

WDM MUX/DEMUX Channel Spacing Standards - Official Technical Overview & Hardware Datasheet

WDM MUX/DEMUX CHANNEL SPACING STANDARDS - OFFICIAL TECHNICAL OVERVIEW & HARDWARE DATASHEET

EXECUTIVE SUMMARY

This document provides a comprehensive technical overview of the Wavelength Division Multiplexing (WDM) Multiplexer/Demultiplexer (MUX/DEMUX) product family, with a specific focus on the critical parameter of channel spacing. As the foundation of modern Dense Wavelength Division Multiplexing (DWDM) and Coarse Wavelength Division Multiplexing (CWDM) systems, channel spacing directly dictates system capacity, reach, and spectral efficiency. This datasheet details the industry-standard channel spacing configurations, including 100 GHz, 50 GHz, and 200 GHz grids, alongside CWDM's 20 nm spacing, and outlines the hardware implementations, performance metrics, and compliance certifications for our carrier-grade optical networking modules.

Designed for seamless integration into high-capacity backbone, metro, and access networks, our WDM MUX/DEMUX solutions deliver unmatched optical performance, thermal stability, and low insertion loss, ensuring reliable wavelength routing across diverse fiber infrastructures.



ARCHITECTURE & CHASSIS DESIGN

The WDM MUX/DEMUX modules are engineered upon a passive, optical-circuit-based architecture, ensuring zero-latency signal processing and robust signal integrity. The chassis designs are optimized for high-density deployment within 1RU and 2RU standard 19-inch racks, as well as compact standalone enclosures for remote or space-constrained locations. The core architectural components include:

- Optical Input/Output Ports: Industry-standard LC/UPC or SC/UPC connectors, supporting bidirectional transmission over single-mode fiber (SMF).
- Thin-Film Filter (TFF) or Arrayed Waveguide Grating (AWG) Technology: For channel spacing of 100 GHz and 50 GHz, AWG technology is predominantly

employed due to its superior temperature stability, low insertion loss, and ability to achieve high channel counts (up to 96 channels on the 50 GHz grid). CWDM modules utilize TFF technology, providing robust performance over a wide temperature range with relaxed chromatic dispersion requirements.

- Integrated Monitoring Port (optional): A dedicated optical tap providing a 1% or 5% signal monitor output for Optical Spectrum Analyzers (OSA) or power meters.

- Passband Characteristics: Ultra-flat passbands with a -0.5 dB bandwidth exceeding 50% of the channel spacing (e.g., >50 GHz for a 100 GHz grid), ensuring minimal signal distortion and high tolerance to laser wavelength drift over temperature and lifetime.

The compact, robust chassis design incorporates efficient passive cooling via an optimized heat-sink aluminum extrusion profile, allowing operation in extended temperature ranges (-5°C to $+70^{\circ}\text{C}$) without the need for active cooling, which contributes to a high Mean Time Between Failures (MTBF) exceeding 500,000 hours.

HARDWARE FEATURES

Our WDM MUX/DEMUX hardware is distinguished by several key features that set the benchmark for optical networking reliability and performance.

1. Channel Spacing Precision: The modules are available in three primary grid variants:

- 100 GHz (0.8 nm) DWDM Grid: Supports up to 48 channels on the ITU-T G.694.1 standard grid, ideal for long-haul and regional applications. Typical insertion loss is < 5.5 dB, with channel isolation > 25 dB.

- 50 GHz (0.4 nm) DWDM Grid: Enables high-capacity transmission with up to 96 channels. Features low insertion loss (< 6.5 dB) and adjacent channel isolation > 30 dB, making it perfect for metro core and data center interconnect (DCI).

- 200 GHz (1.6 nm) DWDM Grid: Optimized for ultra-long-haul links requiring high Optical Signal-to-Noise Ratio (OSNR), with a lower channel count (up to 24 channels) and even lower insertion loss (< 4.0 dB).

- CWDM Grid: Utilizes a 20 nm channel spacing (1271 nm to 1611 nm, 18 channels) as per ITU-T G.694.2, providing a cost-effective solution for shorter reach distances (up to 80 km) with uncooled lasers.

2. Thermal and Wavelength Stability: The modules are fabricated with temperature-insensitive materials and packaging. Over the operating temperature range, the central wavelength drift is maintained at $< \pm 0.05$ nm for DWDM and $< \pm 1$ nm for CWDM, ensuring full compliance with grid specifications.

3. Environmental Hardening: All modules feature a ruggedized metal housing with a hydrophobic, anti-reflective coating on optical interfaces, complying with Telcordia GR-1221-CORE and GR-1209-CORE reliability standards. The housing is available in an optional white powder-coated finish for high-corrosion or industrial environments.

COMPLIANCE & STANDARDS

The WDM MUX/DEMUX product line is fully compliant with the following critical industry standards:

- ITU-T G.694.1: Spectral grids for WDM applications (DWDM).
- ITU-T G.694.2: Spectral grids for WDM applications (CWDM).
- Telcordia GR-1221-CORE: Generic reliability assurance for passive optical components.
- Telcordia GR-1209-CORE: Generic requirements for passive optical components.
- RoHS 2011/65/EU: Restriction of hazardous substances.
- REACH: Registration, evaluation, authorization, and restriction of chemicals.
- IEC 61753-1: Performance standard for optical components.

All components undergo rigorous testing for thermal cycling, humidity, vibration, and mechanical shock to guarantee 100% performance integrity.

TECHNICAL SPECIFICATIONS

The hardware leverages a passive optical design with no moving parts, resulting in extremely low power consumption (typically < 500 mW). The following is a summary of the core hardware capabilities:

- Operating Wavelength Range: DWDM: 1525 nm to 1565 nm (C-band) / 1570 nm to 1610 nm (L-band). CWDM: 1260 nm to 1625 nm.
- Channel Passband: 100 GHz: >50 GHz; 50 GHz: >22 GHz; 200 GHz: >100 GHz; CWDM: +/- 6.5 nm.
- Polarization Dependent Loss (PDL): < 0.3 dB.
- Return Loss: > 45 dB.
- Directivity: > 55 dB.
- Maximum Optical Input Power: 500 mW (27 dBm).

Parameter	Specification
Form Factor	1RU / 2RU Rackmount or Standalone Compact Chassis
Channel Spacing Options	DWDM: 100 GHz, 50 GHz, 200 GHz;

	CWDM: 20 nm
Insertion Loss	DWDM 100 GHz: < 5.5 dB; DWDM 50 GHz: < 6.5 dB; CWDM: < 2.0 dB
Channel Isolation	Adjacent: > 25 dB (100 GHz), > 30 dB (50 GHz); Non-Adjacent: > 45 dB
Operating Temperature	-5°C to +70°C (Extended version: -40°C to +85°C)
Power Supply	Passive; No external power required (except optional active monitoring)
MTBF	> 500,000 hours (Telcordia SR-332)

ORDERING OPTIONS

Our WDM MUX/DEMUX modules are available in a wide array of configurations to suit specific network design requirements. Standard ordering options include:

- Channel Count: 4, 8, 16, 24, 32, 40, 48, or 96 channels (dependent on spacing).
- Channel Spacing: 100 GHz, 50 GHz, 200 GHz (DWDM) or 20 nm (CWDM).
- Configuration: MUX, DEMUX, or MUX/DEMUX pair (bi-directional).
- Connector Type: LC/UPC, LC/APC, SC/UPC, or SC/APC.

- Fiber Type: 0.9 mm, 2.0 mm, or 3.0 mm pigtails, with length options of 1 m or 2 m.
- Chassis Form Factor: 1RU 19-inch rackmount (with sliding rails), 2RU 19-inch rackmount, or standalone compact metal box.
- Optional Features: Integrated optical monitor port (1% tap), integrated attenuator, or integrated optical switch (1x2).

Custom wavelengths, special channel plans, and OEM-badging are available upon request with a typical lead time of 4-6 weeks.

