

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.655

(11/2009)

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

Transmission media and optical systems characteristics –
Optical fibre cables

Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable

Recommendation ITU-T G.655



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Recommendation ITU-T G.655

Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable

Summary

This Recommendation describes the geometrical, mechanical, and transmission attributes of a single-mode optical fibre which has the absolute value of the chromatic dispersion coefficient greater than some non-zero value throughout the wavelength range from 1530 nm to 1565 nm. This dispersion reduces the growth of non-linear effects which are particularly deleterious in dense wavelength division multiplexing systems. The last revision in 2006 adds two new categories of this fibre in Tables D and E. Both of these categories limit the chromatic dispersion coefficient by a pair of bounding curves versus wavelength for the range of 1460 nm to 1625 nm. Although the dispersion can change sign at wavelengths less than 1530 nm, the inclusion of these lower wavelengths is intended to provide information to support coarse wavelength division multiplexing applications which do not have significant non-linear impairments, at channels from 1471 nm and higher. These tables are introduced to distinguish the two main families of ITU-T G.655 fibres that are supported by multiple vendors. Table 1, "G.655.A attributes", Table 2, "G.655.B attributes", and Table 3, "G.655.C attributes", of the 2003 edition have not been changed, of which, only the G.655.C attributes table is included in this current edition. This is the latest revision of a Recommendation that was first created in 1996. This revision adds a new note in the G.655.C, G.655.D and G.655.E attributes tables, allowing higher maximum cabled attenuation for short cables. Jumper cable cut-off wavelength is deleted as well. This revision is expected to improve harmonization with IEC standards.

Source

Recommendation ITU-T G.655 was approved on 13 November 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedures.

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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Introduction

The following paragraphs provide a summary of the evolution of Recommendation ITU-T G.655, from its first 1996 version to the latest 2009 edition.

- | | |
|------|--|
| 1996 | Edition 1.0. |
| 2000 | Edition 2.0. This revision includes the addition of tables for different levels of system support. |
| 2003 | Edition 3.0. In accordance with the agreement on spectral bands, the description of the L band upper limit is changed from 16xx to 1625 nm. Terms of base subcategory and subcategory are revised to base category and category, respectively. PMD requirements are added for all categories and two categories have reduced limits (compared to 0.5 ps/√km). For the macrobending test, mandrel diameter is reduced to 30 mm radius. As seen above, this Recommendation has evolved considerably over the years; therefore, the reader is warned to consider the appropriate version to determine the characteristics of an 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. |
| 2006 | Edition 4.0. This revision adds two new categories of this fibre in Tables D and E. Both of these categories limit the chromatic dispersion coefficient by a pair of bounding curves versus wavelength for the range of 1460 nm to 1625 nm. Although the dispersion can change sign at wavelengths less than 1530 nm, the inclusion of these lower wavelengths is intended to provide information to support coarse wavelength division multiplexing applications which do not have significant non-linear impairments, at channels from 1471 nm and higher. These tables are introduced to distinguish the two main families of G.655 fibres that are supported by multiple vendors. Tables A, B, and C have not been changed. Tables A and B are not included in this version of this Recommendation, but are in the 2003 edition. |
| 2009 | Edition 5.0. IEC 60794-2-11 (2005) is added as one of the Informative references. The tables have been renumbered. Tables 1, 2, and 3 of edition 5.0 correspond, respectively, to Tables 3, 4, and 5 of edition 4.0. Uncabled fibre PMD coefficient requirements have been added in Tables 2 and 3. A new note has been introduced in Tables 1 to 3, to allow higher maximum cabled attenuation for short cables. |

Recommendation ITU-T G.655

Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable

1 Scope

This Recommendation describes a single-mode fibre with a chromatic dispersion coefficient (absolute value) that is greater than some non-zero value throughout the wavelengths larger than 1530 nm. This dispersion reduces the growth of non-linear effects that can be particularly deleterious in dense wavelength division multiplexing (DWDM) systems. At lower wavelengths, the dispersion coefficient can cross zero, but chromatic dispersion coefficient values at these wavelengths may be specified to support coarse wavelength division multiplexing (CWDM) systems that do not have significant impairments due to non-linear effects.

These fibres were originally intended for use at wavelengths in a prescribed region between 1530 nm and 1565 nm. Provisions have been made to support transmission at higher wavelengths of up to 1625 nm and lower wavelengths down to 1460 nm.

In clause 7, Tables 2 and 3 distinguish the two main families of ITU-T G.655 fibre implementations that are supported by multiple vendors. The G.655.A, G.655.B and G.655.C attributes tables can be used to define other implementations. The G.655.A and G.655.B attributes tables of the 2003 edition are not included in the current version of this Recommendation.

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 characteristics 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 7, is intended to support the following related system Recommendations:

- ITU-T G.691;
- ITU-T G.692;
- ITU-T G.693;
- ITU-T G.695;
- ITU-T G.696.1;
- ITU-T G.698.1;
- ITU-T G.957;
- ITU-T G.959.1.

This Recommendation contains a combination of fibre designs able to cover a broad spectrum of applications. Some re-arrangement might be considered in the future. However, the system compatibility of fibres with different characteristics is not proved and, in general, their simultaneous use in one system might be questioned and should be agreed in advance between the user and manufacturers.

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 (2004), *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 (2007), *Definitions and test methods for statistical and non-linear related attributes of single-mode fibre and cable*.

3 Terms and definitions

For the purposes of this Recommendation, the definitions given in [ITU-T G.650.1] and [ITU-T G.650.2] apply. Values shall be rounded to the number of digits given in the tables of recommended values before conformance is evaluated.

4 Abbreviations

This Recommendation uses the following abbreviations:

A_{eff}	Effective area
CWDM	Coarse Wavelength Division Multiplexing
DGD	Differential Group Delay
DWDM	Dense Wavelength Division Multiplexing
GPa	GigaPascal
PMD	Polarization Mode Dispersion
PMD _Q	Statistical Parameter for PMD link
SDH	Synchronous Digital Hierarchy
TBD	To Be Determined
WDM	Wavelength Division Multiplexing

5 Fibre attributes

Only those characteristics of the fibre providing a minimum essential design framework for fibre manufacturers are recommended in this clause. Ranges or limits on values are presented in the tables of clause 7. Of these, cable manufacture or installation may significantly affect the cabled fibre cut-off wavelength and PMD. Otherwise, the recommended characteristics will apply equally to individual fibres, fibres incorporated into a cable wound on a drum, and fibres in an installed cable.