

Supplement

ITU-T G Suppl. 47 (03/2025)

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

Supplements to ITU-T G-series Recommendations

General aspects of optical fibres and cables

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
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.

Supplement 47 to ITU-T G-series Recommendations

General aspects of optical fibres and cables

Summary

Supplement 47 to ITU-T G-series Recommendations provides information on the general transmission characteristics of single-mode optical fibres and cables specified in the ITU-T G.65x-series of Recommendations related to the practical use condition. It covers the environmental and length-related characteristic of ITU-T G.65x-series optical fibres and cables. The fibre material-related characteristics are also described in Appendix I.

Version 3 of this Supplement provides general guidelines for estimating the wavelength dependence of the attenuation coefficient and chromatic dispersion.

History*

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T G Suppl. 47	2009-10-09	15	11.1002/1000/10545
2.0	ITU-T G Suppl. 47	2012-09-21	15	11.1002/1000/11766
3.0	ITU-T G Suppl. 47	2025-03-28	15	11.1002/1000/16389

Keywords

Cables, environmental characteristics, fibre non-linearity, material characteristics, optical fibres.

* 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.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, and information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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

This is an informative ITU-T publication. Mandatory provisions, such as those found in ITU-T Recommendations, are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this publication may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the standards development process.

As of the date of approval of this publication, ITU had not received notice of intellectual property, protected by patents/software copyrights, which may be required to implement this publication. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the appropriate ITU-T databases available via the ITU-T website at <https://www.itu.int/ITU-T/ipr/>.

© ITU 2025

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

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 Supplement	2
4	Abbreviations and acronyms	2
5	Conventions	2
6	Environmental characteristics of optical fibre and cable.....	2
	6.1 Temperature dependence of chromatic dispersion	2
	6.2 Temperature dependence of polarization mode dispersion	3
7	Length-related characteristics of optical fibre and cable	4
	7.1 Cut-off wavelength	4
	7.2 Stimulated Brillouin scattering power rating	5
	7.3 Four-wave mixing efficiency	6
8	Example guidelines for wavelength dependence of optical fibre and cable.....	7
	8.1 Attenuation coefficient	8
	8.2 Chromatic dispersion.....	8
	Appendix I – Intrinsic material characteristics of optical fibre	9
	I.1 Rayleigh scattering	9
	I.2 Material dispersion	9
	I.3 Non-linear refractive index.....	10
	I.4 Raman gain coefficient.....	10
	Bibliography.....	12

Supplement 47 to ITU-T G-series Recommendations

General aspects of optical fibres and cables

1 Scope

The purposes of this Supplement are to understand the transmission properties of the cabled single-mode fibres during use and to promote the proper and effective use of ITU-T G.65x-series Recommendations for single-mode fibres and cables. In particular, when upgrading existing systems to high-speed transmission systems on the basis of the installed transmission line, and/or designing a new transmission line for a high-speed and large-capacity transmission system, the system operators and designers should be provided with useful information not in the fibre Recommendations.

This Supplement covers the general transmission characteristics of single-mode optical fibres and cables related to the practical use conditions. This Supplement contains:

- environmental characteristics of optical fibres and cables,
- length-related characteristics of optical fibres and cables,
- example guidelines for wavelength dependence of optical fibres and cables.

In Appendix I, the optical fibre characteristics related to the fibre material, such as Rayleigh scattering and material dispersion, are described for reference.

This Supplement provides useful guidelines for the design of transmission lines and/or systems. Moreover, it should be updated as and when optical fibre technologies are updated.

2 References

- [[ITU-T G.650.1](#)] Recommendation ITU-T G.650.1 (2024), *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*.
- [[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.657](#)] Recommendation ITU-T G.657 (2024), *Characteristics of a bending-loss insensitive single-mode optical fibre and cable*.
- [[ITU-T G.663](#)] Recommendation ITU-T G.663 (2011), *Application-related aspects of optical amplifier devices and subsystems*.
- [[ITU-T G.691](#)] Recommendation ITU-T G.691 (2006), *Optical interfaces for single channel STM-64 and other SDH systems with optical amplifiers*.
- [[ITU-T G.959.1](#)] Recommendation ITU-T G.959.1 (2024), *Optical transport network physical layer interfaces*.