



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**G.694.2**

(06/2002)

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

Transmission media characteristics – Characteristics of  
optical components and subsystems

---

**Spectral grids for WDM applications:  
CWDM wavelength grid**

ITU-T Recommendation G.694.2

---

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 TESTING EQUIPMENTS	G.450–G.499
TRANSMISSION MEDIA CHARACTERISTICS	G.500–G.599
General	G.600–G.699
Symmetric cable pairs	G.600–G.609
Land coaxial cable pairs	G.610–G.619
Submarine cables	G.620–G.629
Optical fibre cables	G.630–G.649
<b>Characteristics of optical components and subsystems</b>	<b>G.650–G.659</b>
<b>Characteristics of optical components and subsystems</b>	<b>G.660–G.699</b>
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
QUALITY OF SERVICE AND PERFORMANCE	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DIGITAL TERMINAL EQUIPMENTS	G.7000–G.7999
DIGITAL NETWORKS	G.8000–G.8999

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

## **ITU-T Recommendation G.694.2**

### **Spectral grids for WDM applications: CWDM wavelength grid**

#### **Summary**

This Recommendation provides the wavelength grid for coarse wavelength division multiplexing (CWDM) applications. This wavelength grid supports a channel spacing of 20 nm.

#### **Source**

ITU-T Recommendation G.694.2 was prepared by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 June 2002.

## FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. 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

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

## INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation 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 Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

© ITU 2002

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

## CONTENTS

	<b>Page</b>
1 Scope .....	1
2 References.....	1
2.1 Normative references.....	1
2.2 Informative references.....	1
3 Definitions .....	1
3.1 Terms defined in this Recommendation.....	1
3.2 Terms defined in other Recommendations.....	1
4 Abbreviations and acronyms .....	1
5 Coarse WDM and its applications .....	2
6 Nominal central wavelengths for coarse WDM systems.....	2
Appendix I – Central wavelength spacing and wavelength variation.....	3
Appendix II .....	3



# ITU-T Recommendation G.694.2

## Spectral grids for WDM applications: CWDM wavelength grid

### 1 Scope

The purpose of this Recommendation is to provide the definition of a wavelength grid to support coarse wavelength division multiplexing (CWDM) applications. This grid is designed to allow simultaneous transmission of several wavelengths with sufficient separation to permit the use of uncooled sources.

### 2 References

#### 2.1 Normative 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.

- [1] ITU-T Recommendation G.671 (2002), *Transmission characteristics of optical components and subsystems*.

#### 2.2 Informative references

The following ITU-T Recommendations contain other relevant information.

- [2] ITU-T Recommendation G.983.3 (2001), *A broadband optical access system with increased service capability by wavelength allocation*.
- [3] ITU-T Recommendation J.185 (2002), *Transmission equipment for transferring multi-channel television signals over optical access networks by FM conversion*.
- [4] ITU-T Recommendation J.186 (2002), *Transmission equipment for multi-channel television signals over optical access networks by sub-carrier multiplexing (SCM)*.

### 3 Definitions

#### 3.1 Terms defined in this Recommendation

This Recommendation defines the following terms:

**3.1.1 wavelength grid:** A wavelength grid is a reference set of vacuum optical wavelengths used to denote allowed nominal central wavelengths that may be used in defining applications.

#### 3.2 Terms defined in other Recommendations

This Recommendation uses terms defined in ITU-T Rec. G.671:

- Coarse Wavelength Division Multiplexing (CWDM).
- Dense Wavelength Division Multiplexing (DWDM).

### 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

CWDM	Coarse Wavelength Division Multiplexing
DWDM	Dense Wavelength Division Multiplexing
WDM	Wavelength Division Multiplexing

## 5 Coarse WDM and its applications

Coarse Wavelength Division Multiplexing (CWDM), a WDM technology, is characterized by wider channel spacing than Dense WDM (DWDM) as defined in ITU-T Rec. G.671. CWDM systems can realize cost-effective applications, through a combination of uncooled lasers, relaxed laser wavelength selection tolerances and wide pass-band filters.

CWDM systems can be used in transport networks in metropolitan areas for a variety of clients, services and protocols.

Appendix I provides an explanation of the rationale for choosing the central wavelength spacing and the determining factors of the wavelength variation.

## 6 Nominal central wavelengths for coarse WDM systems

The CWDM grid wavelengths within the range 1270 nm to 1610 nm are shown in Table 1. The value of 'c' (speed of light in vacuum) that should be used for converting between wavelength and frequency is  $2.99792458 \times 10^8$  m/s.

**Table 1/G.694.2 – Nominal central wavelengths**

Nominal central wavelengths (nm) for spacing of 20 nm
1270
1290
1310
1330
1350
1370
1390
1410
1430
1450
1470
1490
1510
1530
1550
1570
1590
1610
NOTE – The endpoints of this table are illustrative only.



## **Appendix I**

### **Central wavelength spacing and wavelength variation**

Effective CWDM realizations with uncooled lasers and wide passband filters require a nominal central wavelength spacing of not less than 20 nm. Total source wavelength variation of the order of  $\pm 6-7$  nm is expected to be compatible with current filter technologies. As for the guard-band, one third of the minimum channel spacing is sufficient. Therefore, in order to maximise the number of channels, 20 nm has been chosen.

Specific values and allocations of this variation will be defined in individual applications.

The wavelength variation is determined by mainly two factors. First, the laser manufacturer is allowed a wavelength variation around the nominal wavelength in order to achieve a higher yield and/or relax fabrication tolerances. Second, the use of uncooled lasers will cause the wavelength to change with temperature within the specified temperature range of the laser.

## **Appendix II**

ITU-T Rec. G.983.3 (March 2001) defines the wavelength allocation for video distribution signals multiplexed with B-PON. ITU-T Recs J.185 and J.186 (February 2002) define the wavelength allocation for transferring multi-channel television signals.





## SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
<b>Series G</b>	<b>Transmission systems and media, digital systems and networks</b>
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure and Internet protocol aspects
Series Z	Languages and general software aspects for telecommunication systems

