

Supplement

ITU-T G Suppl. 84 (03/2025)

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

Supplements to ITU-T G-series Recommendations

Operational aspects of optical access

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 84 to ITU-T G-series Recommendations

Operational aspects of optical access

Summary

Supplement 84 to the G-series addresses the operational aspects of PON-based optical access that are common across multiple passive optical network (PON) systems and their technological generations, including testing, troubleshooting, interference detection and interoperability.

History*

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T G Suppl. 84	2025-03-28	15	11.1002/1000/16394

Keywords

Interference, interoperability, mitigation, passive optical network systems, PON, rogue, testing, troubleshooting.

* 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	1
4 Abbreviations and acronyms	1
5 Conventions	2
6 Introduction.....	2
6.1 New optical access network (OAN) operation paradigm.....	2
6.2 Topics of interest of this Supplement.....	2
7 Optical access operations and use cases	3
7.1 ONU activation in TWDM PON systems	3
8 Optical access system troubleshooting	6
8.1 TC layer -based troubleshooting techniques	6
9 Upstream interference detection and mitigation techniques.....	7
9.1 Rogue ONU emulation	7
9.2 Rogue identification via machine learning.....	8
10 Artificial intelligence and machine learning in optical access operations.....	9
10.1 Intelligent operation.....	9
11 Optical access system testing and monitoring	10
11.1 TWDM wavelength mobility testing.....	10
Bibliography.....	15

Supplement 84 to ITU-T G-series Recommendations

Operational aspects of optical access

1 Scope

This Supplement addresses field operational test sets, troubleshooting techniques, interference detection techniques, power efficiency methodology, interoperability, and other aspects of optical access operation. Those aspects may go beyond individual system specification and deserve to be discussed in a single supplement document that provides guidance for specification and design.

2 References

- [[ITU-T G.984.3](#)] Recommendation ITU-T G.984.3 (2014), *Gigabit-capable passive optical networks (G-PON): Transmission convergence layer specification*.
- [[ITU-T G.989.3](#)] Recommendation ITU-T G.989.3 (2021), *40-Gigabit-capable passive optical networks (NG-PON2): Transmission convergence layer specification*.
- [[ITU-T G.9804.2](#)] Recommendation ITU-T G.9804.2 (2021), *Higher speed passive optical networks – Common transmission convergence layer specification*.

3 Definitions

There are no document-specific definitions.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

BWmap	Bandwidth Map
CO	Central Office
DWLCH ID	Downstream Wavelength Channel Identifier
GPON	Gigabit-Capable Passive Optical Network
ICTP	Inter-Channel-Termination Protocol
ML	Machine Learning
MPM	Multi-PON Modules
NG-PON2	Next Generation Passive Optical Network 2
OAN	Optical Access Network
ODN	Optical Distribution Network
OLT	Optical Line Terminal (Central Office located device)
OLT-CT	OLT Channel Termination
OMCI	ONU Management and Control Interface
ONT	Optical Network Termination
ONU	Optical Network Unit (distant terminal)
OOB	Out of Band

PLOAM	Physical Layer Operations, Administration and Maintenance
PMD	Physical Medium Dependant (layer)
PON	Passive Optical Network
PSBd	Physical Synchronization Block-downstream
PHY	Physical Layer
TC	Transmission Convergence (layer)
TWDM	Time and Wavelength Division Multiplexing
WDM	Wavelength Division Multiplexers

5 Conventions

There are no document-specific conventions.

6 Introduction

6.1 New optical access network (OAN) operation paradigm

While individual ITU-T Recommendation series have specified multiple generations of self-standing optical access systems, the everyday life of network operators increasingly consists of dealing with common issues that span multiple system generations, as well as the issues arising from operating multiple system generations simultaneously within the same operational footprint.

As practical experience accumulates, it becomes clear that ensuring smooth operation conditions of an access network may require more than the theoretical considerations that might have formed the foundation of an individual system recommendation. Operators may encounter issues in the field soon after the initial deployment (because their impact was underestimated by the original studies), or years thereafter, both with the equipment that has been in operation for a long time (due to gradual performance deterioration) and with the equipment that has been put into operation recently (because cost-saving efforts have tightened the compliance margins). Examples include out of band (OOB) noise, alien devices or devices gone rogue. Such issues may impact the primary system equipment, namely the optical line terminal (OLT) and optical network unit (ONU), as well as instrumentation equipment such as hand-held monitoring and measurement tools.

While the primary requirements come from operators, increasingly, local regulatory bodies demand the opening of access network infrastructure and unbundling. Opening the infrastructure may lead to technical incompatibility and mutual interference between the equipment of multiple operating companies, requiring engineering choices and operational conventions that allow necessary versatility to be achieved.

The solutions developed for a given system generation for identified issues will be revisited in order to check that they remain valid in the new contexts and will be applied and updated as appropriate.

NOTE – Security aspects of optical access are investigated in parallel in [b-ITU-T G-Sup.81].

6.2 Topics of interest of this Supplement

This Supplement is viewed as an extensible document. The following non-exhaustive list of topics may serve as a guide for contributors to this Supplement.

- A Optical access application scenarios and use cases
 - A.1 Practical aspects of ONU activation in time and wavelength division multiplexing (TWDM) systems
 - A.2 Practical aspects of multi-rate ONU activation