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7100 Nano ROADM

Compact ROADM-on-a-Blade with Colorless/Directionless Add/Drop Options

As the demand for cloud, video, and data center interconnect services drives significant bandwidth growth, creates less predictable traffic patterns, and requires faster wavelength provisioning, network operators have implemented ROADM as the optical layer technology of choice for flexible and scalable transport networks. Addressing the need for ROADM technology in metro/regional networks, Coriant offers a comprehensive ROADM solution with the compact, flexible, and future-proof Coriant® 7100 Nano™ Packet Optical Transport Platform.

The 7100 Nano ROADM solution includes highly integrated ROADM-on-a-blade modules that support colorless/directionless add/drop options. In addition to ROADM, the 5RU 7100 Nano supports a wide range of intelligent services modules in six full size slots, including high-density 10G and 100G transponders and muxponders/ADMs and packet switching, OTN switching, and SONET/SDH switching modules. Furthermore, the innovative Coriant® Pluggable Optical Layer provides options for amplified and unamplified Fixed Optical Add/Drop Multiplexer (FOADM) networks using DWDM and CWDM technology.

COMPACT, INTEGRATED ROADM-ON-A-BLADE

The 7100 Nano supports up to eight ROADM degrees with 88 channels leveraging a compact ROADM-on-a-blade design that integrates key functions including a broadcast and select Wavelength Selective Switch (WSS), input amplifier, output amplifier, optical channel power monitoring (OCM), and OSC into a single module. ROADM-on-a-blade options include a single slot eight degree module, enabling six ROADM degrees in a single 5RU 7100 Nano shelf, and a cost-effective four degree double slot module.

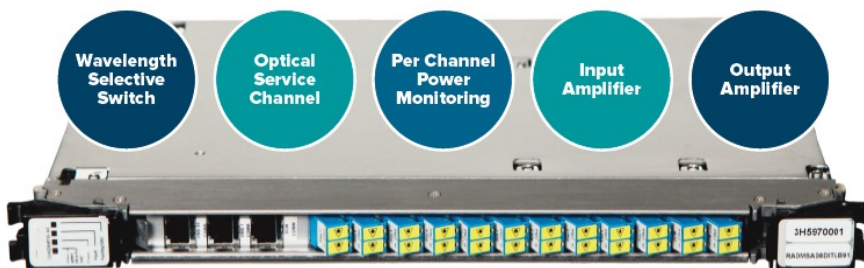


Figure 1: 7100 Nano ROADM-on-a-blade

BENEFITS OF THE CORIANT® 7100 NANO ROADM

- **Minimizes operational costs** with reduced footprint and power consumption, simplified installation, and automatic wavelength balancing
- **Accelerates provisioning** for new wavelengths with simplified planning while eliminating the need to visit intermediate nodes
- **Reduces new wavelength CapEx** with optical express that virtually eliminates the need for expensive OEO regens in metro/regional networks
- **Maximizes network availability** with integrated per channel power monitoring, an integrated OTDR option, and Layer 0 restoration with directionless and colorless/directionless add/drop options
- **Prepares for the future** with the ability to add/drop any wavelength at any node along with support for up to 8 degrees and up to 88 channels of 10G or 100G+

With half the number of expensive WSS components per degree relative to a route and select architecture, the 7100 Nano ROADM-on-a-blade broadcast and select architecture has advantages in terms of cost effectiveness, power consumption, and the ability to support optical broadcast for applications such as video distribution. In addition to reduced footprint and power, the Coriant ROADM solution also minimizes optical layer OpEx with automatic power balancing and per channel equalization enabled by the integrated OCM and the ability of the WSS to attenuate individual channels. OpEx is further reduced with simplified planning enabled by the flexible add/drop and pass-through of ROADM, simplified cabling facilitating quick and easy installation, and a minimal number of parts simplifying sparring.

Eight Degree OADM88-8DS

Targeted for applications that require more than four degrees, the lowest footprint, or directionless/colorless add/drop, the OADM88-8DS-xR provides up to 88 channels and up to eight degrees and is available in three different versions based on the type of integrated amplifiers. The OADM88-8DS-IR consists of a single stage amplifier that supports spans from 0 dB to 18 dB gain excluding DCM losses, the OADM88-8DS-LR supports spans from 14 dB to 26 dB while the OADM88-8DS-ER supports spans from 25 dB to 35 dB. The OADM88-8DS has one DWDM line port, one DCM port, two auxiliary ports to the patch panels, seven expansion ports to the other seven ROADM degrees and three RJ45 ports for OMD and DCM inventory. The line port of the OADM88-8DS is interoperable with the two-slot OADM88-4D module.

Four Degree OADM88-4D

Providing the most cost-effective ROADM-on-a-blade option, the OADM88-4D-xR is a two-slot module, supporting up to 88 channels and four degrees and is available in the same three versions based on input amplifiers: IR, LR, and ER. The OADM88-4D has one DWDM link port, one DCM port, two auxiliary ports to the patch panels, and three expansion ports to the other three ROADM degrees and three RJ45 ports for OMD and DCM inventory.

ROADM-on-a-Blade Internal Architecture

As shown in the Figure 2 OADM88-4D-LR/ER example, the signal in the ingress direction comes in from the line and first passes through a filter, which drops the 1510 nm OSC signal, and then enters the input amplifier, which compensates for losses incurred on the span. In the case of the LR and ER versions, as shown in Figure 2, the amplifier is a mid-stage EDFA that compensates for DCM losses, while in the case of the IR version, it is a single stage EDFA. The signal then passes through a series of splitters, which send it toward the OMD filters for drop and to the other three OADM88s (for a four degree ROADM, as shown in Figure 2) or seven OADM88s (for an eight degree ROADM). In the egress path, the add signal from the add/drop structure is combined and added to the 4x1 or 8x1 WSS together with the express channels from the other three (four degree ROADM) or seven (eight degree ROADM) OADM88s. The WSS then selects the appropriate source for each channel, balances them, and sends these signals to the output amplifier, which compensates for losses in the OADM88. The OSC channel is added before all of the channels egress the line port.

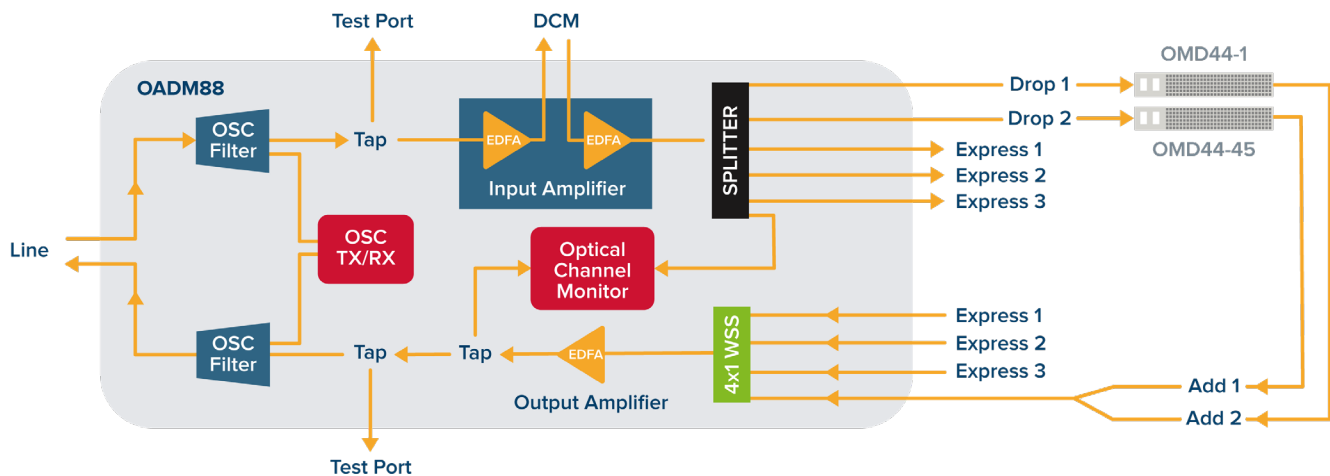


Figure 2: OADM88-4D-LR/ER Internal Architecture

FLEXIBLE ADD/DROP OPTIONS INCLUDING COLORLESS AND DIRECTIONLESS

The 7100 Nano ROADM solution provides flexible add/drop options including colored/directional, colored/directionless, and colorless/directionless. While colored/directional add/drop provides the most cost-effective option, drivers for directionless and colorless/directionless include SDN and ASON/GMPLS enabled restoration, SDN use cases such as network defragmentation and service assurance, and faster provisioning with preinstalled cards.

Cost-effective Colored/Directional Add/Drop

Using any of the two ROADM-on-a-blade modules (four degree or eight degree) along with the OMD44 patch panels, the 7100 Nano supports colored/directional add/drop. The OMD44-1 supports add/drop of channels 1–44, while the OMD44-45 supports channels 45–88. The OMD44s are based on a 50 GHz AWG filter with an offset filter to block the channels being sent to the other OMD44, thus avoiding the need for an interleaver/de-interleaver in the ROADM-on-a-blade. Starting with only a single OMD44 patch panel, it is possible to add/drop 44 wavelengths, then in the case of future traffic expansion, a second OMD44 patch panel can be added to support add/drop of the full 88 wavelengths, thereby enabling a pay-as-you-grow option.

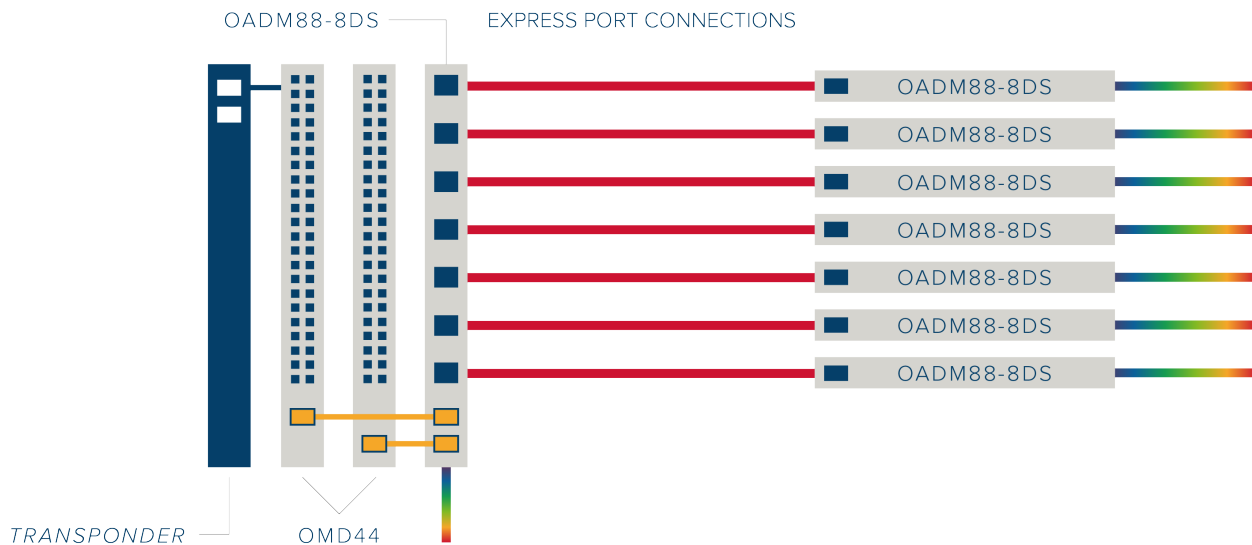


Figure 3: Colored/Directional Add/Drop with the OMD44s

Colored/Directionless Add/Drop

The 7100 Nano ROADM solution also supports colored/directionless add/drop using the eight degree ROADM-on-a-blade module, two slot DXOADM module, and the OMD88, an 88 channel mux/demux patch panel. In the receive direction, the OMD88 multiplexes the port module signals and sends them to the DXOADM. The DXOADM splits the optical signal into up to seven directions and distributes them through the express ports of each OADM88-8D-xR in the network element. In the other direction, the DXOADM receives express port signals from the OADM88-8D-xRs and sends the signals to the OMD88 for distribution to the appropriate port modules. This configuration enables up to 88 transponders to connect to up to seven degrees within the network element. Up to two DXOADMs can be supported per 7100 Nano with each one reducing the number of ROADM degrees by one.

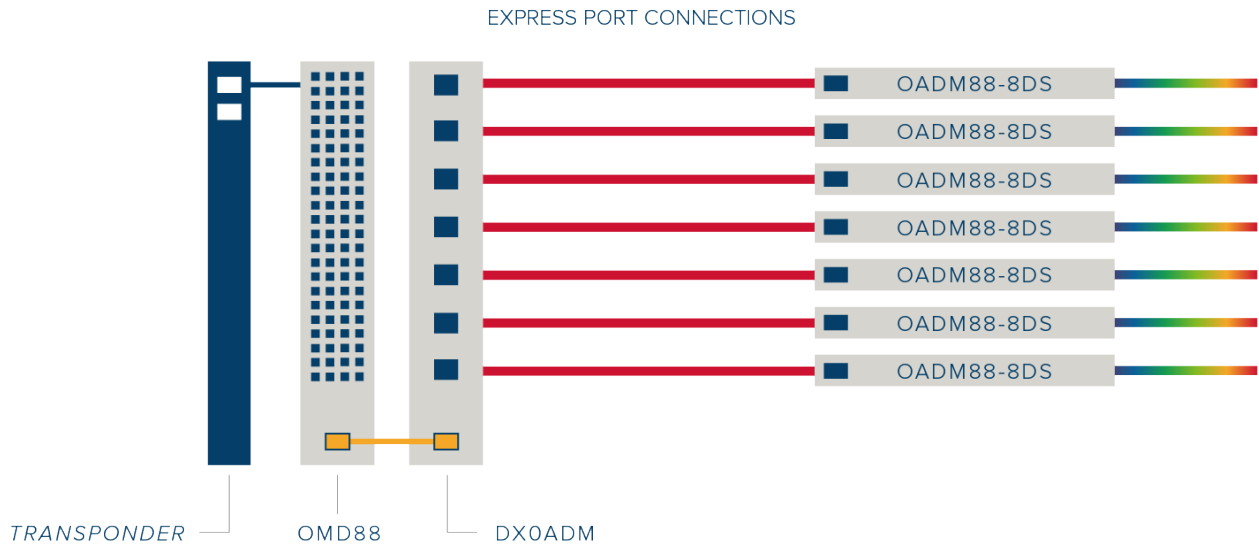


Figure 4: Colored/Directionless Architecture

Colorless/Directionless Add/Drop

Using the eight degree ROADM-on-a-blade module, CX-16U colorless module, and the DXOADM directionless, the 7100 Nano ROADM solution supports colorless/directionless functionality. The CX-16U provides 16 colorless add/drop ports using twin 16x1 WSS. Interface modules can be connected directly to each of these 16 ports. Alternatively, up to five coherent colorless add/drops can be supported per CX-16U add/drop port with the 5:1 OPSC (Optical Power Splitter/Combiner) enabling a total of 80 coherent colorless add/drops per CX-16U. The 5:1 OPSC can also be used for low cost, low port count colorless/directionless coherent add/drop by connecting it directly to the DXOADM in place of the CX-16U or OMD88.

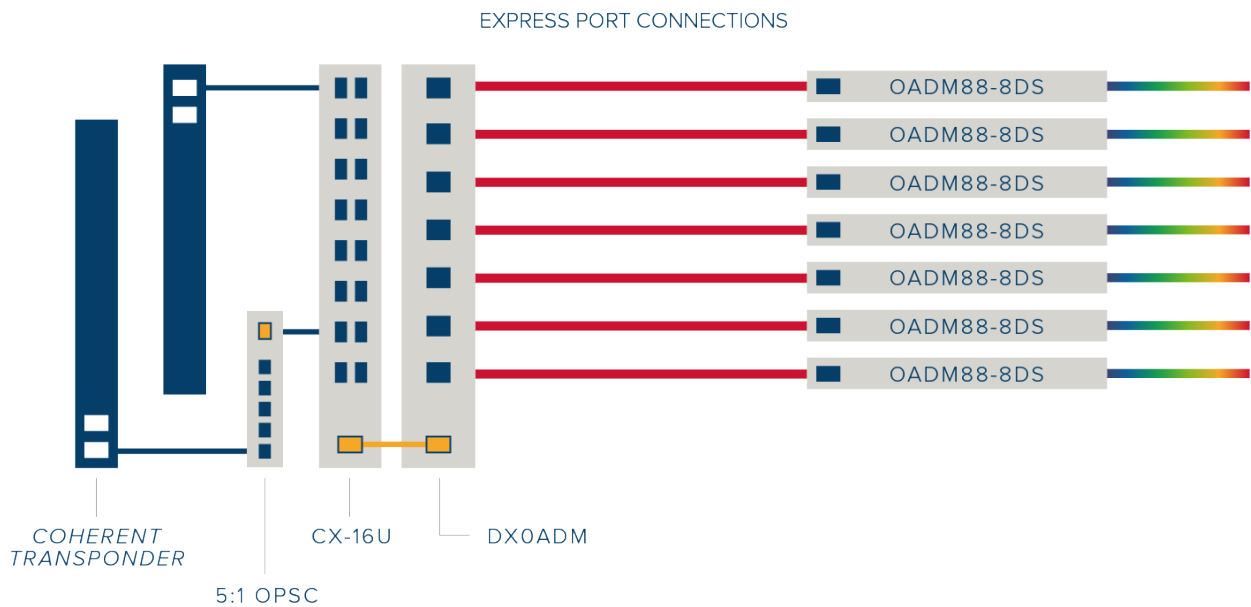


Figure 5: Colorless/Directionless Architecture with 5:1 OPSC, CX-16U, DXOADM, and OADM88

COMPACT, INTEGRATED OTDR FOR FAST FAULT LOCATION AND FIBER TESTING

An integrated OTDR option enables fiber cuts to be quickly located, fiber testing before commissioning or after a cut, intrusion detection, and fiber trend analysis. Based on the OFP1 form factor of the Pluggable Optical Layer, the O1OTDR supports both in-service and out-of-service OTDR on up to 16 fibers (i.e., 8 bi-directional degrees) and is housed in the OFP1 slot of the Pluggable Optical Carrier Card (POCC). It can be used on EDFA-only spans as well as hybrid EDFA/Raman spans. It supports measurements with resolution down to as little as 1 meter over distances of approximately 100 kilometers, with the graphical display of OTDR data supported in both the Coriant Transcend™ Software Suite and from a standalone OTDR viewer. In order to support in-service operation, it operates at 1625 nm in the L-band and therefore requires a filter cable to separate this from the C-band, which is used for the DWDM channels.

EXTENDED REACH OPTIONS WITH EXTERNAL RAMAN AND BOOSTER AMPLIFIERS

Complementing the integrated EDFA input and output amplifiers of the OADM88 ROADM-on-a-blade modules, externally mounted 1RU Raman and booster amplifiers enable the solution to support spans in excess of 35 dB, including up to 49 dB with the full 88 channels or up to 55 dB with a reduced channel count. The 7100 Nano System Processor Module (SPM-N) can act as a management gateway to these external amplifiers simplifying remote management of these devices.

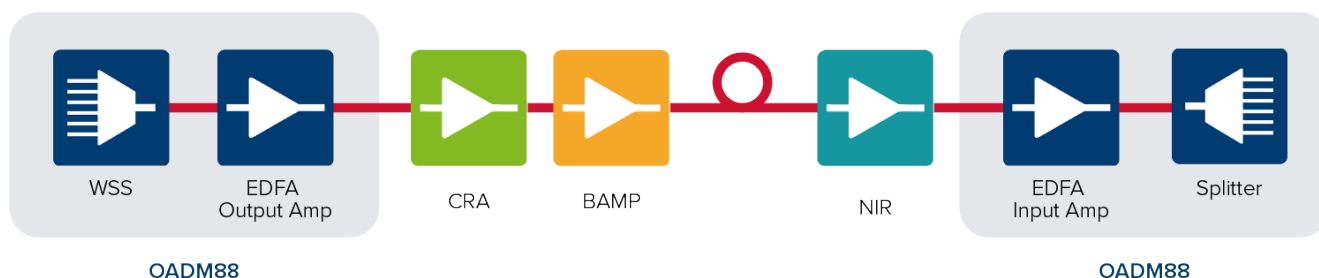


Figure 6: External Raman and Booster Amplifiers in a long span

Network Interface RAMAN (NIR)

The 1RU NIR is a counter-propagating Raman amplifier installed in the span receive path as a pre-amplifier. It provides an additional 700 mW of optical power to the signal received from the span and a typical gain of 14.5 dB to the C-band.

Booster Amplifier (BAMP)

The 1RU BAMP is an erbium doped fiber amplifier (EDFA) acting as a post-amplifier to provide between 6 dB and 9 dB (selectable) of additional gain to the signal from the OADM88. Two BAMPs can be cascaded for even more gain.

Co-Propagating Raman Amplifier (CRA)

The 1RU CRA is a 700 mW co-propagating Raman amplifier that acts as a post-amplifier to provide additional optical power to the span in the transmit direction. The CRA provides a typical gain of 10.8 dB to the C-band and 9.5 dB to the OSC.

TECHNICAL SPECIFICATIONS

OADM88-8DS-xR

- Single slot module
- Up to 6 modules (slots 1 to 6) in a 7100 Nano main shelf
- Up to 88 channels, up to 8 degrees
- Single integrated card includes: WSS, Input Amplifier, Output Amplifier, OSC, OCM
- Automatic Transmit Power Shutdown (ATPS), Automatic Power Reduction (APR), and Automatic Gain Control (AGC)
- Supported Span Losses:
 - OADM88-8DS-IR: 0 dB to 18 dB (excluding DCM loss)
 - OADM88-8DS-LR: 14 dB to 26 dB
 - OADM88-8DS-ER: 24 dB to 35 dB
- Supports directionless and colorless/directionless configurations
- Typical Power Consumption:
 - OADM88-8DS-IR: 46.1 W
 - OADM88-8DS-LR: 39.6 W
 - OADM88-8DS-ER: 44.8 W

OADM88-4D-xR

- Two slot module
- Up to 2 modules (slots 1 & 2 and/or 4 & 5) in a 7100 Nano main shelf
- Up to 88 channels, up to 4 degrees
- Single integrated card includes: WSS, Input Amplifier, Output Amplifier, OSC, OCM
- Automatic Transmit Power Shutdown (ATPS), Automatic Power Reduction (APR), and Automatic Gain Control (AGC)
- Supported Span Losses:
 - OADM88-4D-IR: 0 dB to 18 dB (excluding DCM loss)
 - OADM88-4D-LR: 14 dB to 26 dB
 - OADM88-4D-ER: 24 dB to 35 dB

- Typical Power Consumption:
 - OADM88-4D-IR/LR: 40 W
 - OADM88-4D-ER: 45 W

DXOADM

- Two slot module
- Enables colored/directionless add/drop with OMD88
- Enables colorless/directionless add/drop with CX-16U and/or 5:1 OPSC
- Contains WSS, Optical Splitter, and Input and Output Amplifier
- Up to 2 modules (slots 1 & 2 and/or 4 & 5) in a 7100 Nano main shelf
- Typical Power Consumption: 34 W

CX-16U

- Single slot module
- Enables colorless/directionless add/drop with DXOADM
- 16 add/drop ports per module
- Each add/drop port can support one interface directly or five coherent interfaces with 5:1 OPSC
- Contains twin 16x1 WSS
- Up to 4 modules (slots 2, 3, 5, and 6) in a 7100 Nano main shelf or 6 modules (slots 1 to 6) in a 7100 Nano port shelf
- Typical power consumption: 26 W

OMD88

- 2RU External add/drop patch panel
- Passive AWG filter
- Supports colored/directionless add/drop with DXOADM (and OADM88-8DSs)
- 88 add/drop ports
- RJ45 Interface for inventory management
- Dimensions: 88.9 mm H x 434.5 mm W x 166.2 mm D

- Mounted vertically in a six-inch or ten-inch spacer panel or horizontally in any empty 2RU space on the rack

OMD44-x

- 1RU External add/drop patch panel
- Passive AWG filter with integrated offset filter
- Supports colored/directional add/drop when connected to OADM88 ROADM-on-a-blade modules
- OMD44-1: Channels 1–44
- OMD44-45: Channels 45–88
- RJ45 Interface for inventory management
- Dimensions: 43.2 mm H x 439.1 mm W x 166.7 mm D
- Mounted vertically in a six-inch spacer panel or horizontally in any empty 1RU space on the rack

5:1 OPSC

- Half width unit: Up to two 5:1 OPSC modules can be mounted in 1RU 7100 DCM shelf
- Passive 5 to 1 Splitter/Combiner card
- Each 5:1 OPSC enables five colorless coherent add/drop ports when connected to a single CX-16U add/drop port or the DXOADM
- Dimensions: 44.5 mm H x 215.90 mm W x 162.05 mm

O1OTDR

- Optical Time Domain Reflectometer at 1625 nm
- In-service and out-of-service operation
- 16 Ports (8 bi-directional degrees)
- 0 to 100 km; Accuracy to 1 m
- OFP1 form factor
- Housed in the OFP1 slot of Pluggable Optical Carrier Card (POCC)

TECHNICAL SPECIFICATIONS

NIR

- 1RU External Amplifier Unit
- Counter-Propagating Raman Amplifier
- 3 Raman pumps with 700 mW pump power
- Signal Wavelength Range: 1529 – 1565 nm (C-band)
- Target Signal Gain under ideal conditions for G.652 (SMF) fiber: 14.5 dB
- Typical OSC Gain (G.652 Fiber @ 1510 nm): 9.5 dB
- Automatic Power Reduction (APR) and Automatic Gain Control (AGC)
- Management: 100M RJ45 Ethernet Port, RS232 Port, SNMP, 7191 Craft Station, Embedded Browser-based Craft Station
- Redundant fans, replaceable filters
- Redundant -48V DC Power Feeds
- Typical Power Consumption: 37 W
- Dimensions: 43.4 mm H x 447.2 mm W x 286.0 mm D

BAMP

- 1RU External Amplifier Unit
- EDFA Booster Amplifier
- Optical gain for C-band Signals: 6 dB to 9 dB
- OSC Booster Amplifier: Boosts OSC to 12 dBm—15 dBm
- Automatic Power Reduction (APR) and Automatic Gain Control (AGC)
- Management: 100M RJ45 Ethernet Port, RS232 port, SNMP, 7191 Craft Station, Embedded Browser-based Craft Station
- Redundant Fans, Replaceable Filters
- Redundant -48V DC Power Feeds
- Power Consumption: 38 W (Typical)
- Dimensions: 43.4 mm H x 447.2 mm W x 286.0 mm D

CRA

- 1RU External Amplifier Unit
- Co-propagating Raman Amplifier with 700 mW pump power
- Signal Wavelength Range: 1529 – 1565 nm (C-band)
- Signal Gain under ideal conditions for G.652 (SMF) fiber with 17 dBm input power: 10.8 dB
- OSC Gain (G.652 fiber @ 1510 nm): Up to 9.7 dBm
- Automatic Power Reduction (APR) and Automatic Gain Control (AGC)
- Management: 100M RJ45 Ethernet Port, RS232 Port, SNMP, 7191 Craft Station, Embedded Browser-based Craft Station
- Redundant Fans, Replaceable Filters
- Redundant -48V DC Power Feeds
- Power Consumption: 37 W (typical)
- Dimensions: 43.4 mm H x 447.2 mm W x 286.0 mm D

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