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Digital Transport

Prisma IP™ Wavelength-Selected RPT Ring Interface Cards for ITU DWDM and CWDM Optical Networks

Description

Rapid growth in the fiber optics transport industry has created a situation where the demand for optical fiber bandwidth is growing faster than new fiber can be installed. One way to respond to this increased demand is to use wavelength division multiplexing (WDM) to enable multiple optical layer signals to share one physical fiber. Two popular formats are to incorporate CWDM (coarse wavelength division multiplexing) or DWDM (dense wavelength division multiplexing) technologies to greatly increase the data carrying capacity of a single optical fiber.

CWDM RPT I/O Card

ITU DWDM RPT I/O Card

The Prisma IP™ Resilient Packet Transport (RPT) Ring I/O card is the main optical transceiver interface between the Prisma IP chassis and the optical transport network. Each RPT Ring I/O card contains a laser for transmitting the packet data to an adjacent node and an optical receiver (photodetector) for receiving the packet data from the adjacent node. Two of these Ring I/O cards are required in each Prisma IP M-Series or C-Series chassis for the implementation of a RPT Ring.

The Prisma IP RPT Ring I/O cards are available with wavelength-selected lasers and high-sensitivity optical receivers specifically designed for CWDM or DWDM applications. The CWDM RPT Ring I/O card will permit the carriage of 8 wavelengths per fiber, and the DWDM RPT I/O card will permit the carriage of 48 wavelengths per fiber, increasing the available bandwidth from 2.5 Gbps to as much as 120 Gbps per fiber.

Features

- CWDM versions utilize inexpensive uncooled lasers and optical multiplexing devices
- DWDM versions compatible with ITU 100 GHz DWDM channel spacing
- Port Status LEDs to monitor laser performance and optical receive performance
- Laser maximum dispersion limits of 80 km, 100 km, or 170 km

Applications

- CWDM versions are for cost-effective, multi-wavelength metro applications (<80 km)
- DWDM versions are for high-density wavelength division multiplexing (24-48 per fiber)
- DWDM versions are also useful for traversing very long distances between nodes (100-170 km)

Coarse Wavelength Division Multiplexing (CWDM) Applications

The Prisma IP CWDM RPT I/O cards incorporate CWDM transceivers. CWDM technology is based upon an optical channel spacing that is much wider than DWDM systems (20 nm versus 1.6 nm). Since the optical channel spacing is wider, it is not necessary to utilize a thermoelectric cooler to ensure the CWDM laser's stability. In addition, the filtering characteristics of the passive optical CWDM multiplexer and demultiplexer components are much less critical (and less expensive).

The availability of CWDM RPT Ring I/O cards makes it possible to offer a multi-wavelength optical transport solution at much lower cost point than for conventional ITU DWDM systems. The disadvantages of the CWDM lasers are that they cannot be used with EDFAs (erbium doped fiber amplifers), and that they do not have the narrower optical line characteristics to permit long span lengths between nodes. However, for short-reach (<80 km) urban multi-wavelength architectures, the CWDM cards would be a more cost-effective network solution than the DWDM versions.

The CWDM RPT Ring I/O cards are offered in 8 standard CWDM wavelengths. By equipping each Prisma IP chassis with unique wavelength CWDM RPT I/O cards, up to eight 2.5 Gbps RPT signals may be placed on a single fiber with 20 nm spacing between optical carriers.

Dense Wavelength Division Multiplexing (DWDM) Applications

The Prisma IP DWDM RPT I/O cards incorporate wavelength-selected lasers based upon the ITU recommendation for DWDM systems. DWDM technology is based upon an optical channel spacing that is much narrower than CWDM systems (1.6 nm versus 20 nm). Since the optical channel spacing is narrower, it is critical to ensure correct inter-channel spacing between optical carriers. It is necessary to utilize a thermoelectric cooler in the laser to ensure the DWDM laser's stability. Due to the narrower channel spacing, the filtering characteristics of the passive optical DWDM multiplexer and demultiplexer components are more critical.

The availability of DWDM RPT Ring I/O cards makes it possible to offer a multi-wavelength optical transport solution at higher optical carrier densities than for conventional or CWDM systems. The DWDM RPT Ring I/O cards can be used with EDFAs (erbium doped fiber amplifers) to increase the maximum distance between active RPT nodes. The lasers used in the DWDM RPT Ring I/O cards have the narrow linewidth and low chirp characteristics to permit longer span lengths between nodes.

The ITU DWDM RPT Ring I/O Cards are offered in three different dispersion limit classifications. For metro applications, the 100 km DWDM RPT Ring I/O version is available for use in high-density, un-amplified applications with up to 100 km between active RPT nodes. For longer distance applications, there is a 170 km version available that can be used in conjunction with EDFAs to permit construction of longer distance spans between active RPT nodes.

Each of the three dispersion classes of lasers is available in up to 24 different optical wavelengths. These wavelengths are compatible with the ITU recommended DWDM channels and spacings. By equipping each Prisma IP chassis with unique wavelength RPT I/O cards, up to 24 2.5 Gbps RPT signals may be placed on a single fiber with 200 GHz spacing.

Specifications

Electrical and Optical Specifications

	CWDM 80 km	ITU DWDM 100 km	ITU DWDM 170 km
Laser Type	Direct Modulated Uncooled Isolated DFB Laser	Direct Modulated Isolated DFB Laser w/ integrated TEC cooling	Direct Modulated Isolated DFB Laser w/ integrated TEC cooling
Optical Output Power	0 dBm, ± 0.5 dB	0 dBm, ± 0.5 dB	+7 dBm, ± 0.5 dB
Available Wavelengths (see Ordering Info)	8 CWDM standard wavelengths from 1470 nm to 1610 nm	24 ITU DWDM wavelengths from 1530.33 nm to 1567.13 nm	24 ITU DWDM wavelengths from 1530.33 nm to 1567.13 nm
Wavelength Spacing	20 nm	200 GHz	200 GHz
Wavelength Stability	± 6 nm for 20 nm channel operation	± 140 pm for 100 GHz channel operation	± 140 pm for 100 GHz channel operation
Dispersion Performance	>1400 ps/nm	>1800 ps/nm	>3000 ps/nm
Dispersion Penalty for maximum reach and 3.125 Gbps	3 dB at 80 km	3 dB at 100 km	3 dB at 170 km
Dispersion Penalty for maximum reach and 2.5 Gbps	2 dB at 80 km	2 dB at 100 km	2 dB at 170 km
Dispersion Penalty for maximum reach and 1.25 Gbps	1 dB at 80 km	1 dB at 100 km	1 dB at 170 km
Receiver Type	High Sensitivity Avalanche Photodiode Detector (APD)	High Sensitivity Avalanche Photodiode Detector (APD)	High Sensitivity Avalanche Photodiode Detector (APD)
Receiver Minimum Optical Input Level (Sensitivity Threshold)	-29 dBm for $3x10^{-11}$ BER	-29 dBm for $3x10^{-11}$ BER	-29 dBm for $3x10^{-11}$ BER
Receiver Maximum Optical Input Level (Overload Point)	-7 dBm max.	-7 dBm max.	-7 dBm max.
Connector Type	SC/UPC Duplex	SC/UPC Duplex	SC/UPC Duplex
Power Consumption at-48V DC	< 5.5 watts	< 7.7 watts	< 7.7 watts

Specifications, continued

General Specifications

Data Rates	
Supported Line/Data Rates	3.125 Gbps Line Rate for 2.5 Gbps Data Rate 2.5 Gbps Line Rate for 2.0 Gbps Data Rate 1.25 Gbps Line Rate for 1.0 Gbps Data Rate
Status Monitoring and Control	
Local Monitoring and Control	Front Panel LEDs and SysCon Command Line Interface (CLI)
Remote Monitoring and Control	SysCon CLI Access via Telnet EMS Client/Server with Graphical User Interface (GUI) SysCon SNMP Traps to Network Manager
Status LEDs	
POWER	Green
TX (Laser Output Port Status)	Multicolor Red/Orange/Green, flashing Red = Laser Fail or Out of Lock Green = Normal Operation
RX (Optical Receiver Port Status)	Multicolor Red/Orange/Green, flashing Red = No or Low Optical Input Orange = Received Bit Errors Occuring Green = Normal Operation – No Errors
Physical Specifications	
Dimensions	Double-Width Prisma IP RPT I/O Card Slot (rear)
Storage Temperature	-40°C to 70°C / -40°F to 158°F
Operating Temperature	0° to 50°C / 32° to 122° F *(extended operation above 40° C / 104° F not recommended)*
Operating Humidity	5 to 85% non-condensing
Operating Altitude	Up to 4,000 meters
Agency Compliance	
Safety	UL60950, CSA-C22.2 No.950, EN60950/A4 EN60825-1, EN60825-2
Emissions	FCC Part 15B Class A, IECS-003 Class A EN55022 Class A for M chassis EN55022 Class B for C chassis EN61000-3-2 for C chassis EN300 386 clause 7.1 for M chassis EN300 386 clause 7.2 for C chassis
Immunity	EN55024, GR-1089-CORE EN300 386 clause 7.1 for M chassis EN300 386 clause 7.2 for C chassis

Ordering Information

The RPT Ring I/O card for CWDM applications is available with lasers in eight possible wavelengths or “channels”. Please consult the table below for the correct part number for your application.

CWDM Channel Number	Wavelength (nm)	Part Number 80 km CWDM
1	1610	753062.1610
2	1590	753062.1590
3	1570	753062.1570
4	1550	753062.1550
5	1530	753062.1530
6	1510	753062.1510
7	1490	753062.1490
8	1470	753062.1470

The RPT Ring I/O card for DWDM or Long Reach applications is available with lasers of three different dispersion penalty specs and up to 24 wavelengths or “channels”. Please consult the table below for the correct part number for your application.

ITU DWDM Channel Number	Wavelength (nm)	Part Number 100 km DWDM	Part Number 170 km DWDM
13	1567.13	753061.13	753060.13
15	1565.50	753061.15	753060.15
17	1563.86	753061.17	753060.17
19	1562.23	753061.19	753060.19
21	1560.61	753061.21	753060.21
23	1558.98	753061.23	753060.23
25	1557.36	753061.25	753060.25
27	1555.75	753061.27	753060.27
29	1554.13	753061.29	753060.29
31	1552.52	753061.31	753060.31
33	1550.92	753061.33	753060.33
35	1549.32	753061.35	753060.35
37	1547.72	753061.37	753060.37
39	1546.12	753061.39	753060.39
41	1544.53	753061.41	753060.41
43	1542.94	753061.43	753060.43
45	1541.35	753061.45	753060.45
47	1539.77	753061.47	753060.47
49	1538.19	753061.49	753060.49
51	1536.61	753061.51	753060.51
53	1535.04	753061.53	753060.53
55	1533.47	753061.55	753060.55
57	1531.90	753061.57	753060.57
59	1530.33	753061.59	753060.59

Ordering Note: The DWDM RPT Ring I/O cards are currently offered with lasers in 200 GHz channel increments only (odd channel numbers) for compatibility with commonly available DWDM multiplexers and demultiplexers. The lasers in this product are actually specified to operate in a 100 GHz channel spacing DWDM environment. Please consult the Digital Transport Applications Engineering group for information about special ordering even channel (100 GHz) lasers if your application requires them.

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