

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.652

(11/2016)

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

Transmission media and optical systems characteristics –
Optical fibre cables

Characteristics of a single-mode optical fibre and cable

Recommendation ITU-T G.652

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.652

Characteristics of a single-mode optical fibre and cable

Summary

Recommendation ITU-T G.652 describes the geometrical, mechanical and transmission attributes of a single-mode optical fibre and cable which has zero-dispersion wavelength around 1310 nm. The ITU-T G.652 fibre was originally optimized for use in the 1310 nm wavelength region, but can also be used in the 1550 nm region. This is the latest revision of a Recommendation that was first created in 1984 and deals with some relatively minor modifications. This revision is intended to maintain the continuing commercial success of this fibre in the evolving world of high-performance optical transmission systems.

Table 1 "G.652.A attributes" and Table 3 "G.652.C attributes" of the 2009 edition have not been changed and are not incorporated in this 2016 edition. These tables are still available in the 2009 edition of ITU-T G.652 Recommendation. These optical fibres and cables can be used for systems with less stringent polarization mode dispersion (PMD) requirements (e.g., systems with short link lengths or those with high PMD tolerance).

Table 2 "G.652.B attributes" and Table 4 "G.652.D attributes" of the 2009 edition have been maintained with revisions in this 2016 edition, renumbered to Table 1 "G.652.B attributes" and Table 2 "G.652.D attributes".

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.652	1984-10-19		11.1002/1000/4091
2.0	ITU-T G.652	1988-11-25		11.1002/1000/882
3.0	ITU-T G.652	1993-03-12	XV	11.1002/1000/883
4.0	ITU-T G.652	1997-04-08	15	11.1002/1000/4018
5.0	ITU-T G.652	2000-10-06	15	This revision includes the addition of tables for different levels of system support. 11.1002/1000/5183
6.0	ITU-T G.652	2003-03-16	15	This revision clarified the nomenclature for the different categories or fibre. Also, in accordance with the agreement on spectral band description, the upper limit of the L-band is changed from 16XX to 1625 nm. The attenuation characteristics for reduced water peak categories, (G.652.C and G.652.D) are generalized to a broad region from a single wavelength. PMD requirements are added for all categories and two categories have reduced limits (compared to $0.5 \text{ ps}/\sqrt{\text{km}}$). For the macrobending test, mandrel diameter is reduced to 30 mm radius. As seen above, this Recommendation has evolved considerably over the

* 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>.

years; therefore the reader is warned to consider the appropriate version to determine the characteristics of already deployed product, taking into account the year of production. In fact, products are expected to comply with the Recommendation that was in force at the time of their manufacture, but may not fully comply with subsequent versions of the Recommendation.

[11.1002/1000/6261](#)

7.0 ITU-T G.652 2005-06-29 15

Support of G.695 applications is noted.

A clarification of the method of fitting chromatic dispersion coefficient values and their use is provided in 5.10, along with some text on use of the statistics of chromatic dispersion for system design.

A clarification of the relationship of the PMD_Q of uncabled fibre to cabled fibre is provided in 6.2.

In the tables of requirements:

The uncabled fibre PMD line item is removed from the tables and the note on the requirement for uncabled fibre PMD is modified.

The tolerance of MFD at 1310 nm is reduced.

The maximum dispersion slope at the zero dispersion wavelength is reduced.

The maximum concentricity error is reduced.

The maximum macrobending loss is reduced.

The wording for the water peak requirement in Tables 3 and 4 are modified to reflect a reference to the specification over the range vs the specification at 1310 nm.

[11.1002/1000/8522](#)

8.0 ITU-T G.652 2009-11-13 15

Add IEC-60794-2-11 as an informative reference in clause 2.2.

Editorial correction at start of clause 6.2 (PMD).

New note has been introduced in Table 1 – 4 allowing higher maximum cabled attenuation (1.0 dB/km) for short indoor cables.

Modification in Tables 3 and 4 to the cabled attenuation at 1383 nm (max. 0.40 dB/km).

New text has been introduced in Tables 3 and 4 concerning hydrogen ageing (note 3).

[11.1002/1000/10389](#)

9.0 ITU-T G.652 2016-11-13 15

Tables 1 and 3 of edition 8 have not been changed. These tables are not included in this version of Recommendation ITU-T G.652, but are in the 2009 edition.

The tables in this edition have been renumbered. Tables 1 and 2 of this edition 9 correspond respectively to Tables 2 and 4 of edition 8.

New clause 5 “Conventions” has been added. Following clause numbers have been renumbered.

Chromatic dispersion specification for G.652.D fibres has been changed into boundary line specification.

In clause 6.10 the text concerning chromatic dispersion for G.652.D fibres has been modified.

In clause 7.2 (PMD) a note has been added about usability of high PMD fibre and cable for systems with less stringent PMD requirements.

In clause 8 only Table 1 (G.652.B) and Table 2 (G.652.D) are indicated. Here also a reference to IEC fibre designations is mentioned.

In Table 1 (G.652.B) and Table 2 (G.652.D) Note 1 has been extended with text concerning attenuation coefficient at a wavelength longer than 1625 nm.

In Table 1 (G.652.B) new Note 3 and Table 2 (G.652.D) new Note 5 describe usability of high PMD fibre and cable for system with less stringent PMD requirements.

In Table 2 (G.652.D) the nominal mode field diameter upper range has been reduced.

In Table 2 (G.652.D) the mode field diameter tolerance has been tightened.

In Table 2 (G.652.D) the cladding diameter tolerance has been tightened.

In Table 2 (G.652.D) new specification has been introduced for chromatic dispersion.

In Table 2 (G.652.D) text has been added and renewed concerning attenuation coefficient at 1383 nm.

In Table 2 (G.652.D) the attenuation specifications have been edited to two decimal places.

Added in Appendix I a new clause I.6 “An example of statistical methodology”

New Appendix II has been added highlighting the data collection on maximum and minimum chromatic dispersion over wavelength range 1270 nm to 1625 nm for the boundary line specification of G.652.D fibres

[11.1002/1000/13076](https://www.itu.int/rec/TG-FA/11/1002/1000/13076)

Keywords

Dispersion un-shifted optical fibre, optical fibre and cable, single-mode optical fibre.

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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Table of Contents

	Page
1 Scope.....	1
2 References.....	1
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	2
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.....	3
6.7 Material properties of the fibre.....	4
6.8 Refractive index profile	4
6.9 Longitudinal uniformity of chromatic dispersion.....	4
6.10 Chromatic dispersion.....	4
7 Cable attributes	5
7.1 Attenuation coefficient	5
7.2 Polarization mode dispersion coefficient	6
8 Tables of recommended values	6
Appendix I – Information about cabled fibre link attributes used for system design.....	10
I.1 Attenuation	10
I.2 Chromatic dispersion.....	10
I.3 Differential group delay (DGD)	11
I.4 Tables of common typical values	11
I.5 Non-linear coefficient.....	12
I.6 An example of statistical methodology	12
Appendix II – Information on data collection of G.652.D fibre maximum/minimum chromatic dispersion for boundary line specification.....	14
Bibliography.....	16

Recommendation ITU-T G.652

Characteristics of a single-mode optical fibre and cable

1 Scope

This Recommendation describes a single-mode optical fibre and cable which has zero-dispersion wavelength around 1310 nm and can be used in the 1310 nm and 1550 nm regions. Both analogue and digital transmission can be used with this fibre.

The geometrical, optical, transmission and mechanical parameters are described below in three categories of attributes:

- fibre attributes are those attributes that are retained throughout cabling and installation;
- cable attributes that are recommended for cables as they are delivered;
- link attributes that are characteristic of concatenated cables, describing estimation methods of system interface parameters based on measurements, modelling or other considerations. Information for link attributes and system design are in Appendix I.

This Recommendation and the different performance categories found in the tables of clause 8 are intended to support the following related system Recommendations:

Category	Recommendations
Characteristics of optical systems	[b-ITU-T G.691], [b-ITU-T G.692], [b-ITU-T G.693], [b-ITU-T G.695], [b-ITU-T G.696.1], [b-ITU-T G.698.1], [b-ITU-T G.698.2], [b-ITU-T G.698.3]
Digital line systems	[b-ITU-T G.957], [b-ITU-T G.959.1]
Optical line systems for local and access networks	[b-ITU-T G.983.1], [b-ITU-T G.984.2], [b-ITU-T G.985], [b-ITU-T G.986], [b-ITU-T G.987.2], [b-ITU-T G.989.2]

NOTE – Depending on the length of the links, dispersion accommodation can be necessary for some [b-ITU-T G.691], [b-ITU-T G.692] or [b-ITU-T G.959.1] application codes.

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 this fibre, including the definitions of the relevant parameters, their test methods and relevant values, will be refined as studies and experience progress.

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.650.1] Recommendation ITU-T G.650.1 (2010), *Definitions and test methods for linear, deterministic attributes of single-mode fibre and cable*.

[ITU-T G.650.2] Recommendation ITU-T G.650.2 (2015), *Definitions and test methods for statistical and non-linear related attributes of single-mode fibre and cable*.