

International Telecommunication Union

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**G.984.5**  
**Amendment 1**  
(10/2009)

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

Digital sections and digital line system – Optical line  
systems for local and access networks

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Gigabit-capable passive optical networks (G-PON):  
Enhancement band

**Amendment 1**

Recommendation ITU-T G.984.5 (2007) –  
Amendment 1



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## **Recommendation ITU-T G.984.5**

### **Gigabit-capable passive optical networks (G-PON): Enhancement band**

#### **Amendment 1**

##### **Summary**

Amendment 1 to Recommendation ITU-T G.984.5 defines the specifications for the "WDM1r" and "WDM1rn" devices, and also provides some direction regarding the deployment of such filters.

##### **Source**

Amendment 1 to Recommendation ITU-T G.984.5 (2007) was agreed on 9 October 2009 by ITU-T Study Group 15 (2009-2012).

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## **Recommendation ITU-T G.984.5**

### **Gigabit-capable passive optical networks (G-PON): Enhancement band**

#### **Amendment 1**

##### **1) Changes to Appendix I**

*Modify the appendix to read:*

#### **Appendix I**

##### **Example of WDM1 and WDM1r characteristics**

(This appendix does not form an integral part of this Recommendation)

The WDM1 filter that is described in the main text of this Recommendation can have several configurations depending on whether the video overlay service or the optical fault access (OTDR) is provided. Furthermore, the interface to the NGA system may utilize two fibres so as to reduce the internal loss of the NGA optical subsystem. This appendix presents several examples of the filter characteristics.

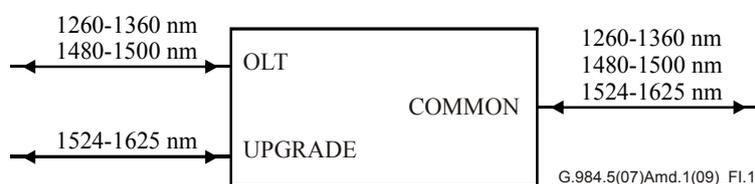
The first example given of a WDM1 filter was defined in the first consented version of this Recommendation (released in September 2007). It is hereby deprecated, as the wavelength plan for NGA systems has become incompatible with its definition. We retain its description below for historical reference.

The subsequent examples of filters are termed "WDM1r" to signify that they are revised specifications that reflect the consented newer wavelength plan for NGA systems. There are two examples of the NGA interface: a single-fibre NGA interface, and a dual-fibre NGA interface. There are four examples of added wavelength service ports: none, Video, OTDR, and video + OTDR. There are two upstream wavelength plans for the G-PON interface that allow coexistence with NGA. All the combinations (16) of these interfaces are possible.

Table I.1 shows sample parameters of the deprecated WDM1 filter that combines (downstream) and isolates (upstream) the G-PON up/down signals and enhancement band. Figure I.1 shows the reference diagram of WDM1.

**Table I.1 – Parameters for WDM1 (deprecated)**

Specification	Value
Loss without connectors – G-PON wavelength span	< 0.7 dB (1260-1500 nm)
Loss without connectors for enhancement bands	< 1.0 dB (1524-1625 nm)
Isolation – COM – OLT (1524-1625 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – UPGRADE (1480-1500 nm, 1260-1360 nm)	> 30 dB
Max optical power	+23 dBm
Return Loss	> 50 dB
Directivity	> 50 dB
NOTE 1 – The wavelength range of 1524-1530 nm should not be used by NGA downstream signals.	
NOTE 2 – The specification of WDM1 in the range of 1625-1660 nm for applications such as inserting an OTDR signal onto the PON is for future study.	

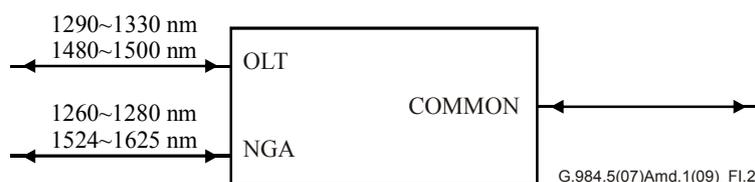


**Figure I.1 – Reference diagram of WDM1 (deprecated)**

Table I.2 shows sample parameters of the single-fibre WDM1r filter that combines (downstream) and isolates (upstream) the G-PON up/down signals and NGA bands. Figure I.2 shows the reference diagram of the single-fibre WDM1r.

**Table I.2 – Parameters for a single-fibre WDM1r**

Specification	Value
Loss without connectors – G-PON wavelength span	< 0.8 dB (1290-1330 nm and 1480-1500 nm)
Loss without connectors for enhancement bands	< 1.0 dB (1260-1280 nm and 1524-1625 nm)
Isolation – COM – G-PON OLT (1260-1280 nm and 1524-1625 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – NGA OLT (1480-1500 nm, 1290-1360 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Max optical power	+23 dBm
Return Loss	> 50 dB
Directivity	> 50 dB

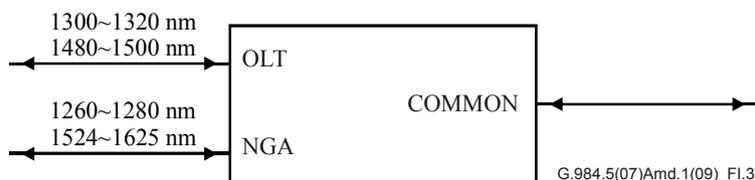


**Figure I.2 – Reference diagram of a single-fibre WDM1r**

Table I.3 shows sample parameters of the single-fibre WDM1rn filter that combines (downstream) and isolates (upstream) the G-PON up/down signals and NGA bands. The WDM1rn can be used when all of the G-PON ONUs comply with the narrow upstream wavelength option. Figure I.3 shows the reference diagram of the single-fibre WDM1rn.

**Table I.3 – Parameters for a single-fibre WDM1rn**

Specification	Value
Loss without connectors – G-PON wavelength span	< 0.8 dB (1300-1320 nm and 1480-1500 nm)
Loss without connectors for enhancement bands	< 1.0 dB (1260-1280 nm and 1524-1625 nm)
Isolation – COM – G-PON OLT (1260-1280 nm and 1524-1625 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – NGA OLT (1480-1500 nm, 1300-1360 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Max optical power	+23 dBm
Return Loss	> 50 dB
Directivity	> 50 dB

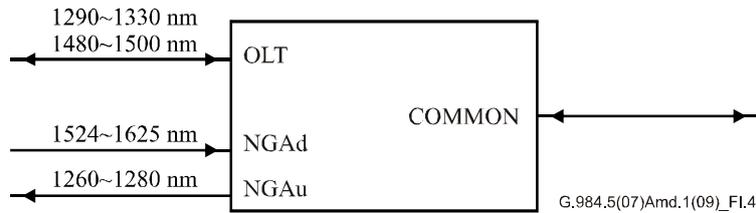


**Figure I.3 – Reference diagram of a single-fibre WDM1rn**

Table I.4 shows sample parameters of the dual-fibre WDM1r filter that combines (downstream) and isolates (upstream) the G-PON up/down signals and NGA bands. Figure I.4 shows the reference diagram of the dual-fibre WDM1r.

**Table I.4 – Parameters for a dual-fibre WDM1r**

Specification	Value
Loss without connectors – COM – G-PON	< 0.8 dB (1290-1330 nm and 1480-1500 nm)
Loss without connectors – COM – NGAd	< 0.8 dB (1575-1581 nm)
Loss without connectors – COM – NGAu	< 0.8 dB (1260-1280 nm)
Isolation – COM – G-PON OLT (1260-1280 nm and 1524-1625 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – NGAd OLT (1480-1500 nm, 1260-1360 nm)	N/A
Isolation – COM – NGAu OLT (1480-1625 nm, 1290-1360 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Max optical power	+23 dBm
Return Loss	> 50 dB
Directivity	> 50 dB

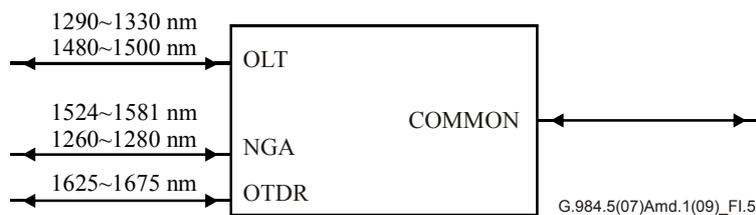


**Figure I.4 – Reference diagram of a dual-fibre WDM1r**

Table I.5 shows sample parameters of a single-fibre WDM1r filter supporting OTDR capability. The wavelength range assumed for the OTDR is referred to in ITU-T L.66. Note that the wavelength range of the NGAd port changes with the presence of this optional ports. Figure I.5 shows the reference diagram of this filter.

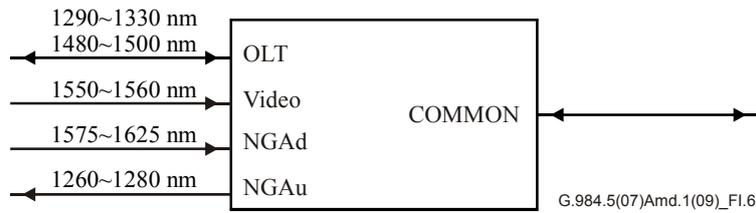
**Table I.5 – Parameters for a single-fibre WDM1r with OTDR port**

Specification	Value
Loss without connectors – G-PON bands	≤ 1.0 dB (1290-1330 nm and 1480-1500 nm)
Loss without connectors for NGA bands	≤ 1.2 dB (1260-1280 nm and 1524-1581 nm)
Loss without connectors for OTDR band	≤ 1.1 dB (1600 + nm)
Isolation – COM – NGA OLT (1260-1280 nm and 1524-1581 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – G-PON OLT (1480-1500 nm, 1290-1360 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – OTDR (1625-1675 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Max optical power for G-PON or NGA ports	+23 dBm
Max optical power for OTDR port	FFS
Return Loss	> 50 dB
Directivity	> 50 dB



**Figure I.5 – Reference diagram of a WDM1r with OTDR support**

Figure I.6 shows the reference diagram of the dual-fibre WDM1r with video support. The detailed example specifications for this filter are for future study.

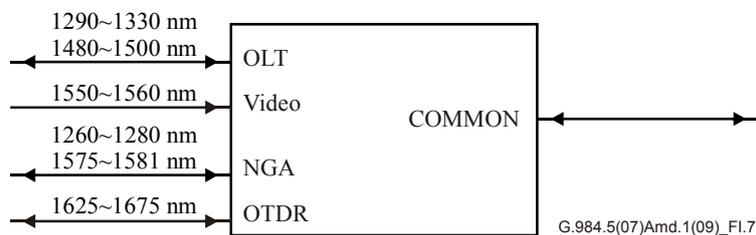


**Figure I.6 – Reference diagram of a dual-fibre WDM1r with video support**

Table I.6 shows sample parameters of a single-fibre WDM1r filter supporting OTDR and video capability. Note that the wavelength range of the NGA port changes with the presence of the optional ports. Figure I.7 shows the reference diagram of this filter.

**Table I.6 – Parameters for a single-fibre WDM1r with video and OTDR port**

Specification	Value
Loss without connectors – G-PON bands	≤ 1.0 dB (1290-1330 nm and 1480-1500 nm)
Loss without connectors for NGA bands	≤ 1.5 dB (1260-1280 nm and 1575-1581 nm)
Loss without connectors for OTDR band	≤ 1.1 dB (1625-1675 nm)
Loss without connectors for RF video band	≤ 1.7 dB (1550-1560 nm)
Isolation – COM – NGA OLT (1260-1280 nm and 1575-1581 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – G-PON OLT (1480-1500 nm, 1290-1360 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – OTDR (1625-1675 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Isolation – COM – RF video (1550-1560 nm)	TBD (> 30 dB (higher values may be required depending on the application))
Max optical power for G-PON or NGA ports	+23 dBm
Max optical power for OTDR port	FFS
Max optical power for RF video port	+23 dBm
Return Loss	> 50 dB
Directivity	> 50 dB



**Figure I.7 – Reference diagram of a WDM1r with video and OTDR support**





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