

# Infinera Groove (GX) Series G30 – Open Line System

*Flexible Metro OLS with Compact Pluggables and Open ROADM*

With benefits including reduced vendor lock-in, faster innovation, and competitive pricing throughout the network lifecycle, leading to lower CapEx and OpEx, optical network disaggregation is being embraced by a wide range of network operators, decoupling transponder/muxponder and optical line system purchasing decisions. At the same time, following the Groove (GX) Series G30’s lead, the devices used for this optical disaggregation have evolved to compact modular form factors with slot-based architectures that provide the flexibility to mix different types of sleds and evolve between technology generations within a common platform. The GX G30 Open Line System enables network operators to address a wide range of metro/DCI applications, saving on cost, space, and power by selecting only the optical layer functions required at the time of purchase, with the investment protection of being able to add new functions as needed later.

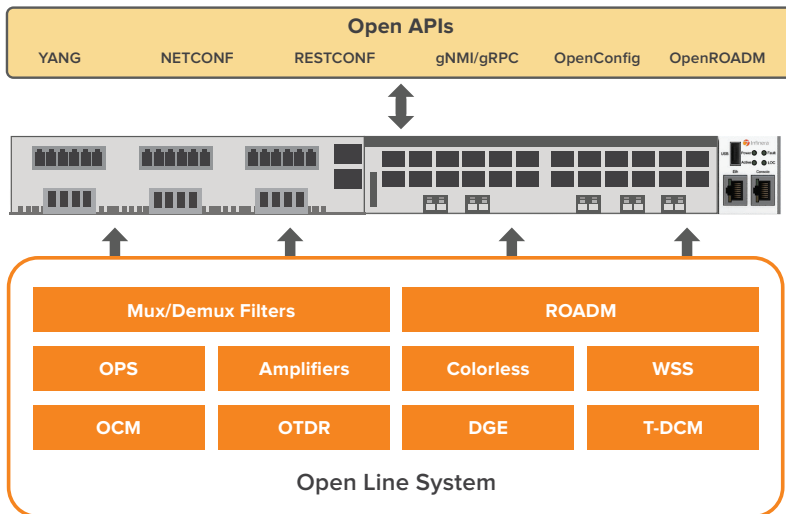


Figure 1: The GX G30 Open Line System

## FLEXIBLE COMPACT MODULAR PLATFORM FOR NETWORK DISAGGREGATION

Part of the GX Series of compact modular platforms, the GX G30 is a 1RU compact modular system that can be supported in 19”, 21”, and 23” racks with 600 mm or greater depth. It supports redundant AC or DC power supplies, redundant fans with front-to-back airflow, and a field-replaceable controller. It has four slots and supports a range of single-slot and double-slot hot-swappable sleds for muxponder and open line system applications.

### BENEFITS OF THE GX G30 OLS

- **Avoid** vendor lock-in with Open ROADM compliance, open APIs, and support for both Infinera and third-party transponders/muxponders
- **Minimize** footprint with two ROADM degrees in a single rack unit and a range of compact optical layer pluggables
- **Save** on CapEx with the ability to select only the functionality needed and avoid paying for unwanted features
- **Future-proof** line system investments with the ability to add functionality with new pluggables as your needs evolve
- **Reduce** operational costs and speed service delivery with automation enabled by RESTCONF/NETCONF open APIs and gNMI/gRPC streaming telemetry



Infinera GX G30 OLS

The GX G30 supports a wide range of optical layer functions, including variable gain amplifiers, OTDR, optical protection switching (OPS), optical channel monitoring (OCM), optical supervisory channel (OSC), tuneable dispersion compensation (T-DCM), eight-channel DWDM filters, eight- and 16-channel colorless add/drop, dynamic gain equalization, and 1 x 4 WSS in the compact OFP2 form factor of Infinera's innovative Pluggable Optical Layer. Up to three of these OPF2s can be housed in the double-slot OCC-2 sled. A nine-degree ROADM with integrated amplifiers, OCMs, and Open ROADM-compliant OSC is available as a double-slot sled, as are 48- and 96-channel mux/demux filters. ROADM add/drop options include colored-directional, colorless-directional, and colorless-directionless. 64-channel 75 GHz and 48-channel 100 GHz mux/demux filters are also available as 2RU external units. Leveraging these functions, the GX OLS can address metro/DCI applications including point-to-point, chain, and ring topologies, as well as mesh ROADM.

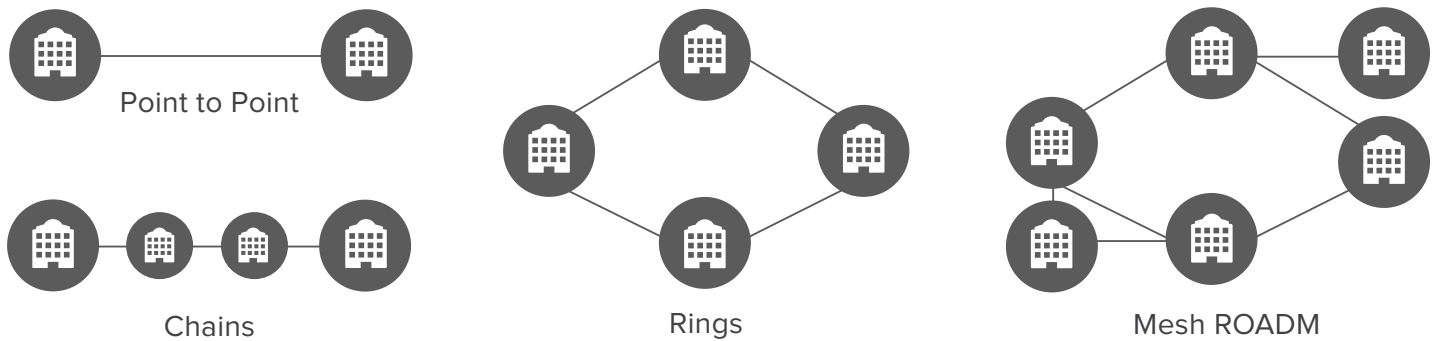


Figure 2: Groove OLS metro applications

## OPEN LINE SYSTEM SLEDS

### OCC-2 OFP2 Carrier Sled

The dual-slot OCC-2 is a carrier sled for up to three OFP2 optical layer pluggables. Up to two OCC-2s can be supported in the GX G30. This sled also provides two SFP cages and a one-wire communications interface for inventory management of external passive equipment (i.e., OMD64C).



### Nine-degree ROADM Sled

The dual slot RD09SM is a fully integrated nine-degree broadcast-and-select ROADM-on-a-sled with a single 1 x 9 WSS. In addition to the WSS, it includes a two-port OCM, OTDR and monitor ports, a 1510-nm OSC with pluggable SFP, a variable gain pre-amplifier, and booster amplifiers. It is Open ROADM-compliant and supports spans from 0 to 27 dB. It supports fixed grid and flexible grid operation and is L-band upgradeable. It supports an extended C-band with 102 channels/5.1 THz total capacity. Colorless-directionless add/drop is supported in combination with CAD16 OFP2s.



### 48-channel and 96-channel DWDM Mux/Demux Sled

The OMD48 sled is a two-slot passive sled. It provides 48 x 100 GHz channels with 12 MTP ports and four channels (MTP12) per port. It can be used for both PAM4 direct detect and coherent applications and has a maximum insertion loss of 6 dB. The OMD96 sled is also a two-slot passive sled. It provides 96 x 50 GHz channels with 24 MTP ports and four channels (MTP12) per port. It can be used for coherent applications and has a maximum insertion loss of 8.2 dB.



## OFP2 PLUGGABLES FOR THE OCC-2

The OCC-2 supports a wide range of compact optical layer pluggables based on the CFP2-like OFP2 form factor of Infinera's innovative Pluggable Optical Layer, which has a height of 19.5 mm, a width of 50.5 mm, and a depth of 154.4 mm.

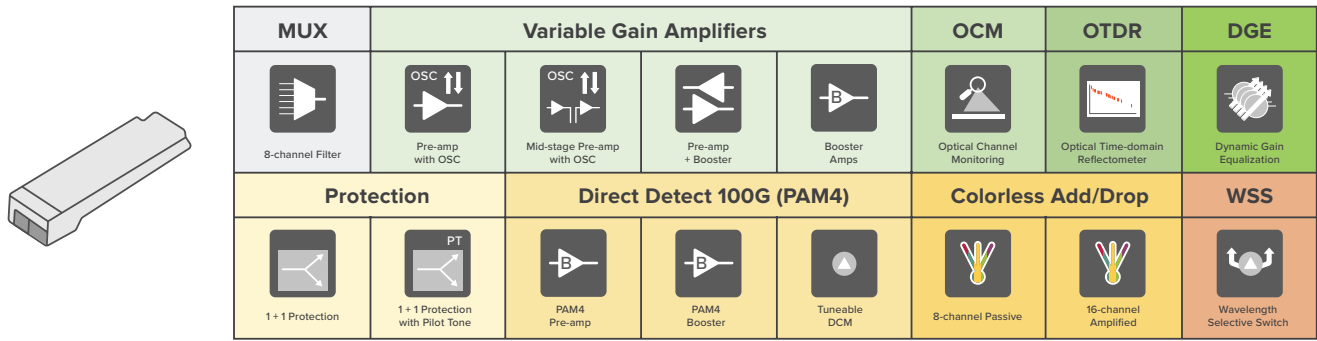


Figure 3: OFP2 optical layer pluggables

### OFP2 Variable Gain Amplifiers

Variable gain amplifiers are available in the OFP2 form factor. Available options include four pre-amplifiers with OSC (O2PAOSC, O2PAHIR, O2PAHLR, O2PAHER), two booster amplifiers (O2BAH, O2BAX), and a pre-amp plus booster (O2PABA). The four pre-amplifiers with OSC are optimized for different span losses and channel counts, while the two pre-amps plus boosters are optimized for different applications. The O2BAH booster amplifier has a gain range of 4 to 16 dB and is ideal for fixed DWDM/FOADM and high-powered coherent interfaces, including CFP2-DCO, while the O2BAX has a gain range from 10 to 22 dB and is ideal for applications including ROADM and low power coherent pluggables like 400ZR QSFP-DD.

These amplifiers support a wide range of applications, including point-to-point, chain, ring, and mesh ROADM (with 1 x 4 WSS OFP2) topologies. They can be used for terminal sites, add/drop sites, and intermediate line amplifier (ILA) sites. Up to 96 channels and span losses of up to 35 dB are supported. The OFP2 amplifiers have a maximum power consumption of between 8 and 11 W.

Equipment	Pre-amp	Mid-stage Access	Booster	Automatic Gain Control	Max Channels		Max Span Loss
					P2P	Cascade	
O2PAOSC	1			OSC	96	40	18 dB
O2PAHIR	1	✓		OSC	96	96	18 dB
O2PAHLR	1	✓		OSC	96	96	26 dB
O2PAHER	1	✓		OSC	96	96	35 dB
O2BAH			1	OSC	96	96	35 dB <sup>1</sup>
O2BAX			1	OSC	96	96	35 dB <sup>1</sup>
O2PABA	1		1		96	-	30 dB

<sup>1</sup> With pre-amplifier, span loss limited by OSC.

Table 1: OFP2 variable gain amplifiers

All these amplifiers support gain flattening filters (GFF), transient suppression control (TSC), and automatic power shutdown (APS). GFF ensures a flat gain response across the specified operating band and input power range, while TSC prevents dramatic changes in optical power from propagating. APS automatically shuts down the amplifier when the aggregate input power falls below a specified threshold. The O2BAX also provides tilt correction. OFP2 amplifiers are available with an OSC for in-band management, span loss tracking, and automatic gain control (AGC), as well as a span loss degradation shut-off feature for proactive protection switching. The O2PAHIR, O2PAHLR, and O2PAHER all provide mid-stage access, enabling a DCM to be supported without reducing the maximum span loss.

### OFP2 Amplifiers and Tuneable DCM for PAM4 100G

Beyond the variable gain amplifiers described previously, two additional OFP2 amplifiers are supported in the GX G30: the O2PAOLR high-power pre-amplifier with dual OSCs and the O2BAU high-power booster amplifier. Together with the O2TDCM tuneable dispersion compensation module, they enable support for direct detect 100G based on PAM4. Up to 96 channels are supported with spans of up to 15 dB.

## **OF2 OTDR**

The O2OTDR OF2 supports both in-service and out-of-service OTDR on up to four fibers (i.e., two bidirectional degrees). It supports measurements with resolution down to as little as 1 meter and distances of approximately 100 km. In order to support in-service operation, it operates at 1625 nm in the L-band and therefore requires a filter for separation from the C-band, which is used for the DWDM channels.

## **OF2 Optical Protection Switches**

The O2OPS OF2 provides a cost-effective option for supporting a variety of protection schemes, including 1+1 OTS, 1+1 OMS, 1+1 OCh, and 1+1 Client. It provides a single protection switch in an OF2 form factor with protection switching triggered by loss of signal (LOS). The O2OPS1PT provides a pilot tone, enabling it to be used for 1+1 OCh protection with colorless add/drop, where loss of signal cannot be used as a reliable indicator that the channel has failed.

## **OF2 Optical Channel Monitoring**

The O2OCM provides per-channel power monitoring on four ports (i.e., two degrees in two directions), and can be used to provide optical layer visibility, enabling proactive troubleshooting.

## **OF2 Eight-channel Mux/Demux Filters**

The OMD8 provides an eight-channel filter for mux/demux and add/drop applications in an OF2 form factor; it provides add/drop loss of 3.6 dB in and back-to-back express loss of 1.2dB. Two versions of the OMD8 are available: band 1 (191.7-192.4 THz) and band 2 (192.6-193.3 THz).

## **OF2 Colorless Add/Drop**

The CAD8 is an OF2 form factor pluggable splitter/combiner that enables eight colorless flexible grid add/drop ports. The CAD8E can be deployed with the CAD8 to expand the number of colorless add/drop ports per fiber to 16. The CAD16 provides 16 amplified colorless add/drop ports, also in an OF2 form factor.

## **OF2 Dynamic Gain Equalizer**

The O2DGE provides the option of dynamic gain equalization, balancing wavelength power levels, with 6.25 GHz resolution on attenuation in order to maximize reach, at sites that do not need full ROADM functionality such as intermediate line amplifiers (ILAs) and FOADMs. The O2DGE includes two OCMs. A single DGE is required for two directions (east and west).

## **OF2 Wavelength Selective Switch**

The O2W04S provides a 1 x 4 broadcast-and-select wavelength selective switch (WSS). It includes two integrated OCMs enabling bidirectional per-channel power monitoring. It supports both fixed grid and flexible grid operation. A 1610-nm OSC loopback is provided for port-side laser safety. It enables up to four ROADM degrees in a node and up to two ROADM degrees in a single rack unit. Colored-directional, colorless-directional, and colorless-directionless add/drop options are supported.

# **EXTERNAL PASSIVE EQUIPMENT**

## **DWDM Mux/Demux Units**

The OMD64C is a 2RU external unit with 64 LC ports for mux/demux, an LC port for the DWDM line, and LC power for monitoring. It provides a mux/demux filter for 64 x 75 GHz channels, ideal for high-baud-rate wavelengths from the Groove G30 CHM2T muxponder (max 72 Gbaud). The OMD48E is a 2RU external unit with 48 LC ports for mux/demux, an LC port for the DWDM line, and LC power for monitoring. It provides a mux/demux filter for 48 x 100 GHz channels, ideal for ultra-high-baud-rate optical engines including Infinera's ICE6. They both have low insertion loss of around 6 dB and provide an RJ45 port for one-wire inventory management from the USB interfaces on the OCC-2 sled.

## **Additional Passive Equipment**

The GX G30 OLS can also leverage a wide range of passive equipment from the Infinera Pluggable Optical Layer portfolio. This portfolio includes a 1RU eight-slot passive shelf with single- and dual-slot cartridges for a wide range of passive functions, including eight-channel and four-channel DWDM filters, a DWDM band mux, eight-channel and four-channel CWDM filters, an OTDR filter, and dispersion compensation modules. DWDM, CWDM, and OTDR filter are also available. For more details, see the Infinera Pluggable Optical Layer data sheet.

## LEVERAGE THE SAME PLATFORM FOR TRANSPONDER/MUXPONDER/ADM FUNCTIONS

		CHM2T	UTM2	CHM1G	CHM1	CHM2	XTM-2
Slots		2	2	1	1	2	2
Line	Wavelengths	100G-600G	100G/200G	100G/200G	100G/150G/200G	100G/150G/200G	-
	Interfaces	2 x integrated	2 x CFP2-DCO	2 x CFP2-ACO	2 x CFP2-ACO	2 x CFP2-ACO	-
	Line per GX G30	2.4 Tb/s	400 Gb/s <sup>1</sup>	1.6 Tb/s	1.6 Tb/s	800 Gb/s	-
Clients	100G/400G QSFP	12 (3 x 400 GbE)	-	-	-	-	-
	40G/100G QSFP	-	-	-	-	10 (4 x 100G, 10 x 40G, 40 x 10G)	-
	100G QSFP28	-	2	4	4	-	2
	40G/4 x 10G QSFP+	-	2	-	-	-	-
	10G SFP+	-	-	-	-	-	20
	1G/10G SFP/SFP+	-	12	-	-	-	-
Other	Encryption	✓	✓	✓	-	✓	✓
	Open ROADM FEC	-	✓	✓	-	-	-
	ADM	-	✓	-	-	-	✓
	8G/16G Fibre Channel	-	✓	-	-	✓	✓

<sup>1</sup> Each UTM2 can support 2 x 100G coherent or 1 x 200G coherent

Table 2: GX G30 muxponder sleds

The GX G30 also supports a wide range of transponder/muxponder/ADM sleds, as listed in table 2. For more details, see the Groove (GX) G30 - Muxponder data sheet.

## AUTOMATION ENABLED BY OPEN APIS AND STREAMING TELEMETRY

The Groove GX G30 OLS supports management, automation, and streaming telemetry via open interfaces. It supports WebGUI, CLI, SNMP, TACACS+, syslog and YANG-modeled NETCONF and RESTCONF APIs, and gNMI/gRPC streaming telemetry. It is OpenConfig and Open ROADM compliant. An OSPF-based DCN is supported with in-band management via OSC (or GCC0 with GX G30 Muxponders) and out-of-band management via Ethernet interfaces. Additional manageability features include zero-touch commissioning (ZTC) and the management of multiple G30 units as a single entity. The GX G30 is managed under Infinera Transcend Controller/NMS and Infinera DNA NMS.

### TECHNICAL SPECIFICATIONS

#### Groove G30 Physical Dimensions

- Height: 1RU, 44 mm, 1.73 inches
- Width: 440 mm, 17.3 in
- Depth: 510 mm, 20.1 in
- Rack installation into two- or four-post standard 19-inch, 21-inch, and 23-inch racks
- Weight: 3.2 kg/7.1 lb configuration without sleds

#### Groove G30 System Configuration and Modularity

- Four single-slot sleds
- Two dual-slot sleds
- Single-slot sleds and dual-slot sleds can be mixed within the same system

- All sleds are field replaceable and hot swappable

#### Electrical Power

- 220 V AC PSU
- 48 V DC PSU
- 240 V DC PSU
- 1:1 PSU redundancy
- Field-replaceable units

#### Cooling and Fans

- Front-to-back straight-through airflow
- 4:1 fans, field-replaceable units, indefinite operation with a single fan failure
- Filler cards required in unused slots

#### Management and Console Ports

- 2 x RJ-45 front access
- 2 x RJ-45 rear access
- 1 x USB front access
- Field-replaceable controller and SD memory card

#### Regulatory and Compliance

- RoHS-6 compliant and lead-free per Directive 2002/95/EC
- GR-3160-Core Generic Requirements for Telecommunications Data Center Equipment and Spaces
- Telcordia GR-326-Core Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies

### Regulatory and Compliance cont.

- Telcordia GR-1435-Core Generic Requirements for Multi-Fiber Optical Connectors
- Emissions: FCC Part 15 Class A, EN55022/CISPR Class A Compliant, CE Laser Safety: ANSI Class 1M, IEC Class 1M, EN 60825-1/2, 21 CFR 1040 US FDA CDR, Class 1
- Electrical Safety: UL 60950, CSA22.2 60950 and IEC 60950

### Environmental

- Operating Temperature: 0° to 40° C/32° to 104° F
- Transport and Storage: -40° to +70° C/-40° to 158° F/40°C +93% RH
- Humidity: 5% to 90% non-condensing

### Management Options

- Management and control platforms:
  - Infinera Transcend Controller
  - Infinera Transcend NMS
  - Infinera DNA NMS
- Command line interface (CLI)
- Zero-touch commissioning (ZTC)
- Syslog
- TACACS+/Radius
- WebGUI
- NETCONF
- RESTCONF
- Native YANG models
- OpenConfig
- Open ROADM
- gNMI/gRPC
- SNMP Fault and Performance Management
- OSPF-based DCN
- Multiple GX G30 units can be managed as a single entity

### OLS Service Modules/Sleds

- Dual-slot Optical Carrier Card (OCC-2) Sled
  - Two OCC-2 modules can be supported within a single Groove G30
  - 198.5 x 39.5 x 333 mm/7.8 x 1.56 x 13.1 in (W x H x D)
  - 1.5 kg/3.33 lb
  - Two SFP pluggable interfaces
  - Three OFP2 pluggable interfaces
  - Typical power consumption is 16 W for the OCC-2 without any interfaces equipped; the total power consumption will depend on the type and quantity of inserted SFP/OFP2 modules

- Example power consumption for PABA OFP2 is 5.2 W/unit typical and BAH OFP2 is 8 W/unit typical
- Dual-slot ROADM (RD09SM) Sled
  - Fully integrated nine-degree broadcast-and-select ROADM-on-a-sled
  - Single 1 x 9 WSS
  - Two-port OCM
  - OTDR and monitor ports
  - 1510 nm OSC with pluggable SFP
  - Variable gain pre-amplifier and booster amplifiers
  - Supports spans from 0 to 27 dB
  - Open ROADM compliant
  - Fixed grid and flexible grid operation
  - Extended C-band with 102 channels/5.1 THz total capacity
  - Colorless-directionless add/drop
  - L-band upgradeable
- Dual-slot Optical Multiplexer/Demultiplexer (OMD) Sleds
  - 198.5 x 39.5 x 333 mm/7.8 x 1.56 x 13.1 in (W x H x D)
  - 2.55 kg/5.67 lb
  - OMD96 – 96-channel multiplexer/demultiplexer
    - Two OMD96-2 modules can be supported within a single Groove G30
    - Coherent applications
    - Operating wavelengths: ~191.35-196.1 THz
    - Channel number: 96
    - Channel spacing: 50 GHz
    - Low insertion loss: 8.2 dB, 44 GHz 3 dB bandwidth
    - 24 MTP® ports for 96 A/D, each has four channels of TX and RX
    - 1 x dual LC connector for DWDM port, 2 x LC connector for DWDM in/out power monitor
- OMD48 - 48 channels for point-to-point applications
  - Two OMD48 modules can be supported within a single Groove G30
  - Coherent and PAM4 applications
  - Operating wavelengths: ITU standard grid C-band channels: 196.1, 196.0, 191.5, 191.4 THz
  - Channel number: 48
  - Channel spacing: 100 GHz
  - Insertion loss: 6 dB
  - Connectors: 12 MTP® connectors ports for 48 A/D, each has four channels TX and RX

- 1 x dual LC connector for DWDM port, 2 x LC connector for DWDM in/out power monitor
- Power consumption for OMD sleds is 0.8 W typical

### EDFA OFP2 Pluggable Common Specifications

- Operating ambient temperature: -5° to 50° C
- Operating relative humidity: 5% to 90% non-condensing
- Storage temperature: -40° to +70° C (GR-63-CORE)
- Physical dimensions:
  - Height: 1.99 in (50.5 mm)
  - Width: 0.77 in (19.5 mm)
  - Depth: 6.08 in (154.4 mm)
- Regulatory compliance: GR-468-CORE Generic Reliability Assurance Requirements for Optoelectronic Devices Used in Telecommunications Equipment
- Weight: 6.5 oz (0.185 kg)
- Equipped in an OCC-2 in the OFP2 slots (three per OCC-2)
- MBTF: 25 years per SR-332 (40° C, 50% electrical stress, 90% confidence interval)
- RoHS: 6/6 compliant assembly
- Automatic gain control (AGC) that maintains a constant output power to prevent far end transceiver input overload. The module maintains constant power for each channel in the aggregated optical signal according to the gain as long as the total output power does not exceed the maximum rated value.
- Automatic power shutdown when the aggregate input falls below the threshold
- Span loss degradation shut-off feature for proactive protection switching

### TDCM OFP2 Pluggable

- Supports up to 96 channels/carriers
- Application: direct detect (i.e. PAM4) line system
- Max 80 km

### OTDR OFP2 Pluggable

- Supports 4 x OTDR ports
- Each port can be used for one-direction OTDR testing

## TECHNICAL SPECIFICATIONS CONTINUED

### **OTDR OFP2 Pluggable cont.**

- Can be used for two degrees with four fibers of OTDR application
- In-service monitoring and out-of-service diagnostic

### **OPS/OPS1PT OFP2 Pluggables**

- 1+1 OTS protection: Single span and multi span (OSC presence)
- 1+1 OMS protection
- 1+1 OCh protection for both colored (OPS) and colorless add/drop (OPS1PT)
- 1+1 Client protection

### **OCM OFP2 Pluggable**

- Per-channel optical power monitoring
- Channel frequency channel monitoring

### **OMD8 OFP2 Pluggables**

- Eight-channel fixed filter multiplexer/demultiplexer
- Insertion loss: 3.6 dB (add/drop), 0.7 dB (express)
- Two versions: band 1 (191.7-192.4 THz) and band 2 (192.6-193.3 THz)

### **CAD8/CAD8E OFP2 Pluggables**

- Eight-channel coherent colorless add/drop
- Extendable to 16 channels with CAD8E

### **CAD16 OFP2 Pluggable**

- 16-channel coherent colorless add/drop
- Amplified

### **DGE OFP2 Pluggable**

- Dynamic gain equalization
- Up to two directions of equalization
- 2 x OCMs
- ILA, FOADM, and DCO P2P applications
- Supports fixed grid and flexible grid
- Automated balancing

### **WSS OFP2 Pluggable**

- Up to four-degree ROADM, with additional one degree for add/drop
- Broadcast-and-select architecture with single 1 x 4 WSS
- Supports fixed grid and flexible grid
- 2 x OCM monitor
- 1610 nm OSC loopback for port side laser safety

### **OMD64C 2RU External Unit**

- Height: 2RU, 88 mm, 3.48 inches
- Width: 482.6 mm, 19.1 inches
- Depth: 166 mm, 6.56 inches
- Channel number: 64
- Channel spacing: 75 GHz
- Operating wavelengths: 191.3625 THz (Channel 1) to 196.0875 THz (Channel 64)

- Insertion loss: ~6 dB
- Connectors: 66 x dual LC connector
- One-wire connector for inventory management

### **OMD48E 2RU External Unit**

- Height: 2RU, 88 mm, 3.48 inches
- Width: 482.6 mm, 19.1 inches
- Depth: 166 mm, 6.56 inches
- Channel number: 48
- Channel spacing: 100 GHz
- Operating wavelengths: ITU C-band 191.4 THz (Channel 1) to 196.1 THz (Channel 48)
- Insertion loss: ~6 dB
- Connectors: 50 x dual LC connector
- One-wire connector for inventory management

*\*Product features and specifications are subject to change*