networks can also be described as space limited, where bend optimized cabling can be advantageous.

It is the aim of Recommendation ITU-T G.657 to support this optimization by recommending strongly improved bending performance compared with the existing ITU-T G.652 single-mode fibre and cables. This is done by means of two categories of single-mode fibres, one of which, category A, is fully compliant with the ITU-T G.652 single-mode fibres and can be deployed throughout the general transport and datacentre networks as well as the access network. The other, category B, is not necessarily compliant with Recommendation ITU-T G.652 but is capable of low values of macrobending losses at very low bend radii and is intended for application in the access network inside buildings or near buildings (e.g., outside building riser cabling). These category B fibres are system compatible with ITU-T G.657.A and ITU-T G.652.D fibres in access networks.

This fifth edition of Recommendation ITU-T G.657, amongst other things, extends the application space for ITU-T G.657 fibre and merges category B2 into category A2.

History*

Edition	Recommendation	Approval	Study Group	Unique ID
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Keywords

Bending-loss insensitive optical fibre, dispersion un-shifted optical fibre, optical fibre and cable, single-mode optical fibre.

* To access the Recommendation, type the URL <https://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID.

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Table of Contents

	Page
1 Scope.....	1
2 References.....	2
3 Definitions	2
3.1 Terms defined elsewhere	2
3.2 Terms defined in this Recommendation.....	2
4 Abbreviations and acronyms	2
5 Conventions	2
6 Fibre attributes	2
6.1 Mode field diameter	3
6.2 Cladding diameter	3
6.3 Core concentricity error.....	3
6.4 Non-circularity	3
6.5 Cut-off wavelength.....	3
6.6 Macrobending loss.....	4
6.7 Material properties of the fibre.....	4
6.8 Refractive index profile	5
6.9 Longitudinal uniformity of chromatic dispersion.....	5
6.10 Chromatic dispersion.....	5
7 Cable attributes	6
7.1 Attenuation coefficient	6
7.2 Polarization mode dispersion coefficient	7
8 Recommended value tables	7
Appendix I – Lifetime expectation in the case of small radius bending of single-mode fibre.....	12
Bibliography.....	13

Introduction

Worldwide, technologies for broadband access networks and general transport networks are advancing rapidly. Among these, the technology applying single-mode fibre provides for a high-capacity transmission medium which can answer the growing demand for high-speed networks.

The experience with the installation and operation of single-mode fibre and cable-based networks is huge and Recommendation ITU-T G.652, which describes its characteristics, has been adapted to this experience. Nevertheless, the specific use in an optical access network and some particular areas of general transport and datacentre networks puts different demands on the fibre and cable. Due to dense distribution and drop-cable network, limited space and the many manipulations in parts of these networks, fibre and cable requirements may be optimized for improved macrobending loss. It is the aim of this Recommendation to support this optimization by recommending different attribute values for the existing ITU-T G.652 single-mode fibre and cables and by recommending other categories of single-mode fibre types.

As for the network structures in which the single-mode optical fibre cable is used, users are referred to the extensive information that is available in the references listed in the bibliography.

Change log

Overview of the changes introduced in this Recommendation since it was first approved in 2006.

Edition	Recommendation	Changes
1.0	ITU-T G.657 (2006)	
2.0	ITU-T G.657 (2009)	
2.1	ITU-T G.657 (2009) Amd. 1 (2010)	
3.0	ITU-T G.657 (2012)	Chromatic dispersion and PMD specifications have been introduced for sub-category G.657.B fibres. The attenuation and MFD specifications for B sub-category fibres have been modified. Also, the new Appendix I (agreed in 2010 and published as Amendment 1 (06/2010) has been introduced.
4.0	ITU-T G.657 (2016)	The title and scope have been modified to include the usage of sub-category G.657.A macrobending loss improved fibres for all applications (access networks as well as general transport networks) where G.652.D fibres are used. Added new clause 5 "Conventions". Following clause numbers have been renumbered. In clause 6.10 the text concerning chromatic dispersion for G.657.A fibres has been modified in harmonization with G.652.D fibres. In Table 1 and 2 (G.657.A & B) the nominal mode field diameter upper range has been reduced. In Table 1 (G.657.A) new specification has been introduced for chromatic dispersion in harmonization with G.652.D fibres. Appendix I of Edition 3 has been moved to Appendix I of [ITU-T G-Sup.59]
5.0	ITU-T G.657 (2024)	Extended application space to include datacentres. Merged category B2 into Category A2. Updated the cutoff wavelength Note on length and bending dependence similar to the changes in other 65x series standards.

Recommendation ITU-T G.657

Characteristics of a bending-loss insensitive single-mode optical fibre and cable

1 Scope

This Recommendation describes two categories of single-mode optical fibre cable with improved bending loss performance compared with that of ITU-T G.652 fibres. ITU-T G.657 fibre was originally developed for use in access networks, including inside buildings at the end of these networks. Category A contains two subcategories which differ in macrobending loss.

Category A fibres are optimized for reduced macrobending loss compared to ITU-T G.652.D fibres. These fibres can be deployed throughout not only access networks and general transport networks such as metro networks, but also in other networks where bending-loss insensitive fibres are required to achieve installed performance requirements, e.g., datacentre networks. These fibres are suitable for use in the O-, E-, S-, C- and L-band (i.e., throughout the 1260 nm to 1625 nm range). Fibres and requirements in this category are a subset of ITU-T G.652.D and are therefore compliant¹ with ITU-T G.652.D fibres and have the same transmission and interconnection properties. Thus, ITU-T G.657.A fibres can be used for all networks where ITU-T G.652.D fibres are specified.

Subcategory ITU-T G.657.A1 fibres are appropriate for a minimum design radius of 10 mm.

Subcategory ITU-T G.657.A2 fibres are appropriate for a minimum design radius of 7.5 mm.

Category B fibres are optimized for further reduced macrobending loss and therefore are capable of being used at very low values of bending radius. These fibres are intended for short reach distances (less than 1 000 m) at the end of access networks, in particular inside buildings, inside premises or near buildings (e.g., outside building riser cabling). They are also intended for short reach applications such as optical interconnection inside buildings or datacentres. The application length of ITU-T G.657.B fibre depends on the deployment strategy of each network operator. These fibres are suitable for use in the O-, E-, S-, C- and L-band (i.e., throughout the 1260 nm to 1625 nm range). Category B fibres are not necessarily compliant with ITU-T G.652.D in terms of chromatic dispersion coefficient and polarization mode dispersion (PMD) specifications. These fibres, however, are system compatible² with ITU-T G.657.A and ITU-T G.652.D fibres in access networks.

Subcategory ITU-T G.657.B3 fibres are appropriate for a minimum design radius of 5 mm.

The meaning of the terms used in this Recommendation and the guidelines to be followed in the measurement to verify the various characteristics are given in [ITU-T G.650.1] and [ITU-T G.650.2]. The characteristics of these fibre categories, including the definitions of the relevant parameters, their test methods and relevant values, will be refined as studies and experience progress.

¹ Compliance here means adherence to the referenced Recommendation ([ITU-T G.652], category D) meeting or exceeding the values of the specified attributes.

² Compatibility means here that the product in this category will introduce negligible system impairment or deployment issues but may not be compliant with the referenced Recommendation ([ITU-T G.652], category D).