



Configure Controllers

There are six types of controllers for Cisco NCS 1010. The controllers are the OTS, OTS-OCH, OSC, DFB, OCH, and OMS controllers. This chapter describes the tasks that are used to configure and view these controllers.

Table 1: Controllers

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 LINE side of the OLT and ILA nodes using the <code>hw-module</code> command in Flex-Grid configuration. OTS-OCH controller supports optical cross-connection between the LINE side and ADD/DROP side of the OLT nodes only. The channel IDs must be the same for both LINE side and COM side OTS-OCH controllers.
Optical Service Channel (OSC)	The OSC controller represents the optical layer of the OSC channel. Line ports host the OSC controller.
Distributed Feedback (DFB)	The DFB controller represents the dedicated DFB laser on the line side of the OLT and ILA nodes with a RAMAN module for link continuity. The line ports host the DFB controller along with the OSC controller.
Optical Channel (OCH)	By default, the OCH controllers are automatically configured when Mux/Demux panels and breakout panels are brought up.
Optical Multiplex Section (OMS)	By default, the OMS controllers are automatically configured when Mux/Demux panels and breakout panels are brought up.

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OTS Controllers

There are two types of controller models supported on Cisco NCS 1010. They are:

ILA Controller Model

When the NCS1K-ILA-2R-C, NCS1K-ILA-L, NCS1K-ILA-R-C and NCS1K-ILA-C cards are brought up, four OTS controllers are created by default. The OTS controllers are:

- OTS controllers for side 1:
 - LINE 0 port: ots 0/0/0/0 (L band line OTS controller)
 - L-BAND 1 port: ots 0/0/0/1 (L band line OTS controller)
- OTS controllers for side 2:
 - LINE 2 port: ots 0/0/0/2 (L band line OTS controller)
 - L-BAND 3 port: ots 0/0/0/3 (L band line OTS controller)

Table 2: Feature History

Feature Name	Release Information	Feature Description
NCS 1010 L-Band and C+L-Band Support.	Cisco IOS XR Release 7.9.1	NCS 1010 now supports C+L-Band. The addition of the L-Band to the existing C-Band provides more channels increasing the data transfer capacity of the optical line system.

- L-band gain range: (ILA)
 - EDFA Gain Range 1 range: 10.8 — 25.8
 - EDFA Gain Range 2 range: 18.8 — 38.8
- EDFA1: Instance 1 (OLT)
 - 0 -> Gain Range Mode 1: 13.3dB — 26.3dB
 - 1 -> Gain Range mode 2: 21.3dB — 39.3dB

The following figures and tables show the three ILA variants and the mapping between physical ports and controllers:

Figure 1: NCS1K-ILA-2R-C

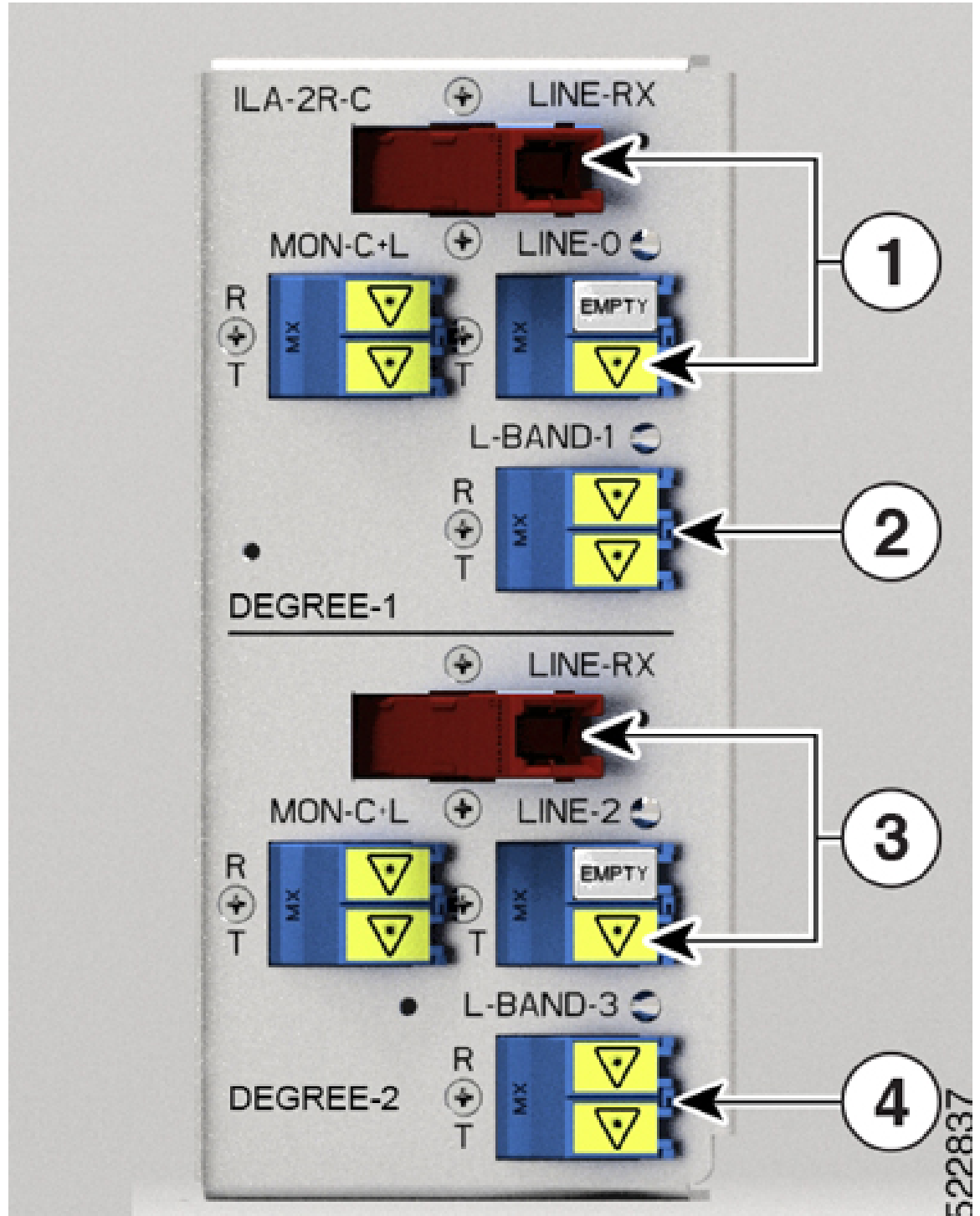


Table 3: NCS1K-ILA-2R-C Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, DFB0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, DFB0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3

Figure 2: NCS1K-ILA-R-C

Table 4: NCS1K-ILA-R-C Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, DFB0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3

Figure 3: NCS1K-ILA-C

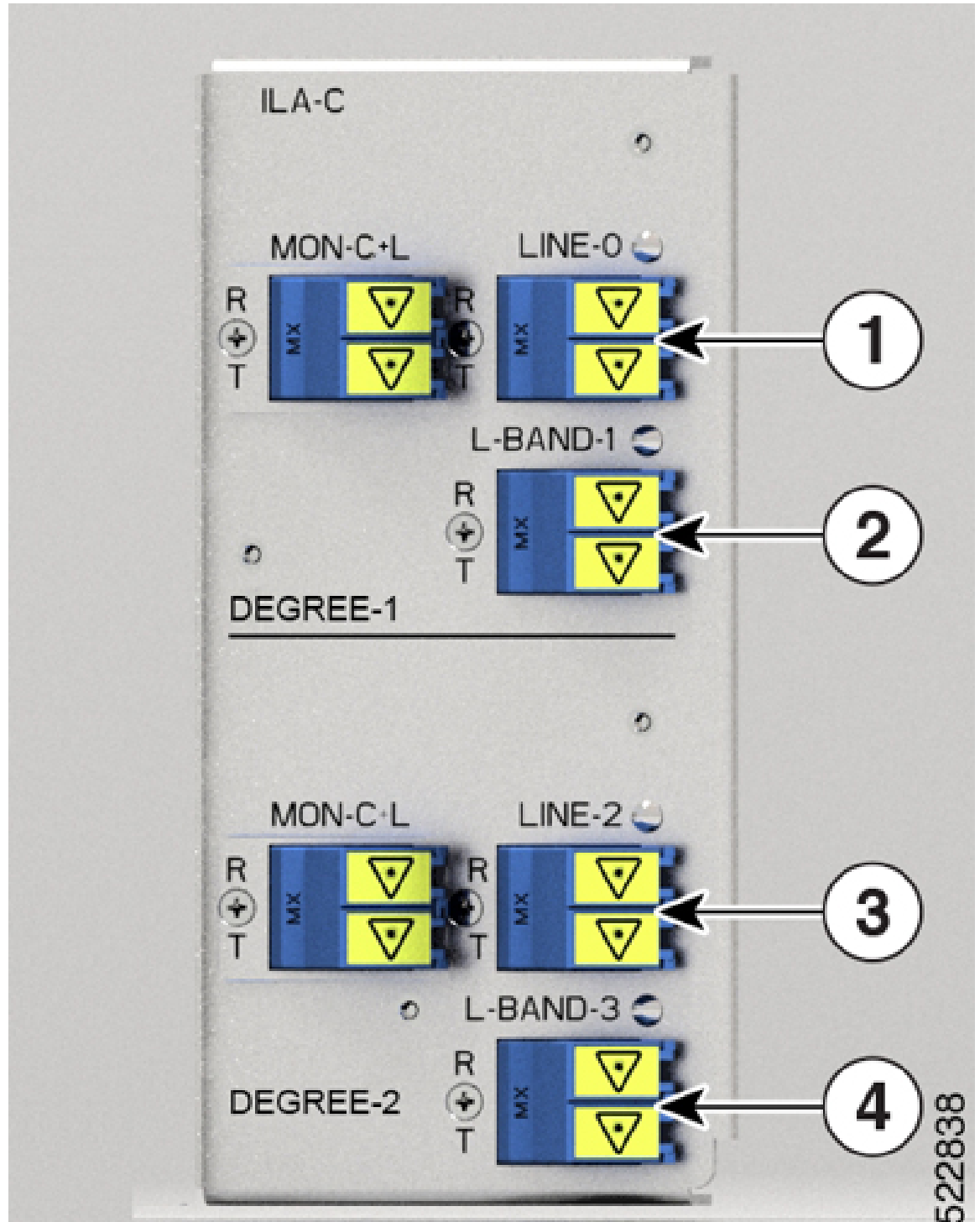
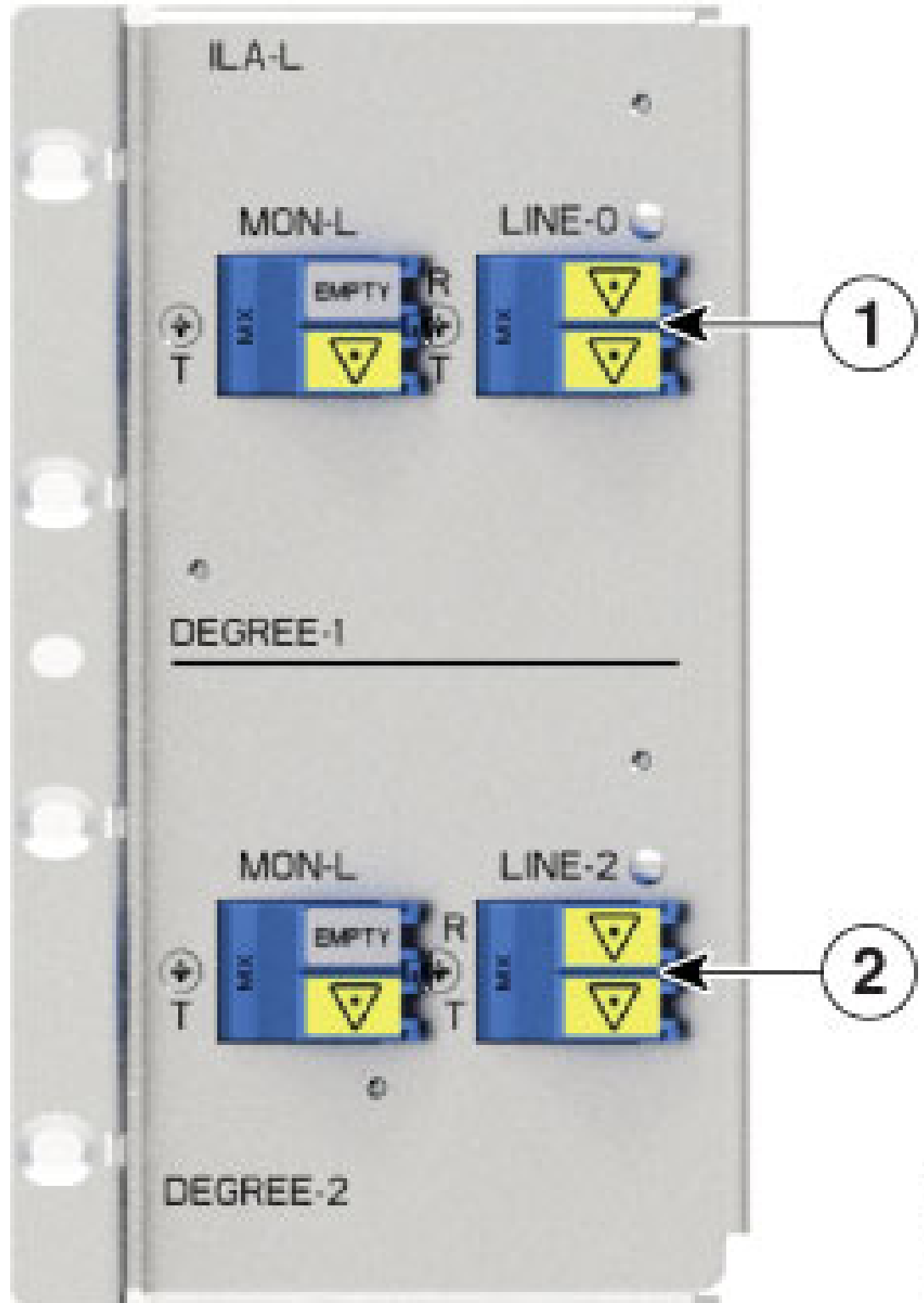


Table 5: NCS1K-ILA-C Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3

Figure 4: NCS1K-ILA-L



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Table 6: NCS1K-ILA-L Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x

To view the card type, use the following command:

```
RP/0/RP0/CPU0:ios#show platform
```

The following output highlights the *NCS1K-ILA-C* card type for the ILA controller model.

```
Fri Mar 25 09:23:43.417 UTC
Node                Type                State                Config state
-----
0/RP0/CPU0          NCS1010-CNTRLR-K9(Active) IOS XR RUN           NSHUT, NMON
0/PM0                NCS1010-AC-PSU      OPERATIONAL          NSHUT, NMON
0/PM1                NCS1010-AC-PSU      OPERATIONAL          NSHUT, NMON
0/FT0                NCS1010-FAN         OPERATIONAL          NSHUT, NMON
0/FT1                NCS1010-FAN         OPERATIONAL          NSHUT, NMON
0/0/NXR0           NCS1K-ILA-C        OPERATIONAL       NSHUT, NMON
0/2                  NCS1K-BRK-SA        OPERATIONAL          NSHUT, NMON
RP/0/RP0/CPU0:ios#
```

The following output highlights the *NCS1K-E-ILA-R-C* card type for the ILA controller model.

```
Fri Jun 9 07:04:19.710 UTC
Node                Type                State                Config state
-----
0/RP0/CPU0          NCS1010-CNTRLR-K9(Active) IOS XR RUN           NSHUT, NMON
0/PM0                NCS1010-AC-PSU      OPERATIONAL          NSHUT, NMON
0/PM1                NCS1010-AC-PSU      OFFLINE              NSHUT, NMON
0/FT0                NCS1010-FAN         OPERATIONAL          NSHUT, NMON
0/FT1                NCS1010-FAN         OPERATIONAL          NSHUT, NMON
0/0/NXR0           NCS1K-E-ILA-R-C   OPERATIONAL       NSHUT, NMON
RP/0/RP0/CPU0:ios#
```

To view the OTS controller status on the ILA cards, use the `show controller description` command.

```
RP/0/RP0/CPU0:ios#show controller description
```

The following output highlights the status of the OTS controller interfaces (*ots0/0/0/0...ots0/0/0/3*) on the ILA cards

```
Fri Mar 25 09:24:53.386 UTC
Interface          Status          Description
-----
Osc0/0/0/0         up
Osc0/0/0/2         up
Ots0/0/0/0       up
Ots0/0/0/1       up
Ots0/0/0/2       up
Ots0/0/0/3       up
RP/0/RP0/CPU0:ios#
```

To view the parameters of the LINE 0 OTS controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0
```

The following output displays the parameters of the LINE 0 OTS controller *ots 0/0/0/0*.

```

Fri Mar 25 09:27:44.146 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Green

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

Alarm Statistics:
-----
LOW-TX-PWR = 0
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(C+L) = 20.00 dBm
Total TX Power(C+L) = 20.00 dBm
Total RX Power = 20.00 dBm
Total TX Power = 23.01 dBm
RX Signal Power = -30.00 dBm
TX Signal Power = 20.00 dBm
TX Voa Attenuation = 0.0 dB
Egress Ampli Gain = 8.0 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

Configured Parameters:
-----
TX Voa Attenuation = 0.0 dB
Egress Ampli Gain = 8.0 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

```

To view the parameters of the LINE 2 OTS controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/2
```

The following output displays the parameters of the LINE 2 OTS controller *ots 0/0/0/2*.

Wed Jun 29 15:54:05.699 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(C+L) = 20.00 dBm
Total TX Power(C+L) = 20.00 dBm
Total RX Power = 20.00 dBm
Total TX Power = 23.01 dBm
RX Signal Power = -30.00 dBm
TX Signal Power = 20.00 dBm
TX Voa Attenuation = 0.0 dB
Egress Ampli Gain = 8.0 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

Configured Parameters:

TX Voa Attenuation = 0.0 dB
Egress Ampli Gain = 8.0 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

The following output displays the parameters of the LINE 1 OTS controller *ots 0/0/0/1*.

```
RP/0/RP0/CPU0:OLT-C-14#show controllers ots 0/0/0/1
Mon Feb 27 20:34:00.257 UTC
```

```
Controller State: Up
```

```
Transport Admin State: In Service
```

```
LED State: Green
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms: None
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 1
```

```
RX-LOC = 0
```

```
TX-POWER-FAIL-LOW = 2
```

```
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 = 19.39 dBm
```

```
Total Tx Power = 3.99 dBm
```

```
Configured Parameters:
```

```
-----
```

OLT Controller Model

When the NCS1K-OLT-L, NCS1K-OLT-R-C, and NCS1K-OLT-C cards are brought up, 34 and 33 OTS controllers are created by default for C band and L Band OLT cards respectively.

- LINE 0 port: ots 0/0/0/0 (C band line OTS controller)
- L-BAND 1 port: ots 0/0/0/1 (L band line OTS controller)
- LC port: ots 0/0/0/2 (Add1 Rx/Drop1 Tx OTS controller)
- LC port: ots 0/0/0/3 (Add2 Rx/Drop2 Tx OTS controller)
- MPO ports: ots 0/0/0/4 to ots 0/0/0/11
- MPO ports: ots 0/0/0/12 to ots 0/0/0/19
- MPO ports: ots 0/0/0/20 to ots 0/0/0/27
- MPO ports: ots 0/0/0/28 to ots 0/0/0/33

The following figures and tables show the two OLT variants and the mapping between physical ports and controllers:

Figure 5: NCS1K-OLT-R-C

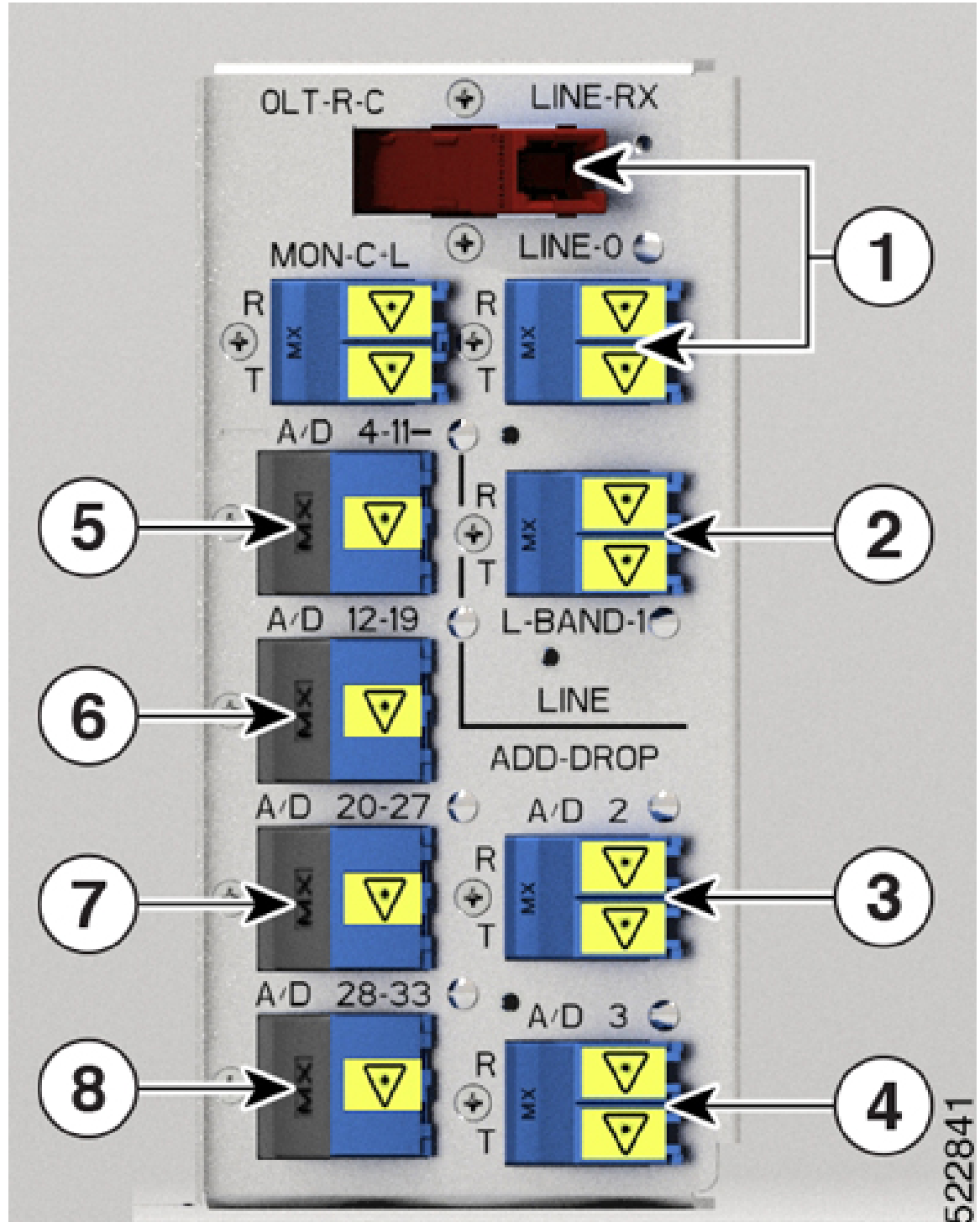


Table 7: NCS1K-OLT-R-C Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, DFB0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
5	Parent Controller: OTS0/0/0/4-11 Child Controller: COM OTS-OCH 0/0/0/4-11/x
6	Parent Controller: OTS0/0/0/12-19 Child Controller: COM OTS-OCH 0/0/0/12-19/x
7	Parent Controller: OTS0/0/0/20-27 Child Controller: COM OTS-OCH 0/0/0/20-27/x
8	Parent Controller: OTS0/0/0/28-33 Child Controller: COM OTS-OCH 0/0/0/28-33/x

Figure 6: NCS1K-OLT-C

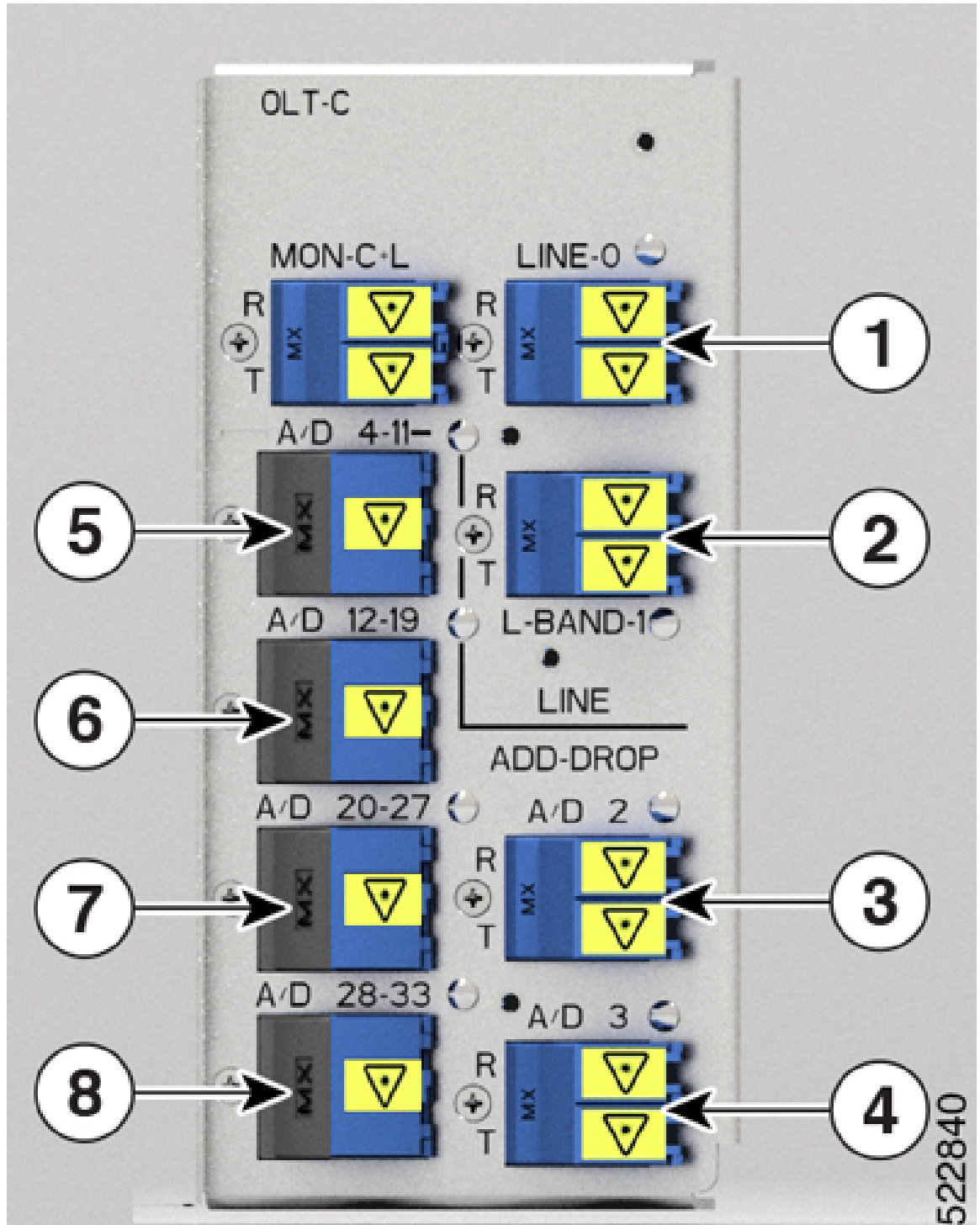


Table 8: NCS1K-OLT-C Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
5	Parent Controller: OTS0/0/0/4-11 Child Controller: COM OTS-OCH 0/0/0/4-11/x
6	Parent Controller: OTS0/0/0/12-19 Child Controller: COM OTS-OCH 0/0/0/12-19/x
7	Parent Controller: OTS0/0/0/20-27 Child Controller: COM OTS-OCH 0/0/0/20-27/x
8	Parent Controller: OTS0/0/0/28-33 Child Controller: COM OTS-OCH 0/0/0/28-33/x

Figure 7: NCS1K-OLT-L

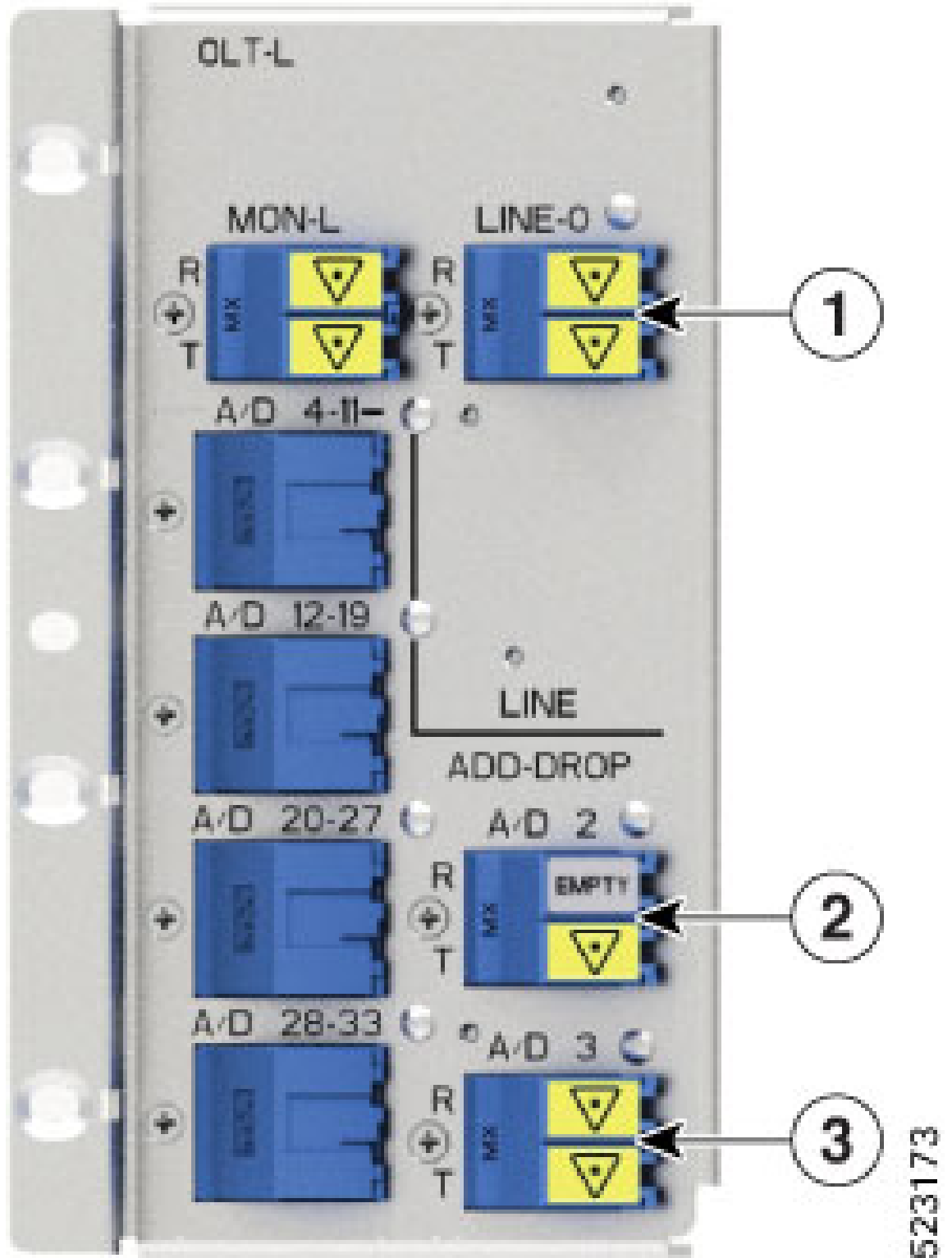


Table 9: NCS1K-OLT-L Port Mapping

1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/x
2	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
3	Parent Controller: OTS0/0/0/3

To view the platform information, use the following command:

```
RP/0/RP0/CPU0:ios#s
```

The following output highlights the *NCS1K-OLT-R-C* card type for the OLT controller model.

```
Wed Jun 29 16:00:14.373 UTC
Node                Type                State                Config state
-----
0/RP0/CPU0          NCS1010-CNTRLR-K9 (Active) IOS XR RUN           NSHUT, NMON
0/PM0                NCS1010-AC-PSU      OPERATIONAL          NSHUT, NMON
0/PM1                NCS1010-AC-PSU      OPERATIONAL          NSHUT, NMON
0/FT0                NCS1010-FAN         OPERATIONAL          NSHUT, NMON
0/FT1                NCS1010-FAN         OPERATIONAL          NSHUT, NMON
0/0/NXR0           NCS1K-OLT-R-C      OPERATIONAL       NSHUT, NMON
0/2                  NCS1K-BRK-SA        OPERATIONAL          NSHUT, NMON
0/2/0                NCS1K-BRK-8         OPERATIONAL          NSHUT, NMON
0/2/1                NCS1K-BRK-16        OPERATIONAL          NSHUT, NMON
0/2/2                NCS1K-BRK-24        OPERATIONAL          NSHUT, NMON
RP/0/RP0/CPU0:ios#
```

To view the OTS controller status on the NCS1K-OLT-R-C line card, use the `show controller description` command.

```
RP/0/RP0/CPU0:ios#show controller description
```

The following output highlights the status of the OTS controller interfaces (*ots0/0/0/0...ots0/0/0/33*) on the OLT cards

```
Wed Jun 29 16:03:59.914 UTC

Interface                Status                Description
-----
Dfb0/0/0/0              up
Osc0/0/0/0              up
Ots0/0/0/0            up
Ots0/0/0/1            up
Ots0/0/0/2            up
.
.
Output snipped
.
.
Ots0/0/0/30             up
Ots0/0/0/31             up
Ots0/0/0/32             up
Ots0/0/0/33             up
```

To view the parameters of the LINE 0 OTS controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0
```

The following output displays the parameters of the LINE 0 OTS controller *ots 0/0/0/0*.

```
Wed Jun 29 16:07:16.771 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(C+L) = -10.00 dBm
```

```
Total TX Power(C+L) = 20.00 dBm
```

```
Total RX Power = 20.00 dBm
```

```
Total TX Power = 20.00 dBm
```

```
RX Signal Power = 20.00 dBm
```

```
TX Signal Power = 20.00 dBm
```

```
TX Voa Attenuation = 0.0 dB
```

```
Ingress Ampli Gain = 12.0 dB
```

```
Ingress Ampli Tilt = 0.0 dB
```

```
Ingress Ampli Gain Range = Normal
```

```
Ingress Ampli Safety Control mode = auto
```

```
Ingress Ampli Osri = OFF
```

```
Ingress Ampli Force Apr = OFF
```

```
Egress Ampli Gain = 16.0 dB
```

```
Egress Ampli Tilt = 0.0 dB
```

```
Egress Ampli Safety Control mode = auto
```

```
Egress Ampli Osri = OFF
```

```
Egress Ampli Force Apr = OFF
```

```
Configured Parameters:
```

```
-----
```

```
TX Voa Attenuation = 0.0 dB
```

```
Ingress Ampli Gain = 12.0 dB
```

```
Ingress Ampli Tilt = 0.0 dB
```

```
Ingress Ampli Gain Range = Normal
```

```
Ingress Ampli Safety Control mode = auto
Ingress Ampli Osri = OFF
Ingress Ampli Force Apr = OFF
Egress Ampli Gain = 16.0 dB
Egress Ampli Tilt = 0.0 dB
Egress Ampli Safety Control mode = auto
Egress Ampli Osri = OFF
Egress Ampli Force Apr = OFF
```

To view the Raman parameters of the LINE 0 OTS controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 raman-info
```

The following output displays the Raman parameters of the LINE 0 OTS controller *ots 0/0/0/0*.

```
Wed Mar 23 06:02:41.093 UTC
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms: None
```

```
Alarm Statistics:
```

```
-----
```

```
RAMAN-AUTO-POW-RED = 0
RAMAN-1-LOW-POW = 0
RAMAN-2-LOW-POW = 0
RAMAN-3-LOW-POW = 0
RAMAN-4-LOW-POW = 0
RAMAN-5-LOW-POW = 0
RAMAN-1-HIGH-POW = 0
RAMAN-2-HIGH-POW = 0
RAMAN-3-HIGH-POW = 0
RAMAN-4-HIGH-POW = 0
RAMAN-5-HIGH-POW = 0
```

```
Parameter Statistics:
```

```
-----
```

```
Raman Safety Control mode = auto
Raman Osri = OFF
Raman Force Apr = OFF
Composite Raman Power = 10.40 mW
```

```
RAMAN Pump Info:
```

```
-----
```

Instance	Wavelength(nm)	Power(mW)
1	1424.00	0.00
2	1438.00	0.10
3	1457.00	10.00
4	1470.00	0.20
5	1495.00	1.20

```
Configured Parameters:
```

```
-----
```

```
Raman Safety Control mode = auto
Raman Osri = OFF
Raman Force Apr = OFF
```

```
RAMAN Pump Info:
```

```
-----
```

Instance	Power(mW)
1	45.00
2	40.00

```

3          40.00
4          40.00
5          35.00

```

To view the parameters on OTS port 2 or 3, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/2
```

The following output displays the parameters of the OTS port 2 controller *ots 0/0/0/2*.

```
Wed Mar 23 06:14:53.465 UTC
```

```
Controller State: Down
```

```
Transport Admin State: In Service
```

```
LED State: Red
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms:
```

```
    RX-LOS-P
```

```
    TX-POWER-FAIL-LOW
```

```
Alarm Statistics:
```

```
-----
```

```
LOW-TX-PWR = 0
```

```
RX-LOS-P = 1
```

```
RX-LOC = 0
```

```
TX-POWER-FAIL-LOW = 1
```

```
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 = -50.00 dBm
```

```
Total TX Power = -50.00 dBm
```

```
Ingress Ampli Gain = 0.0 dB
```

```
Ingress Ampli Tilt = 0.0 dB
```

```
Configured Parameters:
```

```
-----
```

```
Ingress Ampli Gain = 16.0 dB
```

```
Ingress Ampli Tilt = 0.0 dB
```

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/1
```

```
Wed Mar 23 06:17:57.475 UTC
```

```
Controller State: Down
```

```
Transport Admin State: In Service
```

```
LED State: Red
```

```

Alarm Status:
-----
Detected Alarms:
    RX-LOS-P
    TX-POWER-FAIL-LOW

Alarm Statistics:
-----
LOW-TX-PWR = 0
RX-LOS-P = 1
RX-LOC = 0
TX-POWER-FAIL-LOW = 1
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:
-----

Configured Parameters:
-----

RP/0/RP0/CPU0:OLT-C-14#sh controllers ots 0/0/0/1
Mon Feb 27 20:34:00.257 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Green

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

Alarm Statistics:
-----
RX-LOS-P = 1
RX-LOC = 0
TX-POWER-FAIL-LOW = 2
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 = 19.39 dBm
Total Tx Power = 3.99 dBm
```

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

```
RP/0/RP0/CPU0:OLT-C-14#
```

To view the parameters on the MPO port, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/33
```

The following output displays the parameters for the MPO port *ots 0/0/0/33*.

```
Sun Apr 10 14:04:40.513 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 = -5.00 dBm
Total TX Power = -10.50 dBm
```

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


Configure OTS Controllers

The Optical Transport Section (OTS) controller holds all the optical parameters for the OTS optical interfaces. The optical interface has different capabilities depending on its hardware components such as photodiode, VOA, amplifier, and OCM.

There are multiple parameters for the OTS controllers. You can configure the parameters that are required for the different configuration for an OTS controller on an ILA node by using the following commands in the Ots controller configuration mode:

- **tx-voa-attenuation** *value*
- **egress-ampli-gain-range** {normal | extended}
- **egress-ampli-gain** *value*
- **egress-ampli-tilt** *value*
- **egress-ampli-osri** {on | off}
- **egress-ampli-safety-control-mode** {auto | disabled}
- **egress-ampli-force-apr** {on | off}
- **raman-tx-power** *Raman-transmit-pump-instance* **power** *power-value*
- **raman-tx-power-disable** *Raman-transmit-pump-instance*
- **raman-force-apr** {on | off}
- **raman-osri** {on | off}
- **raman-safety-control-mode** {auto | disabled}

There are multiple parameters for the OTS controllers. You can configure the parameters that are required for the different configuration for an OTS controller on an OLT node by using the following commands in the Ots controller configuration mode:

- **tx-voa-attenuation** *value*
- **egress-ampli-gain** *value*
- **egress-ampli-tilt** *value*
- **egress-ampli-osri** {on | off}
- **egress-ampli-safety-control-mode** {auto | disabled}
- **egress-ampli-force-apr** {on | off}
- **egress-channel-slice** *channel-slice* **attn** *attenuation-value*
- **ingress-ampli-gain-range** {normal | extended}
- **ingress-ampli-gain** *value*
- **ingress-ampli-tilt** *value*
- **ingress-ampli-osri** {on | off}
- **ingress-ampli-safety-control-mode** {auto | disabled}

- **ingress-ampli-force-apr** {on | off}
- **ingress-channel-slice** *channel-slice* **attn** *attenuation-value*
- **raman-tx-power** *Raman-transmit-pump-instance* **power** *power-value*
- **raman-tx-power-disable** *Raman-transmit-pump-instance*
- **raman-force-apr** {on | off}
- **raman-osri** {on | off}
- **raman-safety-control-mode** {auto | disabled}

OTS Controller Configuration Parameters

Table 10: OTS Controller Configuration Parameters

Parameter	Description	Hardware Capability	Range	Default	Notes
tx-voa-attenuation	TX VOA attenuation set point	VOA	<ul style="list-style-type: none"> • OLT: 0–20 dB • ILA: 0–15 dB 	0.0	—
ampli-safety-control-mode (ingress/egress)	Amplifier control mode	Amplifier	auto and disabled	automatic	—

Parameter	Description	Hardware Capability	Range	Default	Notes
ampli-gain-range (ingress/egress)	Amplifier gain range	Amplifier	normal and extended	normal	

Parameter	Description	Hardware Capability	Range	Default	Notes
					<p>If you change the gain range from Normal to Extended or the opposite way, without updating the proper gain value for the new gain range, then the following may happen:</p> <ul style="list-style-type: none"> • The EDFA switches to the preconfigured or default value of the gain causing a mismatch between the operational and configured gain. • The gain configuration is lost during the reload of software or line card, as the configured gain mismatches with the latest gain-range. This may result in traffic interruption during these reload operations. <p>Hence, we recommend that you explicitly configure the gain range mode as normal or extended, and the corresponding gain values for each mode to get the expected results.</p> <p>The following are a few example scenarios that may not work as expected:</p> <ul style="list-style-type: none"> • Scenario 1: Current running config: <pre>controller Ots R/S/I/P egress-ampli-gain-range extended egress-ampli-gain <gain value in extended mode></pre> New applied config: <pre>controller Ots R/S/I/P no egress-ampli-gain-range extended commit</pre> • Scenario 2: Current running config: <pre>controller Ots R/S/I/P egress-ampli-gain-range extended egress-ampli-gain <gain value in extended mode></pre> New applied config: <pre>controller Ots R/S/I/P egress-ampli-gain-range Normal commit</pre>

Parameter	Description	Hardware Capability	Range	Default	Notes
					<ul style="list-style-type: none"> Scenario 3: Current running config: <code>controller Ots R/S/I/P</code> <code>egress-ampli-gain <gain value in normal mode></code> New applied config: <code>controller Ots R/S/I/P</code> <code>egress-ampli-gain-range extended</code> <code>commit</code> <p>The following is another example scenario that involves commit-replace command where you replace the existing gain configuration that does not have explicitly configured gain-range, with new gain-range and gain value.</p> <p>Scenario 4: Current running config: <code>controller Ots R/S/I/P</code> <code>egress-ampli-gain <gain value in normal mode></code></p> <p>New applied config: <code>controller Ots R/S/I/P</code> <code>egress-ampli-gain-range extended</code> <code>egress-ampli-gain <gain value in extended mode></code> <code>commit replace</code></p>
ampli-gain (ingress/egress)	Amplifier gain set point	Amplifier	80–380	OLT ingress: 12, egress: 16 ILA: 8	<p>The actual range of amplifier gain set point depends on amplifier gain range.</p> <p>Note Gain is calibrated to line port and so the supported range varies in Raman variants (OLT-C-R, ILA-C-R, and ILA-C-2R) due to insertion loss by Raman amplifier.</p>
ampli-tilt (ingress/egress)	Amplifier tilt	Amplifier	–5 to +5	0.0	—
osri (ingress/egress)	Optical safety remote interlock	Amplifier	on and off	off	When osri is on, the EDFA is in shut state and vice versa.

Parameter	Description	Hardware Capability	Range	Default	Notes
ampli-force-apr (ingress/egress)	—	Amplifier	on and off	off	When ampli-force-apr is set to <i>on</i> , the EDFA output power is clamped to 8 dBm.
channel-slice <i>channel-slice</i> attn <i>attenuation</i> (ingress/egress)	Channel slice attenuation set point	—	1–1548 (channel slice) OLT: 0–250 (attenuation value in 0.1 dB) ILA: 0–50 (attenuation value in 0.1 dB)	0.0	—
raman-tx-power <i>pump instance</i> value <i>value</i>	Tx power	Raman amplifier	1–5 (pump instance) The values are: • Pump 1: 45–30 • Pump 2: 40–30 • Pump 3: 40–20 • Pump 4: 40–20 • Pump 5: 35–10	—	—
raman-tx-power-disable <i>pump instance</i>	Tx power	Raman amplifier	—	—	—

Parameter	Description	Hardware Capability	Range	Default	Notes
raman-force-apr	—	Raman amplifier	on and off	off	When raman-force-apr is set to <i>on</i> , the Raman pump maximum output power is clamped to 10 mW.
raman-osri	Optical safety remote interlock	Raman amplifier	on and off	off	When raman-osri is set to <i>on</i> , the Raman pumps are switched off.

Channel Slice Attenuation

The attenuation for the channel slices is automatically configured by APC.

To view the channel slice attenuation information, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 channel-slice-attenuation-info
```

The following sample output shows the channel slice attenuation information:

```
Sun Mar 27 15:27:27.600 UTC

Attenuation Slices spacing      :          3.125 GHz
Attenuation Slices Range       :          1 - 1548
Slice start wavelength         :        1566.82 nm
Slice start frequency          :        191337.50 GHz

Sub Channel Attenuation information :
Ingress Channel Slice Attenuation :
-----
spectrum-slice num              Attenuation values (dB)
-----
 1 - 12      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
13 - 24      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
25 - 36      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
37 - 48      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
49 - 60      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
61 - 72      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
.
.
output snipped
.
.
1501 - 1512  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1513 - 1524  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1525 - 1536  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1537 - 1548  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
-----
Egress Channel Slice Attenuation :
```

```

-----
spectrum-slice num                Attenuation values (dB)
-----
  1 - 12      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 13 - 24      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 25 - 36      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 37 - 48      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 49 - 60      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 61 - 72      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
.
.
output snipped
.
.
1501 - 1512   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1513 - 1524   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1525 - 1536   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1537 - 1548   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0

```

To modify the attenuation values manually, APC must be disabled first using the following commands:

```

RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#optical-line-control controller ots 0/0/0/0 apc disable
RP/0/RP0/CPU0:ios(config)#commit

```

For more information on APC commands, see the section, "[Configure APC](#)".

To modify the attenuation value for an egress channel slice, use the following commands:



Note The OTS controller commands do not support decimal inputs. The OTS controller commands consider the inputs to one decimal place for the parameter values. In the following example, the *attn* value for the *egress-channel-slice 10* is provided as *100* to configure the *attn* value for the *egress-channel-slice 10* to *10.0 dB*.

```

RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0 egress-channel-slice 10 attn 100
RP/0/RP0/CPU0:ios(config)#commit
Sun Apr 10 14:47:37.849 UTC
RP/0/RP0/CPU0:ios(config)#end

```

To view the modified attenuation value for egress channel slice 10, use the following command:

```

RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 channel-slice-attenuation-info

```

The following output highlights the modified attenuation value for *egress channel slice 10* that is set to *10.0 dB*.

```

Sun Apr 10 14:47:47.050 UTC

Attenuation Slices spacing      :          3.125 GHz
Attenuation Slices Range       :          1 - 1548
Slice start wavelength         :        1566.82 nm
Slice start frequency          :       191337.50 GHz

```


Sub Channel Attenuation information :
 Ingress Channel Slice Attenuation :

```
-----
spectrum-slice num          Attenuation values (dB)
-----
  1 - 12      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 13 - 24      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 25 - 36      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 37 - 48      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 49 - 60      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 61 - 72      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
.
.
output snipped
.
1501 - 1512   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1513 - 1524   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1525 - 1536   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1537 - 1548   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
-----
```

Egress Channel Slice Attenuation :

```
-----
spectrum-slice num          Attenuation values (dB)
-----
  1 - 12      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  10.0  25.0
25.0
 13 - 24      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 25 - 36      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 37 - 48      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 49 - 60      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
 61 - 72      25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
.
.
output snipped
.
1501 - 1512   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1513 - 1524   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1525 - 1536   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
1537 - 1548   25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0
25.0
-----
```

RP/0/RP0/CPU0:ios#

Examples

In the following example, the tx-voa-attenuation is set to 10 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#tx-voa-attenuation 100
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-gain is set to 20 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain 200
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-tilt is set to 2.5 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-tilt 25
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following examples, the egress-ampli-gain-range is set to extended and Normal.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain-range extended
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain 360
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain-range normal
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain 150
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-safety-control-mode is set to auto.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-safety-control-mode auto
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-osri is set to on.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-osri on
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-force-apr is set to on.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-force-apr on
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-channel-slice attenuation is set to 20 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-channel-slice 1 attn 200
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, to establish connection using the existing GRPC framework.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#optical-line-control
```

```
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#partner-band-port ipv4 address 10.10.1.2
RP/0/RP0/CPU0:ios(config-Ots)#controller Ots0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the raman-tx-power is set to 55 mW.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#raman-tx-power 1 value 5500
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the raman-force-apr is set to on.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#raman-force-apr on
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the raman-osri is set to on.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#raman-osri on
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

Configure Partner Band IP Address

NCS1010 can be configured to operate in both C and L-band wavelengths to increase the capacity of optical fibers. This can be done by connecting the C-band OLT or ILA line cards to the L-band OLT or ILA line cards respectively.

To establish a connection between C and L-band nodes, configure the L-band peer IP on C-band node and C-band peer IP on L-band node using the following commands in the Optical Line Control configuration:

optical-line-control

controller ots *Rack/Slot/Instance/Port*

partner-band-port ipv4 address *ip-address controller ots Rack/Slot/Instance/Port*

Example

The following output displays the peer node L-band IP address 192.168.1.2 is configured on the C-band node.

```
RP/0/RP0/CPU0:ios#conf
Wed Jul 6 04:45:47.720 UTC
RP/0/RP0/CPU0:ios(config)#optical-line-control controller Ots0/0/0/0
RP/0/RP0/CPU0:ios(config)#partner-band-port ipv4 address 192.168.1.2 controller Ots0/0/0/0
```



Note The above configuration needs to be made on all the C and L-band nodes in the Optical Line Control configuration mode.

OTS-OCH Controllers

The OTS-OCH controllers are not created by default when the cards (NCS1K-ILA-2R-C, NCS1K-ILA-R-C, NCS1K-ILA-C, NCS1K-OLT-R-C, and NCS1K-OLT-C) are brought up. The LINE OTS-OCH controllers can be created using the **hw-module** command.

Optical Cross Connections

Optical Cross Connections can be configured only on OLT nodes. In these nodes, the OTS-OCH controller is not created automatically on the Add/Drop ports (COM side). The optical cross connect configuration defines the line side OTS-OCH channel as the source and creates an OTS-OCH controller on the Add/Drop port to which the cross connection is made. The channel ID must be the same for both the LINE side and COM side OTS-OCH controllers.

Flex Grid Validation

The following validations are performed before the **hw-module** configurations are committed:

- The channel ID is any value 1–194.
- The center frequency must be within the C-band spectrum, for the OLT-C cards. The frequency range is 191.3375-196.1750 THz.
- The center frequency must be within the L-band spectrum, for the OLT-L card. The frequency range is 184.6153-190.8875 THz.
- The supported channel width range is 25.000GHz to 4837.500 GHz. From Release 7.9.1, overlap of channels is permitted as Nyquist channels are supported. See [Nyquist Channels, on page 64](#).
- From Release 7.9.1, you can set the channel centre frequency and width with 1MHz resolution.

Create OTS-OCH Controllers

To create the OTS-OCH controllers on the LINE side of the ILA-C, ILA-R-C, or ILA-2R-C node, use the following commands in the configuration mode:

- **hw-module location** *location* **inline-ampli grid-mode** *mode*
- **channel-id** *channel-id* **centre-freq** *frequency* **width** *channel-width*

To create the OTS-OCH controllers on the LINE side of the ILA-C node, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
Thu Apr 7 13:14:49.841 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXR0 inline-ampli grid-mode flex
RP/0/RP0/CPU0:ios(config-hwmod-ila-flexi)#channel-id 1 centre-freq 196.1 width 75
RP/0/RP0/CPU0:ios(config-hwmod-ila-flexi)# commit
```

The OTS-OCH controller is created on both the LINE 0 and LINE 2 ports of the ILA-C node. To view the OTS-OCH controllers, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och ?
```

The following output displays the OTS-OCH controller is created on both the LINE 0 and LINE 2 ports of the ILA-C node.

```

0/0/0/0/1          Ots-Och Interface Instance
0/0/0/2/1          Ots-Och Interface Instance
R/S/I/P/B or R/S/I/P Forward interface in Rack/Slot/Instance/Port/Breakout format or
R/S/I/P format

```

To view the parameters of the OTS-OCH controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och 0/0/0/0/1
```

The following output displays the parameters of the OTS-OCH controller.

```

Thu Apr  7 13:22:29.125 UTC

Controller State: Up

Transport Admin State: In Service

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

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

Parameter Statistics:
-----
Total RX Power = -10.50 dBm
Total TX Power = -10.50 dBm

```

```

Configured Parameters:
-----

```

To create the OTS-OCH controller on the LINE side of the OLT-C or OLT-R-C node, use the following commands in the configuration mode:

- **hw-module location** *location* **terminal-ampli grid-mode mode**
- **channel-id** *channel-id* **centre-freq** *frequency* **width** *channel-width*

To configure the optical cross-connect, use the following command in the configuration mode:

```
controller ots-och Rack/Slot/Instance/Port/Channel-id-number add-drop-channel ots-och
Rack/Slot/Instance/Port/Channel-id-number
```

To create the OTS-OCH controller on the LINE side of an OLT-R-C node, use the following commands:

```

RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/nxr0 terminal-ampli grid-mode flex
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#channel-id 1 centre-freq 196.1 width 75
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#commit

```

To view the OTS-OCH controller that is created on the LINE side, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och ?
```

The following output highlights the OTS-OCH controller that is created on the LINE side.

```

0/0/0/0/1          Ots-Och Interface Instance
R/S/I/P/B or R/S/I/P Forward interface in Rack/Slot/Instance/Port/Breakout format or
R/S/I/P format

```

To configure the optical cross-connect, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
Mon Apr  4 14:54:32.834 UTC
RP/0/RP0/CPU0:ios(config)#controller ots-och 0/0/0/0/1 add-drop-channel ots-och 0/0/0/33/1
RP/0/RP0/CPU0:ios(config)#commit
```

The OTS-OCH controller is created on the Add/Drop port to which the cross-connection is made on the COM side. To view the OTS-OCH controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controller ots-och ?
```

The following output highlights the OTS-OCH controller that is created on the Add/Drop port to which the cross-connection is made on the COM side.

```
0/0/0/0/1          Ots-Och Interface Instance
0/0/0/33/1        Ots-Och Interface Instance
R/S/I/P/B or R/S/I/P Forward interface in Rack/Slot/Instance/Port/Breakout format or
R/S/I/P format
```

You can also use python-based configuration script to automatically create 75 or 150 GHz fixed grid channels on ports 2 and 3 using the following commands:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#load script /pkg/script/flexgrid_config_builder.py args -w75 -c
terminal-ampli
Loading.
6839 bytes parsed in 1 sec (6835)bytes/sec
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```



Note This script can be used only for a colored solution that uses the NCS1K-MD-320/E-C patch panel with fixed channel width.

To view the OTS-OCH controllers, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och ?
```

The following output displays the OTS-OCH controller interfaces:

```
0/0/0/0/1          Ots-Och Interface Instance
0/0/0/0/10         Ots-Och Interface Instance
.
.
output snipped
.
.
0/0/0/0/29         Ots-Och Interface Instance
0/0/0/0/3          Ots-Och Interface Instance
0/0/0/0/49         Ots-Och Interface Instance
0/0/0/0/5          Ots-Och Interface Instance
.
.
output snipped
.
.
0/0/0/0/64         Ots-Och Interface Instance
0/0/0/0/7          Ots-Och Interface Instance
0/0/0/0/8          Ots-Och Interface Instance
0/0/0/0/9          Ots-Och Interface Instance
R/S/I/P/B or R/S/I/P Forward interface in Rack/Slot/Instance/Port/Breakout format or
```

R/S/I/P format

To view the flex grid information on the OLT node, use the following command:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0/NXR0 terminal-ampli
```

The following output displays the flex grid information on the OLT node.

Tue Jun 28 15:46:07.026 UTC

Legend:

- NXC - Channel not cross-connected
- ACTIVE - Channel cross-connected to data port
- ASE - Channel filled with ASE
- FAILED - Data channel failed, pending transition to ASE

Location: 0/0/NXR0

Status: Provisioned

Flex Grid Info

Channel Number	Centre Frequency (THz)	Channel Width (GHz)	Channel Status
1	196.100000	75.000	NXC
2	196.025000	75.000	NXC
3	195.950000	75.000	NXC
4	195.875000	75.000	NXC
5	195.800000	75.000	NXC
6	195.725000	75.000	NXC
7	195.650000	75.000	NXC
8	195.575000	75.000	NXC
9	195.500000	75.000	NXC
10	195.425000	75.000	NXC
11	195.350000	75.000	NXC
12	195.275000	75.000	NXC
13	195.200000	75.000	NXC
14	195.125000	75.000	NXC
15	195.050000	75.000	NXC
16	194.975000	75.000	NXC
17	194.900000	75.000	NXC
18	194.825000	75.000	NXC
19	194.750000	75.000	NXC
20	194.675000	75.000	NXC
21	194.600000	75.000	NXC
22	194.525000	75.000	NXC
23	194.450000	75.000	NXC
24	194.375000	75.000	NXC
25	194.300000	75.000	NXC
26	194.225000	75.000	NXC
27	194.150000	75.000	NXC
28	194.075000	75.000	NXC
29	194.000000	75.000	NXC
30	193.925000	75.000	NXC
31	193.850000	75.000	NXC
32	193.775000	75.000	NXC
33	193.700000	75.000	NXC
34	193.625000	75.000	NXC
35	193.550000	75.000	NXC
36	193.475000	75.000	NXC
37	193.400000	75.000	NXC
38	193.325000	75.000	NXC
39	193.250000	75.000	NXC
40	193.175000	75.000	NXC
41	193.100000	75.000	NXC

42	193.025000	75.000	NXC
43	192.950000	75.000	NXC
44	192.875000	75.000	NXC
45	192.800000	75.000	NXC
46	192.725000	75.000	NXC
47	192.650000	75.000	NXC
48	192.575000	75.000	NXC
49	192.500000	75.000	NXC
50	192.425000	75.000	NXC
51	192.350000	75.000	NXC
52	192.275000	75.000	NXC
53	192.200000	75.000	NXC
54	192.125000	75.000	NXC
55	192.050000	75.000	NXC
56	191.975000	75.000	NXC
57	191.900000	75.000	NXC
58	191.825000	75.000	NXC
59	191.750000	75.000	NXC
60	191.675000	75.000	NXC
61	191.600000	75.000	NXC
62	191.525000	75.000	NXC
63	191.450000	75.000	NXC
64	191.375000	75.000	NXC



Note The legend provides information about the channel's status. By default, the channels are brought up with NXC channel status.

To view the flex grid information on the ILA node, use the following command:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0/nxr0 inline-ampli
```

The following output displays the flex grid information on the ILA node.

```
Sat Jul 2 02:46:33.657 UTC
Location:          0/0/NXR0
Status:            Provisioned
Flex Grid Info
Channel Number    Centre Frequency (THz)    Channel Width (GHz)
1                 191.375000                75.000
2                 191.450000                75.000
3                 191.525000                75.000
4                 191.600000                75.000
5                 191.675000                75.000
6                 191.750000                75.000
7                 191.825000                75.000
8                 191.900000                75.000
9                 191.975000                75.000
10                192.050000                75.000
11                192.125000                75.000
12                192.200000                75.000
13                192.275000                75.000
14                192.350000                75.000
15                192.425000                75.000
16                192.500000                75.000
17                192.575000                75.000
18                192.650000                75.000
19                192.725000                75.000
20                192.800000                75.000
21                192.875000                75.000
22                192.950000                75.000
23                193.025000                75.000
```


24	193.100000	75.000
25	193.175000	75.000
26	193.250000	75.000
27	193.325000	75.000
28	193.400000	75.000
29	193.475000	75.000
30	193.550000	75.000
31	193.625000	75.000
32	193.700000	75.000
33	193.775000	75.000
34	193.850000	75.000
35	193.925000	75.000
36	194.000000	75.000
37	194.075000	75.000
38	194.150000	75.000
39	194.225000	75.000
40	194.300000	75.000
41	194.375000	75.000
42	194.450000	75.000
43	194.525000	75.000
44	194.600000	75.000
45	194.675000	75.000
46	194.750000	75.000
47	194.825000	75.000
48	194.900000	75.000
49	194.975000	75.000
50	195.050000	75.000
51	195.125000	75.000
52	195.200000	75.000
53	195.275000	75.000
54	195.350000	75.000
55	195.425000	75.000
56	195.500000	75.000
57	195.575000	75.000
58	195.650000	75.000
59	195.725000	75.000
60	195.800000	75.000
61	195.875000	75.000
62	195.950000	75.000
63	196.025000	75.000
64	196.100000	75.000

To view the parameters of the OTS-OCH controller (LINE side), use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och 0/0/0/0/1
```

The following output displays the parameters of the OTS-OCH controller on the LINE side.

```
Tue Apr 5 06:32:29.696 UTC
```

```
Controller State: Up
```

```
Transport Admin State: In Service
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms: None
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 0
```

```
TX-POWER-FAIL-LOW = 0
```

```
Parameter Statistics:
```

```

-----
Total RX Power = -10.50 dBm
Total TX Power = -10.50 dBm

Cross Connect Info:
-----
Add-Drop Channel = Ots-Och0/0/0/33/1

Configured Parameters:
-----

```



Note The Add/Drop channel that is cross-connected to the line port, 0/0/0/1 is displayed in the output.

DFB Controllers

The line port in the NCS1K-OLT-R-C, NCS1K-ILA-R-C, and NCS1K-ILA-2R-C line cards have a DFB (Distributed Feedback) controller in addition to the OSC controller. The DFB laser at 191.1 THz is used to perform a link continuity check on the Raman span for optical safety. The power of DFB laser can be regulated with a VOA.

To view the parameters of the LINE 0 DFB controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers dfb 0/0/0/0
```

The following output displays the parameters of the LINE 0 DFB controller.

```

Wed Mar 23 06:05:09.074 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

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

Alarm Statistics:
-----
RX-LOS-P = 1
TX-POWER-FAIL-LOW = 106

Parameter Statistics:
-----
Total TX Power = 6.79 dBm
Total RX Power = -8.30 dBm
TX Voa Attenuation = 0.0 dB

Configured Parameters:

```

```
-----
TX Voa Attenuation = 0.0 dB
```

Configure DFB Controllers

There are multiple parameters for the DFB controllers. You can configure the following parameters for a DFB controller on a NCS1K-OLT-R-C, NCS1K-ILA-R-C, or NCS1K-ILA-2R-C node by using the following commands in the configuration mode:

- **controller dfb** *Rack/Slot/Instance/Port*
- **tx-voa-attenuation** *value*
- **tx-low-threshold** *value*
- **sec-admin-state** {**normal** | **maintenance**}
- **transmit-shutdown**
- **shutdown**

Examples

In the following example, the *tx-voa-attenuation* is set to 2 dB.



Note The DFB controller commands do not support decimal inputs. The DFB controller commands consider the inputs to one decimal place for the parameter values. In this example, the *tx-voa-attenuation* value for the DFB controller *dfb 0/0/0/0* is provided as 20 to configure the *tx-voa-attenuation* value for *dfb 0/0/0/0* to 2.0 dB.

```
RP/0/RP0/CPU0:ios#configure
Thu Apr 21 17:00:57.654 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#controller dfb 0/0/0/0 tx-voa-attenuation 20
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

To view the configured *tx-voa-attenuation* value, use the following command:

```
RP/0/RP0/CPU0:ios#show controller dfb 0/0/0/0
```

The following output highlights the *tx-voa-attenuation* of the DFB controller that is set to 2.0 dB.

```
Thu Apr 21 17:02:06.316 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

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

Alarm Statistics:
-----
```

```

RX-LOS-P = 0
TX-POWER-FAIL-LOW = 0

Parameter Statistics:
-----
Total TX Power = 20.00 dBm
Total RX Power = 10.00 dBm
TX Voa Attenuation = 2.0 dB

Configured Parameters:
-----
TX Voa Attenuation = 2.0 dB

```

The DFB laser power is attenuated based on the updated value and the TX power changes accordingly.

In the following example, the *sec-admin-state* is set to *maintenance*.

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller dfb 0/0/0/0 sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end

```

To view the configured *sec-admin-state* value, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers dfb 0/0/0/0
```

The following output highlights the *sec-admin-state* set to *maintenance*.

```

Thu Apr 21 17:05:41.311 UTC

Controller State: Up

Transport Admin State: Maintenance

Laser State: On

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

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

Parameter Statistics:
-----
Total TX Power = 20.00 dBm
Total RX Power = 10.00 dBm
TX Voa Attenuation = 2.0 dB

Configured Parameters:
-----
TX Voa Attenuation = 2.0 dB

```

In the following example, the DFB controller is shut down.

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller dfb 0/0/0/0 shutdown
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end

```

To view the configured value, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers dfb 0/0/0/0
```

The following output highlights the *Controller State*, *Transport Admin State*, and *Laser State* set to *shut down*.

```
Thu Apr 21 17:08:40.211 UTC
```

```
Controller State: Administratively Down
```

```
Transport Admin State: Out Of Service
```

```
Laser State: Off
```

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

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

```
Parameter Statistics:
-----
Total TX Power = -50.00 dBm
Total RX Power = 10.00 dBm
TX Voa Attenuation = 2.0 dB
```

```
Configured Parameters:
-----
TX Voa Attenuation = 2.0 dB
```

OSC Controllers

The Optical Service Channel (OSC) controller is used to represent the optical capabilities, configuration, and monitoring of the OSC laser. The corresponding Gigabit Ethernet interface is the child interface that represents Ethernet capabilities, configuration, and monitoring.

OSC provides a communication channel for traffic coming from a UDC port. OSC serves as a channel probe to check fiber continuity between two nodes. OSC provides remote node management functionality. OSC is generated and terminated on each line side. OSC-C operates at a frequency of 198.50 THz and OSC-L operates at a frequency of 184.450 THz.

Nodes with NCS1K-OLT-R-C or NCS1K-OLT-C, NCS1K-OLT-L cards have one OSC controller. To view the status of the OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controller description
```

The following output highlights the status of the OSC controller for the NCS1K-OLT-R-C or NCS1K-OLT-C, NCS1K-OLT-L or NCS1K-ILA-L cards.

```
Tue Apr 12 17:17:51.306 UTC
```

Interface	Status	Description
Osc0/0/0/0	up	
Ots0/0/0/0	up	

```
Ots0/0/0/1          up
Ots0/0/0/2          up
.
.
output snipped
.
.
Ots0/0/0/31         up
Ots0/0/0/32         up
Ots0/0/0/33         up
```

Nodes with NCS1K-ILA-2R-C, NCS1K-ILA-R-C, NCS1K-ILA-L or NCS1K-ILA-C card have two OSC controllers. To view the OSC controllers, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers description
```

The following output highlights the status of the OSC controller for the NCS1K-ILA-2R-C, NCS1K-ILA-R-C, NCS1K-ILA-L or NCS1K-ILA-C card.

```
Tue Apr 12 17:20:20.667 UTC
```

Interface	Status	Description
Osc0/0/0/0	up	
Osc0/0/0/2	up	
Ots0/0/0/0	up	
Ots0/0/0/1	up	
Ots0/0/0/2	up	
Ots0/0/0/3	up	

To view the parameters of the LINE 0 OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output shows the parameters of the LINE 0 OSC controller.

```
Wed Mar 23 06:04:18.565 UTC
```

```
Controller State: Down
```

```
Transport Admin State: In Service
```

```
Laser State: Off
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms:
```

```
    RX-LOS-P
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 369
```

```
TX-POWER-FAIL-LOW = 0
```

```
Parameter Statistics:
```

```
-----
```

```
Total TX Power = -50.00 dBm
```

```
Total RX Power = -50.00 dBm
```

```
Configured Parameters:
```

```
-----
```

Configure OSC Controllers

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 an ILA or OLT node by using the following commands in the configuration mode:

- **transmit-power** *value*
- **sec-admin-state** {**normal** | **maintenance**}
- **tx-low-threshold**
- **shutdown**

Examples

In the following example, the transmit-power is set to 2 dBm. The OSC Tx power can be changed by configuring the OSC transmit power attribute. This attribute internally regulates the OSC Tx VOA.



Note The OSC controller commands do not support decimal inputs. The OSC controller commands consider the inputs to one decimal place for the parameter values. In this example, the transmit-power parameter is provided as *20* to configure the transmit-power parameter to *2 dBm*.

```
RP/0/RP0/CPU0:ios(config)#controller osc 0/0/0/0 transmit-power 20
Fri May 13 11:26:53.445 UTC
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config)#commit
Fri May 13 11:26:55.127 UTC
RP/0/RP0/CPU0:ios(config)#end
```

To view the parameters of the OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output shows the parameters of the OSC controller.

```
Fri May 13 11:26:59.542 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

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

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

Parameter Statistics:
-----
Total TX Power = 1.89 dBm
Total RX Power = -17.30 dBm
```

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

In the following example, the *sec-admin-state* is set to *maintenance*.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/0/0/0 sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

To view the parameters of the OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output highlights the *Transport Admin State* of the OSC controller that is set to *Maintenance*.

```
Fri Apr 22 15:55:36.324 UTC
```

```
Controller State: Up
```

```
Transport Admin State: Maintenance
```

```
Laser State: On
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms: None
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 0
```

```
TX-POWER-FAIL-LOW = 0
```

```
Parameter Statistics:
```

```
-----
```

```
Total TX Power = -10.00 dBm
```

```
Total RX Power = -30.00 dBm
```

```
Configured Parameters:
```

```
-----
```

In the following example, the OSC controller is *shut down*.

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

To view the parameters of the OSC controller that is *shut down*, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output highlights the *Controller State*, *Transport Admin State*, and *Laser State* of the OSC controller that is *shut down*.

```
Tue Apr 12 17:33:12.998 UTC
```

```
Controller State: Administratively Down
```

```
Transport Admin State: Out Of Service
```

```
Laser State: Off
```



```

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

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

Parameter Statistics:
-----
Total TX Power = -50.00 dBm
Total RX Power = -30.00 dBm

Configured Parameters:
-----

```

Gigabit Ethernet Interfaces

A Gigabit Ethernet interface represents the packet layer of an OSC channel.

To view the parameters of a Gigabit Ethernet interface, use the following command:

```
RP/0/RP0/CPU0:ios#show interfaces gigabitEthernet 0/0/0/0
```

The following output shows the parameters of a Gigabit Ethernet interface.

```

Tue Apr 19 10:57:18.251 UTC
GigabitEthernet0/0/0/0 is up, line protocol is up
  Interface state transitions: 1
  Hardware is GigabitEthernet, address is 38fd.f866.096c (bia 38fd.f866.096c) - IP of the
  OSC controller
  Internet address is 10.7.1.1/24
  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 01:14:28
  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

```

To view the IPv4 address of a Gigabit Ethernet interface, use the following command:

```
RP/0/RP0/CPU0:ios#show ipv4 interface brief
```

The following output highlights the interface, IPv4 address (*IP-Address*), status, operational status of the routing protocol (*Protocol*), VPN routing and forwarding (VRF) instance name (*Vrf-Name*) of the Gigabit Ethernet interface.

```

Tue Apr 19 10:58:02.951 UTC

Interface                IP-Address      Status          Protocol Vrf-Name
Loopback0                10.3.3.11      Up              Up       default

```

```

Loopback3                10.1.1.1                Up                    Up                    default
GigabitEthernet0/0/0/0  10.7.1.1                Up                    Up                    default
MgmtEth0/RP0/CPU0/0     10.33.0.61              Up                    Up                    default
PTP0/RP0/CPU0/0         unassigned               Shutdown              Down                  default
MgmtEth0/RP0/CPU0/1     unassigned               Shutdown              Down                  default
PTP0/RP0/CPU0/1         unassigned               Shutdown              Down                  default
MgmtEth0/RP0/CPU0/2     unassigned               Shutdown              Down                  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 the following 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 0/0/0/0 shutdown
RP/0/RP0/CPU0:ios(config)#commit

```

The UDC ports on the OLT and ILA nodes carry 100 Mbps traffic. To see the port parameters, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers switch summary
```

The following output highlights the *UDC0* and *UDC1* ports values including their 100 Mbps traffic speed.

```
Mon May 9 07:30:03.726 UTC
```

```

Rack Card Switch Rack Serial Number
-----
0 RP0 RP-SW FCB2546B08L

Port Phys Admin Port Protocol Forward Connects To
-----
0 Up Up 10-Gbps - Forwarding CPU0
1 Up Up 10-Gbps - Forwarding CPU1
2 Down Down 1-Gbps - Forwarding DEWEY
3 Down Down Unknown - Forwarding Unused
4 Up Up 1-Gbps - Forwarding MGMT0
5 Down Up 1-Gbps - Forwarding MGMT1
6 Down Up 1-Gbps - Forwarding MGMT2
7 Down Down 1-Gbps - Forwarding Unused
8 Down Up 1-Gbps - Forwarding PTP0
9 Down Up 1-Gbps - Forwarding PTP1
10 Up Up 100-Mbps - Forwarding UDC0
11 Up Up 100-Mbps - Forwarding UDC1
12 Up Up 100-Mbps - Forwarding OSC0
13 Up Up 100-Mbps - Forwarding OSC1
14 Down Down 10-Mbps - Forwarding Unused
15 Down Down Unknown - Forwarding Unused

```

The Tx and Rx drops counters do not increment on the node when the fiber is removed from the UDC0 or UDC1 port of the neighboring node. To view the statistics, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers switch statistics
```

The following output highlights the Tx and Rx drops counters on the node when the fiber is removed from the *UDC0* and *UDC1* ports.

```
Mon May 9 07:30:10.164 UTC
```

```

Rack Card Switch Rack Serial Number
-----
0 RP0 RP-SW FCB2546B08L

Phys State Tx Rx Tx Drops/ Rx Drops/

```

Port	State	Changes	Packets	Packets	Errors	Errors
Connects To						
0	Up	1	8250025	3171592	0	0
CPU0						
1	Up	1	6380049	10790031	0	0
CPU1						
2	Down	0	0	0	0	0
DEWEY						
3	Down	0	0	0	0	0
UnUsed						
4	Up	2	3171749	8319773	49	0
MGMT0						
5	Down	0	0	0	0	0
MGMT1						
6	Down	0	0	0	0	0
MGMT2						
7	Down	0	0	0	0	0
UnUsed						
8	Down	2	0	0	0	0
PTP0						
9	Down	2	0	0	0	0
PTP1						
10	Up	0	0	0	0	0
UDC0						
11	Up	0	497065830	3937555205	0	0
UDC1						
12	Up	0	0	0	0	0
OSC0						
13	Up	0	508219613	503446049	3440127611	1218
OSC1						
14	Down	0	0	0	0	0
UnUsed						
15	Down	0	0	0	0	0
UnUsed						

OCH Controller

When nodes with Mux/Demux panels and breakout panels are brought up, OCH controllers are created by default. The OCH controllers for the patch panels are:

Table 11: Supported Interfaces

Patch Panel	Port Type	OCH Ports	Interfaces
NCS1K-BRK-8	LC Ports	8	och R/S/I/0 to och R/S/I/7
NCS1K-BRK-24	LC Ports	24	och R/S/I/0 to och R/S/I/23
NCS1K-MD-320/E-C	LC Ports	32	och R/S/I/0 to och R/S/I/31



Note R/S/I/P stands for Rack/Slot/Instance/Port.

The following table displays the C-band odd and even channel plans for the NCS1K-MD-320/E-C patch panel.

Table 12: NCS1K-MD-320/E-C Channel Plan

Port	Frequency (THz)	Wavelength (nm)	Frequency (THz)	Wavelength (nm)
0	196.100	1528.77	196.025	1529.36
1	195.950	1529.94	195.875	1530.53
2	195.800	1531.12	195.725	1531.70
3	195.650	1532.29	195.575	1532.88
4	195.500	1533.47	195.425	1534.05
5	195.350	1534.64	195.275	1535.23
6	195.200	1535.82	195.125	1536.41
7	195.050	1537.00	194.975	1537.59
8	194.900	1538.19	194.825	1538.78
9	194.750	1539.37	194.675	1537.59
10	194.600	1540.56	194.525	1541.15
11	194.450	1541.75	194.375	1541.34
12	194.300	1542.94	194.225	1543.53
13	194.150	1544.13	194.075	1544.72
14	194.00	1545.32	193.925	1545.92
15	193.850	1546.52	193.775	1547.12
16	193.700	1547.72	193.625	1548.31
17	193.550	1548.91	193.475	1549.52
18	193.400	1550.12	193.325	1550.72
19	193.250	1551.32	193.175	1551.92
20	193.100	1552.52	193.025	1553.13
21	192.950	1553.73	192.875	1554.34
22	192.800	1554.94	192.725	1555.55
23	192.650	1556.15	192.575	1556.76
24	192.500	1557.36	192.425	1557.97

Port	Frequency (THz)	Wavelength (nm)	Frequency (THz)	Wavelength (nm)
25	192.350	1558.58	192.275	1559.19
26	192.200	1559.79	192.125	1560.40
27	192.050	1561.01	191.975	1561.62
28	191.900	1562.23	191.825	1562.84
29	191.750	1563.45	191.675	1564.07
30	191.600	1564.68	191.525	1565.29
31	191.450	1565.90	191.375	1566.52

To view the status of the OCH controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controller description
```

The following shows the status of the OCH controller.

Tue Apr 12 17:17:51.306 UTC

```

Interface                Status      Description
-----
Och0/1/0/0                up
Och0/1/0/1                up
Och0/1/0/2                up
Och0/1/0/3                up
Och0/1/0/4                up
Och0/1/0/5                up
Och0/1/0/6                up
.
.
Output snipped
.
.
Och0/1/0/28               up
Och0/1/0/29               up
Och0/1/0/30               up
Och0/1/0/31               up
Oms0/1/0/32               up
Och0/3/0/0                up
Och0/3/0/1                up
Och0/3/0/2                up
Och0/3/0/3                up
Och0/3/0/4                up
Och0/3/0/5                up
Och0/3/0/6                up
Och0/3/0/7                up
.
.
Output snipped
.
.
Och0/3/0/28               up
Och0/3/0/29               up
Och0/3/0/30               up
Och0/3/0/31               up
Oms0/3/0/32               up

```

To view the parameters of the OCH controller for the NCS1K-BRK-8 panel, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0
```

The following output shows the parameters of the OCH controller for the NCS1K-BRK-8 panel.

```
Tue May 10 11:27:31.354 UTC
```

```
Controller State: Down
```

```
LED State: Red
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms:
```

```
    RX-LOS-P
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 1
```

```
TX-POWER-FAIL-LOW = 0
```

```
Parameter Statistics:
```

```
-----
```

```
TX Power = -50.00 dBm
```

```
RX Power = -50.00 dBm
```

To view the parameters of the OCH controller for the Mux/Demux panel, use the following command:



Note The parameters of the OCH controller for the Mux/Demux panel contain information about the Channel Width, Frequency, and Wavelength.

```
RP/0/RP0/CPU0:ios#show controllers och 0/2/0/0
```

The following output highlights the Channel Width, Frequency, and Wavelength parameters of the OCH controller for the Mux/Demux panel.

```
Wed May 25 11:50:03.481 UTC
```

```
Controller State: Down
```

```
LED State: Red
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms:
```

```
    RX-LOS-P
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 1
```

```
TX-POWER-FAIL-LOW = 0
```

```
Parameter Statistics:
```

```
-----
```

```
TX Power = -50.00 dBm
```

```
RX Power = -50.00 dBm
```

```
channel Frequency = 196.025 THz
```

```
Maximum Channel Width = 150.0 GHz
```

```
Channel Wavelength = 1529.36 nm
```

OMS Controller

When nodes with Mux/Demux panels and breakout panels are brought up, OMS controllers are created by default. The OMS controllers for the patch panels are:

Table 13: Supported Interfaces

Patch Panel	Port Type	OMS Ports	Interfaces
NCS1K-BRK-8	MPO Ports	8	oms R/S/I/8 to oms R/S/I/15
NCS1K-BRK-24	MPO Ports	8	oms R/S/I/24 to oms R/S/I/31
NCS1K-MD-32O/E-C	LC Ports	1	oms R/S/I/32



Note R/S/I/P stands for Rack/Slot/Instance/Port.

To view the status of the OMS controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controller description
```

The following output shows the status of the OMS controller.

```
Tue Apr 12 17:17:51.306 UTC
```

```
Interface                Status      Description
-----
Och0/1/0/0                up
Och0/1/0/1                up
Och0/1/0/2                up
.
.
Output snipped
.
.
Och0/1/0/29               up
Och0/1/0/30               up
Och0/1/0/31               up
Oms0/1/0/32              up
Och0/3/0/0                up
Och0/3/0/1                up
.
.
Output snipped
.
.
Och0/3/0/29               up
Och0/3/0/30               up
Och0/3/0/31               up
Oms0/3/0/32              up
```

To view the parameters of the OMS controller for the BRK-24 panel, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/1/0/25
```

The following output shows the parameters of the OMS controller for the BRK-24 panel.

```
Thu Jul 14 11:05:50.419 UTC

Controller State: Down

Transport Admin State: Automatic In Service

LED State: Red

    Alarm Status:
    -----
    Detected Alarms:
        RX-LOS-P

    Alarm Statistics:
    -----
    RX-LOS-P = 1
    TX-POWER-FAIL-LOW = 0

    Parameter Statistics:
    -----
    TX Power = -7.40 dBm
    RX Power = -50.00 dBm
```

To view the parameters of the OMS controller for the Mux/Demux panel, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/32
```

The following output shows the parameters of the OMS controller for the Mux/Demux panel.

```
Tue May 10 11:28:02.856 UTC

Controller State: Down

LED State: Red

    Alarm Status:
    -----
    Detected Alarms:
        RX-LOS-P

    Alarm Statistics:
    -----
    RX-LOS-P = 1
    TX-POWER-FAIL-LOW = 0

    Parameter Statistics:
    -----
    TX Power = -50.00 dBm
    RX Power = -50.00 dBm
```

Insertion loss for each port is calculated and the power values are displayed on the OMS controller for NCS1K-BRK-8 and OCH controller for NCS1K-BRK-24. Insertion loss per port for NCS1K-BRK-24 is 5.9 dBm and NCS1K-BRK-8 is 0.6 dBm. The NCS1K-MD-320/E-C panels have a maximum insertion loss of 6.2 dBm for the respective Mux and Demux sections.

AINS

The Automatic-In-Service (AINS) feature allows the OTS, OMS and OCH controllers to automatically move to the automatic-in-service state after the system boots up. A soak time period is associated with the AINS

state. By default, the soak time period is one minute. The controllers automatically moves to the In-Service state after the soak time period is completed. During the AINS maintenance window, alarms are not propagated to the EMS/NMS monitoring system.

Soak Time Period

Soak time period for the controllers to move from AINS to In-Service state is 1 minute. You cannot configure the soak time.

The AINS soak time period restarts when there are line card cold reloads or power cycles.

All alarms are suppressed during the AINS state. When the optical and ethernet alarms are raised on the port during the soak time period, the port remains in the AINS state. These alarms are not displayed in the output of the **show alarms brief system active** command but these alarms are displayed in the output of the **show alarms brief system conditions** command. When all the alarms clear, the port moves to IS state.

Displaying the AINS Configuration

AINS is supported for the COM side controllers on the OTS port. It is not supported for the line side OTS-OCH controllers on OLT and ILA cards. After the optical cross connections are configured, the COM side OTS-OCH controller boot ups in AINS state.

This example displays the OTS controller statistics with AINS Soak time running.

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/2
```

```
Wed Jun 22 09:43:04.356 UTC
```

```
Controller State: Down
```

```
Transport Admin State: Automatic In Service
```

```
LED State: Red
```

```
Alarm Status:
```

```
-----
```

```
Detected Alarms:
```

```
RX-LOS-P
```

```
TX-POWER-FAIL-LOW
```

```
Alarm Statistics:
```

```
-----
```

```
RX-LOS-P = 1
```

```
RX-LOC = 0
```

```
TX-POWER-FAIL-LOW = 1
```

```
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 = -50.00 dBm
Total TX Power = -50.00 dBm
Ingress Ampli Gain = 0.0 dB
Ingress Ampli Tilt = 0.0 dB

```

```
Configured Parameters:
```

```

-----
Ingress Ampli Gain = 16.0 dB
Ingress Ampli Tilt = 0.0 dB

```

The following example displays the OTS-OCH cross-connect controller statistics with AINS Soak time running.

```
RP/0/RP0/CPU0:ios#show controllers ots-och 0/0/0/13/20
```

```
Tue Jul 12 10:19:48.838 UTC
```

```
Controller State: Down
```

```
Transport Admin State: Automatic In Service
```

```
Alarm Status:
```

```

-----
Detected Alarms:
      RX-LOS-P
      TX-POWER-FAIL-LOW

```

```
Alarm Statistics:
```

```

-----
RX-LOS-P = 1
TX-POWER-FAIL-LOW = 1

```

```
Parameter Statistics:
```

```

-----
Total RX Power = -50.00 dBm
Total TX Power = -50.00 dBm

```

```
Cross Connect Info:
```

```

-----
line Channel = Ots-Och0/0/0/0/20

```

```
Configured Parameters:
```

```

-----
Rx Low Threshold = -50.0 dBm
Tx Low Threshold = -50.0 dBm

```

The following example displays the OCH controller statistics in AINS state.

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0
```

```
Wed Jul 6 14:28:12.500 UTC
```

```
Controller State: Down
```

```
Transport Admin State: Automatic In Service
```

```
LED State: Red
```

```
Alarm Status:
```

```

-----
Detected Alarms:
RX-LOS-P

Alarm Statistics:
-----
RX-LOS-P = 1
TX-POWER-FAIL-LOW = 0

Parameter Statistics:
-----
TX Power = -50.00 dBm
RX Power = -20.72 dBm

```

The following example displays the OCH controller statistics after AINS Soak time expiry. When the soak time expires, the Transport Admin State of OCH controller changes from *Automatic In Service* to *In Service*.

```

RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0

Wed Jul 6 14:29:59.242 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Off

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

```

```

Alarm Statistics:
-----
RX-LOS-P = 1
TX-POWER-FAIL-LOW = 0

Parameter Statistics:
-----
TX Power = -50.00 dBm
RX Power = 2.79 dBm

```

The following example displays the OMS controller statistics in *AINS state*.

```

RP/0/RP0/CPU0:ios#show controllers oms 0/1/0/25

Tue Jul 12 10:32:05.258 UTC

Controller State: Down

Transport Admin State: Automatic In Service

LED State: Red

    Alarm Status:
    -----
    Detected Alarms:
        RX-LOS-P

    Alarm Statistics:
    -----
    RX-LOS-P = 1
    TX-POWER-FAIL-LOW = 0

    Parameter Statistics:

```

```

-----
TX Power = -7.40 dBm
RX Power = -19.91 dBm

```

All the alarms reported for the controllers in AINS state are displayed in the output of the **show alarms brief system conditions** command.

The following example displays the controller alarms in *AINS state*.

```
RP/0/RP0/CPU0:ios#show alarms brief system conditions
```

```
Mon Jul 25 05:43:50.073 UTC
```

```
-----
Conditions
-----
```

Location	Severity	Group	Set Time	Description
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/1 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/2 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/4 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/5 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/6 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/7 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/8 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/9 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/10 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/11 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/12 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/13 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/14 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/15 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/16 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/17 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/18 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/19 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/21 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Och0/1/0/22 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Oms0/1/0/31 - Loss
0/1 of Signal - Payload	Critical	Controller	07/21/2022 11:11:54 UTC	Oms0/1/0/26 - Loss

0/1	Critical	Controller	07/21/2022 11:11:54 UTC	Oms0/1/0/27 - Loss
of Signal - Payload				
0/1	Critical	Controller	07/21/2022 11:11:54 UTC	Oms0/1/0/28 - Loss
of Signal - Payload				
0/1	Critical	Controller	07/21/2022 11:11:54 UTC	Oms0/1/0/29 - Loss
of Signal - Payload				
0/1	Critical	Controller	07/21/2022 11:11:54 UTC	Oms0/1/0/30 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/33 -
Output OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/33 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/9 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/9 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/8 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/8 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/7 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/7 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/6 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/6 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/5 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/5 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/4 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/4 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/3 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/3 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/2 - Output
OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/2 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/32 -
Output OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/32 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/31 -
Output OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/31 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/30 -
Output OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/30 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/29 -
Output OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/29 - Loss
of Signal - Payload				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/28 -
Output OTS Power Reading Below The Fail-Low Threshold				
0/0	Critical	Controller	07/21/2022 11:12:00 UTC	Ots0/0/0/28 - Loss
of Signal - Payload				

```

0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/25 -
Output OTS Power Reading Below The Fail-Low Threshold
0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/25 - Loss
of Signal - Payload
0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/10 -
Output OTS Power Reading Below The Fail-Low Threshold
0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/10 - Loss
of Signal - Payload
0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/11 -
Output OTS Power Reading Below The Fail-Low Threshold
0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/11 - Loss
of Signal - Payload
0/0          Critical      Controller      07/21/2022 11:12:00 UTC    Ots0/0/0/12 -
Output OTS Power Reading Below The Fail-Low Threshold

```

Headless Mode

The headless mode of operation allows Cisco NCS 1010 to operate errorless during software upgrades and when the controller card is either physically absent or in a failed state. For example, NCS 1010 operates in headless mode for up to 72 hours, during process restarts, controller reload, line card warm reload, line card FPD upgrade, or removal of the controller (Online Insertion and Removal (OIR)). During this time, traffic is not impacted, although the control plane is not up and running. However, you cannot provision anything nor view operational data with a nonfunctional controller. Performance monitoring data based on 15 minutes and 24-hour intervals are not supported with a nonfunctional controller.

OIR is done during the upgrade or replacement of controller cards. When you initiate an OIR, you cannot reach the NCS 1010 through any medium. When the OIR completes, the NCS 1010 becomes reachable.

You can initiate OIR on the controller unit for the following scenarios:

- FPD upgrade failure
- Software image update failure
- Bootup failure

ASE Loading

Table 14: Feature History

Feature Name	Release Information	Description
ASE Loading Enhancements	Cisco IOS XR Release 7.9.1	<p>In addition to the C-band, ASE (Amplified Spontaneous Emission) loading on OLT cards is now enabled for L-band. ASE loading makes the system intrinsically stable and tolerant to power transients by populating the transmission spectrum with noise. It is done to keep the fiber activated even when provisioned optical channels are unavailable during system startup, channel failures, and channel deletion.</p> <p>Also, you can now create overlapping channels (Nyquist channels) on the OLT cards. As a result, fiber utilization is considerably improved as more channels are accommodated within a single fiber. During the failure of overlapping channels, ASE loading fills the void with an overlapping ASE spectrum.</p>

The OLT card (both OLT-C and OLT-L) includes a Noise Loader (NL) EDFA, which acts as an Amplified Spontaneous Emission (ASE) or noise source. The NL connected to the 2x33 ports Wavelength Selective Switch (WSS) loads optical noise. The optical noise fills the Line-TX optical spectrum, when the provisioned optical channels are not available on the ADD- 1 RX, ADD- 2 RX, or COM (OTS0/0/0/2 - OTS0/0/0/33) ports. For more details about the ports, see [OLT Functional Layout](#).

Benefits of ASE Loading:

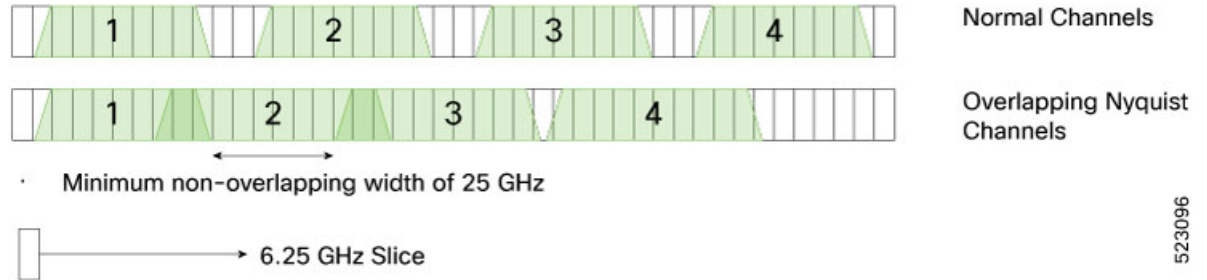
- Completely populates the transmission spectrum at LINE-TX independent of the actual system traffic load, thereby easing the system regulation starting from the Day-1 of the installation.
- The same channel load is maintained during channel failures or channel deletion, which makes the system tolerant to power transients.
- System performances can be verified efficiently because the ASE pattern emulates the full spectrum load also for the nonlinear interaction in the fibers, such as Four Wave Mixing (FWM), Cross Phase Modulations (XPM), and Stimulated Raman Scattering (SRS). Also, gradual fiber degradation that affects utilization of full-fiber capacity can be tracked.
- Keeps the system running the full-channel configuration, which makes the system be intrinsically stable and provide optimal performance.

Nyquist Channels

From Cisco IOS-XR Release 7.9.1, Nyquist channels are supported on both OLT-C and OLT-L cards. The Nyquist channels can overlap on each other.

The following image depicts a sample of four normal channels and four Nyquist (overlapping) channels:

Figure 8: Normal Channels and Nyquist Channels



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While creating the overlapping channels, consider the following conditions.

- If two channels share at least one slice, then it is considered as overlap.
- For the Nyquist overlapped channels, the channels must be cross connected to the same A/D port of the OLT card. If tried to cross-connect to a different port, the NCS 1010 software rejects the configuration with an error message.
- The center frequency of a channel must be outside the spectral range of any other channel.
- The Nyquist channels must have a minimum width of 25GHz of nonoverlapping region.

How ASE Operates

The following is the list of operations that are performed as part of the ASE loading:

1. The NL emits a total power of 16 dBm, and generates a power-spectral density (PSD) that is approximately equal to -10 dBm/12.5 GHz at the WSS input port. The OCM7 port monitors profile of the generated ASE channel. A Variable Optical Attenuator (VOA) available between the NL and the WSS input port regulates the ASE channel level properly.
2. The Cisco NCS 1010 controller sets a predefined value for the VOA so that the ASE channels that are obtained at the COM TX-1 port are equalized to the actual traffic channels to fill out the spectrum at the input of the fixed gain amplifier.
3. When the controller detects a missing channel, for example any failure on the ADD/ EXP ports, it sends an updated attenuation value to the OLT. The OLT applies this value as a new attenuation setpoint and executes the transition from ADDs/EXPs path to ASE in the impacted wavelengths, thus ensuring fast recovery of the initial total optical power on the LINE-TX port.
4. When the optical power is restored, the controller sends a restoration command to the OLT. The OLT executes the transition from ASE to ADDs/EXPs in the impacted wavelengths ensuring minimal total optical power disturbance on the LINE-TX port, thus allowing a smooth fade-out of the ASE.

How ASE Is Managed

The default target ASE Load Spectral Density (AL_SD) is set to 81% for the OLT-C card and 78% for the OLT-L card. This default AL_SD is defined based on the frequency grid at 75 GHz with the first channel centered at 191.375 THz for OLT-C card and 186.125 THz for the OLT-L card. The spectrum is allocated through logical bins with 3.125-GHz width such that each physical slice is associated to two bins. Based on the above, the first ASE channel for the OLT-C card has:

- Bins 1 and 2 blocked (frequency range 191.33750 – 191.34375 THz)
- Bins 3–22 opened (frequency range 191.34375 to 191.40625 THz)
- Bins 23 and 24 blocked (frequency range 191.40625 – 191.4125 THz)

The first ASE channel for the OLT-L card has:

- Bins 13 and 14 blocked (frequency range 186.0875 – 186.09375 THz)
- Bins 15–34 opened (frequency range 186.09375 to 186.15625 THz)
- Bins 35 and 36 blocked (frequency range 186.15625 – 186.1625 THz)

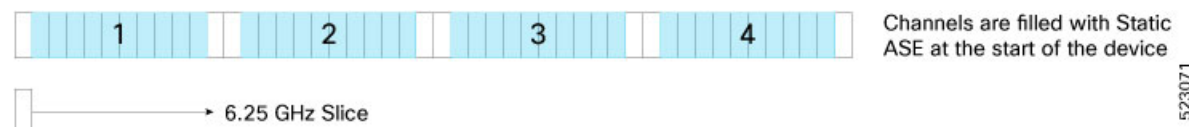
All the other ASE channels are defined similarly by shifting all the settings by 75 GHz (24 bins).



Note The ASE channels on the bins 1537–1548 and 1-12 are retained as blocked for Automatic VOA Shutdown (AVS) for the OLT-C and OLT-L cards respectively. In this AVS mode, the VOA is set at maximum attenuation value, when the channel is not provisioned to ensure the system reliability in case power is accidentally inserted.

Static ASE—At the system startup, without any channel provisioned, the complete ASE Load pattern is forwarded to the OLT LINE-TX port.

Figure 9: Static ASE



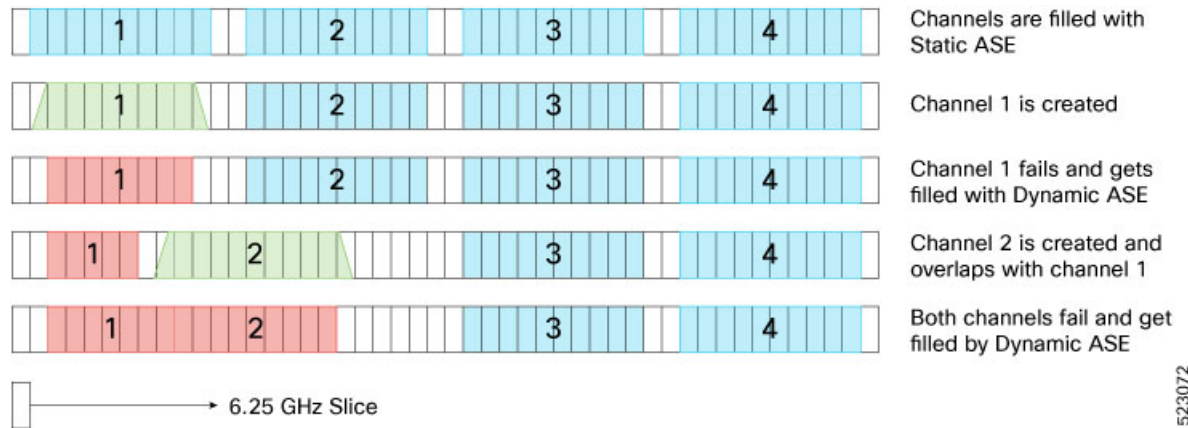
Dynamic ASE—When a traffic channel fails (for example, the PSD within the set of slices that are dedicated to the traffic channel is below a given threshold) an equivalent temporary ASE channel is inserted to maintain the spectral density on the line port. This dynamic ASE channel fills the original traffic channel with only a single slice guard band, at the beginning and the end. When the original traffic channel is restored, the temporary ASE channel is removed, and the original routing on the WSS is reestablished.

Dynamic ASE—With the Nyquist channels, dynamic ASE has the following behavior changes:

- A minimum guard band of 6.25GHz is maintained between the active channel and the dynamic ASE, so the guard band of dynamic ASE will be 6.25 GHz + unused portion of the next user channel.
- When there are two channels, and if channel 1 has failed and channel 2 overlaps channel 1, the dynamic ASE is filled in the slices other than the overlapping slices while leaving at least one slice as guard band.
- If both channel 1 and channel 2 are overlapping and both have failed, dynamic ASE fills both the channels without leaving any guardband.

- Static ASE and Dynamic ASE cannot overlap.

Figure 10: Dynamic ASE with Nyquist Channels



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Optical Channel Monitoring

The Optical Channel Monitor (OCM) blocks in the OLT and ILA cards provide per-channel optical power monitoring.

The OLT-C card has a single OCM device with 37 OCM measuring points (OCM1 - OCM37). You can read the OCM data for all the OCM blocks through the IOS-XR commands, except OCM1, OCM4, and OCM7.

The measuring points in the OLT-C card are:

- LINE-TX
- LINE-RX
- 2x33 ports of WSS in the multiplexer section of the OLT-C card

See [OLT Functional Layout](#) for details of the ports.

Table 15: Optical Specifications for OCM in OLT-C

Parameter	Unit	Minimum	Typical	Maximum	Note
Dynamic ranges	dBm/12.5GHz	-10		10	Ports: LINE-TX, COM-RX-1 and internal Noise Loader port
		-30		0	Port LINE-RX
		-35		0	Ports: ADD-RX-1 and ADD-RX-2
		-35		5	Ports ADD/DROP-i (i=3..32) (on DROP ports OCM is virtual)
Accuracy	dB	± 0.5		± 2	Depending on the adjacent channel relative power
Frequency range	THz	191.175 191.150		196.175	Out-of-band channel frequency 191.150 - 191.3375 THz are available only as row-data values.
Frequency accuracy (absolute)	GHz			± 5	
Frequency accuracy (relative)	GHz			+/-3	
Resolution Bandwidth	GHz		12.5		
Frequency step	GHz	3.125			
Scan Time	ms			250	Single port

The ILA-C card has a single OCM device with 4 OCM measuring points.

The measuring points in the ILA-C card are:

- Input port of EDFA1
- Input port of EDFA2

- Output port of EDFA1
- Output port of EDFA2

See [ILA Functional Layout](#) for details of the ports.

Table 16: Optical Specifications for OCM in ILA-C

Parameter	Unit	Min.	Typical	Max	Note
Dynamic ranges	dBm/12.5GHz	-30		0	LINE-RX ports
		-10		10	LINE-TX ports
Accuracy	dB	± 0.5		± 2	Depending on the adjacent channel relative power
Frequency range	THz	191.175		196.175	
Frequency accuracy (absolute)	GHz			± 5	
Frequency accuracy (relative)	GHz			± 3	
Resolution Bandwidth	GHz		12.5		
Frequency step	GHz	3.125			
Scan Time	ms			250	Single port

View OCM Data

You can view the raw OCM data (slice level channel power) using the following commands:

```
RP/0/RP0/CPU0:ios#sh controllers ots 0/0/0/0 spectrum-info
Fri Feb 4 13:12:49.841UTC
Spectrum Slices spacing      :          3.125 GHz
Spectrum Slices Range       :          1 - 1548
Slice start wavelength      :          1566.82 nm
Slice start frequency       :          191337.50 GHz
Spectrum power information :
Rx power :
-----
spectrum-slice num          Rx-power values (dBm)
-----
   1 - 12                   -88.8 -88.8 -88.8 -88.8   -88.8 -88.8 -88.8 -88.8
-88.8 -88.8 -88.8 -88.8
  13 - 24                   -88.8 -88.8 -88.8 -88.8   -88.8 -88.8 -88.8 -88.8
-88.8 -88.8 -88.8 -88.8
.....
.....
.....
1537 - 1548                 -88.8 -88.8 -88.8 -88.8   -88.8 -88.8 -88.8 -88.8
-88.8 -88.8 -88.8 -88.8
```

```

-----
Tx power :
-----
spectrum-slice num                Tx-power values (dBm)
-----
1 - 12                -9.5  -7.3  -6.0  -5.2    -4.9  -4.8  -4.6  -4.4    -4.4
   -4.4  -4.4  -4.4
13 - 24                -4.4  -4.5  -4.6  -4.8    -5.1  -5.5  -6.4  -7.7    -9.6
   -12.0 -13.2 -11.4
25 - 36                -9.2  -7.7  -6.7  -6.2    -6.0  -5.9  -5.7  -5.6    -5.6
   -5.5  -5.4  -5.4
37 - 48                -5.3  -5.3  -5.4  -5.5    -5.8  -6.1  -6.6  -7.3    -8.6
   -10.4 -12.2 -11.8
.....
.....
.....
1525 - 1536            -2.4  -2.4  -2.4  -2.4    -2.4  -2.3  -2.3  -3.0
-4.2  -6.5 -10.3 -14.9
1537 - 1548            -19.3 -22.6 -24.3 -25.3    -26.1 -26.6 -27.1 -27.6
-27.9 -28.2 -28.4 -28.6

```

The preceding sample displays the Rx-power values (OCM3 raw data) and Tx-power values (OCM2 raw data) at the line sides. Similarly, you can view the OCM raw data for the COM side controllers OTS0/0/0/2 to 0/0/0/33.

You can also view the grid OCM data (per channel power level) for a particular channel in the ILA-C and OLT-C cards. By default, the channels are not created. Create a channel using the following commands:

configure

hw-module location *location* **terminal-ampli grid-mode** *mode*

channel-id *channel id* **centre-freq** *frequency* **width** *channel-width*

commit

The following is a sample to configure the channel on an OLT-C card:

```

RP/0/RP0/CPU0:ios#config
Fri Feb 4 13:14:49.841 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXR0 terminal-ampli grid-mode flex
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#channel-id 1 centre-freq 196.1 width 75
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)# commit
Fri Feb 4 13:15:12.841 UTC

```

```
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#end
```

The following sample shows the OTS OCH controller channel parameters such as Total Rx power and Total Tx power.

```

RP/0/RP0/CPU0:ios#sh controllers ots-och 0/0/0/0/1
Fri Feb 4 13:15:59.125 UTC
Controller State: Up
Transport Admin State: In Service
LED State: Yellow
Parameter Statistics:
-----
Total RX Power = -10.50 dBm
Total TX Power = -10.50 dBm
Configured Parameters:
-----
RP/0/RP0/CPU0:ios#

```

To view the grid OCM data for a particular channel in the ILA-C card, create a channel using the following commands:

configure

hw-module location *location* **inline-ampli grid-mode** *mode*

channel-id *channel id* **centre-freq** *frequency* **width** *channel-width*

commit

The following is a sample to a configure the OTS-OCH controller on an ILA-C card:

```
RP/0/RP0/CPU0:ios#config
Fri Feb 4 13:15:49.841 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXR0 inline-ampli grid-mode flex
RP/0/RP0/CPU0:ios(config-hwmod-ila-flexi)#channel-id 1 centre-freq 196.1 width 75
RP/0/RP0/CPU0:ios(config-hwmod-ila-flexi)# commit
Fri Feb 4 13:15:12.841 UTC
```

```
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#end
```

The following sample shows the OTS OCH controller channel parameters such as Total Rx power and Total Tx power.

```
RP/0/RP0/CPU0:ios#sh controllers ots-och 0/0/0/2/1
Fri Feb 4 13:15:59.125 UTC
Controller State: Up
Transport Admin State: In Service
Alarm Status:
-----
Detected Alarms: None
Alarm Statistics:
-----
RX-LOS-P = 0
TX-POWER-FAIL-LOW = 0
Parameter Statistics:
-----
Total RX Power = -10.50 dBm
Total TX Power = -10.50 dBm
Configured Parameters:
-----
RP/0/RP0/CPU0:ios#
```