MOLS 2.0

The latest Metro DCI Open Line System, MOLS 2.0 is hosted on the NCS 1014 chassis. This includes support for:

- an EDFA amplifier (NCS1K14-EDFA2) that hosts
  - an OTDR pluggable (ONS-QSFP-OTDR),
  - a coherent probe pluggable (DP01QSDD-ZT5-A1), and
  - an OSC pluggable (ONS-SC-PTP-1510), and
  - a pair of 32-channel colored add/drop passive modules
    - NCS1K-MD-32O-CE
    - NCS1K-MD-32E-CE

- EDFA2 line card, on page 1
- NCS1K-MD-32x-CE mux/demux passive patch panels, on page 30

EDFA2 line card

The new EDFA2 line card is an optical amplifier that serves as an essential component of the line system solution. It functions as a DWDM optical terminal and includes a C-band bidirectional amplifier with channel power control capabilities

This card enhances optical signal amplification along with the integration support for the Optical Supervisory Channel (OSC), Optical Time Domain Reflectometer (OTDR), and QDD Coherent Probe pluggables.

This image shows the EDFA2 optical amplifier line card.

Figure 1: NCS1K14-EDFA2 optical amplifier line card

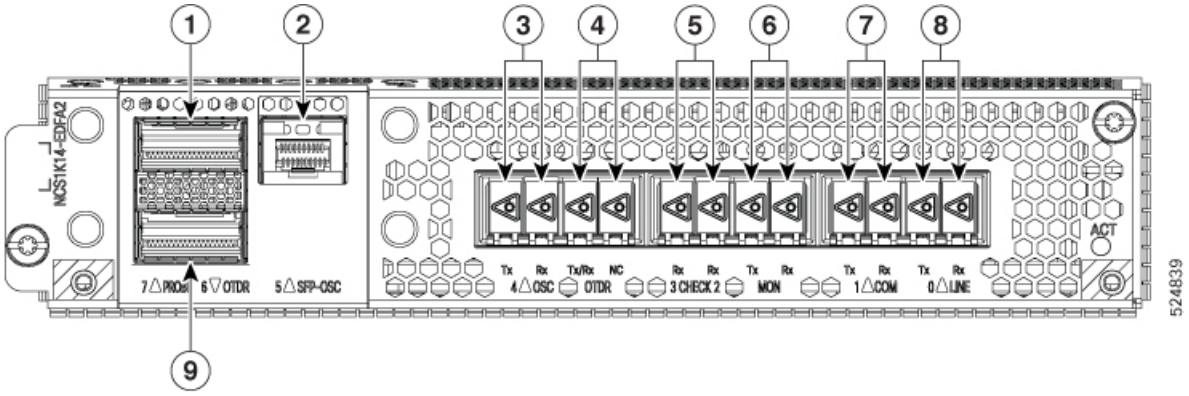

Table 1: EDFA2 line card interfaces

Callout	Connector label	Connector type	Port name
1	PROBE	LC	Coherent probe 7
2	SFP-OSC	LC	OSC port 5
3	OSC	LC	OSC TX 4
			OSC RX 4
4	OTDR	LC	OTDR TX/RX
			OTDR NC
5	CHECK	LC	CHECK RX 2
			CHECK RX 3
6	MON	LC	MON TX
			MON RX
7	COM	LC	COM TX 1
			COM RX 1
8	LINE	LC	LINE TX 0
			LINE RX 0
9	OTDR	LC	OTDR port 6

Figure 2: EDFA2 amplifier line card optical diagram

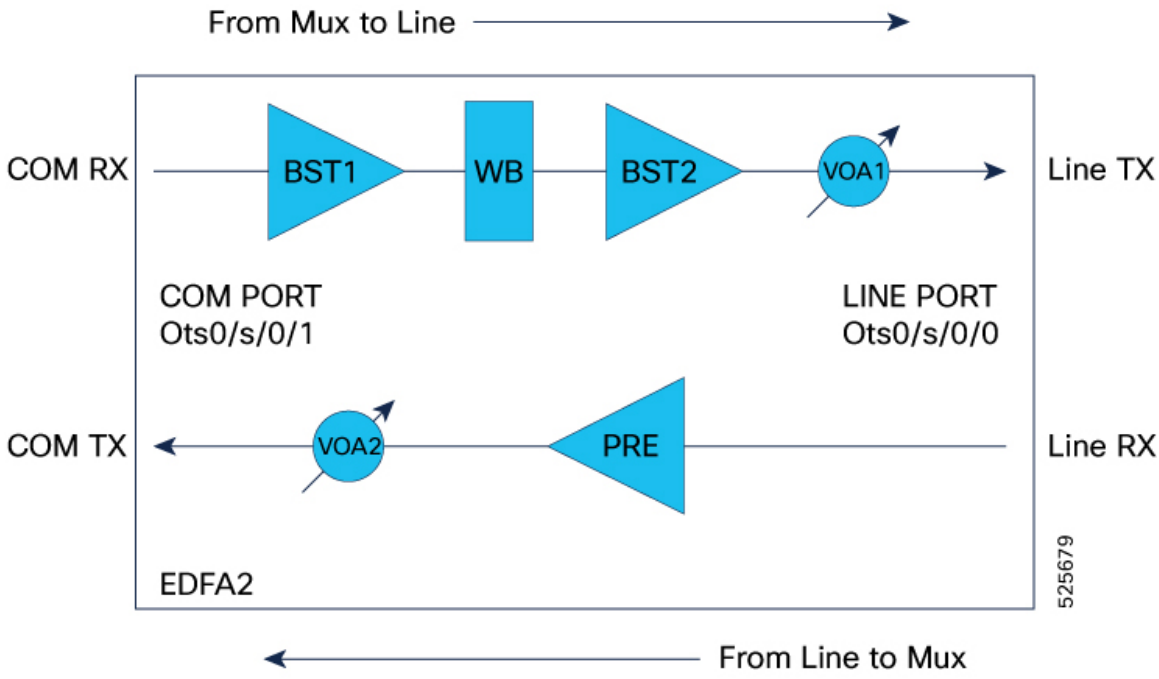

Table 2: Key components of the EDFA2 amplifier line card

Monodirectional transmitter section	Monodirectional receiver section
Path: From COM-RX port to LINE-TX port	**Path:** From LINE-RX port to COM-TX port
Components: • **Booster EDFA (BST1):** Features two switchable fixed gains. • **Wavelength Blocker (WB):** Offers flexible spectrum capability to equalize or block different sections of the C-band optical spectrum. • **Booster EDFA (BST2):** Provides true variable gain. • **Variable Optical Attenuator (VOA1):** Regulates signal power at the LINE-TX port.	**Components:** • **EDFA Preamplifier (PRE):** Offers true variable gain with two programmable gain ranges. • **Variable Optical Attenuator (VOA2):** Regulates signal power at the COM-TX port.

EDFA2 line card features

Theses are EDFA2 line card features:

- The card comprises an optical module, pluggable cages for OTDR and OSC, and a DWDM trunk interface. It features integrated management for alarms, performance monitoring, and optical power level control.

- The EDFA2 card operates with a maximum power consumption of 35W excluding QSFP-DDs and the Optical module.
- The EDFA2 card operates with a maximum power consumption of 220W including OSC, OTDR, and Coherent probe.
- For Release 25.1.1, only single-span point-to-point configurations are supported. This setup requires two nodes, each equipped with an EDFA2 card, with the span connected to their respective Line ports.

Supported modules and optical channel

The EDFA2 line card supports these modules and channel:

- ONS-QSFP-OTDR — ONS OTDR pluggable module
- DP01QSDD-ZT5-A1 — QDD coherent probe pluggable module
- ONS-SC-PTP-1510 — SFP Optical Supervisory Channel

EDFA2 controllers

Table 3: Feature History

Feature Name	Release Information	Feature Description
NCS1K14-EDFA2 Port configurations	Cisco IOS XR Release 25.1.1	The NCS1K14-EDFA2 line card is an optical amplifier card that offers OTDR, coherent probe, and OSC support to NCS 1014 networks. This card has an OTDR QDD port for initiating OTDR scan and bidirectional OTDR LC ports to test the fiber health. The probe QDD port enables optical line verification towards the NCS1K-MD-32X-CE patch panel. This card supports different datapath controllers such as: • OTS controller • OTS-OCH controller • OSC controller • Optics controller This card provides up to 796 slices at 6.25GHz spacing. The card has an internal Wave Blocker that can attenuate the optical power of provisioned channels slice by slice at 6.25 GHz. You can set up this EDFA card in flex grid mode to adapt signal amplification on each channel.

There are four types of controllers for EDFA2 card. The controllers are the OTS, OTS-OCH, OSC, and Optics controllers.

Table 4: Controller types supported on EDFA2 card

Controller types	Description
Optical Transport Section (OTS)	The OTS controller holds all the optical parameters for the OTS optical interfaces.
OTS-OCH	The OTS-OCH controller is created on the channel of the EDFA2 card using the `hw-module` command in Flex-Grid configuration.
Optical Service Channel (OSC)	The OSC controller represents the optical layer of the OSC channel. Line ports host the OSC controller.
GiabitEthernet for OSC	The OSC controller represents SFP pluggable for Optical Supervisory Channel/Gigabit Ethernet Interface.
OTDR	The OTS controller is a function or component within a system that manages the operation of an OTDR device.
Optics	The Optics controller represents Coherent Probe and SFP pluggable for Optical Supervisory Channel/Gigabit Ethernet Interface.
CoherentDSP	The Optics controller represents the QSFP DD for Coherent Probe.

EDFA2 controllers parameters

Controllers holds all the optical parameters for the optical interfaces. The optical interface has different capabilities depending on its hardware components such as photodiode, VOA, amplifier, and OCM.

OTS controller:

The OTS controller is created by default when you bring up the EDFA2 line card. In the EDFA2 line card, the OTS controller is supported on the LINE and COM optical ports. OTS controllers associated to LINE and COM optical ports will be in the form of:

- LINE: controller Ots 0/<slot-id>/0/0 where slot-id is 0…3
- COM: controller Ots 0/<slot-id>/0/1 where slot-id is 0…3
- CHECK:
  - controller Ots 0/<slot-id>/0/2 where slot-id is 0…3
  - controller Ots 0/<slot-id>/0/3 where slot-id is 0…3

OSC controller:

The EDFA2 card includes Optical Service Channel (OSC) ports, which enable the creation of a bidirectional communication channel to connect two nodes in a DWDM network.

- controller Osc 0/<slot-id>/0/0 where slot-id is 0…3 (this represents the OSC channel towards LINE-TX)
- controller Osc 0/<slot-id>/0/4 where slot-id is 0…3 (this represents the OSC physical port towards the OSC pluggable)

Optics:

- controller optics 0/<slot-id>/0/5 where slot-id is 0…3
- controller optics 0/<slot-id>/0/7 where slot-id is 0…3

The tables list the OTS controller parameters.

Table 5: Egress LINE and COM ports OTS parameters

Parameter	Description	Applicable modules	Value	Default
egress-ampli-mode	amplifier mode	amplifier	gain mode	gain mode
egress-ampli-gain-range	amplifier gain range	amplifier	normal and extended: on ots 0/<slot-id>/0/0 only normal is supported	normal
egress-ampli-gain	amplifier gain set point	amplifier	ots 0/<slot-id>/0/0 from 12 to 27 dB ots 0/<slot-id>/0/1 from 0 to 28 dB in normal ots 0/<slot-id>/0/1 from 20 to 39 dB in extended	on ots 0/x/0/0 default gain is 17 dB on ots 0/x/0/1 default gain is 5 dB
egress-ampli-tilt	amplifier tilt set point	amplifier	-5 to 5 dB	0 dB
egress-ampli-safety-control-mode	amplifier safety mode configuration	amplifier	auto and disabled	auto
egress-ampli-osri	amplifier optical safety remote interlock	amplifier	on and off	off
egress-ampli-force-apr	amplifier automatic power reduction configuration	amplifier	on and off	off

Parameter	Description	Applicable modules	Value	Default
egress-ampli-br-high-threshold	amplifier threshold value for detection of high reflected power at the LINE TX port.	amplifier	-50 to 0 dB	-17 dB
tx-voa-attenuation	TX VOA attenuation set point	VOA	ots 0/<slot-id>/0/0 from 0 to 20 dB ots 0/<slot-id>/0/1 form 0 to 15 dB	0 dB
rx-low-threshold	threshold value for detection of power loss at the LINE and COM RX ports.	photodiode	ots 0/<slot-id>/0/0 -47 to 21 dBm ots 0/<slot-id>/0/1 -30 to 25 dBm	ots 0/x/0/0 -47 dBm ots 0/x/0/1 -30 dBm
tx-low-threshold	Threshold value for detection of power loss at the LINE and COM TX ports.	photodiode	ots 0/<slot-id>/0/0 -22 to 25 dBm ots 0/<slot-id>x/0/1 -20 to 25 dBm	-7 dBm

Table 6: LINE port OTS controller parameters

Parameter	Description	Applicable modules	Value	Default
egress-channel-slice	channel slice attenuation set point	wavelength blocker	0 to 15 dB attenuating signal 15.1 to 25 dB blocking signal	25 dB
egress-ampli-br-high-threshold	amplifier threshold value for detection of high reflected power at the LINE TX port.	amplifier	-50 to 0 dB	-17 dB

Table 7: Ingress COM port OTS controller parameters

Parameter	Description	Applicable modules	Value	Default
ingress-ampli-gain-range	amplifier gain range	amplifier	normal and extended	normal

Parameter	Description	Applicable modules	Value	Default
ingress-ampli-gain	amplifier gain set point	amplifier	normal 5 to 11 dB extended 17 to 23 dB	normal 5 extended 17
ingress-ampli-osri	enable or disable OSRI at the LINE and COM ports	amplifier	on and off	off

Table 8: CHECK port OTS controller parameters

Parameter	Description	Applicable modules	Value	Default
rx-low-threshold	threshold value for detection of power loss at the CHECK 2 and 3 ports.	photodiode	-40 to 10 dBm	-37 dBm

Table 9: Optical ports OTS controller parameters

Parameter	Description	Applicable modules	Value
OTS controller Shutdown (LINE/COM Port)	turn off all the amplifiers on that port	amplifier	shutdown and no shutdown

OTS-OCH controller

OCH controllers associated to different Optical Channels are configured with the command.

controller Ots-Och 0/<slot-id>/0/<port-id>/<ch-id>

Parameter	Description
Ots-Och controller Shutdown (OCHs)	Wavelength Blocker will be set to Not Active for the Ots-Och specific slices in the LINE TX direction, to block the channel transmission

Configure the EDFA2 line card

You can configure the EDFA2 grid mode, define channel properties, and manually set gain and attenuation parameters for various amplifier stages to achieve desired optical power levels.

The EDFA2 configuration comprises three distinct stages, each performing specific amplification and control functions:

- **Stage 1: Ingress (COM RX Port)** This stage includes the EDFA2 Booster 1 (BST1) amplifier, which operates with a fixed gain. Tasks for this stage involve setting the gain value and configuring the gain range.
- **Stage 2: Egress (LINE Port)** This stage incorporates the wavelength blocker (WB), EDFA2 Booster 2 (BST2) amplifier, and a Variable Optical Attenuator (VOA) on the LINE TX port. Tasks for this stage

include setting the gain value, configuring attenuation for WB slices, setting the EDFA2 Egress gain, adjusting TX VOA attenuation, and performing tilt adjustments.

- **Stage 3: Egress (COM TX Port)** This stage is associated with the Pre-amplifier (PRE) and a VOA on the COM TX ports. Tasks for this stage involve setting the gain value, configuring the gain range, and setting VOA attenuation.

Configure the EDFA2 grid mode and ingress amplifier settings

Use this task to configure the EDFA2 grid mode and ingress amplifier settings.

Procedure

Step 1 Configure the EDFA2 to operate in flex grid mode and define its channel properties.

Example:

```
RP/0/RP0/CPU0:ios(config)
RP/0/RP0/CPU0:ios(config)#hw-module location 0/slot/NXR0 terminal-ampli grid-mode flex channel-id
<channel_id> centre-freq <frequency_in_MHz> width <width_in_GHz>
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 2 Set up the Ingress EDFA2 (Booster 1 amplifier) by configuring its gain range and gain value.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/1 ingress-ampli-gain-range <normal|extended>
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/1 ingress-ampli-gain <gain_value_in_tenths_of_dB>
RP/0/RP0/CPU0:ios(config)#commit
```

The EDFA2 is configured for flex grid mode with the specified channel properties, and the Ingress EDFA2 (Booster 1 amplifier) gain range and value are set.

Configure the wavelength blocker for egress EDFA gain and VOA

The NCS1K14-EDFA2 line card features a Wavelength Blocker (WB), an advanced optical component designed to provide precise and dynamic management of optical signals that selectively attenuates or blocks specific wavelengths within a fiber optic signal, providing dynamic control to manage individual channels in the amplified signal. The wavelength blocker enables the selective attenuation or blocking of specific wavelengths—or channels—within a fiber optic signal.

You can set the gain for the second-stage amplifier (BST2), define attenuation values for individual Wavelength Blocker (WB) slices, and configure the VOA attenuation for the LINE TX port.

The optical spectrum operates within the C-band, spanning a frequency range of 4.975 THz (from 191.200 THz to 196.175 THz). It is divided into individual 6.25 GHz slices, numbered from 0 to 796. Each slice can be assigned a specific attenuation value to customize the channel's power profile as needed.

In Release 25.1.1, the attenuation for all slices within the channel must be set manually. In later releases, APC can be enabled to automatically manage slice attenuation, eliminating the need for manual configuration. The

specific slices involved depend on the channel's center frequency and width. In release 25.1.1, manual channel configuration is required to activate the system.

Use this task to configure the wavelength blocker.

Before you begin

Ensure you know the channel's center frequency and width.

Procedure

Step 1 Determine the width and number of slices by dividing the channel width (in GHz) by 6.25; for example, a 150 GHz channel width yields 24 slices (150 / 6.25 = 24), while a 50 GHz channel width yields 8 slices (50 / 6.25 = 8). channel width.

Step 2 Locate the channel slice. The EDFA2 can operate over the C-band with a 4.975 THz frequency range (from 191.200 THz to 196.175 THz) and a 6.25 GHz granularity (where the first slice starts at 191.200 THz), the central slice corresponds to the channel's center frequency and determines its slice range; for example, a 191.375 THz center frequency corresponds to central slice 29, covering slices 17 to 40.

Step 3 Use the command `controller Ots0/slot/0/0 egress-channel-slice` to manually configure the attenuation values for all slices covered by the channel.

Ensure that the attenuation values align with the desired channel profile.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice <slice_number> attn
<attenuation_value_in_tenths_of_dB>
RP/0/RP0/CPU0:ios#commit
```

Table 10: Sample of wavelength blocker configurations

If the channel width to be configured is..	Then..

150 GHz
• **Channel center frequency:** 191.375 THz
• **Slices involved:** 24 slices (150 / 6.25)
• **Central slice:**Slice 29
• **Slice range:** From slice 17 to slice 40
	Commands
	`RP/0/RP0/CPU0:ios(config)#hw-module location 0/slot/NXR0 terminal-ampli grid-mode flex channel-id 1 centre-freq 191.375 width 150`
	`RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 17 attn <attenuation_value>`
	`RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 18 attn <attenuation_value>`
	`...`
	`RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 40 attn <attenuation_value>`
	`RP/0/RP0/CPU0:ios(config)#commit`

If the channel width to be configured is..	Then..
50 GHz • **Channel center frequency:** 191.375 THz • **Slices involved:** 8 slices (50 / 6.25) • **Central slice:** Slice 29 • **Slice range:** From slice 25 to slice 32	**Commands** RP/0/RP0/CPU0:ios(config)#hw-module location 0/slot/NXR0 terminal-ampli grid-mode flex channel-id 1 centre-freq 191.375 width 50 RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 25 attn <attenuation_value>RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 26 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 27 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 28 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 29 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 30 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 31 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/0 egress-channel-slice 32 attn <attenuation_value> RP/0/RP0/CPU0:ios(config)#commit

Note
- Configure all slices within the channel's range for proper attenuation.
- Ensure alignment between the channel's physical parameters (center frequency and width) and the WB slice configuration.

Configure the pre-amplifier EDFA and VOA

Use this task to configure the pre-amplifier EDFA and VOA.

Procedure

Step 1 Configure the pre-amplifier EDFA gain range, gain value, and VOA attenuation.

Example:

```
RP/0/RP0/CPU0:ios(config)
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/1 egress-ampli-gain-range <normal|extended>
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/1 egress-ampli-gain <gain_value_in_tenths_of_dB>
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/1 tx-voa-attenuation
<attenuation_value_in_tenths_of_dB>
RP/0/RP0/CPU0:ios(config)#commit
```

Step 2 (Optional) Configure the low threshold for the specified receiver port.

Example:

```
RP/0/RP0/CPU0:ios(config)
RP/0/RP0/CPU0:ios(config)#controller Ots0/slot/0/X rx-low-threshold <threshold_value_in_tenths_of_dBm>
RP/0/RP0/CPU0:ios(config)#commit
```

Verify EDFA2 configuration

Use this task to verify the EDFA2 configuration.

Procedure

Step 1 Verify the ots controller parameters configured on LINE port.

Example:

```
 RP/0/RP0/CPU0:ios#sh controllers ots0/0/0/0
Wed Oct  2 16:47:19.278 UTC
  Controller State: Up
  Transport Admin State: In Service
  LED State: Green

        Alarm Status:
        -------------
        Detected Alarms: None

        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        RX-LOC = 0
        TX-POWER-FAIL-LOW = 0
        INGRESS-AUTO-LASER-SHUT = 0
        INGRESS-AUTO-POW-RED = 0
        INGRESS-AMPLI-GAIN-LOW = 0
        INGRESS-AMPLI-GAIN-HIGH = 0
        EGRESS-AUTO-LASER-SHUT = 0
        EGRESS-AUTO-POW-RED = 0
        EGRESS-AMPLI-GAIN-LOW = 0
        EGRESS-AMPLI-GAIN-HIGH = 0
        HIGH-TX-BR-PWR = 0
        HIGH-RX-BR-PWR = 0
        SPAN-TOO-SHORT-TX = 0
        SPAN-TOO-SHORT-RX = 0

        Parameter Statistics:
        ---------------------
        Total Rx Power = -4.95 dBm
        Total Tx Power = 1.97 dBm
        Rx Signal Power = -14.19 dBm
        Tx Signal Power = -5.00 dBm
        Tx Voa Attenuation = 10.0 dB

        Egress Ampli Mode = Power
        Egress Ampli Gain = 19.6 dB
        Egress Ampli Tilt = 0.0 dB

        Egress Ampli Safety Control mode = auto
        Egress Ampli OSRI = OFF
        Egress Ampli Force APR = OFF
```

```
Egress Ampli BR Power = -36.90 dBm
Egress Ampli BR Ratio = -31.90 dB

Configured Parameters:
-------------
Tx Voa Attenuation = 10.0 dB

Egress Ampli Mode = Gain
Egress Ampli Gain = 20.0 dB
Egress Ampli Power = -2.0 dBm
Egress Ampli Tilt = 0.0 dB

Egress Ampli Safety Control mode = auto
Egress Ampli OSRI = OFF
Egress Ampli Force APR = OFF
BR High Threshold = -17.0 dBm
```

Step 2 Verify the ots controller parameters configured on the COM port.

Example:

```
 RP/0/RP0/CPU0:ios#sh controllers ots0/0/0/1
Wed Oct  2 16:47:25.596 UTC

 Controller State: Up

 Transport Admin State: In Service

 LED State: Green

        Alarm Status:
        -------------
        Detected Alarms: None

        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        RX-LOC = 0
        TX-POWER-FAIL-LOW = 0
        INGRESS-AUTO-LASER-SHUT = 0
        INGRESS-AUTO-POW-RED = 0
        INGRESS-AMPLI-GAIN-LOW = 0
        INGRESS-AMPLI-GAIN-HIGH = 0
        EGRESS-AUTO-LASER-SHUT = 0
        EGRESS-AUTO-POW-RED = 0
        EGRESS-AMPLI-GAIN-LOW = 0
        EGRESS-AMPLI-GAIN-HIGH = 0
        HIGH-TX-BR-PWR = 0
        HIGH-RX-BR-PWR = 0
        SPAN-TOO-SHORT-TX = 0
        SPAN-TOO-SHORT-RX = 0

        Parameter Statistics:
        ---------------------
        Total Rx Power = -11.89 dBm
        Total Tx Power = 3.99 dBm


        Tx Voa Attenuation = 1.0 dB
        Ingress Ampli Mode = Gain
        Ingress Ampli Gain = 8.0 dB
        Ingress Ampli Gain Range = Normal
```

```
Egress Ampli Mode = Power
Egress Ampli Gain = 19.0 dB
Egress Ampli Tilt = 0.0 dB
Egress Ampli Gain Range = Normal
Egress Ampli Safety Control mode = auto
Egress Ampli OSRI = OFF
Egress Ampli Force APR = OFF
Egress Ampli BR Power = -20.20 dBm
Egress Ampli BR Ratio = -24.20 dB

Configured Parameters:
-------------
Tx Voa Attenuation = 1.0 dB
Ingress Ampli Gain = 8.0 dB
Ingress Ampli Gain Range = Normal
Egress Ampli Mode = Gain
Egress Ampli Gain = 21.0 dB
Egress Ampli Power = -5.0 dBm
Egress Ampli Tilt = 0.0 dB
Egress Ampli Gain Range = Normal
Egress Ampli Safety Control mode = auto
Egress Ampli OSRI = OFF
Egress Ampli Force APR = OFF
BR High Threshold = -17.0 dBm
```

Performance monitoring for EDFA2 card

Service providers use performance monitoring (PM) parameters to gather performance data, store it, set thresholds, and report it. This helps with early detection of network issues.

You can configure and retrieve PM counters at intervals of 30 seconds, 15 minutes, or 24 hours. These parameters simplify troubleshooting operations and increase the amount of data that can be collected directly from the equipment.

The tables list the PM counters for the OTS, OTS-OCH, OSC, Optics, CoherentDSP, and OSC optical controllers.

Table 11: PM parameters supported on OTS controller

PM parameter	Description
OPT[dBm]	Total Tx power
OPR[dBm]	Total Rx power
OPT(S)[dBm]	Tx power
OPR(S)[dBm]	Rx power
OPBR[dBm]	Back reflection
OPBRR[dB]	Back Reflection Ratio
EAGN[dB]	Egress Amplifier Gain
EATL[dB]	Egress Amplifier Tilt
IAGN[dB]	Ingress Amplifier Gain

PM parameter	Description
IATL[dB]	Ingress Amplifier Tilt

Table 12: PM parameters supported on OTS-OCH and OSC controllers

PM parameters	Description
OPT[dBm]	Total Tx power
OPR[dBm]	Total Rx power

Table 13: PM parameters supported on optics controller

PM parameter	Description
LBC[%]	Laser Bias Current
OPT[dBm]	Transmit Optical Power
OPR[dBm]	Receive Optical Power
DGD [ps]	Differential Group Delay
SOPMD[ps^2]	Second Order Polarization Mode Dispersion
OSNR[dB]	Optical Signal to Noise Ratio
PDL[dB]	Polarization Dependent Loss
PCR[rad/s]	Polarization Change Rate
RX_SIG[dBm]	Optical Signal Power
FREQ_OFF[MHz]	Frequency Offset
SNR[dB]	Signal to Noise Ratio

Table 14: PM parameters supported on CoherentDSP controller

PM parameter	Description
EC-BITS	Corrected Errored Bits
UC-WORDS	Uncorrected Codewords
PreFEC BER	PreFEC Bit Error Rate
PostFEC BER	PostFEC Bit Error Rate
Q[dB]	Q Factor
Q_Margin[dB]	Q Factor Margin

Table 15: PM parameters supported on OSC optical controller

PM parameters	Description
LBC[%]	Laser Bias Current

PM parameters	Description
OPT[dBm]	Total Tx power
OPR[dBm]	Total Rx power

OSC controller

Table 16: Feature History

Feature Name	Release Information	Feature Description
OSC support on EDFA-2 card	Cisco IOS XR Release 25.1.1	The EDFA2 card includes Optical Service Channel (OSC) ports, which enable the creation of a bidirectional communication channel to connect two nodes in a DWDM network. It includes two OSC controllers: one representing the OSC channel towards LINE-TX and the other representing the OSC physical port towards the OSC pluggable. To establish an OSC channel between two nodes, you configure the Gigabit Ethernet interface, which serves as the packet layer for the OSC channel, along with the OSPF protocol on the nodes. The OSC channel is beneficial for: • verifying fiber continuity between two nodes. • enabling remote node management. • discovering network topology. • calculating span loss. CLI commands are: • **controller Osc** *R/S/I/P* **tx-low-threshold** *value* • **controller Osc** *R/S/I/P* **rx-low-threshold** *value* • **controller Osc** *R/S/I/P* **transmit-power** *value* • **controller Osc** *R/S/I/P* **sec-admin-state { maintenance | normal }** • **controller Osc** *R/S/I/P* **shutdown**

An Optical Service Channel (OSC) is a bidirectional communication channel that connects two nodes within a DWDM network. The OSC controller is responsible for representing the optical capabilities, configuration, and monitoring of the OSC laser. Its associated Gigabit Ethernet interface acts as the packet layer of an OSC channel representing Ethernet capabilities, configuration, and monitoring.

Functions of OSC

Key functions of the OSC include:

- Providing a communication channel for traffic originating from a UDC port.
- Acting as a channel probe to verify fiber continuity between two nodes.
- Enabling remote node management.
- Discovering topology
- Calculating span loss

Operation frequency

The OSC is generated and terminated on each line side, operating at a frequency of 198.50 THz.

OSC controllers in EDFA2 card

The EDFA2 card has two OSC ports. The OSC controllers associated with the OSC optical port on the NCS1K14-EDFA2 line card are denoted as follows:

- `controller osc 0/<slot-id>/0/0` : This represents the OSC channel towards LINE-TX.
- `controller osc 0/<slot-id>/0/4` : This represents the OSC physical port towards the OSC pluggable.

Establish OSC link between two nodes

Use this task to bring up OSC link between two nodes.

Procedure

Step 1 Configure the OSC controllers on ports 0 and 4.

a) Use the controller OSC command to configure the OSC controllers on port 0 and 4.

Example:

Node 1:

```
RP/0/RP0/CPU0:ios#config t
RP/0/RP0/CPU0:ios(config)#controller Osc 0/3/0/0
RP/0/RP0/CPU0:ios(config-Osc)#description osc_line_tx_ne
RP/0/RP0/CPU0:ios(config-Osc)#commit
RP/0/RP0/CPU0:ios(config-Osc)#exit
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/4
RP/0/RP0/CPU0:ios(config-Osc)#description osc_phy_ne
RP/0/RP0/CPU0:ios(config-Osc)#no shutdown
RP/0/RP0/CPU0:ios(config-Osc)#exit
```

Node 2:

```
RP/0/RP0/CPU0:ios#config t
RP/0/RP0/CPU0:ios(config)#controller Osc 0/1/0/0
RP/0/RP0/CPU0:ios(config-Osc)#description osc_line_tx_fe
RP/0/RP0/CPU0:ios(config-Osc)#commit
RP/0/RP0/CPU0:ios(config-Osc)#exit
RP/0/RP0/CPU0:ios(config)#controller osc 0/1/0/4
RP/0/RP0/CPU0:ios(config-Osc)#description osc_phy_ne
RP/0/RP0/CPU0:ios(config-Osc)#no shutdown
RP/0/RP0/CPU0:ios(config-Osc)#commit
RP/0/RP0/CPU0:ios(config-Osc)#exit
```

Step 2 Configure the interfaces.

a) Use the interface Gigabitethernet command to configure the Gigabit Ethernet interface for the OSC link.

Example:

Node 1:

```
RP/0/RP0/CPU0:ios#config t
RP/0/RP0/CPU0:ios(config)#interface GigabitEthernet 0/3/0/5
RP/0/RP0/CPU0:ios(config-if)#description osc_ge_ne
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 192.0.2.1 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#no shutdown
RP/0/RP0/CPU0:ios(config-if)#exit
```

Node 2:

```
RP/0/RP0/CPU0:ios#config t
RP/0/RP0/CPU0:ios(config)#interface GigabitEthernet0/1/0/5
RP/0/RP0/CPU0:iso(config-if)#description osc_ge_fe
RP/0/RP0/CPU0:iso(config-if)#ipv4 address 192.0.2.20 255.255.255.0
RP/0/RP0/CPU0:iso(config-if)#no shutdown
RP/0/RP0/CPU0:iso(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
```

Step 3 Configure the OSPF process:

a) Use the **router ospf** *process-name* to enable OSPF routing.
b) Use the **distribute link-state** keyword to distribute OSPF link-state data.
c) Use the **segment-routing mpls** keyword to enable MPLS-based segment routing for the OSPF process.

This step is optional.

d) Use the **redistribute connected** keyword to advertise directly connected networks into OSPF
e) Use the **network point-to-point** keyword to configure an interface OSPF network type to point-to-point.
f) Use the **area** keyword to configure an OSPF area.

Example:

Node 1 and 2:

```
RP/0/RP0/CPU0:iso(config)#router ospf 1
RP/0/RP0/CPU0:iso(config-ospf)#distribute link-state
RP/0/RP0/CPU0:iso(config-ospf)#segment-routing mpls
RP/0/RP0/CPU0:iso(config-ospf)#network point-to-point
RP/0/RP0/CPU0:iso(config-ospf)#redistribute connected
RP/0/RP0/CPU0:iso(config-ospf)#area 0
```

Step 4 Add the configured interfaces to the OSPF area.

Example:

Node 1:

```
RP/0/RP0/CPU0:ios(config-ospf-ar)#interface GigabitEthernet0/3/0/5
RP/0/RP0/CPU0:iso(config-ospf-ar)#no shutdown
```

Node 2:

```
RP/0/RP0/CPU0:ios(config-ospf-ar)#interface GigabitEthernet0/1/0/5
RP/0/RP0/CPU0:iso(config-ospf-ar)#no shutdown
```

Step 5 Exit the OSPF area configuration mode and commit your configuration.

Example:

Node 1 and 2:

```
RP/0/RP0/CPU0:ios(config-ospf-ar-if)#exit
RP/0/RP0/CPU0:ios(config-ospf-ar)#exit
RP/0/(config-ospf)#exit
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#exit
```

Step 6 Verify OSC IP connectivity from both ends.

Example:

Node 1:

```
RP/0/RP0/CPU0:ios#ping 192.0.2.20
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.0.2.20 timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

Node 2:

```
RP/0/RP0/CPU0:ios#ping 192.0.2.1
Mon Feb 17 15:11:29.433 IST
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.0.2.1 timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

Configure OSC controller parameters

There are multiple parameters for the OSC controllers. You can configure the parameters that are required for the different configuration for an OSC controller on the NCS1K14-EDFA2 line card.

The parameters are:

- transmit-power
- sec-admin-state
- tx-low-threshold
- rx-low-threshold
- shutdown

Use this task to configure the OSC parameters:

Procedure

Use the **controller osc** *R/S/I/P* command to configure the OSC controller.

a) Use the **transmit-power** <*value*> keyword to specify the transmit-power value.

Example:

Line side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/0
RP/0/RP0/CPU0:ios(config-Osc)#transmit-power 20
Wed Feb 12 13:01:19.298 IST
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config-Osc)#commit
```

Pluggable side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/4
RP/0/RP0/CPU0:ios(config-Osc)#transmit-power -100
Wed Feb 12 13:02:16.123 IST
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config-Osc)#commit
```

Note
To ensure the protection of the OSC pluggable receiver, regardless of the configured transmit power on the OSC controller located at 0/slot-id/0/4, the maximum transmit power will be limited to -9 dBm.

b) Use the **sec-admin-state { maintenance | normal }** keyword to configure the administrative state of the controller as maintenance or normal.

Example:

Line side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/0
RP/0/RP0/CPU0:ios(config-Osc)#sec-admin-state normal
RP/0/RP0/CPU0:ios(config-Osc)#commit
```

Pluggable side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/4
RP/0/RP0/CPU0:ios(config-Osc)#sec-admin-state normal
RP/0/RP0/CPU0:ios(config-Osc)#commit
```

c) Use the **tx-low-threshold** <*value*> keyword to specify the low transmit power threshold value.

Example:

Line side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/0
RP/0/RP0/CPU0:ios(config-osc)#tx-low-threshold 20
RP/0/RP0/CPU0:ios(config)#commit
```

Pluggable side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/4
RP/0/RP0/CPU0:ios(config-osc)#tx-low-threshold 20
RP/0/RP0/CPU0:ios(config)#commit
```

d) Use the **rx-low-threshold** <*value*> keyword to specify the low receive power threshold value.

Example:

Line side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/0
RP/0/RP0/CPU0:ios(config-osc)#rx-low-threshold 50
RP/0/RP0/CPU0:ios(config)#commit
```

Pluggable side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/4
RP/0/RP0/CPU0:ios(config-osc)#rx-low-threshold 50
RP/0/RP0/CPU0:ios(config)#commit
```

e) If you want to disable the configuration of the controller, use the **shutdown** keyword.

Example:

Line side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/0 shutdown
RP/0/RP0/CPU0:ios(config)#commit
```

Pluggable side OSC port:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/3/0/4 shutdown
RP/0/RP0/CPU0:ios(config)#commit
```

Verify OSC controller configurations

Use these steps to verify various OSC controller configurations:

Procedure

Step 1 Use the **show platform** command to display node information for the NCS1K14-EDFA2 line card.

Example:

```
RP/0/RP0/CPU0:ios#show platform
Wed Feb 12 12:58:00.592 IST
Node              Type                       State                     Config state
--------------------------------------------------------------------------------
0/RP0/CPU0        NCS1K14-CNTLR-K9(Active) IOS XR RUN                NSHUT,NMON
0/PM0             NCS1K4-AC-PSU-2          OPERATIONAL               NSHUT,NMON
0/PM1             NCS1K4-AC-PSU-2          OPERATIONAL               NSHUT,NMON
0/FT0             NCS1K14-FAN              OPERATIONAL               NSHUT,NMON
0/FT1             NCS1K14-FAN              OPERATIONAL               NSHUT,NMON
0/FT2             NCS1K14-FAN              OPERATIONAL               NSHUT,NMON
0/0/NXR0          NCS1K14-BLANK            PRESENT                   NSHUT,NMON
```

```
0/1/NXR0          NCS1K4-1.2T-K9          OPERATIONAL             NSHUT,NMON
0/2/NXR0          NCS1K14-BLANK           PRESENT                 NSHUT,NMON
0/3/NXR0          NCS1K14-EDFA2           OPERATIONAL             NSHUT,NMON
0/4               NCS1K-MD-32O-CE         OPERATIONAL             NSHUT,NMON
0/5               NCS1K-MD-32E-CE         OPERATIONAL             NSHUT,NMON
```

Step 2 Use the **show inventory** command to retrieve and display the physical inventory information of the NCS1K14-EDFA2 line card.

Example:

```
RP/0/RP0/CPU0:ios#sh inventory location 0/3/NXR0
Wed Feb 12 12:58:08.589 IST

NAME: "0/3/NXR0", DESCR: "NCS 1014 EDFA terminal with equalization"
PID: NCS1K14-EDFA2     , VID: V00, SN: FCB2831B1NY

NAME: "Optics0/3/0/5", DESCR: "Cisco SFP GE 1510 OSC Pluggable Optics Module"
PID: ONS-SC-PTP-1510   , VID: V01, SN: MZH2719009Z

NAME: "Optics0/3/0/6", DESCR: "Cisco QSFP DD Pluggable Optical Time Domain Reflectometer"
PID: ONS-QSFP-OTDR     , VID: V00 , SN: IIF2814001B

NAME: "Optics0/3/0/7", DESCR: "Cisco QSFP DD ZT5 Pluggable Optics Module"
PID: DP01QSDD-ZT5-A1   , VID: V01 , SN: ACA282500L4
```

Step 3 Use the **show controllers description** command to view the status of the OSC ports.

Example:

```
RP/0/RP0/CPU0:ios#show controllers description | In Osc
Wed Feb 12 12:59:02.294 IST
Osc0/3/0/0                  up
Osc0/3/0/4                  up
```

Step 4 Use the **show controllers osc** *R/S/I/P* command to display the status and configuration information of the OSC controllers on the NCS1K14-EDFA2 card.

Example:

```
sh controllers osc 0/3/0/0
Wed Feb 12 13:01:44.325 IST

 Controller State: Up
 Transport Admin State: In Service
 Laser State: On

 Last link flapped: 00:22:04

  Alarm Status:
  -------------
  Detected Alarms: None

  Alarm Statistics:
  -----------------
  RX-LOS-P = 0
  TX-POWER-FAIL-LOW = 0

  Parameter Statistics:
  ---------------------
  Total Tx Power = 2.05 dBm
  Total Rx Power = -21.24 dBm
  OSNR = 42.40 dB
```

```
  Configured Parameters:
  ----------
```

Step 5 Use the command **show interfaces gigabitEthernet** *R/S/I/P* to view the parameters of the Gigabit Ethernet interface associated with the OSC channel.

Example:

```
RP/0/RP0/CPU0:ios#sh interfaces gigabitEthernet 0/3/0/5
Wed Feb 12 13:05:29.153 IST
GigabitEthernet0/3/0/5 is up, line protocol is up
  Interface state transitions: 1
  Hardware is GigabitEthernet, address is c4ab.4d1b.9380 (bia c4ab.4d1b.9380)
  Description: osc_ge_ne
  Internet address is 192.0.2.1/24
  MTU 1514 bytes, BW 1000000 Kbit (Max: 1000000 Kbit)
     reliability 255/255, txload 0/255, rxload 0/255
  Encapsulation ARPA,
  Full-duplex, 1000Mb/s, unknown, link type is force-up
  output flow control is off, input flow control is off
  loopback not set,
  Last link flapped 00:25:49
  ARP type ARPA, ARP timeout 04:00:00
  Last input Unknown, output Unknown
  Last clearing of "show interface" counters Unknown
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
```

Step 6 Use the command **show ipv4 interface brief** to view the IPv4 address of a Gigabit Ethernet interface.

Example:

```
show ipv4 interface brief
Wed Feb 12 13:05:41.784 IST

Interface                      IP-Address      Status          Protocol Vrf-Name
GigabitEthernet0/3/0/5         192.0.2.1       Up              Up       default
MgmtEth0/RP0/CPU0/0            209.165.201.3     Up              Up       default
PTP0/RP0/CPU0/0                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/1            10.127.126.176    Up              Up       default
```

The Gigabit Ethernet interface must be in Up state for the OSC laser to turn up. When the node comes up, the Gigabit Ethernet interface turns to Down state. Run these commands on the Gigabit Ethernet interface to bring it up.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#no interface gigabitEthernet 0/3/0/5  shutdown
RP/0/RP0/CPU0:ios(config)#commit
```

Step 7 Use the commands **show controllers switch summary** and **show controllers switch statistics** to view the status OSC ports in the NCS1K14-EDFA2 line card.

Example:

```
RP/0/RP0/CPU0:ios#show controllers switch summary
Wed Feb 12 13:06:07.130 IST

Rack  Card  Switch   Rack Serial Number
-----------------------------------------
  0   RP0   RP-SW    FCB2814B1HL

         Phys      Admin      Port          Protocol    Forward
Port     State     State      Speed         State       State       Connects To
-------------------------------------------------------------------------------
 0          Up       Up     10-Gbps            -      Forwarding     CPU0
 1          Up       Up     10-Gbps            -      Forwarding     CPU1
```

```
 2          Up       Up      1-Gbps            -      Forwarding     PTP1
 3          Up       Up      1-Gbps            -      Forwarding     MGMT0
 4          Up       Up      1-Gbps            -      Forwarding     MGMT1
 5          Up       Up      1-Gbps            -      Forwarding     LC3_0
 6        Down       Up      1-Gbps            -      Forwarding     PTP0
 7        Down       Up      1-Gbps            -      Forwarding     LC3_1
 8        Down       Up      1-Gbps            -      Forwarding     LC0_0
 9        Down     Down      1-Gbps            -      Forwarding     PENNY
10        Down       Up      1-Gbps            -      Forwarding     LC2_1
11        Down       Up      1-Gbps            -      Forwarding     LC2_0
12          Up       Up      1-Gbps            -      Forwarding     LC1_0
13        Down       Up      1-Gbps            -      Forwarding     LC0_1
14          Up       Up      1-Gbps            -      Forwarding     LC1_1
15        Down     Down     10-Mbps            -      Forwarding     UnUsed
16        Down       Up      1-Gbps            -      Forwarding     LC0_OSC0
17        Down       Up      1-Gbps            -      Forwarding     LC0_OSC1
18        Down     Down      1-Gbps            -      Forwarding     LC0-OSC2
19        Down     Down      1-Gbps            -      Forwarding     LC0-OSC3
20        Down       Up      1-Gbps            -      Forwarding     LC1_OSC0
21        Down       Up      1-Gbps            -      Forwarding     LC1-OSC1
22        Down     Down      1-Gbps            -      Forwarding     LC1-OSC2
23        Down     Down      1-Gbps            -      Forwarding     LC1-OSC3
24        Down       Up      1-Gbps            -      Forwarding     LC2_OSC0
25        Down       Up      1-Gbps            -      Forwarding     LC2_OSC1
26        Down     Down      1-Gbps            -      Forwarding     LC2_OSC2
27        Down     Down      1-Gbps            -      Forwarding     LC2_OSC3
28          Up       Up      1-Gbps            -      Forwarding     LC3_OSC0
29          Up       Up      1-Gbps            -      Forwarding     LC3_OSC1
30          Up     Down      1-Gbps            -      Forwarding     LC3_OSC2
31          Up     Down      1-Gbps            -      Forwarding     LC3_OSC3

RP/0/RP0/CPU0:ios#show controllers switch statistics
Wed Feb 12 13:06:38.410 IST

Rack  Card  Switch   Rack Serial Number
----------------------------------------
  0   RP0   RP-SW    FCB2814B1HL

                                                          Tx            Rx
          Phys      State          Tx            Rx      Drops/        Drops/
Port      State     Changes       Packets       Packets  Errors        Errors       Connects
 To
 0          Up           1        559115        731932         0             0       CPU0
 1          Up           1          2032          3495         0             0       CPU1
 2          Up           4    1212451356    1352379301           0             0       PTP1

 3          Up           2        138666        142720         0             0       MGMT0
 4          Up           2        259633        124134         0             0       MGMT1
 5          Up          12        219828        176664         0             0       LC3_0
 6        Down           0             0             0         0             0       PTP0
 7        Down           0             0             0         0             0       LC3_1
 8        Down           0             0             0         0             0       LC0_0
 9        Down           0             0             0         0             0       PENNY
10        Down           0             0             0         0             0       LC2_1
11        Down           0             0             0         0             0       LC2_0
12          Up           0        113660        116246         0             0       LC1_0
13        Down           0             0             0         0             0       LC0_1
14          Up           0             0             0         0             0       LC1_1
15        Down           0             0             0         0             0       UnUsed
16        Down           0             0             0         0             0       LC0_OSC0
17        Down           0             0             0         0             0       LC0_OSC1
18        Down           0             0             0         0             0       LC0-OSC2
19        Down           0             0             0         0             0       LC0-OSC3
20        Down           0             0             0         0             0       LC1_OSC0
21        Down           0             0             0         0             0       LC1-OSC1
```

```
22          Down            0               0               0               0               0          LC1-OSC2
23          Down            0               0               0               0               0          LC1-OSC3
24          Down            0               0               0               0               0          LC2_OSC0
25          Down            0               0               0               0               0          LC2_OSC1
26          Down            0               0               0               0               0          LC2_OSC2
27          Down            0               0               0               0               0          LC2_OSC3
28            Up            6               0               0               0               0          LC3_OSC0
29            Up            6      1264648150      1212466505               0               3          LC3_OSC1
30            Up            6               0               0               0               0          LC3_OSC2
31            Up            6               0               0               0               0          LC3_OSC3
```

Step 8 Use the **show controllers optics** *R/S/I/P* command to display status and configuration information about the OSC optics controller.

Example:

```
RP/0/RP0/CPU0:ios#sh controllers optics 0/3/0/5
Wed Feb 12 13:06:56.528 IST

 Controller State: Up

 Transport Admin State: In Service

 Laser State: On

 LED State: Green

 Last link flapped: 00:27:16

 Optics Status

  Optics Type:  1G SFP DWDM

  Alarm Status:
  -------------
  Detected Alarms: None


  LOS/LOL/Fault Status:

  Alarm Statistics:

  -------------
  HIGH-RX-PWR = 0            LOW-RX-PWR = 0
  HIGH-TX-PWR = 0            LOW-TX-PWR = 0
  HIGH-LBC = 0               HIGH-DGD = 0
  OOR-CD = 0               OSNR = 0
  WVL-OOL = 0               MEA  = 0
  IMPROPER-REM = 0
  TX-POWER-PROV-MISMATCH = 0
  Laser Bias Current = 53.1 %
  Actual TX Power = 4.63 dBm
  RX Power = -23.76 dBm
  Frequency Offset = 0 MHz

  Performance Monitoring: Enable

  THRESHOLD VALUES
  ----------------

  Parameter                High Alarm  Low Alarm  High Warning  Low Warning
  -----------------------  ----------  ---------  ------------  -----------
  Rx Power Threshold(dBm)          5.0      -30.0           0.0          0.0
```

```
 Tx Power Threshold(dBm)          8.0        0.0           0.0          0.0
 LBC Threshold(mA)                N/A        N/A          0.00         0.00

 LBC High Threshold = 98 %
 Polarization parameters not supported by optics

Transceiver Vendor Details

 Form Factor   : SFP
 Name    : CISCO-MOLEX
 Part Number   : 10-3548-01
 Rev Number   : 000
 Serial Number   : MZH2719009Z
 PID    : ONS-SC-PTP-1510
 VID    : V01
 Firmware Version       : Major.Minor.Build
 Active                 : .0
 Inactive               : .0
 Date Code(yy/mm/dd)  : 23/05/30
 Fiber Connector Type: LC
 Otn Application Code: Not Set
 Sonet Application Code: Not Set
 Ethernet Compliance Code: Not set

Transceiver Temperature : 28 Celsius



AINS Soak               : None
AINS Timer              : 0h, 0m
AINS remaining time     : 0 seconds
```

UDC OSC connection

The OSC channel carries both UDC and OSC traffic. The EDFA2 card has a single OSC port that supports one OSC channel at a time. To carry UDC traffic over OSC channel, attach a UDC port to a specific OSC port on the EDFA2 card by using a CLI command.

The NCS 1014 chassis does not have dedicated UDC ports but includes two PTP ports. You can convert these PTP ports into UDC ports and connect them to the OSC channel using a CLI command. See Convert PTP ports to UDC ports, on page 27.

Note The NCS 1014 chassis has only two PTP ports, you can connect maximum 2 ports on two EDFA2 cards.

Convert PTP ports to UDC ports

Follow this step to convert the PTP ports available in the NCS 1014 controller into UDC ports and attach them to the Ethernet port corresponding to the OSC channel.

Procedure

Step 1 Enter the command **hw-module location** to convert the PTP ports to UDC ports and attach them to the GigabitEthernet interface of the OSC.

Example:

The output shows the conversoin of two PTP ports into UDC ports.

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/RP0/CPU0 ptp 0 port-mode udc attach interface
GigabitEthernet 0/0/0/5

RP/0/RP0/CPU0:ios(config)#hw-module location 0/RP0/CPU0 ptp 1 port-mode udc attach interface
GigabitEthernet 0/1/0/5
```

Step 2 Enter the command **show controllers switch summary** to verify the UDC ports information. After converting the PTP ports to UDC, check the link ports 2 and 6 for UDC information.

Example:

```
RP/0/RP0/CPU0:ios#show controllers switch summary
Sat Mar 27 19:05:14.646 UTC

Rack  Card  Switch   Rack Serial Number
-----------------------------------------
  0   RP0   RP-SW    FCB2721B2VW

         Phys      Admin      Port          Protocol    Forward
Port     State     State      Speed         State       State       Connects To
-------------------------------------------------------------------------------
 0          Up       Up     10-Gbps            -      Forwarding     CPU0
 1          Up       Up     10-Gbps            -      Forwarding     CPU1
 2        Down       Up      1-Gbps            -      Forwarding     PTP1
 3          Up       Up      1-Gbps            -      Forwarding     MGMT0
 4        Down       Up      1-Gbps            -      Forwarding     MGMT1
 5          Up       Up      1-Gbps            -      Forwarding     LC3_0
 6        Down       Up      1-Gbps            -      Forwarding     PTP0
 7          Up       Up      1-Gbps            -      Forwarding     LC3_1
 8          Up       Up      1-Gbps            -      Forwarding     LC0_0
 9        Down     Down      1-Gbps            -      Forwarding     PENNY
10        Down       Up      1-Gbps            -      Forwarding     LC2_1
.
.
output snipped
.
.
30        Down     Down     10-Mbps            -      Forwarding     UnUsed
31        Down     Down     10-Mbps            -      Forwarding     UnUsed
```

Step 3 Enter the command **show controllers switch statistics** to verify the UDC ports information on ports 2 and 6.

Example:

```
RP/0/RP0/CPU0:ios#show controllers switch statistics detail location 0/RP0/CPU0 port 2
Sat Mar 27 19:14:14.621 UTC

                           Phys      Port
Rack   Card    Switch      Port      State      Speed       Connects To
-----------------------------------------------------------------------
0      RP0     RP-SW        2         Down       1-Gbps      PTP1

Rx Unicast Packets:      0
```

```
Rx Multicast Packets:    0
Rx Broadcast Packets:    0
Rx Flow Control:         0
Rx Good Octets:          0
Rx Bad Octets:           0
Rx FIFO Overrun:         0
Rx Undersize:            0
Rx Fragments:            0
Rx Oversize:             0
Rx Jabber:               0
Rx Errors:               0
Rx Bad CRC:              0
Rx Collisions:           0
Rx Policing Drops:       0
Tx Unicast Packets:      0
Tx Multicast Packets:    0
Tx Broadcast Packets:    0
Tx Flow Control:         0
Tx Good Octets:          0
Tx Deferred Packets:     0
Tx FIFO Underrun/CRC:    0
Tx Multiple Collisions:  0
Tx Excess Collisions:    0
Tx Late Collisions:      0
Tx Policing Drops:       0
Tx Queueing Drops:       0
RxTx Packets 64:         0
RxTx Packets 65-127:     0
RxTx Packets 128-255:    0
RxTx Packets 256-511:    0
RxTx Packets 512-1023:   0
RxTx Packets 1024-Max:   0
```

Step 4 (Optional) Use the **clear controller switch statistics location** to reset the statistics information.

a) Check for the applicable locations for controller statistics.

Example:

```
RP/0/RP0/CPU0:ios#clear controller switch statistics location ?
  0/0/NXR0    Fully qualified location specification
  0/1/NXR0    Fully qualified location specification
  0/2/NXR0    Fully qualified location specification
  0/3/NXR0    Fully qualified location specification
  0/RP0/CPU0  Fully qualified location specification
  WORD        Fully qualified location specification
```

b) Use the controller location, 0/RP0/CPU0, to clear the switch statistics information for the UDC ports.

Example:

```
RP/0/RP0/CPU0:ios#clear controller switch statistics location 0/RP0/CPU0
Mon Jul 21 13:26:31.913 IST

Clear switch statistics ? [yes,no]

Invalid option (edited)
```

How OSC UDC connection works

This image explains OSC UDC connection using two NCS 1014 nodes that are connected to each other through OSC channels created through the EDFA2 line cards.

The process involves these stages:

- After you convert the PTP ports to UDC ports using CLI configuration, the NCS 1014 maps each UDC port to its OSC channel and sends packets from each UDC port through its channel.
- The packets received on the CPU-OSC interface will be transmitted as "untagged" over the OSC channel, whereas UDC packets will be transmitted as "tagged".
- When two OSC ports are directly connected between nodes, the NCS 1014 uses the same tagging method for both sent and received packets.

Note Traffic will be interrupted during a controller cold reset or during a software upgrade when the controller undergoes a cold reset due to a BIOS or any other FPD upgrade. UDC traffic is not impacted during a controller warm reset.

NCS1K-MD-32x-CE mux/demux passive patch panels

Table 17: Feature History

Feature Name	Release Information	Feature Description
NCS1K-MD-32x-CE Mux/Demux passive patch panels support	Cisco IOS XR Release 25.1.1	NCS1K-MD-32O-CE and NCS1K-MD-32E-CE patch panels are a pair of mux/demux passive Athermal Arrayed Waveguide Grating (AAWG) modules designed for odd and even channels, operating in the C-band. The NCS1K-MD-32x-CE module connects to the controller card through a USB 2.0 channel and interfaces with the EDFA2 line card via fiber optics. The patch panel helps to retrieve inventory data, insertion loss of the optical paths, and the optical power levels monitored by the patch panels' photodiodes.

Features

- The MD32x-CE patch panels communicate to the optical line system using a USB communication channel. The dedicted USB 2.0 port in patch panels connect to the controllers to communicate.
- Embedded optical coupler optical splitter.
- The interoperability function with a EDFA2 line card aggregate signals from transponders.
- Seperate port for coherent probe support.
- USB 2.0 for inventory, PD reading, and LED control.
- RX and TX ports for OCH and OMS contoller channels.
- FPD upgrade support.

Limitations

- Loopback is not supported.
- Passive line card reload not supported.

Performance monitoring for NCS1K-MD-32x-CE

Service providers use performance monitoring (PM) parameters to gather performance data, store it, set thresholds, and report it. This helps with early detection of network issues.

You can configure and retrieve PM counters at intervals of 30 seconds, 15 minutes, or 24 hours. These parameters simplify troubleshooting operations and increase the amount of data that can be collected directly from the equipment.

You can view and configure the performance monitoring parameters for optics on OCH and OMS controllers.

The table list the PM counters for the OCH and OMS controllers.

Table 18: PM parameters supported on OCH and OMS controllers

PM parameter	Description
OPT[dBm]	Total Tx power
OPR[dBm]	Total Rx power

Configure PM parameters for NCS1K-MD-32x-CE

Use this task to view and configure the performance monitoring parameters for optics on OCH controllers.

Procedure

Run the **show controllers** command for optics.

Example:

```
RP/0/RP0/CPU0:RINode1#show controllers och 0/5/0/8 pm current 30-sec ?
  optics  show optics pm data in 30-sec interval
RP/0/RP0/CPU0:RINode1#configur
Fri Feb 28 10:46:33.475 IST
RP/0/RP0/CPU0:RINode1(config)#control
control-plane  controller
RP/0/RP0/CPU0:RINode1(config)#controller och 0/5/0/8 pm ?
  15-min   Configure pm parameters of 15 minute interval
  24-hour  Configure pm parameters of 24 hour interval
  30-sec   Configure pm parameters of 30 second interval
RP/0/RP0/CPU0:RINode1(config)#controller och 0/5/0/8 pm 30-sec ?
  optics  Configure och optics layer performance monitoring
```