Cisco NCS 1010 and NCS 1020 Datapath Configuration Guide, IOS XR Releases 26.x.x

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CONTENTS

NCS 1010 Datapath Orchestration

This chapter gives a brief overview of the datapath orchestration that is required for NCS 1010.

For an overview of the NCS 1010 OLS and passive modules, please refer to Cisco NCS 1010 Optical Line System -An Overview.

Document objective

The Cisco Network Convergence System (NCS) 1010 platform includes these configuration guides.:

- The *Cisco NCS 1010 System Setup and Software Installation Guide* describes how to bring up the NCS 1010 system and perform the required software installation.

- The *Cisco NCS 1010 Datapath Configuration Guide* describes how to configure various datapaths on NCS 1010.

- The *Cisco NCS 1010 Optical Applications Configuration Guide* describes multiple optical applications on NCS 1010 that help to bring up the link and maintain traffic.

Document Organization - Data Path Guide

This document is organized into the following chapters:

Chapter	Description
Configure Controllers, on page 3	Describes the tasks to configure and view the parameters of the OTS, OTS-OCH, OSC, DFB, OCH, and OMS controller types.
Monitor Performance, on page 165	Describes the setting and retrieval of PM counters for the OTS, OTS-OCH, OSC, DFB, OCH, and OMS controllers in flex-bin, 30-second, 15-minute, or 24-hour intervals.

Chapter	Description
	Checks the connection between the OLT-C line card and all the other passive modules to find broken links or loops.
	Provides examples of a few NCS 1010 topologies for colored, colorless, and hybrid solutions.

CHAPTER 2

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 `hw-module` 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.

ILA controller models in NCS 1010

This reference lists all the ILA controller models available for the Cisco NCS 1010 platform and details the mapping between their physical ports and controllers. Use this information to identify controller-port assignments for supported in-line amplifier (ILA) line cards, including release-specific models and supported features.

ILA controller models

The ILA controller model is available for the NCS 1010 ILA line cards:

- NCS1K-ILA-C: C-band In-Line Amplifier without Raman

- NCS1K-ILA-R-C: C-band In-Line Amplifier with one side Raman

- NCS1K-ILA-2R-C: C-band In-Line Amplifier with both sides Raman

- NCS1K-ILA-L: L-band In-Line Amplifier without Raman

- NCS1K-E-ILA-R-C: C-band In-Line Amplifier with East-facing Raman, Enhanced

- NCS1K-E-ILA-2R-C: C-band In-Line Amplifier with both sides Raman, Enhanced

- NCS1K-E-ILA-R-C-2: C-band In Line Amplifier with West-facing Raman, Enhanced

Note   For release information of the ILA line cards, refer to *Hardware Installation Guide for Cisco NCS 1010 and Cisco NCS 1000 Passive Modules*.

Port and controller mapping for each ILA line card

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

Figure 1: NCS1K-ILA-C front view
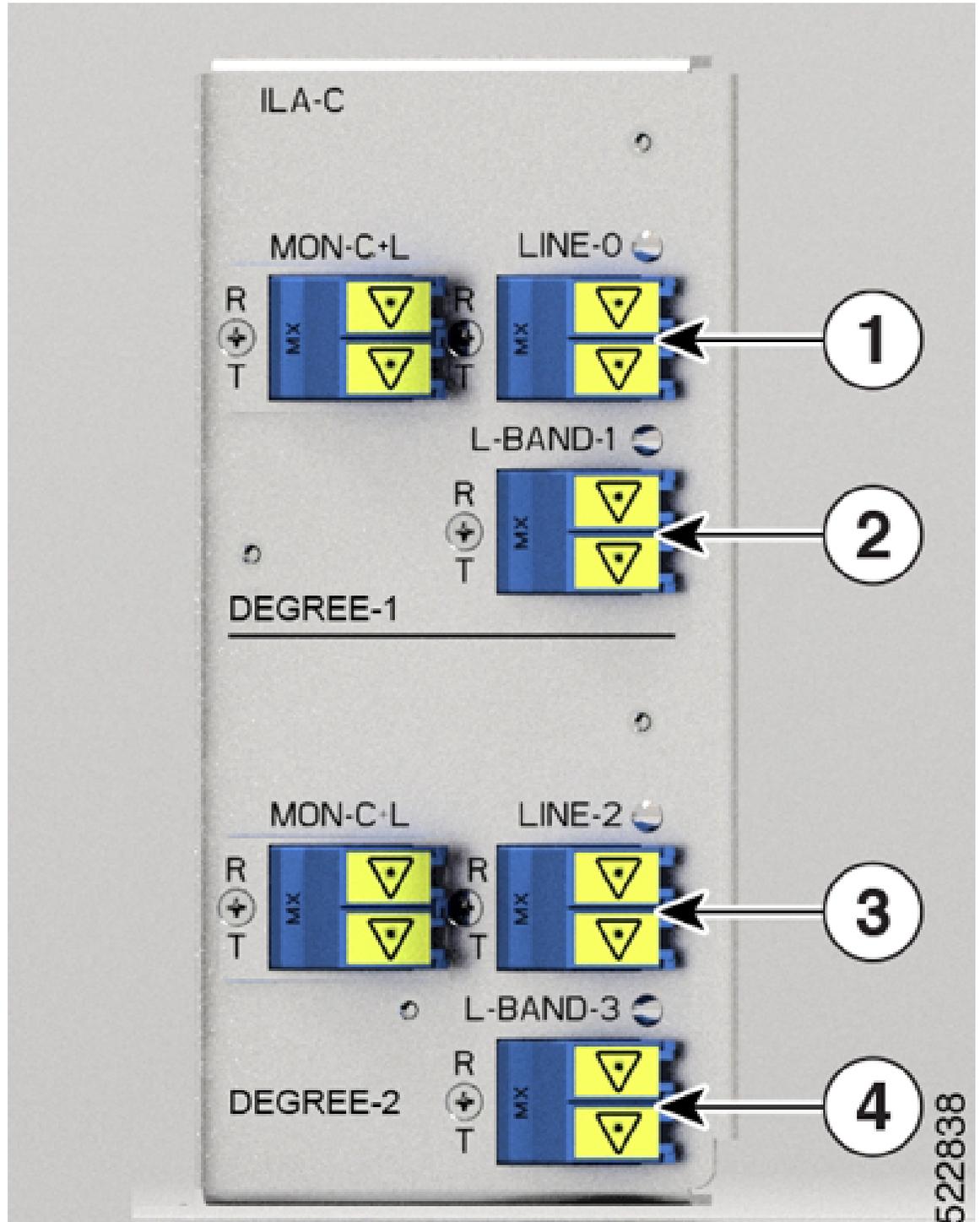
Table 2: NCS1K-ILA-C port mapping

Callout	Port labl	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0
		Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	L-BAND-1	Parent Controller: OTS0/0/0/1
3	LINE-2	Parent Controller: OTS0/0/0/2
		Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	L-BAND-3	Parent Controller: OTS0/0/0/3

Figure 2: NCS1K-ILA-R-C front view

Table 3: NCS1K-ILA-R-C port mapping

Callout	Port labl	Controller types
1	RAMAN pump and LINE-0	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	L-BAND-1	Parent Controller: OTS0/0/0/1
3	LINE-2	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	L-BAND-3	Parent Controller: OTS0/0/0/3

Figure 3: NCS1K-ILA-2R-C front view
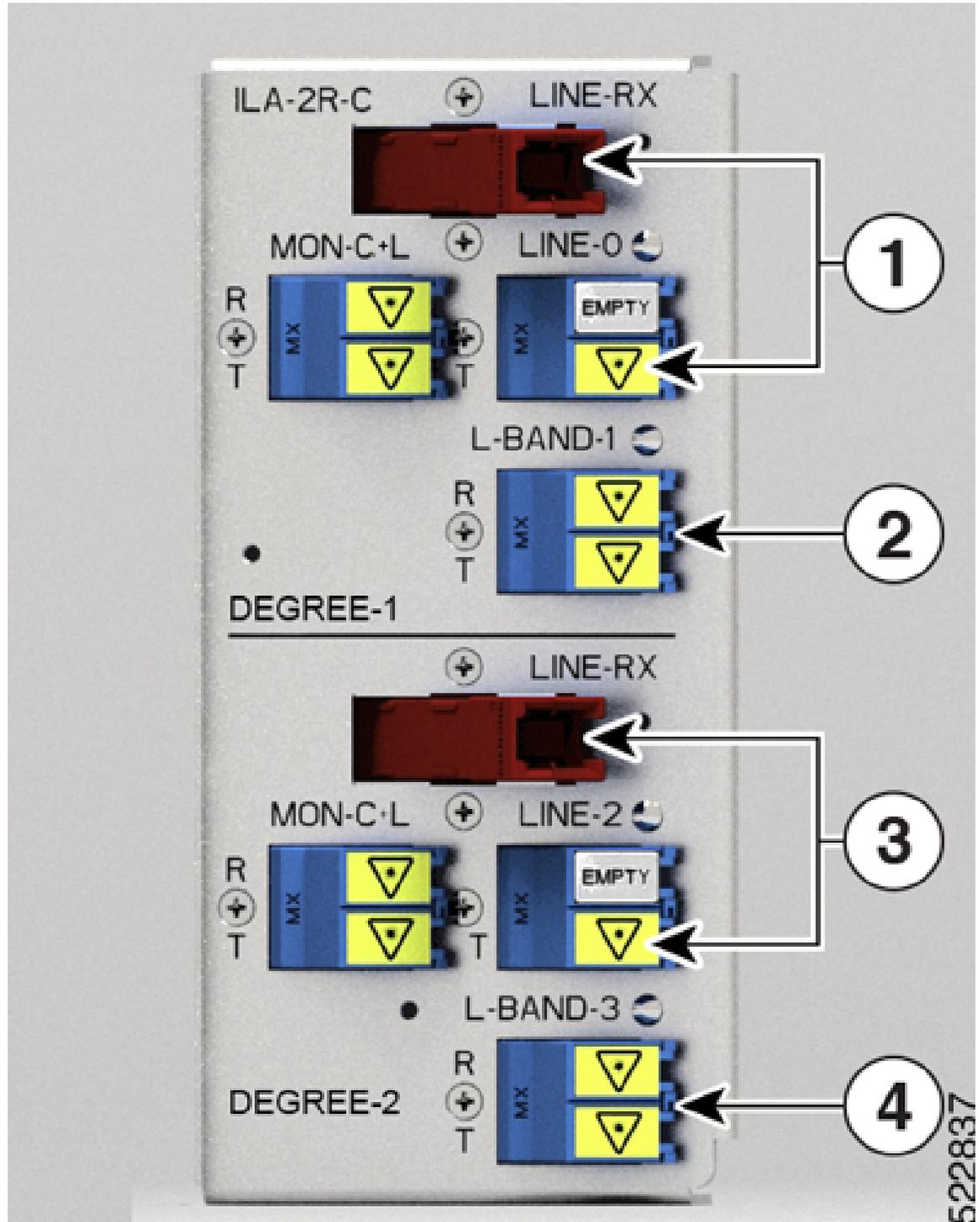
Table 4: NCS1K-ILA-2R-C port mapping

Callout	Port labl	Controller types
1	RAMAN pump and LINE-0	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	L-BAND-1	Parent Controller: OTS0/0/0/1
3	RAMAN pump and LINE-2	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	L-BAND-3	Parent Controller: OTS0/0/0/3

Figure 4: NCS1K-ILA-L front view
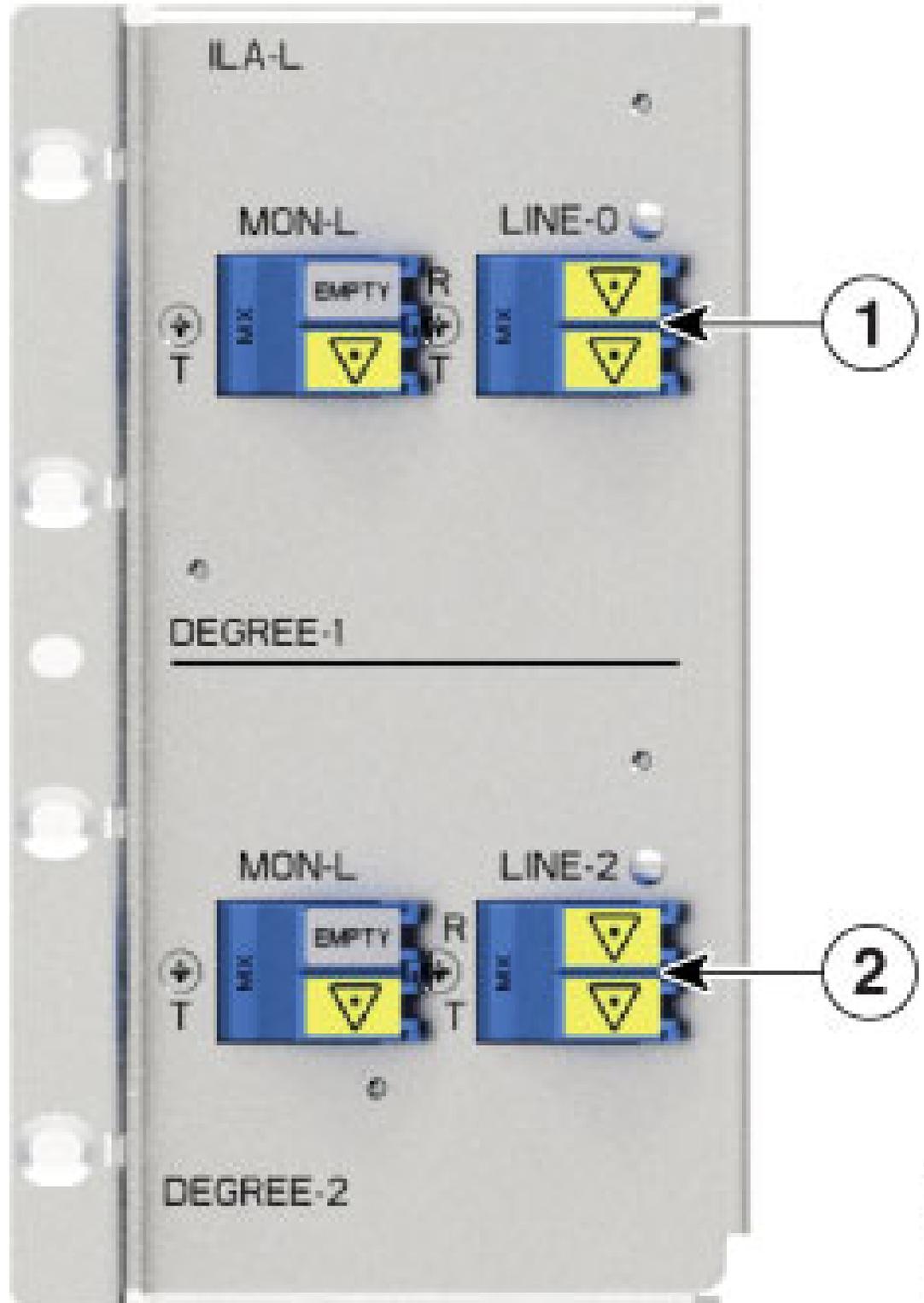
Table 5: NCS1K-ILA-L port mapping

Callout	Port labl	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0
		Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	LINE-2	Parent Controller: OTS0/0/0/2
		Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x

The figures and tables show the three ILA variants that are introduced in Release 7.10.1 and the mapping between their physical ports and controllers:

Note   The new ILA variants have ports that are highlighted in red to indicate the Raman ports.

Figure 5: NCS1K-E-ILA-R-C front view

Configure Controllers

ILA controller models in NCS 1010
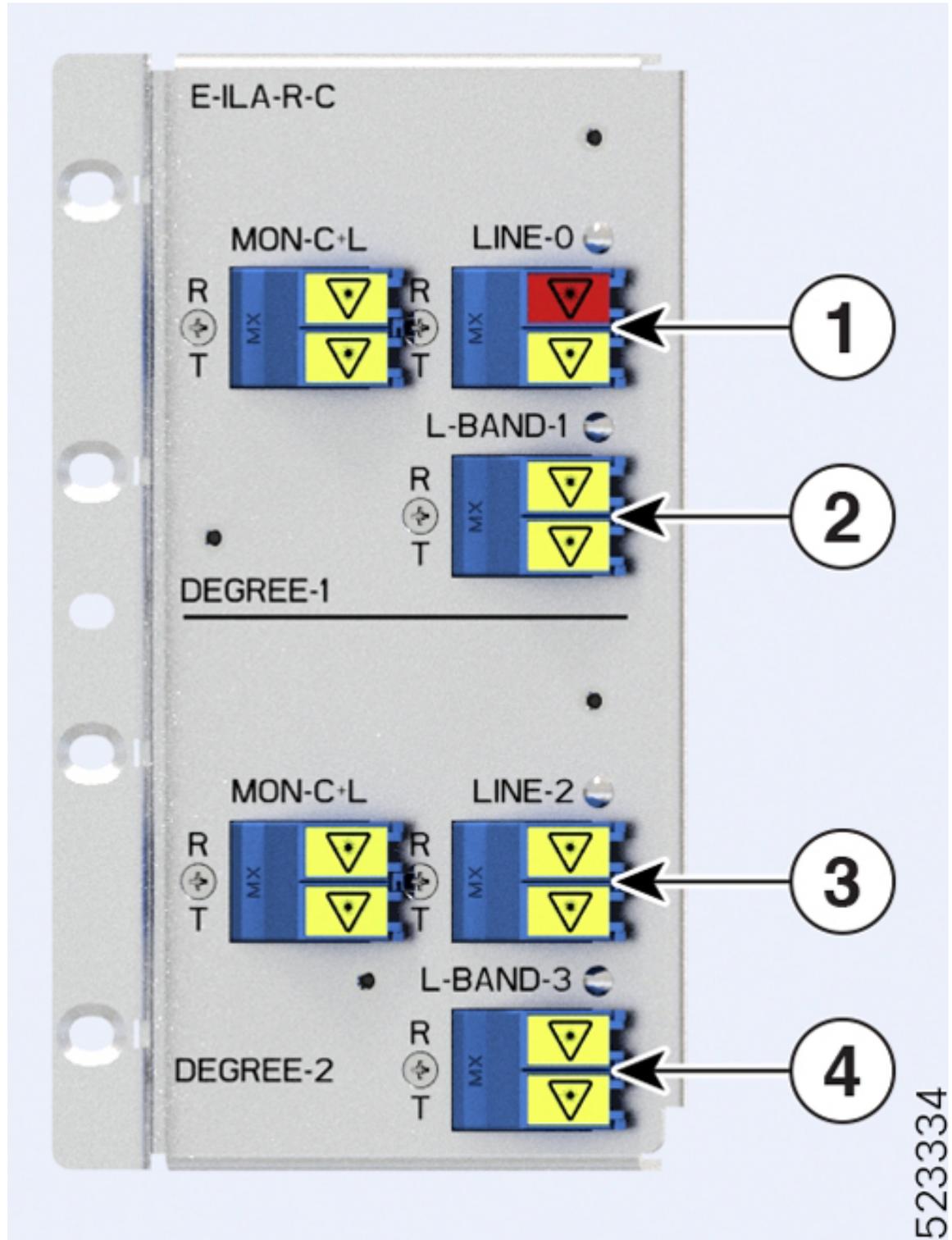
Table 6: E-ILA-R-C port mapping

Callout	Port labl	Controller types
1	RAMAN port and LINE-0	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	L-BAND-1	Parent Controller: OTS0/0/0/1
3	LINE-2	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	L-BAND-3	Parent Controller: OTS0/0/0/3

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Figure 6: NCS1K-E-ILA-2R-C front view
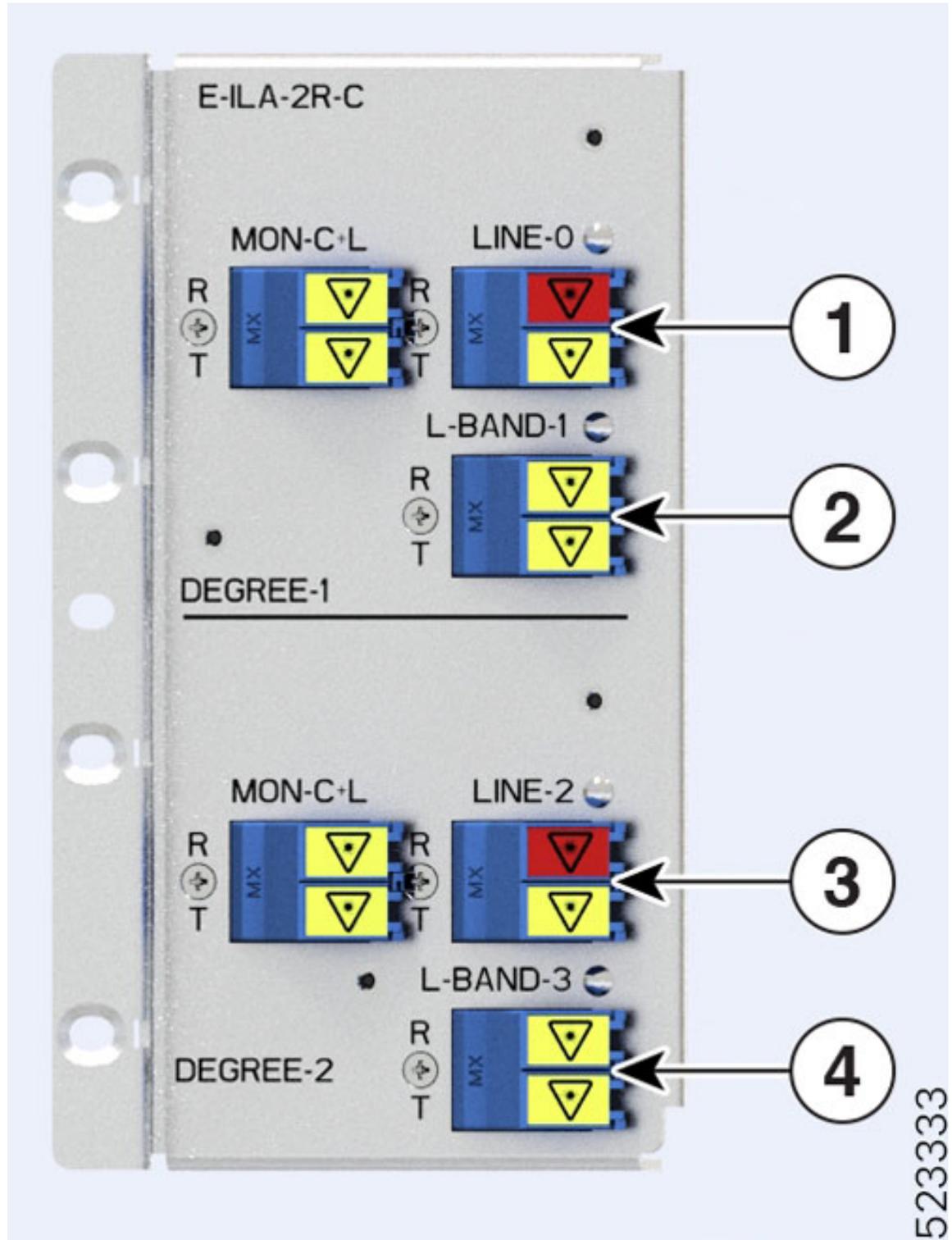
Table 7: E-ILA-2R-C port mapping

Callout	Port labl	Controller types
1	RAMAN port and LINE-0	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	L-BAND-1	Parent Controller: OTS0/0/0/1
3	RAMAN port and LINE-2	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	L-BAND-3	Parent Controller: OTS0/0/0/3

The figure and table show the new ILA variant that is introduced in Release 7.11.1 and the mapping between its physical ports and controllers:

Figure 7: NCS1K-E-ILA-R-C-2 front view
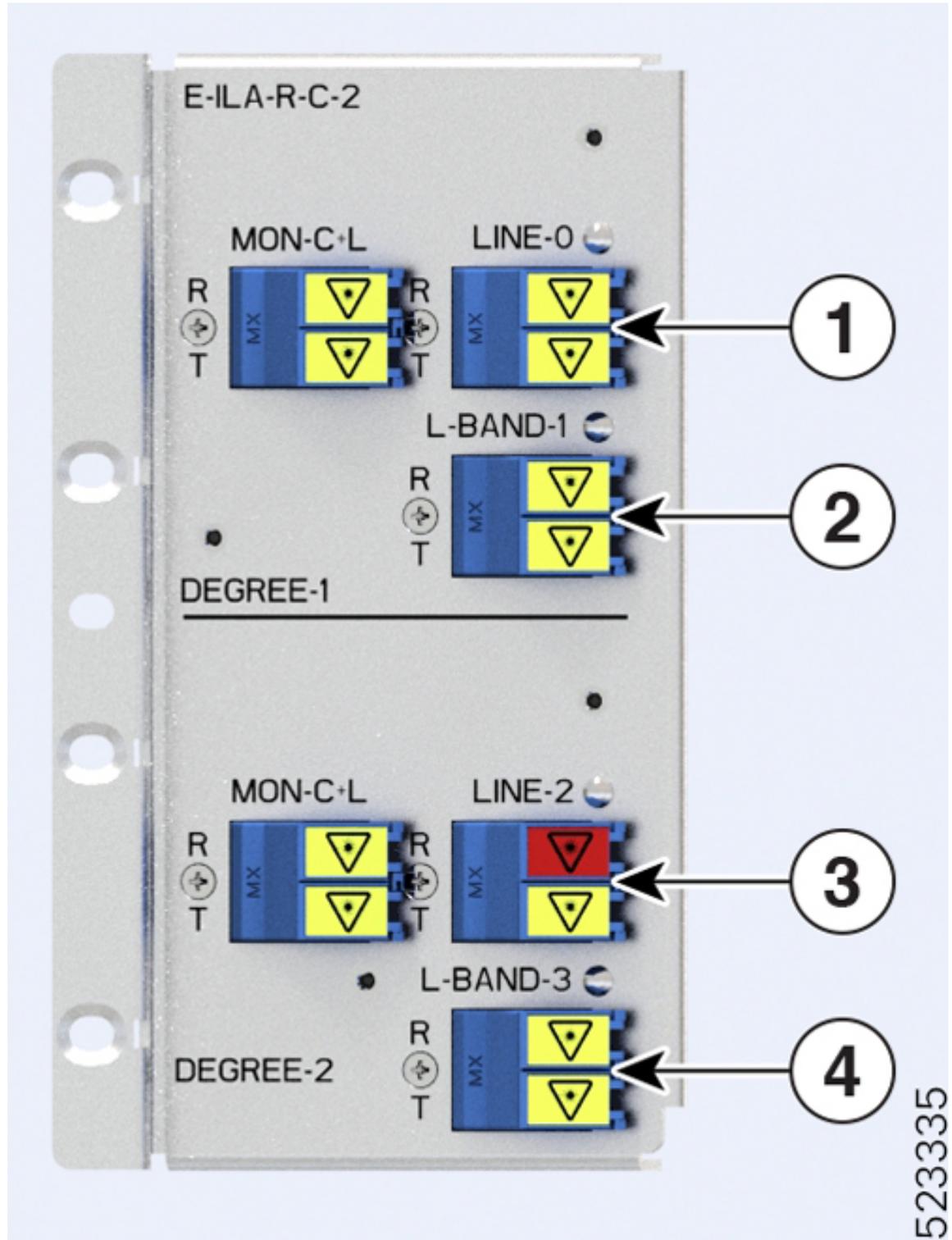
Table 8: E-ILA-R-C-2 port mapping

Callout	Port labl	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	L-BAND-1	Parent Controller: OTS0/0/0/1
3	RAMAN port and LINE-2	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	L-BAND-3	Parent Controller: OTS0/0/0/3

OLT controller models and their port mappings

This reference lists all the OLT controller models available for the Cisco NCS 1010 and NCS 1020 platform. It details the mapping between physical ports and controllers for each OLT and E-OLT cards. Use this information to identify controller-port assignments for supported optical line terminal (OLT) line cards, including release-specific models and supported features.

OLT controller models

The OLT controller model is available for the NCS 1010 OLT line cards:

- NCS1K-OLT-C: C-band Optical Line Terminal without Raman

- NCS1K-OLT-R-C: C-band Optical Line Terminal with Raman

- NCS1K-OLT-L: L-band Optical Line Terminal without Raman

- NCS1K-E-OLT-L: L-band Optical Line Terminal without Raman, enhanced

- NCS1K-E-OLT-C: C-band Optical Line Terminal without Raman, enhanced

- NCS1K-E-OLT-R-C: C-band Optical Line Terminal with Raman, enhanced

Note For release information of the OLT line cards, refer to *Hardware Installation Guide for Cisco NCS 1010 and Cisco NCS 1000 Passive Modules*.

Port and controller mapping for each OLT line card

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

Figure 8: NCS1K-OLT-C

Table 9: NCS1K-OLT-C Port Mapping

Callout	Port label	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	L-BAND-1	Parent Controller: OTS0/0/0/1
3	A/D 2	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
4	A/D 4	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
5	A/D 4-11	Parent Controller: OTS0/0/0/4-11 Child Controller: COM OTS-OCH 0/0/0/4-11/x
6	A/D 12-19	Parent Controller: OTS0/0/0/12-19 Child Controller: COM OTS-OCH 0/0/0/12-19/x
7	A/D 20-27	Parent Controller: OTS0/0/0/20-27 Child Controller: COM OTS-OCH 0/0/0/20-27/x
8	A/D 28-33	Parent Controller: OTS0/0/0/28-33 Child Controller: COM OTS-OCH 0/0/0/28-33/x

Figure 9: NCS1K-OLT-R-C
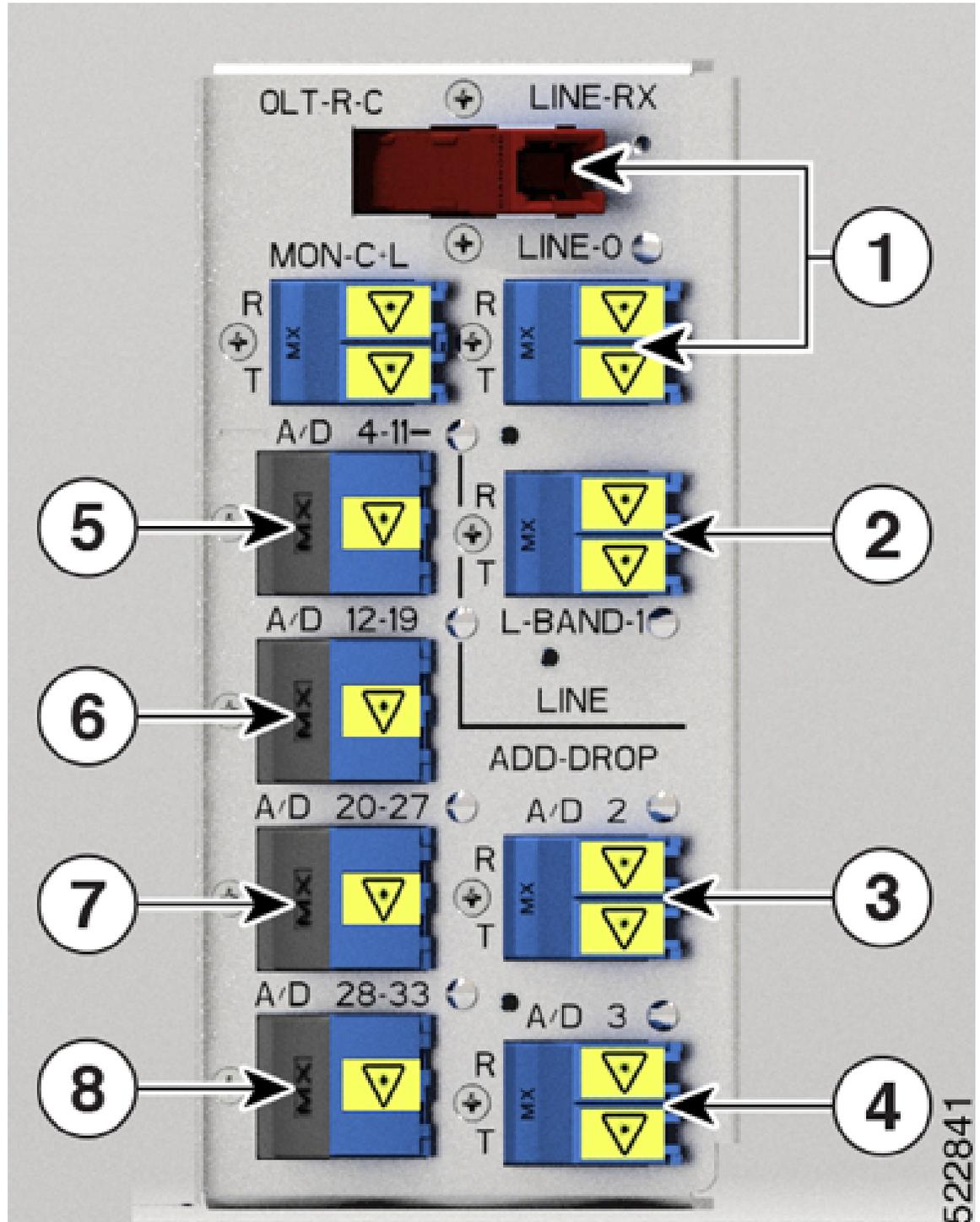
Table 10: NCS1K-OLT-R-C Port Mapping

Callout	Port label	Controller types
1	LINE-RX and LINE-0	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	L-BAND-1	Parent Controller: OTS0/0/0/1
3	A/D 2	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
4	A/D 3	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
5	A/D 4-11	Parent Controller: OTS0/0/0/4-11 Child Controller: COM OTS-OCH 0/0/0/4-11/x
6	A/D 12-19	Parent Controller: OTS0/0/0/12-19 Child Controller: COM OTS-OCH 0/0/0/12-19/x
7	A/D 20-27	Parent Controller: OTS0/0/0/20-27 Child Controller: COM OTS-OCH 0/0/0/20-27/x
8	A/D 28-33	Parent Controller: OTS0/0/0/28-33 Child Controller: COM OTS-OCH 0/0/0/28-33/x

Figure 10: NCS1K-OLT-L
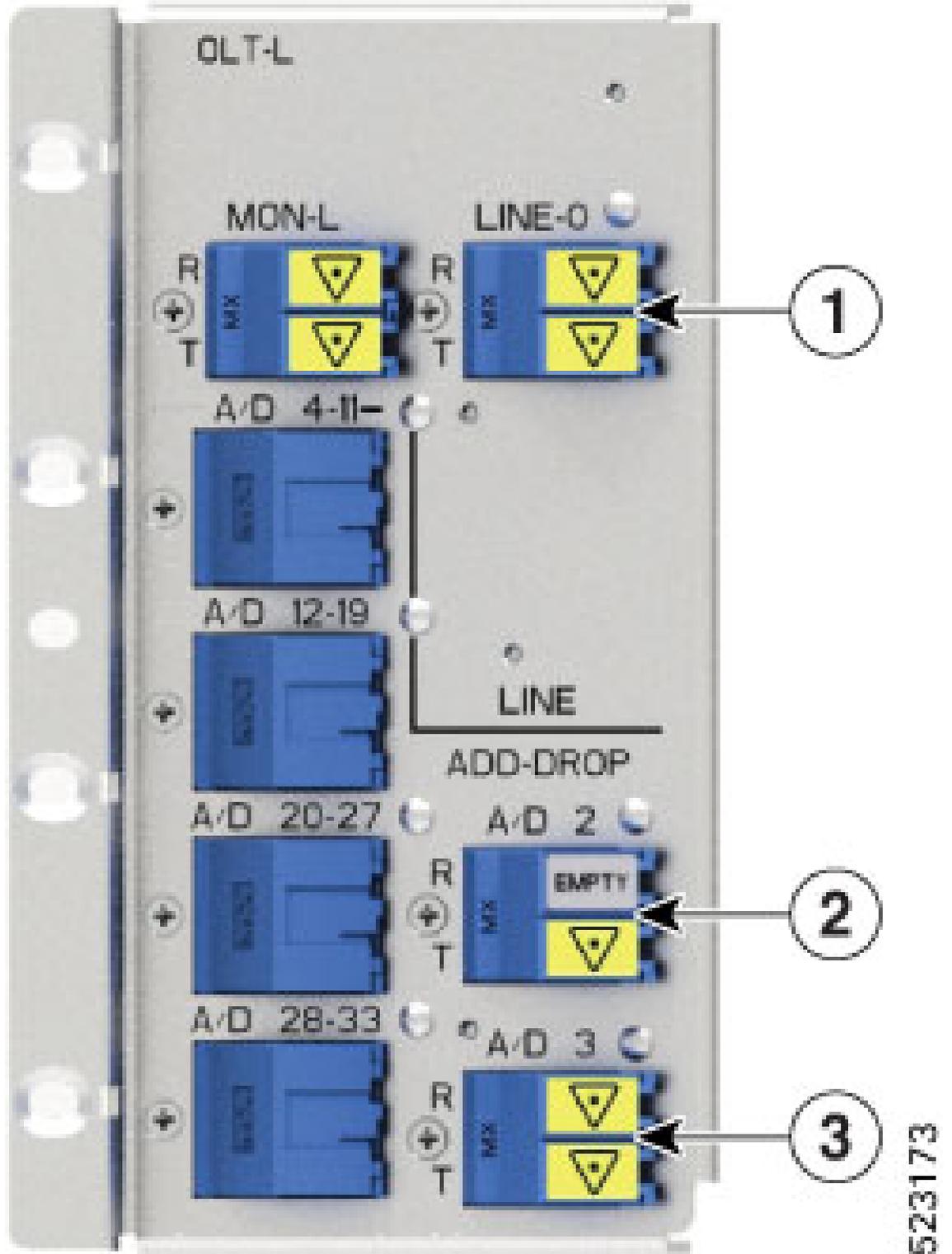
Table 11: NCS1K-OLT-L Port Mapping

Callout	Port label	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	A/D 2	Parent Controller: OTS0/0/0/2 Child Controller: OSC0/0/0/2, Line OTS-OCH 0/0/0/2/x
3	A/D 3	Parent Controller: OTS0/0/0/3

The figures and tables show the three OLT variants that are introduced in Release 7.10.1 and the mapping between their physical ports and controllers:

Figure 11: NCS1K-E-OLT-L

Table 12: NCS1K-E-OLT-L Port Mapping

Callout	Port	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	2	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
3	3	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
4	4	Parent Controller: OTS0/0/0/4 Child Controller: COM OTS-OCH 0/0/0/4/x
5	5	Parent Controller: OTS0/0/0/5 Child Controller: COM OTS-OCH 0/0/0/5/x
6	6	Parent Controller: OTS0/0/0/6 Child Controller: COM OTS-OCH 0/0/0/6/x
7	7	Parent Controller: OTS0/0/0/7 Child Controller: COM OTS-OCH 0/0/0/7/x
8	8	Parent Controller: OTS0/0/0/8 Child Controller: COM OTS-OCH 0/0/0/8/x
9	9	Parent Controller: OTS0/0/0/9 Child Controller: COM OTS-OCH 0/0/0/9/x
10	10	Parent Controller: OTS0/0/0/10 Child Controller: COM OTS-OCH 0/0/0/10/x
11	11	Parent Controller: OTS0/0/0/11 Child Controller: COM OTS-OCH 0/0/0/11/x
12	12	Parent Controller: OTS0/0/0/12 Child Controller: COM OTS-OCH 0/0/0/12/x
13	13	Parent Controller: OTS0/0/0/13 Child Controller: COM OTS-OCH 0/0/0/13/x
14	14	Parent Controller: OTS0/0/0/14 Child Controller: COM OTS-OCH 0/0/0/14/x

Callout	Port	Controller types
15	15	Parent Controller: OTS0/0/0/15 Child Controller: COM OTS-OCH 0/0/0/15/x
16	16	Parent Controller: OTS0/0/0/16 Child Controller: COM OTS-OCH 0/0/0/16/x
17	17	Parent Controller: OTS0/0/0/17 Child Controller: COM OTS-OCH 0/0/0/17/x
18	18-25	Parent Controller: OTS0/0/0/18-25 Child Controller: COM OTS-OCH 0/0/0/18-25/x
19	26-33	Parent Controller: OTS0/0/0/26-33 Child Controller: COM OTS-OCH 0/0/0/26-33/x

Figure 12: NCS1K-E-OLT-C
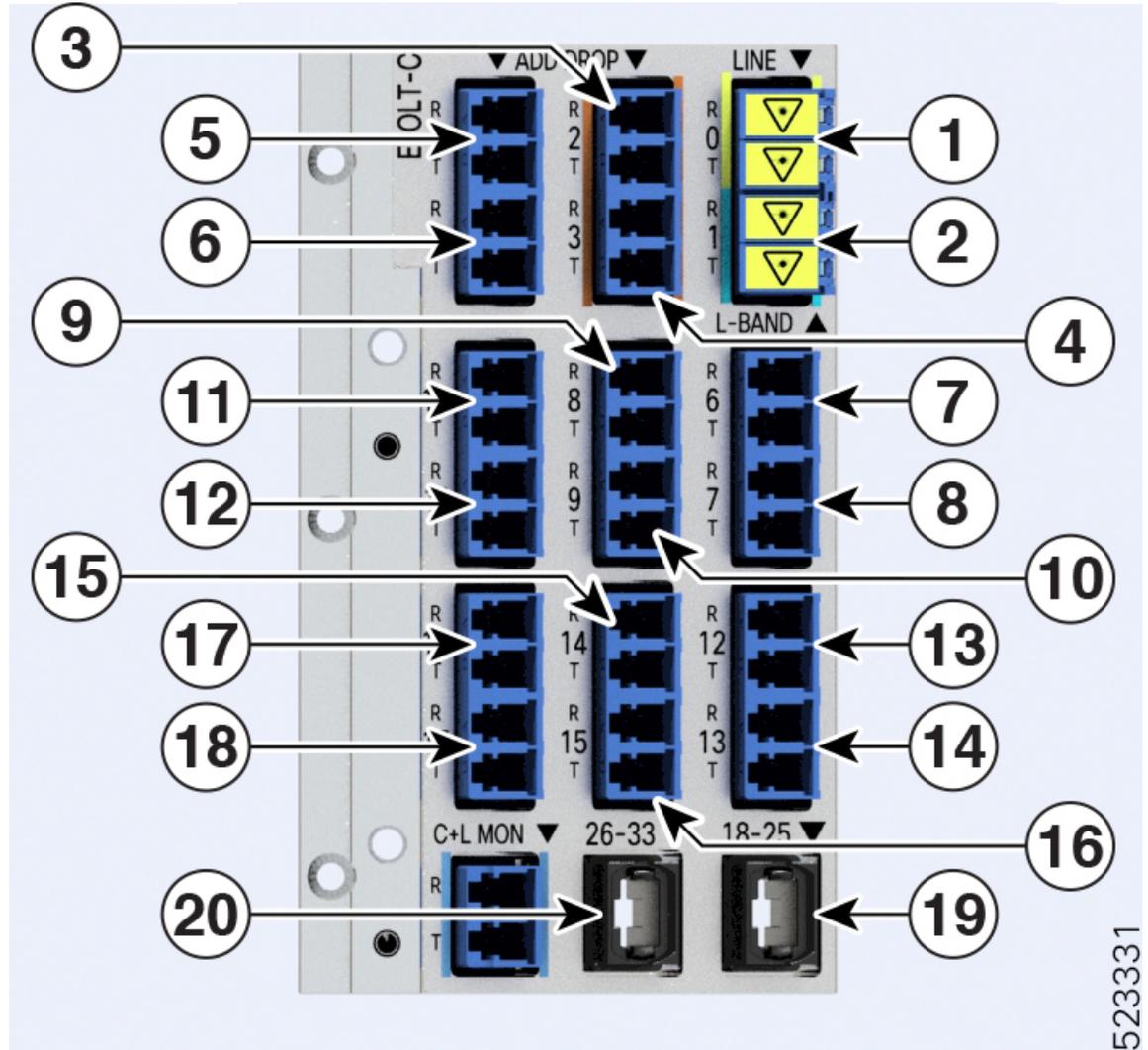
Table 13: NCS1K-E-OLT-C Port Mapping

Callout	Port label	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	1	Parent Controller: OTS0/0/0/1
3	2	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x

Callout	Port label	Controller types
4	3	Parent Controller: OTS0/0/0/3
		Child Controller: COM OTS-OCH 0/0/0/3/x
5	4	Parent Controller: OTS0/0/0/4
		Child Controller: COM OTS-OCH 0/0/0/4/x
6	5	Parent Controller: OTS0/0/0/5
		Child Controller: COM OTS-OCH 0/0/0/5/x
7	6	Parent Controller: OTS0/0/0/6
		Child Controller: COM OTS-OCH 0/0/0/6/x
8	7	Parent Controller: OTS0/0/0/7
		Child Controller: COM OTS-OCH 0/0/0/7/x
9	8	Parent Controller: OTS0/0/0/8
		Child Controller: COM OTS-OCH 0/0/0/8/x
10	9	Parent Controller: OTS0/0/0/9
		Child Controller: COM OTS-OCH 0/0/0/9/x
11	10	Parent Controller: OTS0/0/0/10
		Child Controller: COM OTS-OCH 0/0/0/10/x
12	11	Parent Controller: OTS0/0/0/11
		Child Controller: COM OTS-OCH 0/0/0/11/x
13	12	Parent Controller: OTS0/0/0/12
		Child Controller: COM OTS-OCH 0/0/0/12/x
14	13	Parent Controller: OTS0/0/0/13
		Child Controller: COM OTS-OCH 0/0/0/13/x
15	14	Parent Controller: OTS0/0/0/14
		Child Controller: COM OTS-OCH 0/0/0/14/x
16	15	Parent Controller: OTS0/0/0/15
		Child Controller: COM OTS-OCH 0/0/0/15/x
17	16	Parent Controller: OTS0/0/0/16
		Child Controller: COM OTS-OCH 0/0/0/16/x
18	17	Parent Controller: OTS0/0/0/17
		Child Controller: COM OTS-OCH 0/0/0/17/x

Callout	Port label	Controller types
19	18-25	Parent Controller: OTS0/0/0/18-25
		Child Controller: COM OTS-OCH 0/0/0/18-25/x
20	26-33	Parent Controller: OTS0/0/0/26-33
		Child Controller: COM OTS-OCH 0/0/0/26-33/x

Figure 13: NCS1K-E-OLT-R-C

Note In the image, the port that is highlighted in red is the Raman port.
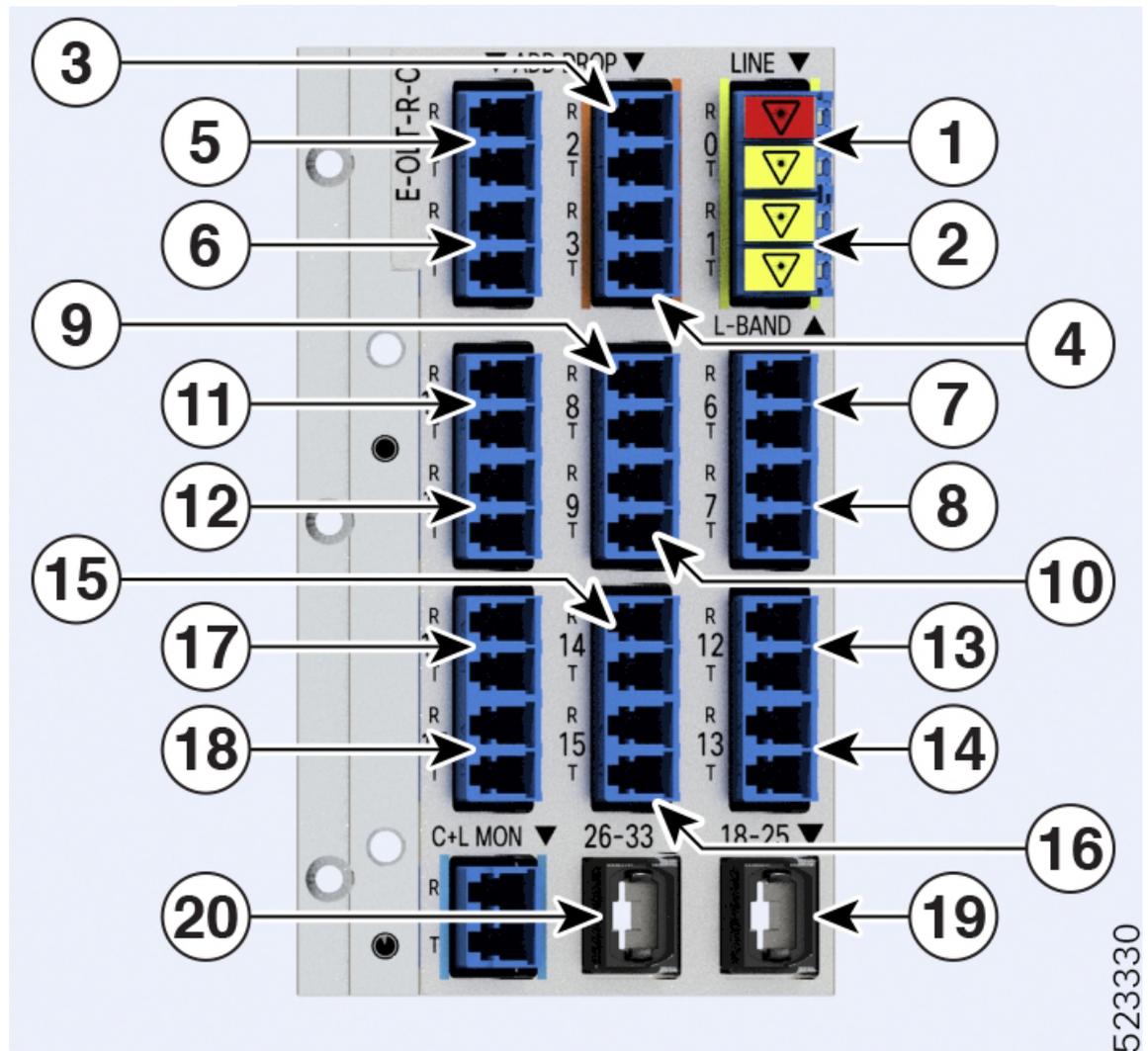
Table 14: NCS1K-E-OLT-R-C Port Mapping

Callout	Port label	Controller types
1	LINE-0	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	1	Parent Controller: OTS0/0/0/1
3	2	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
4	3	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
5	4	Parent Controller: OTS0/0/0/4 Child Controller: COM OTS-OCH 0/0/0/4/x
6	5	Parent Controller: OTS0/0/0/5 Child Controller: COM OTS-OCH 0/0/0/5/x
7	6	Parent Controller: OTS0/0/0/6 Child Controller: COM OTS-OCH 0/0/0/6/x
8	7	Parent Controller: OTS0/0/0/7 Child Controller: COM OTS-OCH 0/0/0/7/x
9	8	Parent Controller: OTS0/0/0/8 Child Controller: COM OTS-OCH 0/0/0/8/x
10	9	Parent Controller: OTS0/0/0/9 Child Controller: COM OTS-OCH 0/0/0/9/x
11	10	Parent Controller: OTS0/0/0/10 Child Controller: COM OTS-OCH 0/0/0/10/x
12	11	Parent Controller: OTS0/0/0/11 Child Controller: COM OTS-OCH 0/0/0/11/x
13	12	Parent Controller: OTS0/0/0/12 Child Controller: COM OTS-OCH 0/0/0/12/x
14	13	Parent Controller: OTS0/0/0/13 Child Controller: COM OTS-OCH 0/0/0/13/x

Callout	Port label	Controller types
15	14	Parent Controller: OTS0/0/0/14 Child Controller: COM OTS-OCH 0/0/0/14/x
16	15	Parent Controller: OTS0/0/0/15 Child Controller: COM OTS-OCH 0/0/0/15/x
17	16	Parent Controller: OTS0/0/0/16 Child Controller: COM OTS-OCH 0/0/0/16/x
18	17	Parent Controller: OTS0/0/0/17 Child Controller: COM OTS-OCH 0/0/0/17/x
19	18-25	Parent Controller: OTS0/0/0/18-25 Child Controller: COM OTS-OCH 0/0/0/18-25/x
20	26-33	Parent Controller: OTS0/0/0/26-33 Child Controller: COM OTS-OCH 0/0/0/26-33/x

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-E-ILA-R-C, NCS1K-E-ILA-2R-C, NCS1K-E-ILA-R-C-2, 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 15: 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:
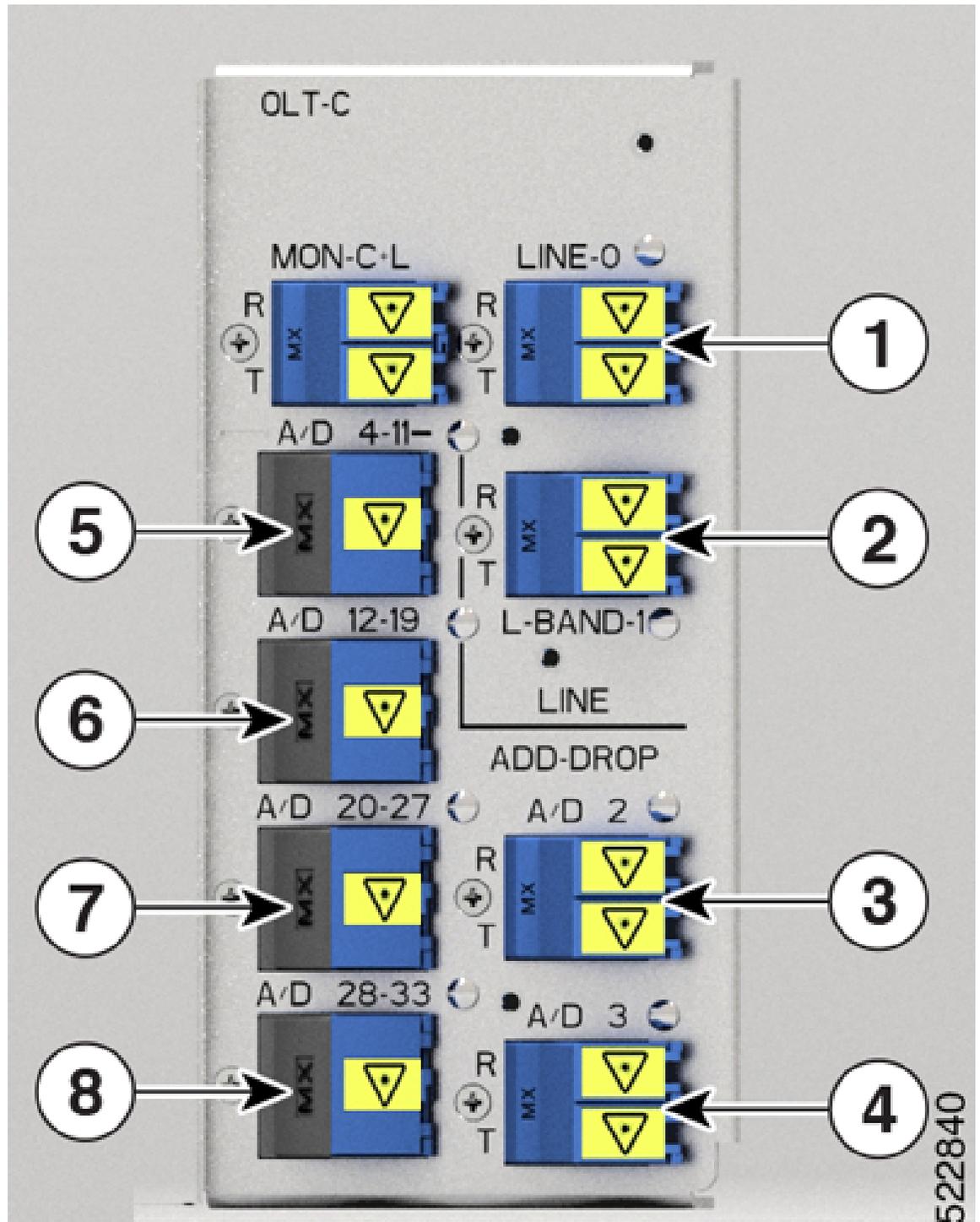
Figure 14: NCS1K-ILA-2R-C
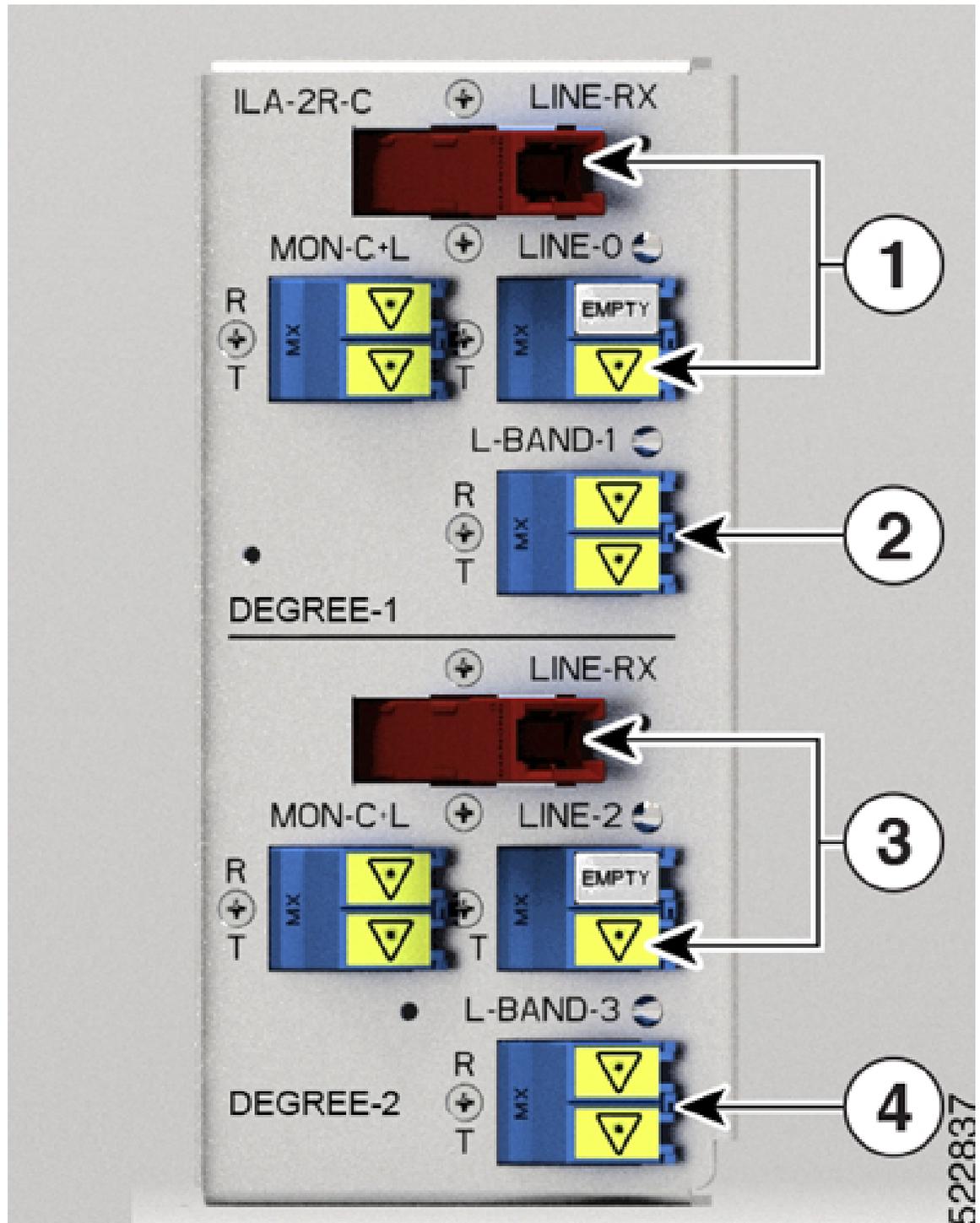
Table 16: NCS1K-ILA-2R-C Port Mapping

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 15: NCS1K-ILA-R-C

Table 17: 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 16: NCS1K-ILA-C

Table 18: 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 17: NCS1K-ILA-L

Table 19: 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

The following figures and tables show the three ILA variants that are introduced in Release 7.10.1 and the mapping between their physical ports and controllers:

Note The new ILA variants have ports that are highlighted in red to indicate the Raman ports.

Figure 18: NCS1K-E-ILA-2R-C
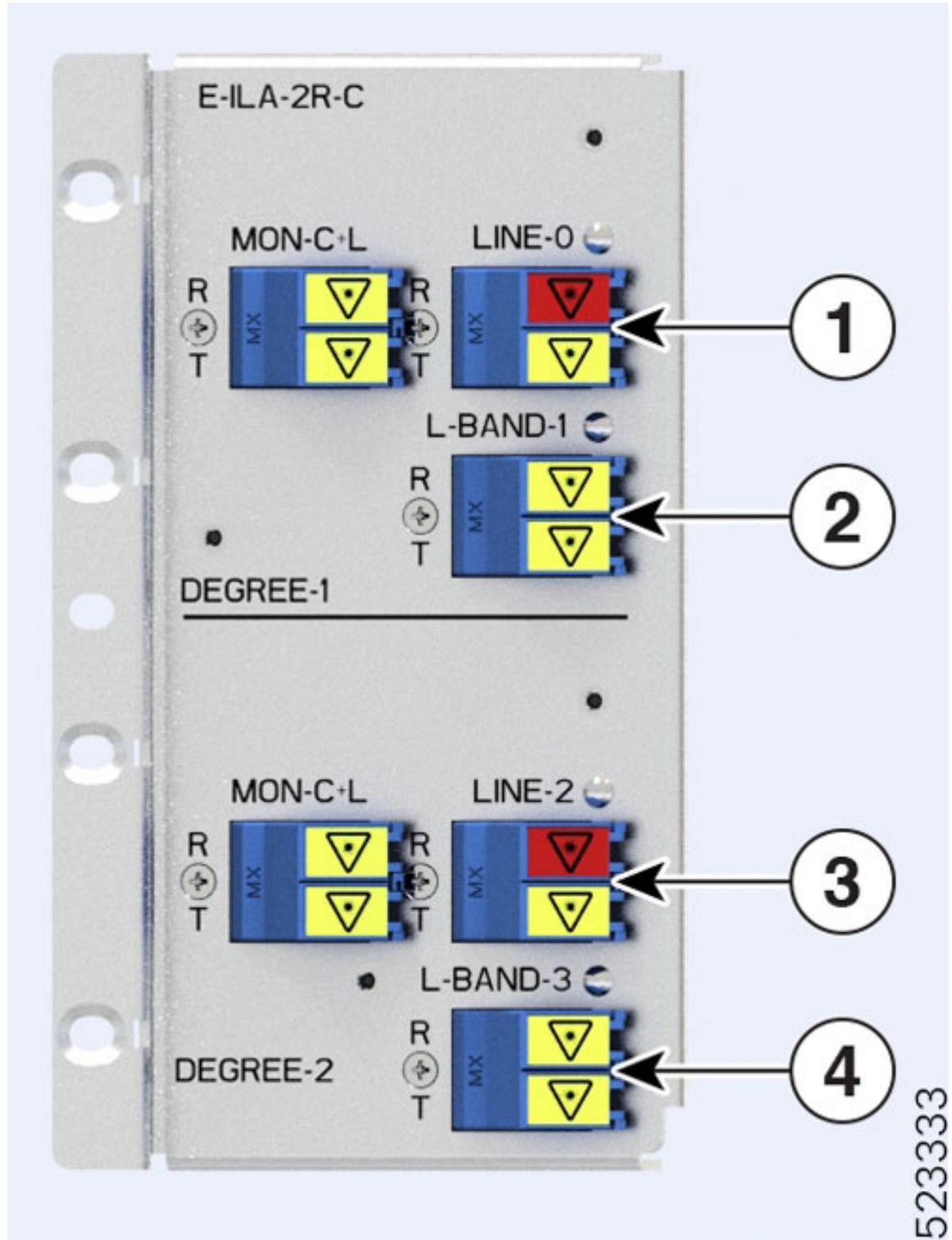
Table 20: E-ILA-2R-C Port Mapping

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 19: NCS1K-E-ILA-R-C
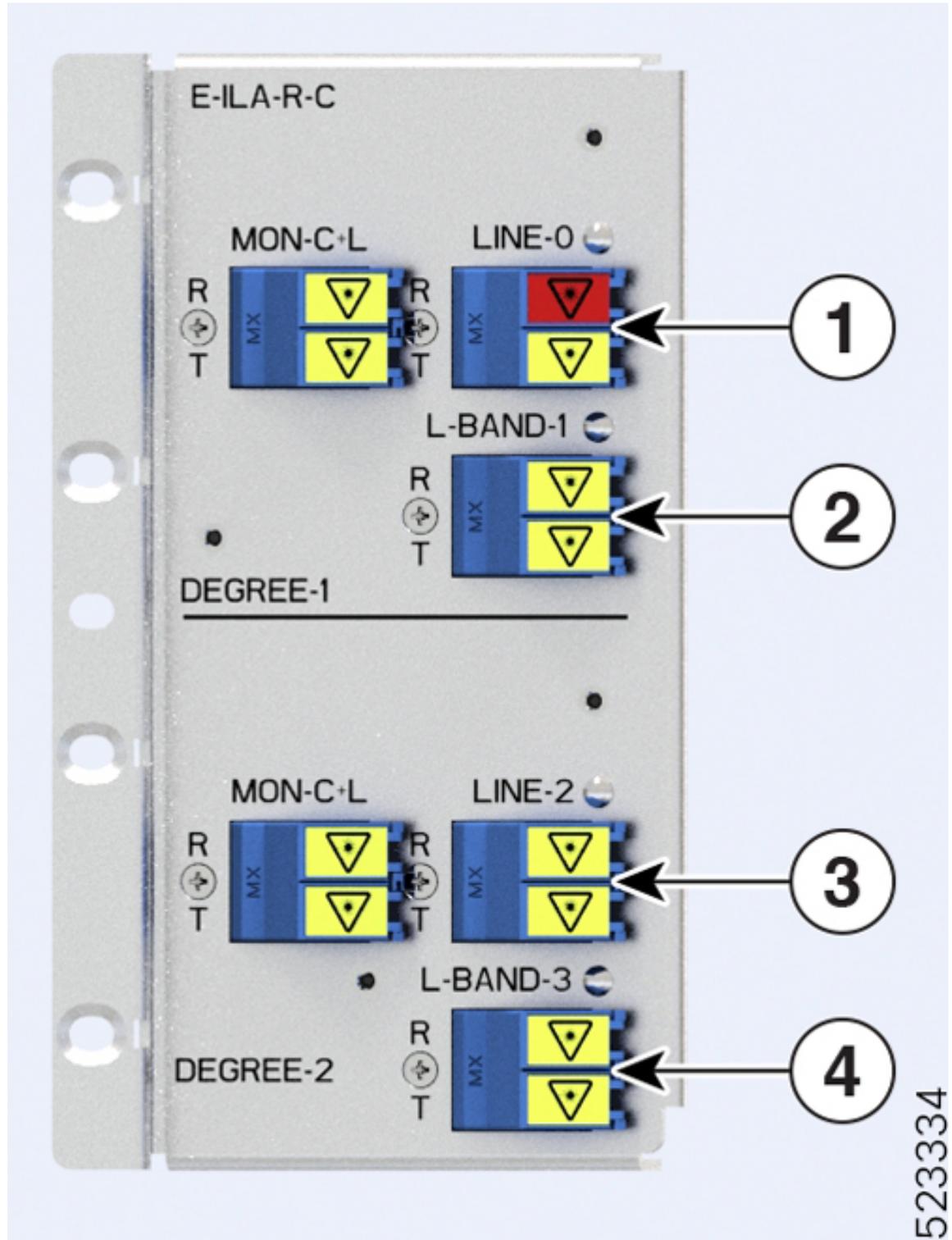
Table 21: E-ILA-R-C Port Mapping

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

The following figures and tables show the new ILA variant that is introduced in Release 7.11.1 and the mapping between its physical ports and controllers:
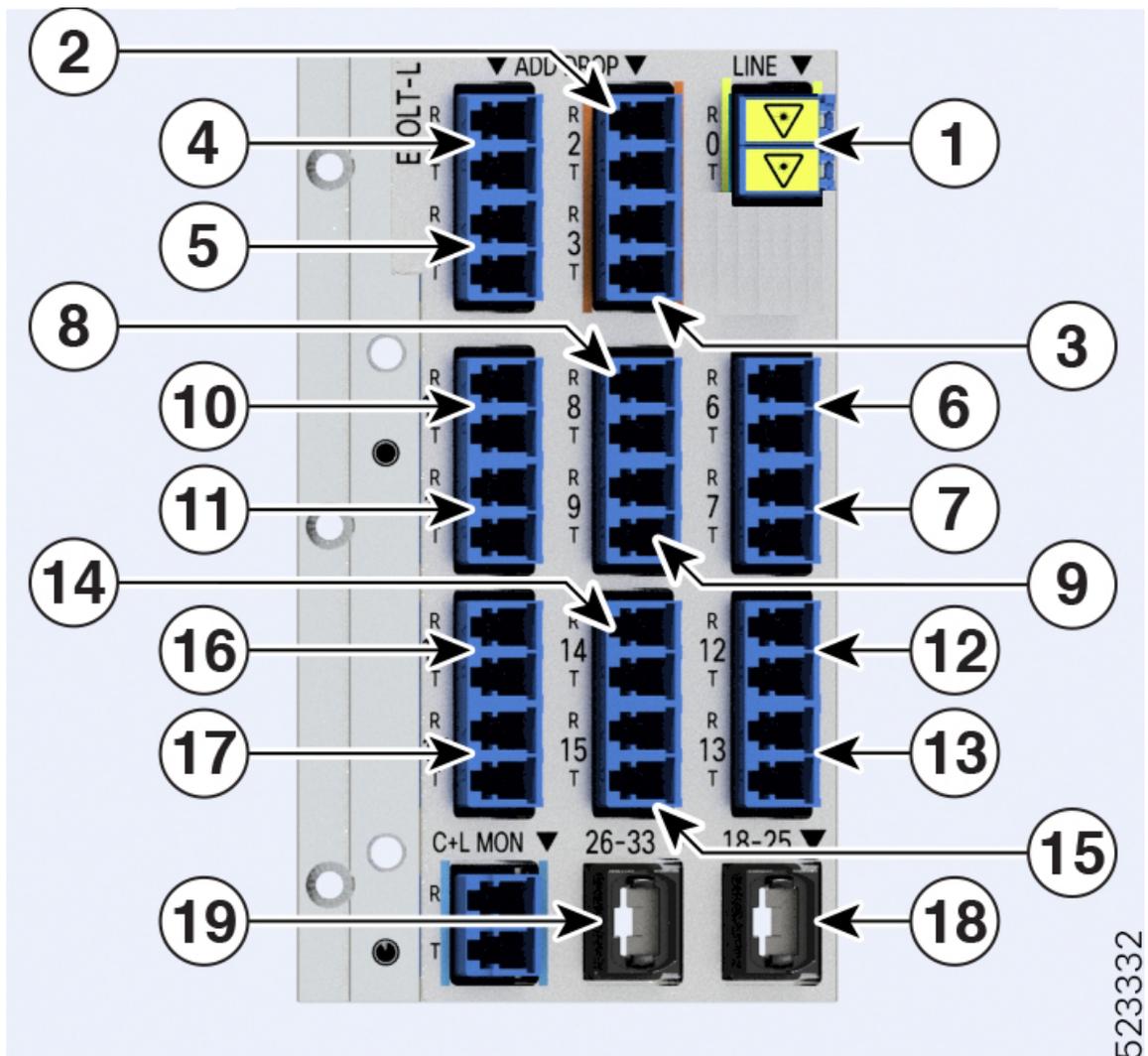
Figure 20: NCS1K-E-ILA-R-C-2

Table 22: E-ILA-R-C-2 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, DFB0/0/0/2, Line OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3

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-CNTLR-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-CNTLR-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
```

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-E-OLT-C, NCS1K-E-OLT-R-C, NCS1K-E-OLT-L, 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

For the new OLT variants, the following lists the Add/Drop ports that are mapped to the OTS controllers:

- 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…17 (Add1…16 Rx/Drop1…16 Tx OTS controller)

- MPO ports: ots 0/0/0/18 to ots 0/0/0/25

- MPO ports: ots 0/0/0/26 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 21: NCS1K-OLT-R-C
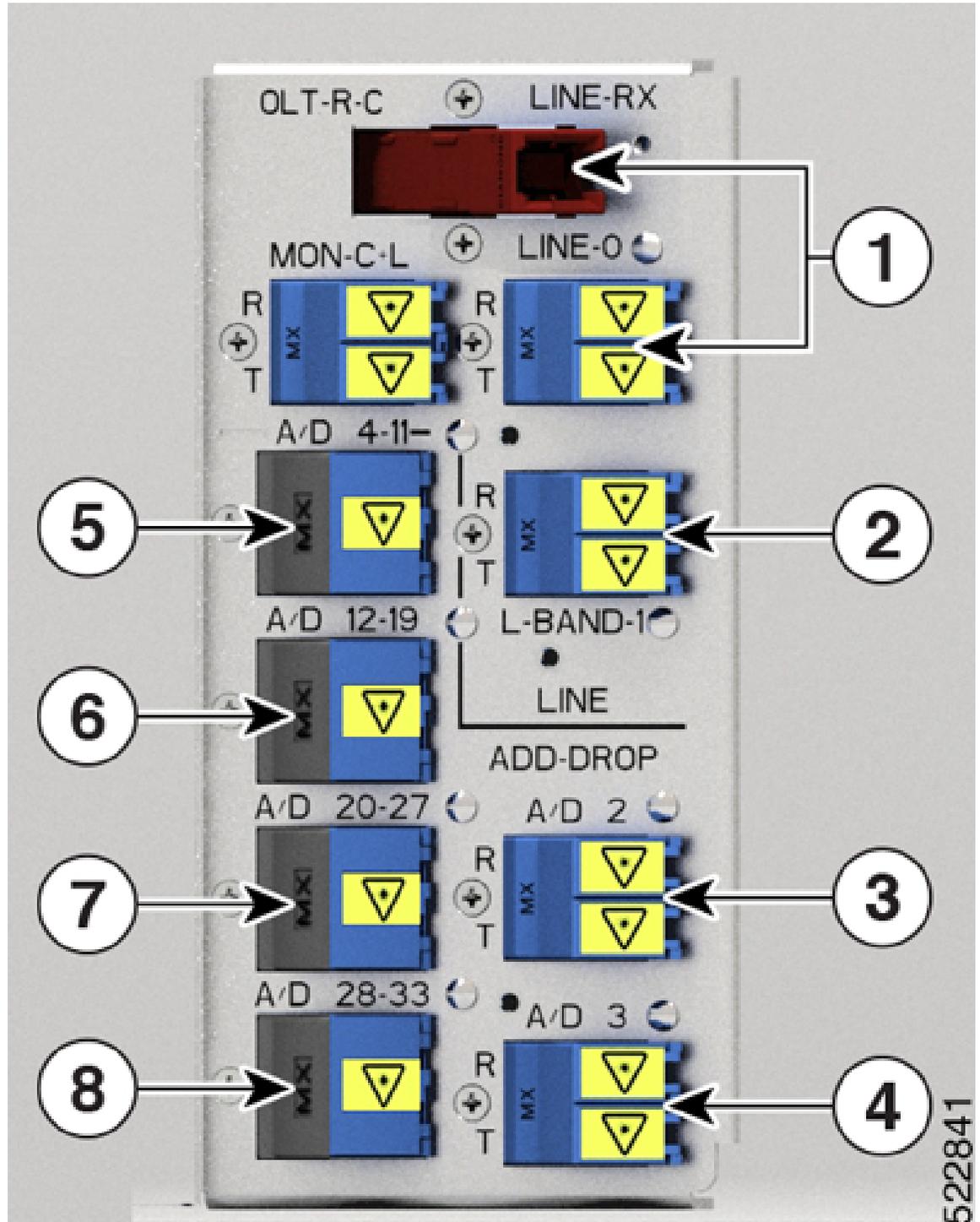
Table 23: NCS1K-OLT-R-C Port Mapping

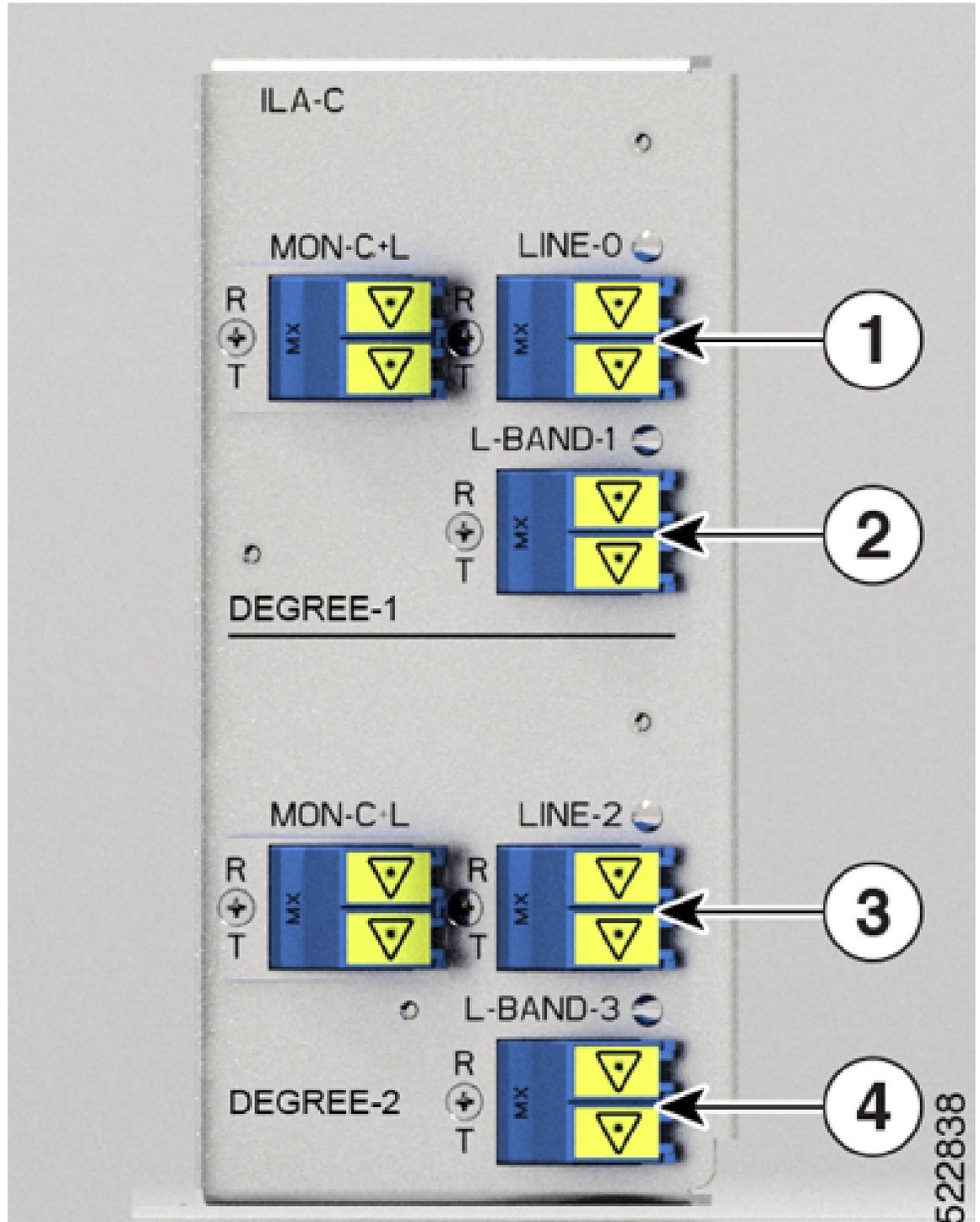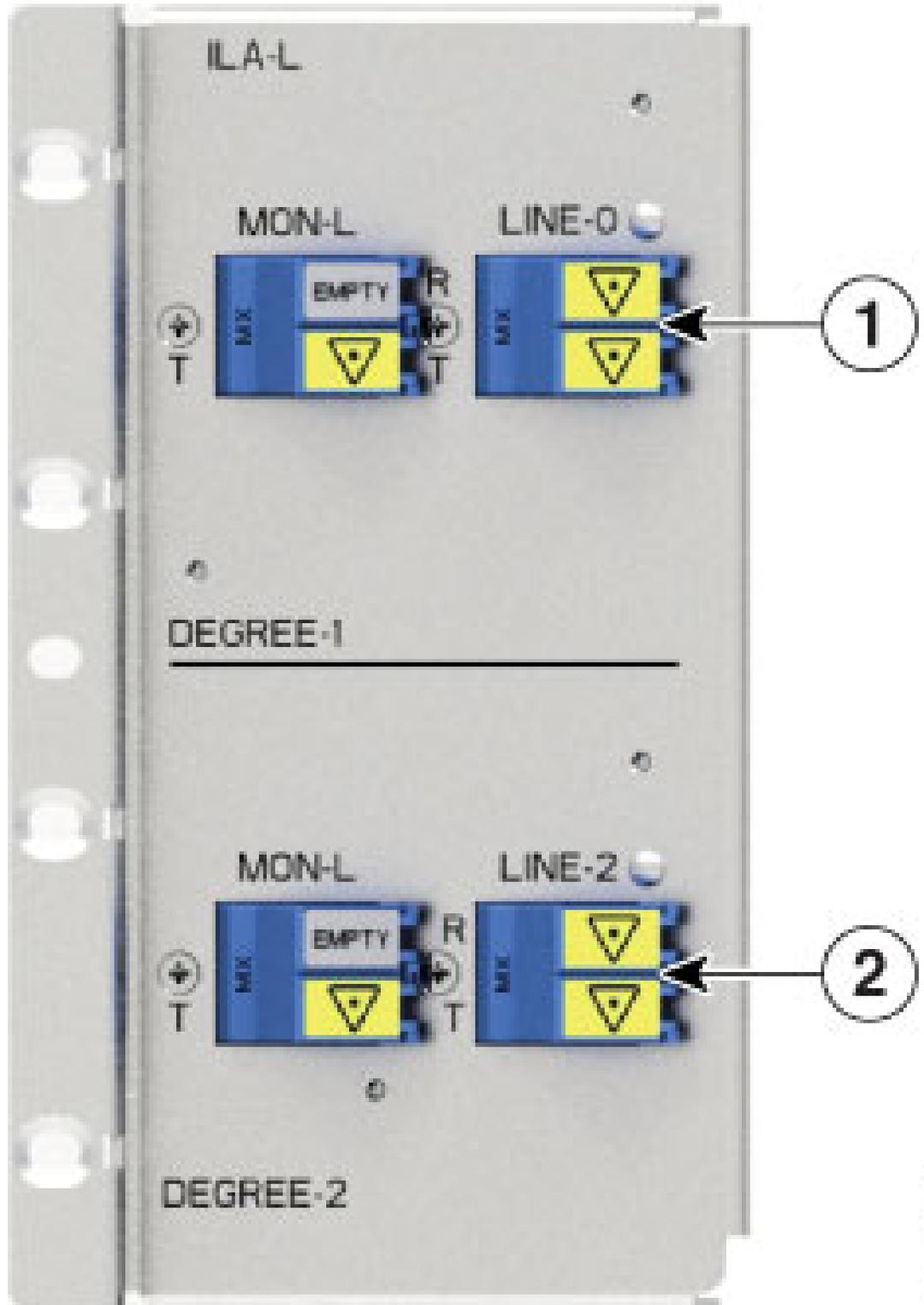|	
1	Parent Controller: OTS0/0/0/0 Child Controller: OSC0/0/0/0, DFB0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2 Child Controller: COM OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3 Child Controller: COM OTS-OCH 0/0/0/3/x
5	Parent Controller: OTS0/0/0/4-11 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 22: NCS1K-OLT-C
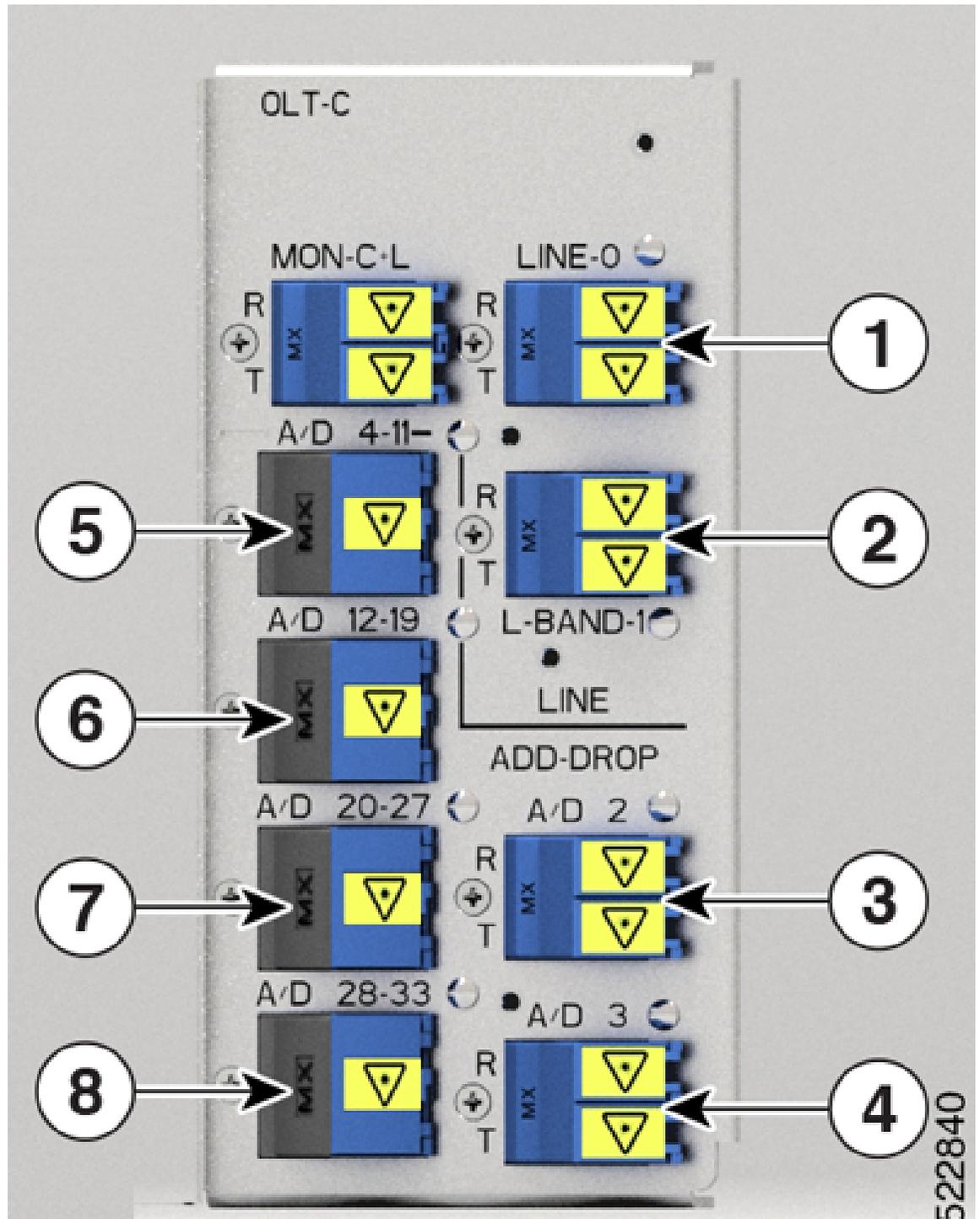
Table 24: NCS1K-OLT-C Port Mapping

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 23: NCS1K-OLT-L
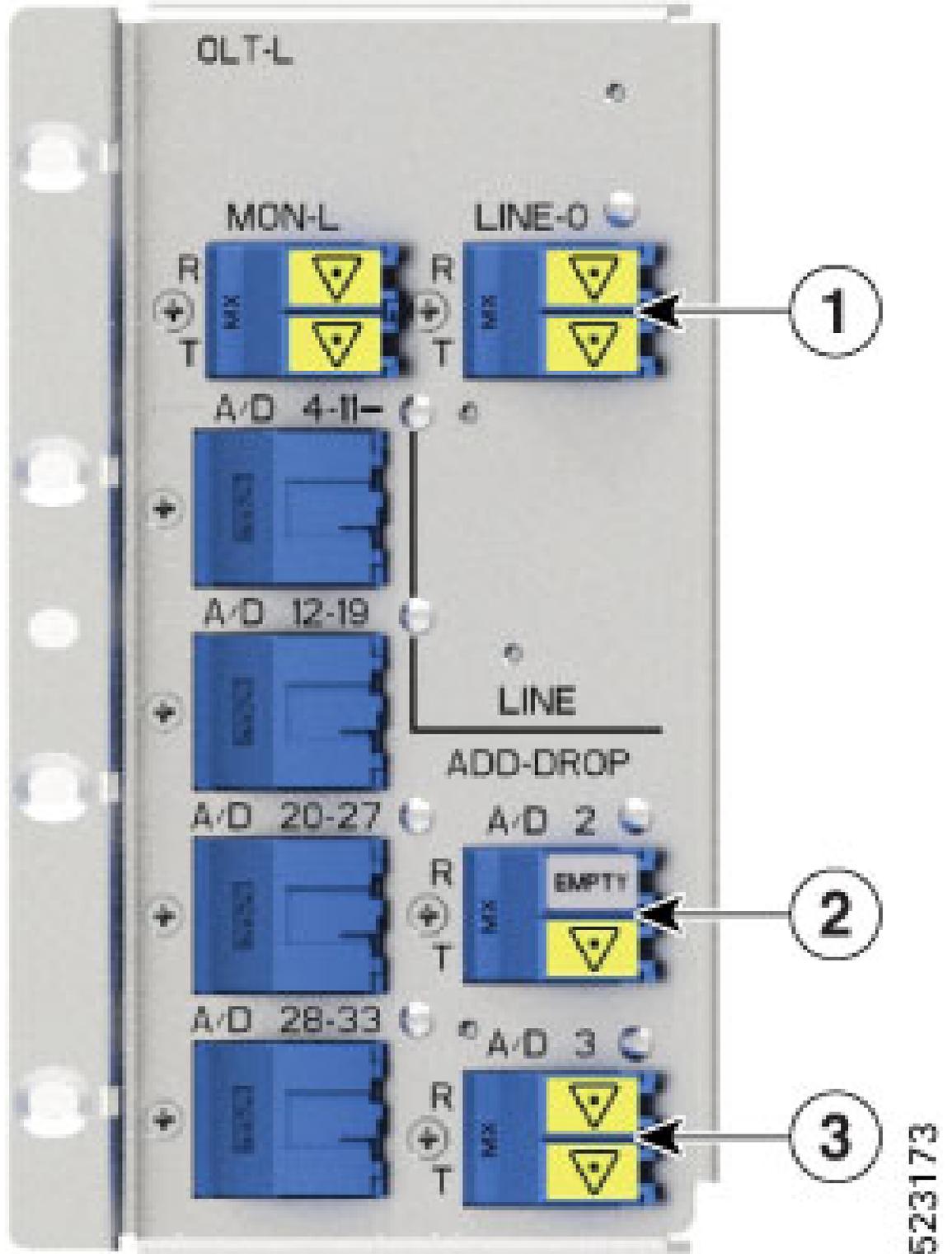
Table 25: NCS1K-OLT-L Port Mapping

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
3	Parent Controller: OTS0/0/0/3

The following figures and tables show the three OLT variants that are introduced in Release 7.10.1 and the mapping between their physical ports and controllers:

Figure 24: NCS1K-E-OLT-L
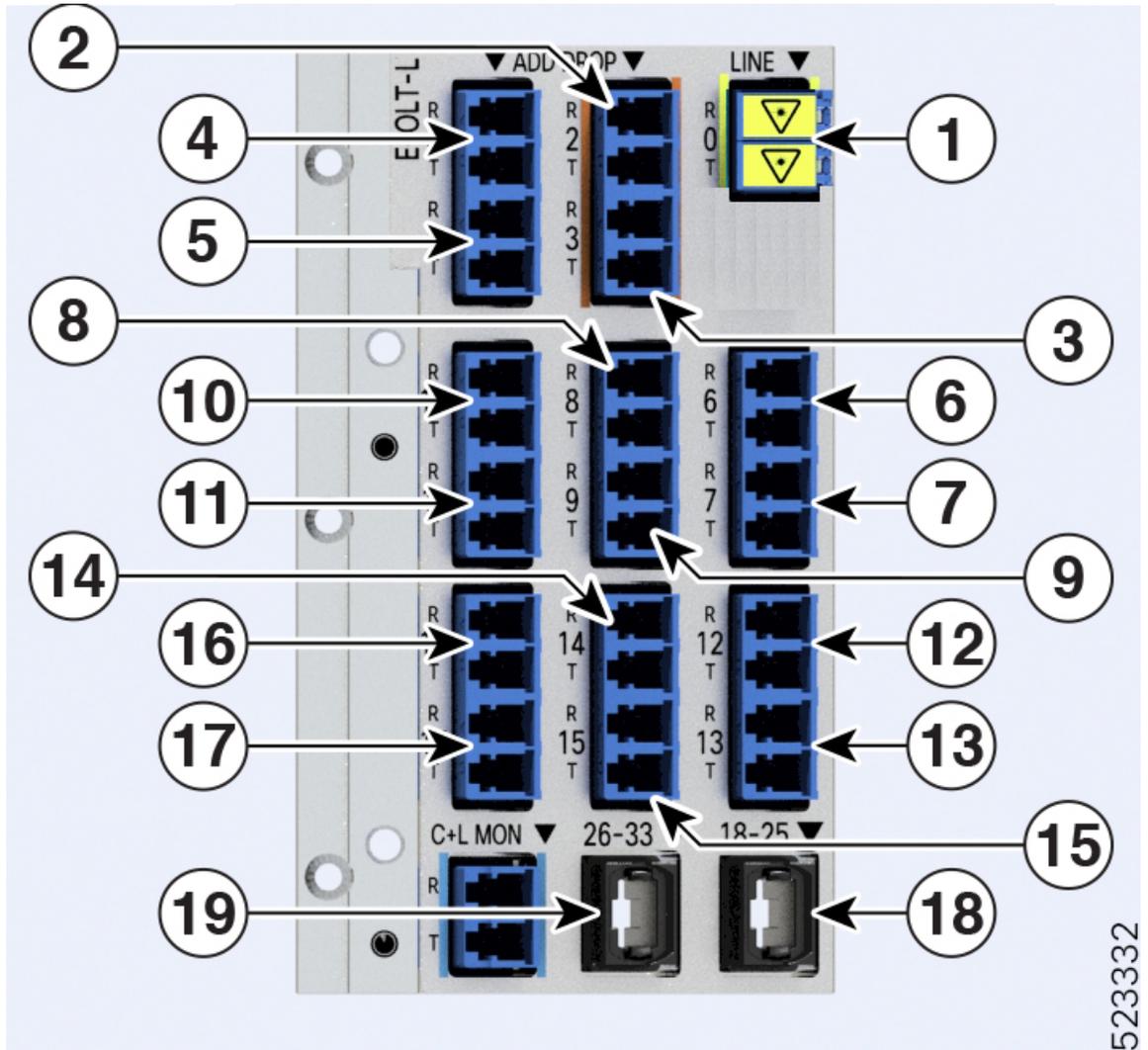
Table 26: NCS1K-E-OLT-L Port Mapping
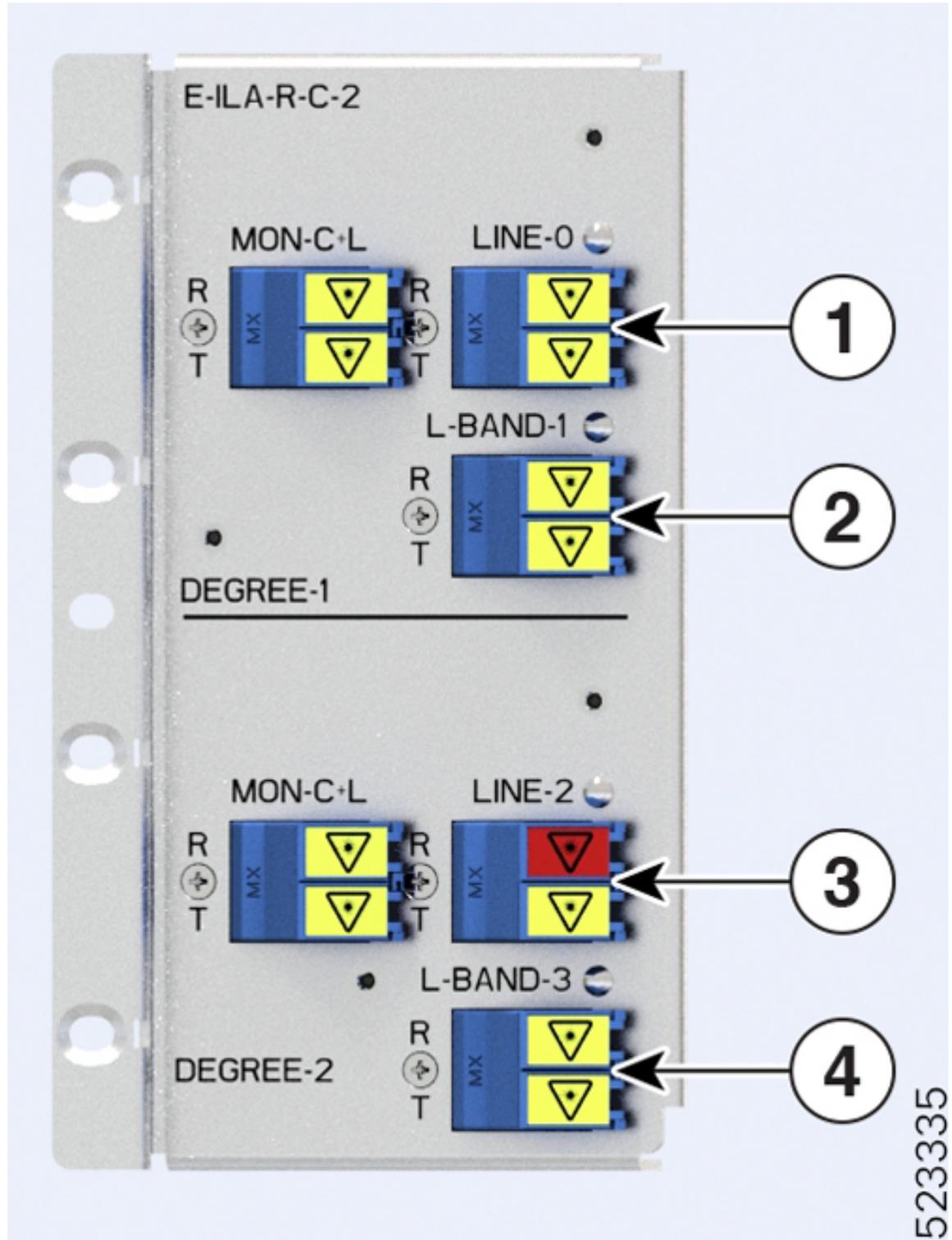
1	Parent Controller: OTS0/0/0/0
	Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/2
	Child Controller: COM OTS-OCH 0/0/0/2/x
3	Parent Controller: OTS0/0/0/3
	Child Controller: COM OTS-OCH 0/0/0/3/x
4	Parent Controller: OTS0/0/0/4
	Child Controller: COM OTS-OCH 0/0/0/4/x
5	Parent Controller: OTS0/0/0/5
	Child Controller: COM OTS-OCH 0/0/0/5/x
6	Parent Controller: OTS0/0/0/6
	Child Controller: COM OTS-OCH 0/0/0/6/x
7	Parent Controller: OTS0/0/0/7
	Child Controller: COM OTS-OCH 0/0/0/7/x
8	Parent Controller: OTS0/0/0/8
	Child Controller: COM OTS-OCH 0/0/0/8/x
9	Parent Controller: OTS0/0/0/9
	Child Controller: COM OTS-OCH 0/0/0/9/x
10	Parent Controller: OTS0/0/0/10
	Child Controller: COM OTS-OCH 0/0/0/10/x
11	Parent Controller: OTS0/0/0/11
	Child Controller: COM OTS-OCH 0/0/0/11/x
12	Parent Controller: OTS0/0/0/12
	Child Controller: COM OTS-OCH 0/0/0/12/x
13	Parent Controller: OTS0/0/0/13
	Child Controller: COM OTS-OCH 0/0/0/13/x
14	Parent Controller: OTS0/0/0/14
	Child Controller: COM OTS-OCH 0/0/0/14/x
15	Parent Controller: OTS0/0/0/15
	Child Controller: COM OTS-OCH 0/0/0/15/x

16	Parent Controller: OTS0/0/0/16
	Child Controller: COM OTS-OCH 0/0/0/16/x
17	Parent Controller: OTS0/0/0/17
	Child Controller: COM OTS-OCH 0/0/0/17/x
18	Parent Controller: OTS0/0/0/18-25
	Child Controller: COM OTS-OCH 0/0/0/18-25/x
19	Parent Controller: OTS0/0/0/26-33
	Child Controller: COM OTS-OCH 0/0/0/26-33/x

Figure 25: NCS1K-E-OLT-C
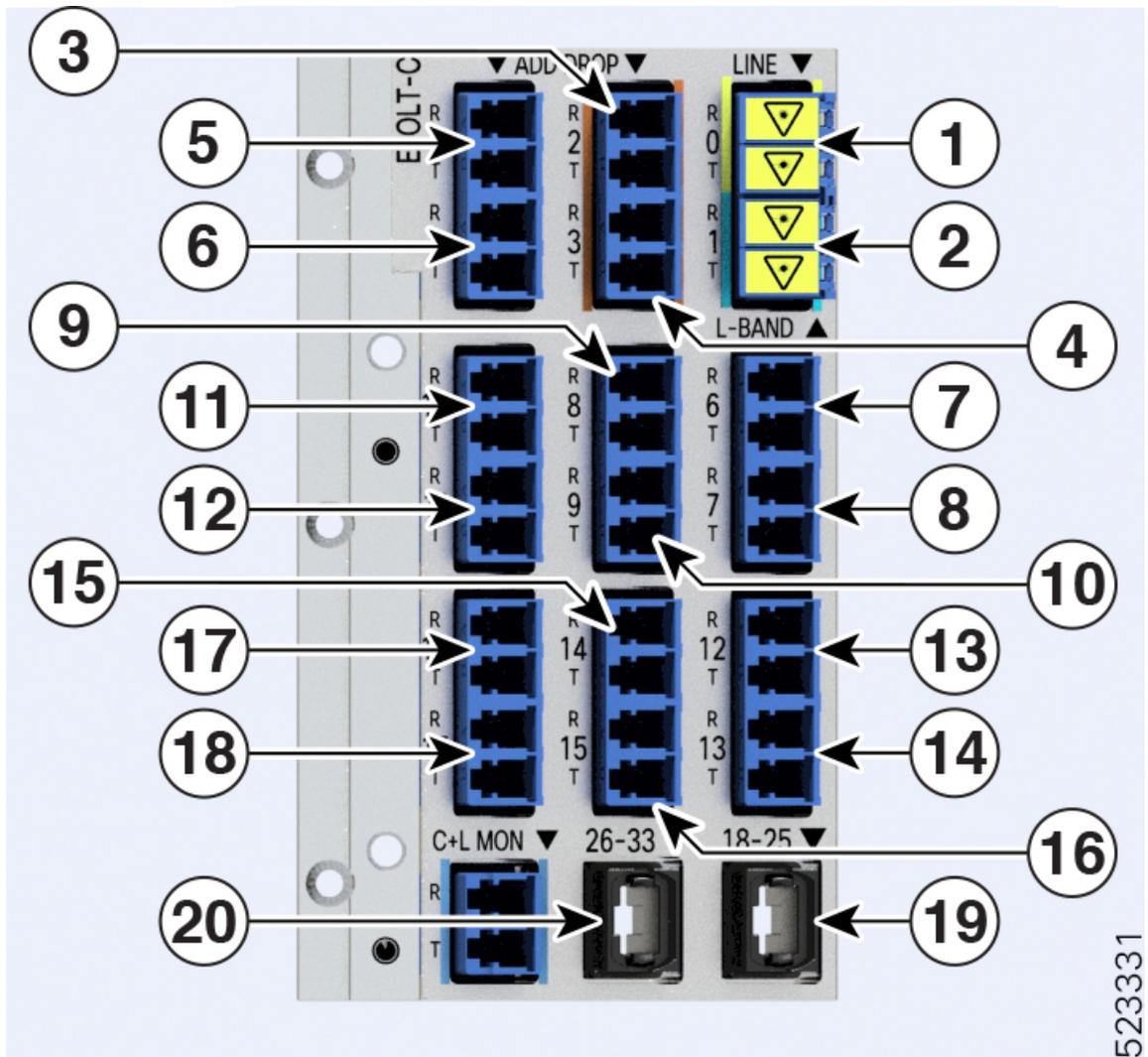
Table 27: NCS1K-E-OLT-C Port Mapping

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
	Child Controller: COM OTS-OCH 0/0/0/4/x
6	Parent Controller: OTS0/0/0/5
	Child Controller: COM OTS-OCH 0/0/0/5/x
7	Parent Controller: OTS0/0/0/6
	Child Controller: COM OTS-OCH 0/0/0/6/x
8	Parent Controller: OTS0/0/0/7
	Child Controller: COM OTS-OCH 0/0/0/7/x
9	Parent Controller: OTS0/0/0/8
	Child Controller: COM OTS-OCH 0/0/0/8/x
10	Parent Controller: OTS0/0/0/9
	Child Controller: COM OTS-OCH 0/0/0/9/x
11	Parent Controller: OTS0/0/0/10
	Child Controller: COM OTS-OCH 0/0/0/10/x
12	Parent Controller: OTS0/0/0/11
	Child Controller: COM OTS-OCH 0/0/0/11/x
13	Parent Controller: OTS0/0/0/12
	Child Controller: COM OTS-OCH 0/0/0/12/x
14	Parent Controller: OTS0/0/0/13
	Child Controller: COM OTS-OCH 0/0/0/13/x
15	Parent Controller: OTS0/0/0/14
	Child Controller: COM OTS-OCH 0/0/0/14/x

16	Parent Controller: OTS0/0/0/15
	Child Controller: COM OTS-OCH 0/0/0/15/x
17	Parent Controller: OTS0/0/0/16
	Child Controller: COM OTS-OCH 0/0/0/16/x
18	Parent Controller: OTS0/0/0/17
	Child Controller: COM OTS-OCH 0/0/0/17/x
19	Parent Controller: OTS0/0/0/18-25
	Child Controller: COM OTS-OCH 0/0/0/18-25/x
20	Parent Controller: OTS0/0/0/26-33
	Child Controller: COM OTS-OCH 0/0/0/26-33/x

Figure 26: NCS1K-E-OLT-R-C

Note   In the following image, the port that is highlighted in red indicate the Raman port.
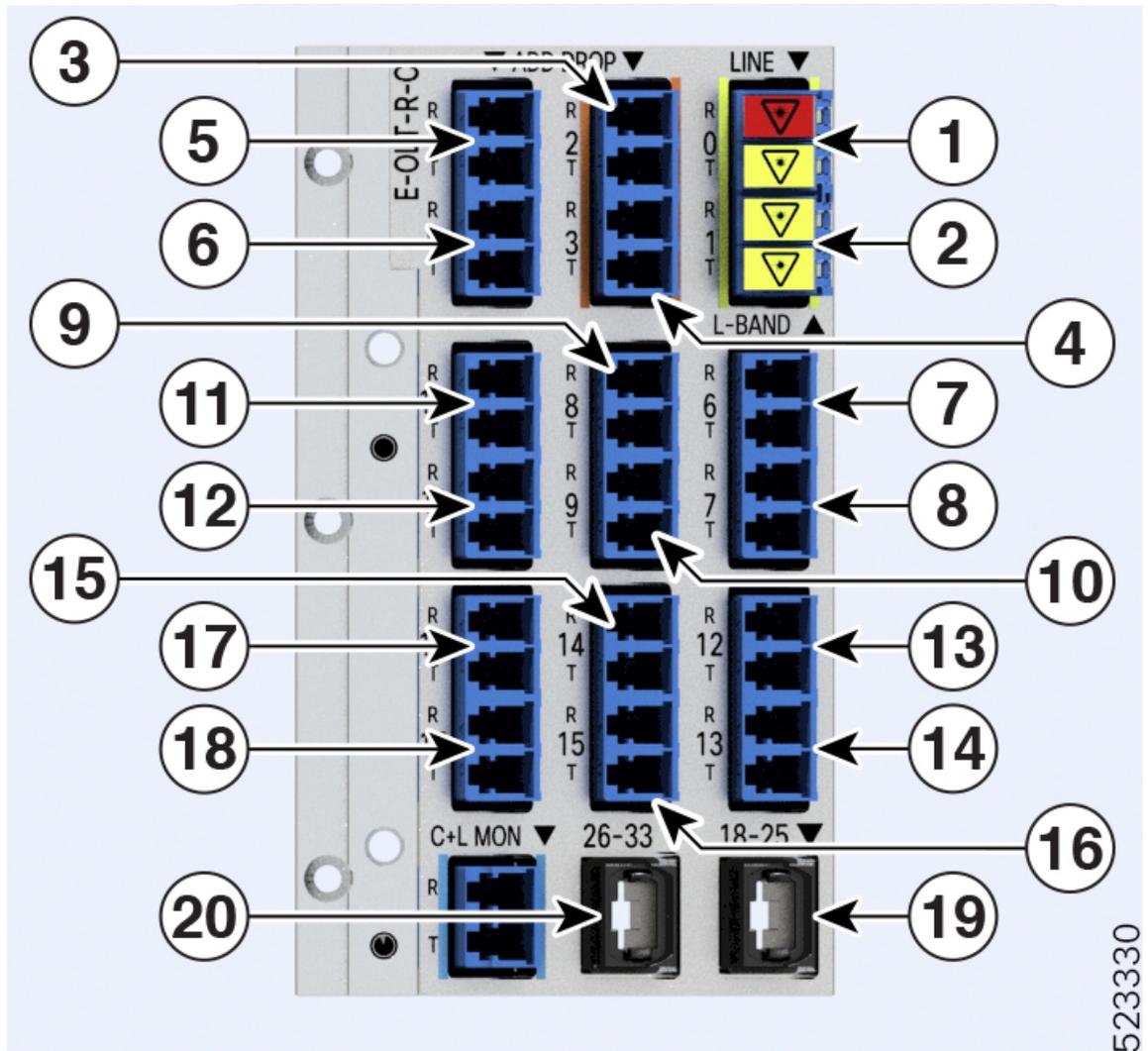
Table 28: NCS1K-E-OLT-R-C Port Mapping

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 Child Controller: COM OTS-OCH 0/0/0/4/x

6	Parent Controller: OTS0/0/0/5
	Child Controller: COM OTS-OCH 0/0/0/5/x
7	Parent Controller: OTS0/0/0/6
	Child Controller: COM OTS-OCH 0/0/0/6/x
8	Parent Controller: OTS0/0/0/7
	Child Controller: COM OTS-OCH 0/0/0/7/x
9	Parent Controller: OTS0/0/0/8
	Child Controller: COM OTS-OCH 0/0/0/8/x
10	Parent Controller: OTS0/0/0/9
	Child Controller: COM OTS-OCH 0/0/0/9/x
11	Parent Controller: OTS0/0/0/10
	Child Controller: COM OTS-OCH 0/0/0/10/x
12	Parent Controller: OTS0/0/0/11
	Child Controller: COM OTS-OCH 0/0/0/11/x
13	Parent Controller: OTS0/0/0/12
	Child Controller: COM OTS-OCH 0/0/0/12/x
14	Parent Controller: OTS0/0/0/13
	Child Controller: COM OTS-OCH 0/0/0/13/x
15	Parent Controller: OTS0/0/0/14
	Child Controller: COM OTS-OCH 0/0/0/14/x
16	Parent Controller: OTS0/0/0/15
	Child Controller: COM OTS-OCH 0/0/0/15/x
17	Parent Controller: OTS0/0/0/16
	Child Controller: COM OTS-OCH 0/0/0/16/x
18	Parent Controller: OTS0/0/0/17
	Child Controller: COM OTS-OCH 0/0/0/17/x
19	Parent Controller: OTS0/0/0/18-25
	Child Controller: COM OTS-OCH 0/0/0/18-25/x
20	Parent Controller: OTS0/0/0/26-33
	Child Controller: COM OTS-OCH 0/0/0/26-33/x

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-CNTLR-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#
```

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

```
Fri Jun  9 07:04:19.710 UTC
Node             Type                         State          Config state
--------------------------------------------------------------------------------
0/RP0/CPU0       NCS1010-CNTLR-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-OLT-R-C              OPERATIONAL    NSHUT,NMON
```

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 paramters 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 29: OTS Controller Configuration Parameters

Parameter	Description	Hardware Capability	Range	Default	Notes
tx-voa-attenuation	TX VOA attenuation set point	VOA	• **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

					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:
					
					• 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.
					
					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.
					
					The following are a few example scenarios that may not work as expected:
					
					• Scenario 1:
					
					Current running config:
					
					`controller Ots R/S/I/P`
					`egress-ampli-gain-range extended`
					`egress-ampli-gain <gain value in extended mode>`
					
					New applied config:
					
					`controller Ots R/S/I/P`
					`no egress-ampli-gain-range extended`
					`commit`
					
					• Scenario 2:
					
					Current running config:
					
					`controller Ots R/S/I/P`
					`egress-ampli-gain-range extended`
					`egress-ampli-gain <gain value in extended mode>`
					
					New applied config:
					
					`controller Ots R/S/I/P`
					`egress-ampli-gain-range Normal`
					`commit`

Parameter	Description	Hardware Capability	Range	Default	Notes

					• Scenario 3:
					
					Current running config:
					
					```controller Ots R/S/I/P egress-ampli-gain <gain value in normal mode>```
					
					New applied config:
					
					```controller Ots R/S/I/P egress-ampli-gain-range extended commit```
					
					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.
					
					Scenario 4:
					
					Current running config:
					
					```controller Ots R/S/I/P egress-ampli-gain <gain value in normal mode>```
					
					New applied config:
					
					```…………..```
					```controller Ots R/S/I/P egress-ampli-gain-range extended egress-ampli-gain <gain value in extended mode> commit replace```

ampli-gain (ingress/egress)	Amplifier gain set point	Amplifier	80–380	OLT ingress: 12, egress: 16 ILA: 8	The actual range of amplifier gain set point depends on amplifier gain range. **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.
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 *on*, the EDFA output power is clamped to 8 dBm.
channel-slice *channel-slice* attn *attenuation* (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 *pump instance* value *value*	Tx power	Raman amplifier	1–5 (pump instance) The values are: • Pump 1: 45–390 • Pump 2: 40–390 • Pump 3: 40–220 • Pump 4: 40–220 • Pump 5: 35–190	—	—
raman-tx-power-disable *pump instance*	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 *on*, 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 *on*, 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
 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 - 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
 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
 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
 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
 .
 .
 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
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
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
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
--------------------------------------------------------------------------------
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
  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 - 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
  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
  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
  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
  .
  .
  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
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
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
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
```

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
  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 - 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
  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
  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
  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
  .
  .
  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
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
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
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
---------------------------------------------------------------------------------
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   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 - 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
  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
  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
  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
  .
  .
  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
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
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
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
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 nods 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 #unique_15 unique_15_Connect_42_section_a5x_yl3_nwb.

- 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-32O/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.

The channel's status is preserved after HA events.

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, 0/0/0/0/1 is displayed in the output.

DFB controllers

The line port in the NCS1K-E-ILA-R-C-2, NCS1K-E-OLT-R-C, NCS1K-E-ILA-R-C, NCS1K-E-ILA-2R-C, 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*.

```
P/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
```

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 30: 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-32O/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-32O/E-C patch panel.

Table 31: NCS1K-MD-32O/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

Port	Frequency (THz)	Wavelength (nm)	Frequency (THz)	Wavelength (nm)
23	192.650	1556.15	192.575	1556.76
24	192.500	1557.36	192.425	1557.97
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
```

OTS controllers

Optical Transport Section (OTS) controller is a datapath controller type for the OTS optical interfaces that

- manages and monitors all the optical interfaces,

- sets the parameters for optical signals

- supports LINE and ADD/DROP ports for C- and L-band signals.

OTS optical interfaces refers to the hardware components in the line cards such as photodiode, VOA, amplifier, and OCM.

OTS controllers for ILA and OLT cards

The OTS controller supports the

- OLT cards for NCS 1010 and NCS 1020 platforms

- ILA cards for NCS 1010 platform

This section contains the topics:

Default OTS controllers for ILA cards

When you bring up the ILA and E-ILA cards, the system creates four OTS controllers by default for line and L-band ports.

Use this table to identify the default OTS controllers assigned for each port and band type:

Degrees	Port	OTS Controller	Band type
Degree-1	LINE 0	ots 0/0/0/0	C/L
Degree-1	L-BAND-1	ots 0/0/0/1	L
Degree-2	LINE 2	ots 0/0/0/2	C/L
Degree-2	L-BAND-3	ots 0/0/0/3	L

The card types supported for this allocation are:

- NCS1K-ILA-C

- NCS1K-ILA-R-C

- NCS1K-ILA-2R-C

- NCS1K-ILA-L

- NCS1K-E-ILA-R-C

- NCS1K-E-ILA-2R-C

- NCS1K-E-ILA-R-C-2

Verify the OTS controllers for ILA cards

Verify the status of the OTS controllers and their values for each port in the ILA card.

By default, when the ILA cards boot, the OTS controllers become activated with default values.

To modify the OTS controllers values, see *Command Reference Guide for NCS 1010*.

Follow these steps to verify the OTS controllers for the ILA and E-ILA cards.

Procedure

Step 1 Verify the OTS controller status on the card.

Run the **show controller description** command.

Example:

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

This 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#
```

Step 2 Use the **show controllers ots 0/0/0/<port>** command to verify the OTS controller values.

Example:

This command displays the LINE-0 OTS controller values.

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

If you want OTS controller status for	then run
LINE-0	**show controllers ots 0/0/0/0**
L-BAND-2	**show controllers ots 0/0/0/1**
LINE-1	**show controllers ots 0/0/0/2**
L-BAND-2	**show controllers ots 0/0/0/3**

Example:

This output highlights the parameters that indicate the OTS controller is in operation.

```
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
```

You have verified the status and values of the OTS controller interfaces on the ILA card.

Default OTS controllers for OLT cards

When you bring up the OLT and E-OLT cards, the system creates 34 OTS controllers by default for line and L-band ports.

Use this table to identify the default OTS controllers assigned for each port and band type:

Table 32: Line side OTS controllers for C-band OLT and E-OLT cards

Card type	Port	Connector type	OTS Controller
C-band OLT and E-OLT	LINE 0	LC	ots 0/0/0/0
C-band OLT and E-OLT	L-BAND-1	LC	ots 0/0/0/1
L-band OLT and E-OLT	LINE 0	LC	ots 0/0/0/0

Table 33: Add/Drop side OTS controllers for C-band and L-band OLT and E-OLT cards

Card type	Port	Connector type	OTS Controller
C- and L-band OLT	A/D2…3	LC	ots 0/0/0/2…3
	A/D4-11	MPO	ots 0/0/0/4 to ots 0/0/0/11
	A/D12-19	MPO	ots 0/0/0/12 to ots 0/0/0/19
	A/D20-27	MPO	ots 0/0/0/20 to ots 0/0/0/27
OLT	A/D28-33	MPO	ots 0/0/0/28 to ots 0/0/0/33
C- and L-band E-OLT	A/D2…17	LC	ots 0/0/0/2…17
	A/D18-25	MPO	ots 0/0/0/18 to ots 0/0/0/25
E-OLT	A/D26-33	MPO	ots 0/0/0/26 to ots 0/0/0/33

The card types supported for this allocation are:

- NCS1K-OLT-C

- NCS1K-OLT-R-C

- NCS1K-OLT-L

      • NCS1K-E-OLT-L

      • NCS1K-E-OLT-C

      • NCS1K-E-OLT-R-C

Verify the OTS controllers for OLT cards

Verify the status of the OTS controllers and their values for each port in the OLT card.

By default, when the OLT cards boot, the OTS controllers become activated with default values.

To modify the OTS controllers values, see *Command Reference Guide for NCS 1010 and NCS 1020*.

Follow these steps to verify the OTS controllers for the OLT and E-OLT cards.

Procedure

Step 1   Verify the OTS controller status on the card.

Run the **show controller description** command.

Example:

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

This 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
```

Step 2   Use the **show controllers ots 0/0/0/<port>** command to verify the OTS controller values.

Example:

This command displays the LINE-0 OTS controller values.

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

If you want OTS controller status for	then run
LINE-0	**show controllers ots 0/0/0/0**

If you want OTS controller status for	then run
L-BAND-1	**show controllers ots 0/0/0/1**
A/D2…33	**show controllers ots 0/0/0/2…33**

Example:

This output highlights the parameters that indicate the OTS controller is in operation.

```
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
```

You have verified the status and values of the OTS controller interfaces on the OLT card.

Comparison of configuration commands for OTS controller parameters for OLT and ILA nodes

This table summarizes the configuration commands used to set OTS controller parameters for OLT and ILA nodes. Use the appropriate command depending on the node type and required parameter.

Table 34: Commands to configure OTS controller parameters for OLT and ILA nodes

Command purpose	ILA	OLT
	tx-voa-attenuation*value*	**tx-voa-attenuation***value*
	egress-ampli-gain-range[**normal**|**extended**]	NA
	egress-ampli-gain*value*	**egress-ampli-gain***value*
	egress-ampli-tilt*value*	**egress-ampli-tilt***value*
	egress-ampli-osri[**on**|**off**]	**egress-ampli-osri**[**on**|**off**]
	egress-ampli-safety-control-mode[**auto**|**disabled**]	**egress-ampli-safety-control-mode**[**auto**|**disabled**]
	egress-ampli-force-apr[**on**|**off**]	**egress-ampli-force-apr**[**on**|**off**]
	raman-tx-power*Raman-transmit-pump-instance***power***power-value*	**raman-tx-power***Raman-transmit-pump-instance***power***power-value*
	raman-tx-power-disable*Raman-transmit-pump-instance*	**raman-tx-power-disable***Raman-transmit-pump-instance*
	raman-force-apr[**on**|**off**]	**raman-force-apr**[**on**|**off**]
	raman-osri[**on**|**off**]	**raman-osri**[**on**|**off**]
	raman-safety-control-mode[**auto**|**disabled**]	**raman-safety-control-mode**[**auto**|**disabled**]

Command purpose	ILA	OLT
	NA	ingress-ampli-gain-range {normal | extended}
	NA	ingress-ampli-gain value
	NA	ingress-ampli-tilt value
	NA	ingress-ampli-osri {on | off}
	NA	ingress-ampli-safety-control-mode {auto | disabled}
	NA	ingress-ampli-force-apr {on | off}
	NA	ingress-channel-slice channel-slice attn attenuation-value

For more information on the commands, see *Cisco NCS 1010 Command Reference Guide.*

OTS Controller Configuration Parameters

This table describes the optical parmater values for the OTS controller configuration.

Table 35: OTS Controller Configuration Parameters

Parameter	Description	Hardware Capability	Range	Default
tx-voa- attenuation	TX VOA attenuation set point	VOA	• **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
ampli-gain-range (ingress/egress)		Amplifier	normal and extended	normal

Parameter	Description	Hardware Capability	Range	Default

	Amplifier gain range
	
	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:
	
	• 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.
	
	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.
	
	The following are a few example scenarios that may not work as expected:
	
	• Scenario 1:
	
	Current running config:
	
	`controller Ots R/S/I/P`
	` egress-ampli-gain-range extended`
	` egress-ampli-gain <gain value in extended mode>`
	
	New applied config:
	
	`controller Ots R/S/I/P`
	` no egress-ampli-gain-range extended`
	
	` commit`
	
	• Scenario 2:
	
	Current running config:
	
	`controller Ots R/S/I/P`
	` egress-ampli-gain-range extended`
	` egress-ampli-gain <gain value in extended mode>`
	
	New applied config:
	
	`controller Ots R/S/I/P`
	` egress-ampli-gain-range Normal`
	` commit`			

Parameter	Description	Hardware Capability	Range	Default
	• Scenario 3: Current running config: ``` controller Ots R/S/I/P egress-ampli-gain <gain value in normal mode> ``` New applied config: ``` controller Ots R/S/I/P egress-ampli-gain-range extended commit ``` Another example is a 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. Scenario 4: Current running config: ``` controller Ots R/S/I/P egress-ampli-gain <gain value in normal mode> ``` New applied config: ``` ………….. controller Ots R/S/I/P egress-ampli-gain-range extended egress-ampli-gain <gain value in extended mode> commit replace ```			
ampli-gain (ingress/egress)	Amplifier gain set point The actual range of amplifier gain set point depends on amplifier gain range. **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.	Amplifier	80–380	OLT ingress: 12, egress: 16 ILA: 8
ampli-tilt (ingress/egress)	Amplifier tilt	Amplifier	−5 to +5	0.0
osri (ingress/egress)	Optical safety remote interlock When **osri** is on, the EDFA is in shut state and vice versa.	Amplifier	on and off	off

Parameter	Description	Hardware Capability	Range	Default
ampli-force-apr (ingress/egress)	— When **ampli-force-apr** is set to *on*, the EDFA output power is clamped to 8 dBm.	Amplifier	on and off	off
channel-slice *channel-slice* attn *attenuation* (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 *pump instance* value *value*	Tx power	Raman amplifier	1–5 (pump instance) The values are: • Pump1: 45–390 • Pump 2: 40–390 • Pump 3: 40–220 • Pump 4: 40–220 • Pump 5: 35–190	—
raman-tx-power-disable *pump instance*	Tx power	Raman amplifier	—	—
raman-force-apr	Force automatic power reduction When **raman-force-apr** is set to *on*, the Raman pump maximum output power is clamped to 10 mW.	Raman amplifier	on and off	off
raman-osri	Optical safety remote interlock When **raman-osri** is set to *on*, the Raman pumps are switched off.	Raman amplifier	on and off	off

Configuration examples for OTS controllers

Use the CLI examples to configure key attributes for OTS controllers.

☞

Important The OTS controller commands do not support decimal inputs. The OTS controller commands consider the inputs to one decimal place for the parameter values. For example, if you provided100 to configure the attn value for the egress-channel-slice 10, then the system takes the value as 10.0 dB.

- This example sets the **tx-voa-attenuation** 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
```

• This example sets the raman-force-apr 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
```

Modify channel slice attenuation for OLT cards

Manually set the channel slice attenuation values for OLT cards.

The Automatic Power Control (APC) automatically configures the attenuation for the channel slices.

Follow these steps to modify channel slice attenuation:

Before you begin

Ensure APC is disabled. If not, run the 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 Configure APC".

Procedure

Step 1 Use the **show controllers ots R/S/I/P channel-slice-attenuation-info** command to view the existing channel slice information.

Example:

This command displays the channel slice attenuation details for LINE-0 port.

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

Example:

This output shows the existing channel slice attenuation information for both egress and ingress channels.

```
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
 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 - 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
 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
 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
 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
 .
 .
 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
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
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
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
-----------------------------------------------------------------------------------
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
 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 - 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
 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
 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
 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
 .
 .
 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
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
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
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
```

Step 2 Set the attenuation value for an egress channel slice.

Example:

This command sets the attenuation for an egress channel slice 10 to *10.0 dB* through LINE-0 port ots 0/0/0/0 controller.

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

Step 3 Verify the modified channel slice information for LINE-0 port.

Example:

This command displays the channel slice attenuation information for LINE-0 port.

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

Example:

This output highlights the modified attenuation value for **egress channel slice 10** that is set to *10.0 dB*. Each column represents the attenuation for each channel slice.

```
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
 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 - 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
 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
 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
 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
 .
 .
 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
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
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
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
-----------------------------------------------------------------------------------
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   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 - 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
 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
 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
 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
 .
 .
 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
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
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
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
RP/0/RP0/CPU0:ios#
```

The selected egress channel slice attenuation value is updated and the change is confirmed.

Configure the partner band IP address

Configure the peer IP addresses on C-band and L-band nodes for inter-band connection to increase optical fiber capacity.

NCS1010 devices support both C and L-band wavelengths. Establishing a connection between C- and L-band nodes requires configuring the peer IP addresses so each node can communicate with its counterpart.

Follow these steps to configure the partner band IP address between C- and L-band nodes:

Before you begin

Identify the rack, slot, instance, and port details for both C-band and L-band nodes.

Procedure

Step 1   Enter Optical Line Control configuration mode.

Example:

```
RP/0/RP0/CPU0:ios(config)# optical-line-control controller Ots0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#
```

The terminal is in optical line control configuration mode.

Step 2   Configure the IP address on the peer nodes.

Option	Description

For the C-band node	configure the L-band peer IP address using:
	
	`optical-line-control`
	`controller ots <Rack/Slot/Instance/Port>`
	`partner-band-port ipv4 address <L-band IP-address>`
	` controller ots <Rack/Slot/Instance/Port>`

For the L-band node	configure the C-band peer IP address using:
	
	`optical-line-control`
	`controller ots <Rack/Slot/Instance/Port>`
	`partner-band-port ipv4 address <C-band IP-address>`
	` controller ots <Rack/Slot/Instance/Port>`

Note
This configuration should be applied on all C and L-band nodes.

Example:

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

The C-band and L-band nodes are successfully interconnected, providing expanded fiber capacity across both bands.

OTS-OCH controllers

Optical Transport Section and Optical Channel (OTS-OCH) controller is a datapath controller type that

- is created on the LINE side of the OLT and ILA nodes using the **hw-module** command in Flex-Grid configuration, and

- supports optical cross-connection between the LINE side and COM side (Add/Drop ports) of the OLT nodes only.

Optical Cross Connection is a type of configuration that

- operates only in OLT nodes,

- defines the line side OTS-OCH channel as the source, and

- creates an OTS-OCH controller on the Add/Drop port (COM side) to which the cross connection is made.

OTS-OCH controllers for ILA and OLT cards

The OTS-OCH controller supports the

Table 36: OTS-OCH configurations

Configurations	OLT	ILA
Optical cross connections	NCS 1010 NCS 1020	NA
Flex grid	NCS 1010	NCS 1010

✎

Note

Validation rules for Flex Grid channel configuration

The following table summarizes the validation rules for configuring Flex Grid channels on OLT and ILA nodes in NCS 1010 and NCS 1020 platforms before committing **hw-module** configurations.

Parameter	Validation rule	Supported platform for OLT	Supported platform for ILA
Channel ID	1 to 194.	NCS 1010, NCS 1020	NCS 1010
Center frequency	OLT-C: 191.3375 to 196.1750 THz OLT-L: 184.6153 to 190.8875 THz	NCS 1010, NCS 1020	NCS 1010
Channel width	25.000 GHz to 4837.500 GHz.	NCS 1010, NCS 1020	NCS 1010
Channel overlap	From R7.9.1, permitted as Nyquist channels are supported. See #unique_15 unique_15_Connect_42_section_a5x_yl3_nwb.	NCS 1010, NCS 1020	NCS 1010
Configuration precision	From R7.9.1, you can set channel center frequency and width with 1 MHz resolution.	NCS 1010, NCS 1020	NCS 1010

Optional: Python scripting for Fixed Grid mode setup
The system configures the OLT and ILA nodes for OTS-OCH controllers as complete Flex Grid mode configuration. However, for ease of Fixed Grid Mode setup, there is a configuration script to create 75 or 150 Ghz or appropriate fixed grid channels using the Flex Grid configuration model.

Usage example
Use the python-based configuration script to automatically create 75 or 150 GHz fixed grid channels on ports 2 and 3 using the commands:

Requirement
Use this script only for a colored solution that uses the NCS1K-MD-32O/E-C patch panel with fixed channel width.

Create OTS-OCH controllers on ILA cards

Create OTS-OCH controllers on ILA cards in NCS 1010 using the commands in configuration mode.

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

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

When the ILA cards boot up, the OTS-OCH controllers are not created by default. The LINE OTS-OCH controllers can be created using the **hw-module** command.

The supported ILA and OLT cards are:

- NCS1K-ILA-2R-C

- NCS1K-ILA-R-C

- NCS1K-ILA-C

- NCS1K-OLT-R-C

- NCS1K-OLT-C

Before you begin

Enter the configuration mode using the **configure** command.

Procedure

Step 1   Create the OTS-OCH controllers on the LINE side of the ILA-C node.

Example:

```
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 for *channel 1 on LINE 0 and LINE 2 ports* of the ILA-C node.

Step 2   View the OTS-OCH controllers.

Run show controllers ots-och.

Example:

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

Example:

This output displays the OTS-OCH controller that is created on both 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
```

Step 3   Use the **show controllers ots-och 0/0/0/0/*** command to view the parameters of the OTS-OCH controller.

Example:

This command displays the LINE-0 OTS-OCH controller values for channel ID 1.

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

If you want OTS-OCH controller status for	then run
LINE-0	show controllers ots-och 0/0/0/0/1
LINE-2	show controllers ots-och 0/0/0/2/1

Example:

This 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:
        -------------
```

Step 4   View the flex grid information on the ILA node

Example:

This command provides the flex grid information on the ILA node.

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

Example:

This 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

The OTS-OCH controllers on the ILA cards are created.

What to do next

Create OTS-OCH controllers on OLT cards.

Create OTS-OCH controllers on OLT cards

Create OTS-OCH controllers on OLT cards in NCS 1010 and NCS 1020 using the commands in configuration mode.

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

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

When the OLT cards boot up, the OTS-OCH controllers are not created by default. The LINE OTS-OCH controllers can be created using the **hw-module** command.

Before you begin

Enter the configuration mode using the **configure** command.

Procedure

Step 1   Create the OTS-OCH controllers on the LINE side of the OLT-C node.

Example:

```
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
```

The OTS-OCH controller is created for *channel 1 on LINE port* in the OLT-C node.

Step 2   View the OTS-OCH controllers.

Run `show controllers ots-och.`

Example:

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

Example:

This output displays the OTS-OCH controller that is created on the LINE port of the OLT-C node.

```
 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
```

Step 3   Use the **show controllers ots-och 0/0/0/0/1** command to view the parameters of the OTS-OCH controller.

Example:

This command displays the LINE-0 OTS-OCH controller values for channel ID 1.

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

Example:

This 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:
            -------------
```

Step 4 View the flex grid information on the OLT node

Example:

This command provides the flex grid information on the OLT node.

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

Example:

This 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
```

The OTS-OCH controllers on the ILA cards are created.

What to do next

Create OTS-OCH controllers on OLT cards.

Create optical cross connection on OLT nodes

Create Optical Cross Connection (OXC) between Line and Add/Drop ports in OLT nodes in NCS 1010 and NCS 1020.

•

By default, all the channels remain blocked in both Add and Drop directions. The OXC configuration unblocks the Add-Drop port channel mentioned as add-drop-channel.

Before you begin

Enter the configuration mode using the **configure** command.

Procedure

Step 1   Use the **controller ots-och***Rack/Slot/Instance/Port/Channel-id-number***add-drop-channel ots-och***Rack/Slot/Instance/Port/Channel-id-number* command to configure the optical cross-connect.

Example:

```
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
```

Line port and add/drop port channel IDs must be the same.

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

Step 2   Use the **show controller ots-och ?** command view the OTS-OCH controller.

Example:

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

Example:

This 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
```

Step 3   Use the **show controllers ots-och 0/0/0/0/*** command to view the parameters of the OTS-OCH controller.

Example:

This command displays the LINE-0 OTS-OCH controller values for channel ID 1.

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

If you want OTS-OCH controller status for	then run
LINE-0	show controllers ots-och 0/0/0/0/1
A/D2…33	show controllers ots-och 0/0/0/2…33/1

Example:

This 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 0/0/0/0/1 is displayed in the output.

Step 4 View the created OTS-OCH controller.

Example:

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

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

Example:

This 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
```

DFB controllers

A distributed feedback (DFB) controller is a datapath controller type for the RAMAN probe that

- represents the optical layer of a DFB channel alongside the OSC controller,

- regulates DFB probe power through a variable optical attenuator (VOA) within the range of −14 to +5 dBm, and

- combines the dedicated DFB probe with other signals at the LINE-TX port in Raman-amplified NCS 1010 nodes.

A DFB probe, also known as a RAMAN probe, is a tuning mechanism that

- operates at the LINE port of ILA and OLT nodes equipped with RAMAN amplifiers,

- generates a dedicated DFB laser at 191.1THz (1568.77nm) to perform a link continuity check for optical safety at LINE-TX port, and

- enables RAMAN tuning to check span loss.

View the parameters of the LINE 0 DFB controller.

Command

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

This output displays the parameters of the LINE 0 DFB controller.

Example

```
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
```

Default DFB controllers for OLT cards

When you bring up the OLT and ILA cards, the system automatically creates a DFB controller for each Raman-enabled line port.

Note DFB controller is supported only in C-band nodes.

Table 37: Default DFB controllers for OLT and ILA cards

Card type	Port	OTS Controller
ILA and E-ILA	LINE-0 (LINE-RX)	dfb 0/0/0/0
ILA and E-ILA	LINE-2 (LINE-RX)	dfb 0/0/0/2
OLT	LINE-0 (LINE-RX)	dfb 0/0/0/0
E-OLT	LINE R-0-T (LINE-R)	dfb 0/0/0/0

The OLT card types supported for this allocation are:

- NCS1K-OLT-R-C
- NCS1K-E-OLT-R-C
- NCS1K-E2-OLT-R-C
- NCS1K-E2-OLT-RE-C

The ILA card types supported for this allocation are:

- NCS1K-ILA-R-C
- NCS1K-ILA-2R-C
- NCS1K-E-ILA-R-C
- NCS1K-E-ILA-2R-C
- NCS1K-E-ILA-R-C-2
- NCS1K-E-ILA-RE-C
- NCS1K-E-ILA-RE-C-2
- NCS1K-E-ILA-2RE-C

Modify the DFB parameters for OLT and ILA cards

Modify the DFB parameters (such as attenuation, admin state, and shutdown) for OLT and ILA cards.

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

    • **shutdown**

DFB controllers support multiple parameter adjustments on OLT and ILA nodes.

Follow these steps to configure the DFB parameters for OLT and ILA cards.

> **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. For example, to configure the *tx-voa-attenuation* value for *dfb 0/0/0/0* to *2.0 dB*, provide the *tx-voa-attenuation* value for the DFB controller *dfb 0/0/0/0* as 20 .

Before you begin

Enter the configuration mode using the **configure** command.

Procedure

Step 1   Set the *tx-voa-attenuation* value.

Example:

This example sets the *tx-voa-attenutation* value to *2.0dB* for LINE-0-RX port.

```
RP/0/RP0/CPU0:ios(config)#controller dfb 0/0/0/0
RP/0/RP0/CPU0:ios(config-Dfb)#tx-voa-attenuation 20
RP/0/RP0/CPU0:ios(config-Dfb)#commit
RP/0/RP0/CPU0:ios(config-Dfb)#end
```

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

Step 2   Set *sec-admin-state*.

Example:

This example sets the *sec-admin-state* to *maintenance* for LINE-0-RX port.

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

Step 3   Shutdown the DFB controller.

Example:

This example shuts down the DFB controller for LINE-0-RX port.

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

The DFB controller on LINE-0-RX port is shut down.

Step 4   (Optional) Check the configured value for the DFB controller.

Use the **show controllers dfb***<R/S/I/P>* command to confirm the settings applied.

Example:

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

Example:

This output highlights the *tx-voa-attenuation* is set to *2.0 dB* and 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
```

Example:

This 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
```

DFB parameters for the selected OLT or ILA card are configured as specified.

What to do next

Verify system alarms or operational impacts using monitoring commands as appropriate.

OCH controllers

An optical channel (OCH) controller is a datapath controller type that

- manages the optical channel ports on NCS 1010 passive modules and CCMD-16 cards,

- enables mapping and identification of OCH interfaces, and

- supports optical cross-connection functions for network operations.

Default OCH controllers for NCs 1010 passive devices and CCMD-16 cards

Passive modules/line cards	Port type	Total channel ports	Port labels	OCH controllers
NCS1K-BRK-8	LC Ports	8	TX-0-RX…TX-7-RX	och R/S/I/0 to och R/S/I/7
NCS1K-BRK-24	LC Ports	24	TX-0-RX…TX-23-RX	och R/S/I/0 to och R/S/I/23
NCS1K-MD-32O/E-C	LC Ports	32	0…31-TX/RX	och R/S/I/0 to och R/S/I/31
NCS1K14-CCMD-16-C	LC Ports	16	A/D1…16	och R/S/I/1 to och R/S/I/16

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

Verify the OCH controller parameters

Verify the status of the OCH controllers and their values for each port in these modules.

- NCS1K-BRK-8

- NCS1K-BRK-24

- NCS1K-MD-32O-C

- NCS1K-MD-32E-C

　　　　• NCS1K14-CCMD-16-C

　　　　• NCS1K14-CCMD-16-L

By default, when the passive modules and the CCMD-16 modules boot, the OCH controllers become activated with default values.

Follow these steps to verify the OCH controllers for the passive modules and CCMD-16 module.

Procedure

Step 1　View the status of the OCH controllers.

Example:

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

Example:

This output highlights the list of activated OCH controllers

```
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
```

Step 2　View the parameters of the OCH controller.

Use the **show controllers och R/S/I/P** command to view the OCH controller parameters.

Example:

This output displays the OCH controller parameters for BRK-8 breakout module.

```
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
```

Example:

This output shows the OCH parameters for mux/demux patch panel.

Note

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

```
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
```

You have verified the operational status and parameter values for all OCH controllers in the specified modules.

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 38: 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

Patch Panel	Port Type	OMS Ports	Interfaces
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-32O/E-C panels have a maximum insertion loss of 6.2 dBm for the respective Mux and Demux sections.

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*.

```
P/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:
        -------------
```

View the Gigabit Ethernet interfaces

Display operational and configuration details for a Gigabit Ethernet interface.

A Gigabit Ethernet interface represents the packet layer of an OSC channel and is used for high-speed data transmission between optical nodes.

Table 39: Feature History

Feature Name	Release Information	Feature Description
1G Speed support on OSC Gigabit Ethernet	Cisco IOS XR Release 25.4.1	The Gigabit Ethernet interface on the OSC now supports data rates up to 1 Gbps, in addition to the existing 100 Mbps. This enhancement allows you to configure the interface speed to 1 Gbps, enabling the use of UDC ports to extend your Data Communication Network (DCN) for monitoring remote NCS 1010 and NCS 1020 sites. To enable 1 Gbps throughput for the Gigabit Ethernet interface, use the command `interface gigabitEthernet R/S/I/P` and set the speed to 1000. IP based Packet forwarding Throughput on OSC Gigabit is maximum 200Mbps and UDC Traffic Over OSC Gigabit is maximun upto 880Mbps. For speed configuration options: • The 100 Mbps speed can be configured using the command `speed 100`. • If the speed configuration is removed using the command `no speed`, the default speed will revert to 100 Mbps. • Configuring a 10 Mbps speed is not supported and will result in failure.

Before you begin

Ensure that the node is operational at the intended speed.

✎

Note   Zero Touch Provisioning (ZTP) is not supported on a 1 GE interface. You must bring up the node at the default 100 Mbps speed, and then change the interface to 1GE.

Follow these steps to view a Gigabit Ethernet interface:

Procedure

Step 1   Run the **show interfaces gigabitEthernet 0/0/0/0** command to view the parameters and status of a Gigabit Ethernet interface.

Note
From R24.4.15, the output for this command is enhanced to include the packet counter information.

Example:

```
RP/0/RP0/CPU0:ios#show run int gigabitEthernet 0/0/0/0
Fri Nov 21 16:00:55.645 IST
interface GigabitEthernet0/0/0/0
 description noshut-interface
 ipv4 address 7.1.11.1 255.255.255.0
 ipv6 enable
 lldp
  enable
 !
 speed 1000
!

RP/0/RP0/CPU0:ios#show int gigabitEthernet 0/0/0/0
Fri Nov 21 16:01:03.275 IST
GigabitEthernet0/0/0/0 is up, line protocol is up
  Interface state transitions: 1
  Hardware is GigabitEthernet, address is 38fd.f866.0693 (bia 38fd.f866.0693)
  Description: noshut-interface
  Internet address is 7.1.11.1/24
  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 20:52:33
  ARP type ARPA, ARP timeout 04:00:00
  Last input 00:00:00, output 00:00:00
  Last clearing of "show interface" counters never
  5 minute input rate 403000 bits/sec, 45 packets/sec
  5 minute output rate 402000 bits/sec, 45 packets/sec
     73461739725 packets input, 4998891729534 bytes, Unknown total input drops
     Unknown drops for unrecognized upper-level protocol
     Received 0 broadcast packets, 48192 multicast packets
            0 runts, 0 giants, 0 throttles, 0 parity
     Unknown input errors, 0 CRC, Unknown frame, Unknown overrun, 0 ignored, 0 abort
     73461747443 packets output, 4998883259525 bytes, Unknown total output drops
     Output 2 broadcast packets, 33519 multicast packets
     Unknown output errors, Unknown underruns, 0 applique, Unknown resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

Step 2   Run the **show ipv4 interface brief** command to view the IPv4 address, status, operational state, and VRF name.

This 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.

Example:

```
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 become active. When the node starts, the Gigabit Ethernet interface changes to *Down* state.

Step 3 Run the **no interface gigabitEthernet** command on the Gigabit Ethernet interface to bring it up.

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.

Example:

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

Step 4 Run the **no speed 1000** command to remove the speed configuration from the interface.

Example:

```
RP/0/RP0/CPU0:ios(config)#interface gigabitEthernet 0/0/0/0
RP/0/RP0/CPU0:ios(config)#no speed 1000
RP/0/RP0/CPU0:ios(config)#commit
```

You successfully display operational and configuration details of the Gigabit Ethernet interface, including speed, status, counters, and port parameters.

Best practice for downgrading from OSC 1G

Remove the 1G OSC speed configuration from OLT and ILA nodes before downgrading from Release 25.4.1 or a later version to a software version that does not support the OSC 1G feature.

• Once you delete the OSC 1G speed configuration, the OSC port operates at 100 Mbps.

• If you remove the 1G setting before downgrading, you do not need to reload any rack after the downgrade.

Release 25.4.1 and later versions support 1 GE OSC speed.

View GE interface statistics

Table 40: Feature History

Feature Name	Release Information	Feature Description

Enhanced Ethernet Statistics Support for GE Interfaces	Cisco IOS XR Release 26.1.1	This feature provides a comprehensive support for the Ethernet Statistics on GE Interfaces through the Command Line Interface (CLI). It allows you to access real-time data on various Ethernet statistics, providing network administrators with essential data for performance monitoring and troubleshooting.
		
		The CLI command introduced is:
		
		    • **show controllers gigabitEthernet R/S/I/P stats**
		
		The CLI command output modified to include packet counters information is:
		
		    • **show interfaces GigabitEthernet R/S/I/P**

The GE interface supports a list of current statistics.

Table 41: Supported list of statistics on GE interface

show interface GE	show controller GE

input_pkts	rx_good_bytes
input_bytes	rx_ucast
input_mcast_pkts	rx_bcast
input_bcast_pkts	rx_mcast
input_crc	rx_undersize
output_pkts	rx_fragments
output_bytes	rx_oversize
output_total_errors	rx_jabber
output_mcast_pkts	rx_fcs
output_bcast_pkts	rx_total_pkts
	rx_total_bytes
	rx_good_pkts
	tx_good_bytes
	tx_ucast
	tx_mcast
	tx_bcast
	tx_total_pkts
	tx_total_bytes
	tx_good_pkts

View the current statistics of the GE interface.

Example

```
show controllers gigabitEthernet r/s/i/p stats
```

The output shows the current statistics of the GE interface.

Example

```
RP/0/RP0/CPU0:ios#show controllers gigabitEthernet 0/0/0/0 stats
Tue Feb 18 04:17:18.023 UTC
Statistics for interface GigabitEthernet0/0/0/0 (cached values):

Ingress:
    Input total bytes          = 153417              Valid = True        Start time =
 11:24:13 Mon Feb 17 2025
    Input good bytes           = 152339              Valid = True        Start time =
 11:24:13 Mon Feb 17 2025

    Input total packets        = 1533                Valid = True        Start time =
 11:24:13 Mon Feb 17 2025
    Input 802.1Q frames        = 0                   Valid = False       Start time =
 11:24:13 Mon Feb 17 2025
    Input pause frames         = 0                   Valid = False       Start time =
 11:24:13 Mon Feb 17 2025
    Input pkts 64 bytes        = 0                   Valid = False       Start time =
 11:24:13 Mon Feb 17 2025
```

```
        Input pkts 65-127 bytes    = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input pkts 128-255 bytes   = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input pkts 256-511 bytes   = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input pkts 512-1023 bytes  = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input pkts 1024-1518 bytes = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input pkts 1519-Max bytes  = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input good pkts            = 1533                 Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input unicast pkts         = 0                    Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input multicast pkts       = 1529                 Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input broadcast pkts       = 4                    Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input drop overrun         = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input drop abort           = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input drop invalid VLAN    = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input drop invalid DMAC    = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input drop invalid encap   = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input drop other           = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025

        Input error giant          = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input error runt           = 0                    Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input error jabbers        = 0                    Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input error fragments      = 0                    Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input error CRC            = 0                    Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Input error collisions     = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input error symbol         = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input error other          = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025

        Input MIB giant            = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input MIB jabber           = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025
        Input MIB CRC              = 0                    Valid = False      Start time =
11:24:13 Mon Feb 17 2025

Egress:
        Output total bytes         = 1291235              Valid = True       Start time =
11:24:13 Mon Feb 17 2025
        Output good bytes          = 1291235              Valid = True       Start time =
11:24:13 Mon Feb 17 2025

        Output total packets       = 12721                Valid = True       Start time =
```

```
11:24:13 Mon Feb 17 2025
    Output 802.1Q frames      = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pause frames       = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 64 bytes      = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 65-127 bytes  = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 128-255 bytes = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 256-511 bytes = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 512-1023 bytes = 0               Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 1024-1518 bytes = 0              Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output pkts 1519-Max bytes = 0               Valid = False     Start time =
11:24:13 Mon Feb 17 2025

    Output good pkts          = 12721            Valid = True      Start time =
11:24:13 Mon Feb 17 2025
    Output unicast pkts       = 0                Valid = True      Start time =
11:24:13 Mon Feb 17 2025
    Output multicast pkts     = 12719            Valid = True      Start time =
11:24:13 Mon Feb 17 2025
    Output broadcast pkts     = 2                Valid = True      Start time =
11:24:13 Mon Feb 17 2025

    Output drop underrun      = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output drop abort         = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025
    Output drop other         = 0                Valid = False     Start time =
11:24:13 Mon Feb 17 2025

    Output error other        = 0                Valid = True      Start time =
11:24:13 Mon Feb 17 2025
```

OSC link speed specifications

These tables provide key technical specifications for the OSC link speeds, including file transfer rates, UDC throughput, and management traffic performance.

Note Speed 1000 Mbps and Speed 100 Mbps are supported. Speed 10 Mbps is not supported.

Table 42: File transfer speed through OSC link

OSC link speed	Transfer rate at first hop	Transfer rate at second hop
100 Mbps (default speed)	87 Mbps	87 Mbps
1 GE (new speed)	232 Mbps	176 Mbps

Table 43: UDC throughput with IPv4 traffic

OSC link speed	UDC throughput (64 packets)	UDC throughput (256 - 1000 packets)	UDC throughput (1514 packets)
100 Mbps (default speed)	68 Mbps	83 Mbps	88 Mbps
1 GE (new speed)	680 Mbps	830 Mbps	880 Mbps

Table 44: Management traffic through OSC link

OSC link speed	IMIX	Packet size 95	Packet size 500	Packet size 1000	Packet size 1500
1000 Mbps	50 Mbps	14 Mbps	60 Mbps	150 Mbps	200 Mbps
100 Mbps	50 Mbps	14 Mbps	60 Mbps	90 Mbps	90 Mbps

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. Afte 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             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/1 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/2 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/4 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/5 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/6 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/7 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/8 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/9 - Loss
 of Signal - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC  Och0/1/0/10 - Loss
```

```
                 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/11 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/12 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/13 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/14 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/15 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/16 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/17 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/18 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/19 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/21 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Och0/1/0/22 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Oms0/1/0/31 - Loss
 of Signal - Payload
0/1              Critical    Controller      07/21/2022 11:11:54 UTC   Oms0/1/0/26 - Loss
 of Signal - Payload
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

Headless mode

A headless mode is a system operation mode that

- enables Cisco NCS 1010 to continue forwarding traffic when the controller card is absent, failed, or being restarted

- maintains errorless operation for up to 72 hours during software upgrades, controller reload, online insertion and removal (OIR), or process restarts, and

- restricts provisioning and viewing operational data, until the controller is restored.

During headless mode, NCS 1010 ensures ongoing traffic forwarding without interruption, even when the controller card is physically missing, in a failed state, or undergoing upgrades or reloads. While the control plane is unavailable, users cannot provision, view operational data, or perform performance monitoring based on 15-minute and 24-hour intervals without a functional controller. After restoration, normal management access and monitoring resume.

OIR is a hardware maintenance procedure performed during controller card upgrade or replacement. During OIR, Cisco NCS 1010 is temporarily unreachable, but returns to normal operation upon completion.

Examples of scenarios that require OIR

- FPD (Field Programmable Device) upgrade failure

- Software image update failure

- Bootup failure

ASE loading

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.

The CHANNEL-NOISE-LOADED alarm is raised when an OTS-OCH controller channel fails and the missing carrier power in the channel is replaced with internally generated ASE noise. The alarm is cleared automatically when the original traffic channel is restored and the temporary ASE noise is removed. For more details about the alarm, see CHANNEL-NOISE-LOADED.

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.

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 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 27: Static ASE
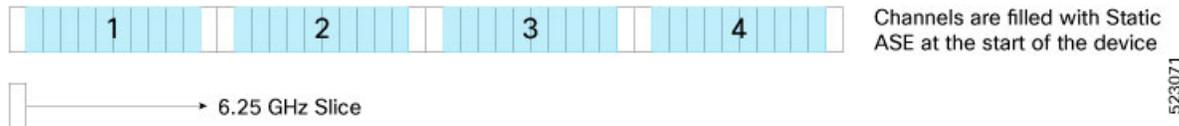
Dynamic ASE—When a traffic channel fails (for example, the PSD within the set of slices that are dedicated to the traffic channel is below a given threshold) an equivalent temporary ASE channel is inserted to maintain the spectral density on the line port. This dynamic ASE channel fills the original 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 28: Dynamic ASE with Nyquist Channels
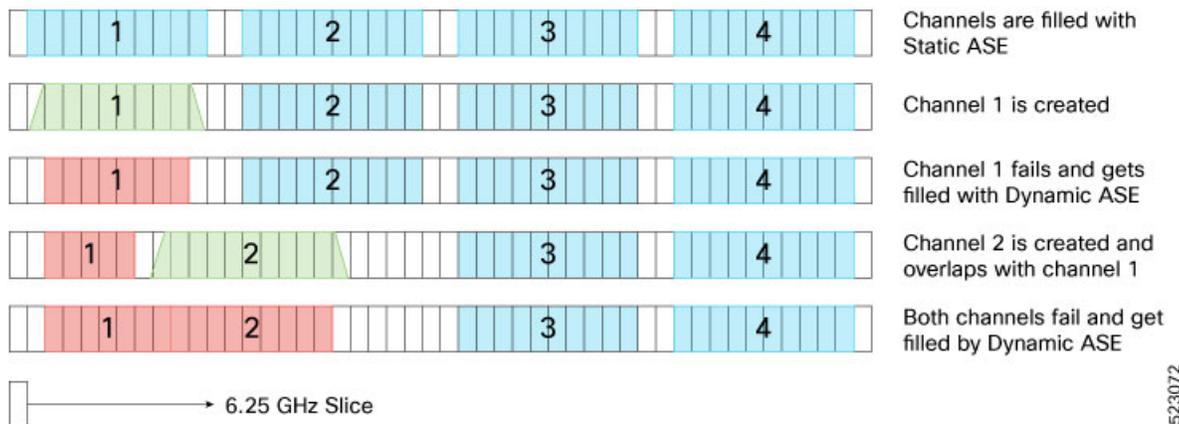
ASE loading disable

Table 45: Feature History

Feature Name	Release Information	Description
ASE Loading Disable	Cisco IOS XR Release 26.1.1	ASE loading can be disabled at both the channel and module levels to improve troubleshooting capabilities. The "ASE Loading Disabled" alarm has been introduced for this feature. Commands modified: The keyword **ase-loading disable** has been added to these commands: **hw-module location** *location* **terminal-ampli** **hw-module location** *location* **terminal-ampli grid-mode flex channel id***<id>*

You can now disable ASE loading for improved troubleshooting. Disabling ASE loading at the channel level raises an 'ASE Loading Disabled' alarm on the OTS-OCH interface. Disabling ASE loading at the spectrum level raises the 'ASE Loading Disabled' alarm on the OTS interface.

If both channel-level and spectrum-level configurations are present to disable ASE loading, only the spectrum-level alarm raises.

Note   ASE Loading Disable is not supported on ILA Node.

Configuring ASE Loading Disable at Spectrum Level

Use this sample to configure ASE loading disable feature and verify the configuraiton at spectrum level.

Before you begin

- Before disabling ASE loading, APC must be paused on all the nodes.

Procedure

Use this sample configuration to enable ASE loading disable feature at spectrum level.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXRO terminal-ampli
```

```
RP/0/RP0/CPU0:ios(config)#ase-loading disable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Use this configuration to verify whether ASE loading is disabled at spectrem level.

```
show running-config hw-module location 0/0/NXR0 terminal-ampli
 ase-loading disable
```

Remove ASE Loading Disable at Spectrum Level

Procedure

Use this sample configuration to remove ASE loading disable feature at spectrum level.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXRO terminal-ampli
RP/0/RP0/CPU0:ios(config)#no ase-loading disable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Configuring ASE Loading Disable at Channel Level

Configure ASE loading disable and verify the configuraiton at channel level.

Before you begin

Before disabling ASE loading, APC must be paused on all the nodes.

Procedure

Use this sample configuration to remove the ASE loading disable feature at the channel level.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXRO terminal-ampli
RP/0/RP0/CPU0:ios(config)#grid-mode flex
RP/0/RP0/CPU0:ios(config)#channel-id 1 ase-loading disable
RP/0/RP0/CPU0:ios(config)#channel-id 1 centre-freq 193.123 width 75
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Use this configuration to verify wheter ASE loading is disabled at channel level.

```
show running-config hw-module location 0/0/NXR0 terminal-ampli grid-mode flex channel-id
```

Remove ASE Loading Disable at Channel Level

Remove ASE loading disable at channel level.

Procedure

Use this sample configuration to disable the ASE loading disable feature at the channel level.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXRO terminal-ampli
RP/0/RP0/CPU0:ios(config)#grid-mode flex
RP/0/RP0/CPU0:ios(config)#no channel-id 1 ase-loading disable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Optical channel monitoring

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

Each OCM refreshes approximately every 200ms. The device reports the channel power based on the OCM power. If the channel power is above the threshold (TH), the channel is declared as Active. If the channel power is below the threshold (TH), the channel is declared as Failed. The dynamic OCM scheduling algorithm creates a list of OCM ports based on the used and unused add/drop ports. Each add/drop port is connected to an OCM port. When creating a cross-connect, the used add/drop port is considered as a used OCM port, and the rest of the ports are considered as unused. Based on the used add/drop ports, the device creates a sequence of used and unused OCM ports. This allows the used OCM ports to refresh the maximum number of times. This approach ensures faster channel recovery.

OCM in OLT-C

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 46: 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

OCM in ILA-C

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 47: 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

Parameter	Unit	Min.	Typical	Max	Note
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

OCM in OLT-L

The measuring points in the OLT-L card are:

- Input and output of preamplifier
- ADD-i-RX ports
- COM1-TX ports
- Output of booster amplifier and noise loader

All OCM specs like accuracy, resolution, and more in L-band are the same as those in C band.

Table 48: Optical specifications for OCM in OLT-L

Parameter	Unit	Minimum	Typical	Maximum	Note
Frequency range	THz	186.05		191.125	Out-of-band channel frequency 190.8875 - 191.125 THz are available only as row-data values.

OCM in ILA-L

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

The measuring points in the ILA-L card are:

- Input port of EDFA1
- Output port of EDFA2

All OCM specs like accuracy, resolution, and more in L-band are the same as those in C band.

Table 49: Optical specifications for OCM in ILA-L

Parameter	Unit	Minimum	Typical	Maximum	Note
Frequency range	THz	186.05		191.125	Out-of-band channel frequency 190.8875 - 191.125 THz are available only as row-data values.

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#
```

Dynamic OCM scheduler

Table 50: Feature History

Feature name	Release information	Feature description
Dynamic OCM Scheduler	Cisco IOS XR Release 24.4.15	Introducing the Dynamic OCM Scheduler, an enhanced OCM scheduler that is designed to optimize optical channel monitoring by replacing static scheduling with a dynamic algorithm. This accelerates the refresh rate of OCM points on the cross-connect ports, significantly boosting power monitoring and failure detection capabilities. By prioritizing cross-connected ports, the dynamic scheduler reduces polling times, effectively capturing micro flaps and alarm fluctuations.

Dynamic OCM scheduler optimizes the refresh rate of OCM points on the cross-connect ports and nonconfigured ports within OLT nodes. It refreshes the monitoring rate of the OCM points on the cross-connect ports at a higher frequency. This enhancement improves monitoring of channel power, failure detection, alarm fluctuations, and micro flaps.

How the dynamic OCM schedule works

Dynamic OCM scheduler treats cross-connect ports as medium priority and nonconfigured ports as low priority.

If you configure **port 1** as a cross-connect port, the OCM scheduler treats the remaining 33 ports as low priority. In this combination, the polling time for OCM points on **port 1** takes approximately one second to complete two OCM refreshments. When you increase the number of cross-connect ports, the refresh rate of the OCM points changes accordingly.

Automatic-In-Service (AINS) state

The AINS state is an administrative state that

- allows the OTS, OMS, and OCH datapath controllers to automatically move to the *Automatic In Service* state after a system bootup,

- prevents alarms reporting to the EMS/NMS monitoring system during the soak time period, and

- helps the affected ports to transition to the *In-Service* state after the soak time period expires.

In NCS 1010, AINS state affects the

- OTS controllers on the COM ports for the OLT and E-OLT cards. See

- OTS-OCH controllers after the optical cross connections are configured on the OLT and E-OLT cards. See

• OMS and OCH controllers for the passive devices. See

AINS does not affect for the line side OTS-OCH controllers on OLT, E-OLT, ILA and E-ILA cards. Line side OTS-OCH controllers are labeled as OTS-OCH 0/0/0/0/x.

AINS soak time period

Soak time period is a timed delay that

- keeps the affected NCS 1010 ports in the AINS state for defined duration after system boot,

- suppress active alarms until the ports transition to the *In-Service* state, and

- lasts for one minute by default.

Characteristics of soak time period

The characteristics of soak timer period are:

- The soak time period for the AINS state is fixed and not configurable.

- The soak timer restarts automatically during line card cold reloads or power cycles.

- During the soak time period, any alarms are suppressed and can be viewed using the `show alarms brief system conditions` command.

- When all alarms are resolved, the system transitions the affected ports to the *In-Service* state.

After an NCS 1010 chassis boots up, its COM ports for OLT and E-OLT cards enter the AINS state. The soak time period begins, lasting one minute. During this time, alarms are suppressed. When the soak time ends, if ther are no outstanding alarms, the ports move into In-Service.

- The soak time period is a predefined value.

- If an active alarm persists after the soak time, the affected port will not transition to In-Service.

A soak time period acts like a 'buffer zone' that delays action, ensuring that transient issues do not trigger alarms during initial startup or recovery.

Verify the AINS state and the suppressed alarms

Follow the steps to verify the administrative state of the affected controller types that are in AINS state.

- OLT and E-OLT cards: OTS and OTS-OCH controllers

- Passive modules: OCH and OMS controllers

When add/drop COM ports enter the AINS state, the alarms reported on those ports are suppressed during the soak time period. Use the steps in this task to check the adminstrative state of those ports and their alarms.

Procedure

Step 1 Use the **show controllers ots R/S/I/P** command to check the adminstrative status of the OTS controller.

Example:

This command displays the OTS controller statistics for Add/Drop 2 port in OLT and E-OLT cards.

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

This output displays the OTS controller statistics highlighting the adminstrative state as *Automatic In Service*.

```
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
```

Step 2 Use the **show controllers ots-och R/S/I/P/x** command to check the adminstrative status of the OTS-OCH controller.

Example:

This command displays the OTS-OCH cross-connect controller statistics for Add/Drop 13 port in E-OLT cards.

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

This output displays the OTS-OCH controller statistics highlighting the adminstrative state as *Automatic In Service*.

```
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
```

Step 3   Use the **show controllers och R/S/I/P** command to check the adminstrative status of the OCH controller in passive modules.

Example:

This command displays the OCH controller statistics for port 0 in passive modules.

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

This output displays the OCH controller statistics highlighting the adminstrative state as *Automatic In Service*.

```
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
```

This 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*.

```
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
```

Step 4   Use the **show controllers oms R/S/I/P** command to check the adminstrative status of the OMS controller in passive modules.

Example:

This command displays the OMS controller statistics for port 25 in NCS1K-MD-32O/E-C passive module.

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

This output displays the OMS controller statistics highlighting the administrative state as *Automatic In Service*.

```
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
```

Step 5 (Optional) Use the **show alarms brief system conditions** command to check the alarms suppressed for the controllers in AINS state.

Example:

This command displays the suppressed alarms in AINS state.

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

This output displays the alarms reported for the affected controller types in AINS state.

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

------------------------------------------------------------------------------------------
Conditions
------------------------------------------------------------------------------------------
Location        Severity    Group        Set Time               Description


------------------------------------------------------------------------------------------
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/1 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/2 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/4 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/5 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/6 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/7 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/8 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/9 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/10 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/11 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/12 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/13 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/14 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/15 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/16 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/17 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/18 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/19 - Loss of Signal
 - Payload
0/1             Critical    Controller   07/21/2022 11:11:54 UTC   Och0/1/0/21 - Loss of Signal
 - Payload
```

```
0/1            Critical    Controller     07/21/2022 11:11:54 UTC    Och0/1/0/22 - Loss of Signal
 - Payload
0/1            Critical    Controller     07/21/2022 11:11:54 UTC    Oms0/1/0/31 - Loss of Signal
 - Payload
0/1            Critical    Controller     07/21/2022 11:11:54 UTC    Oms0/1/0/26 - Loss of Signal
 - Payload
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
```

Monitor Performance

Performance monitoring (PM) parameters are used by service providers to gather, store, set thresholds for, and report performance data for early detection of network issues. You can configure and retrieve PM counters for the various controllers in flex-bin, 30-second, 15-minute, or 24-hour intervals. These parameters simplify troubleshooting operations and enhance data that can be collected directly from the equipment.

Monitor performance

You can set and retrieve PM counters for the OTS, OTS-OCH, OSC, DFB, OCH, and OMS controllers for various intervals.

The OCH and OMS controllers are created when the Mux/Demux panel and breakout panels are powered up using the USB 2.0 connection from the NCS 1010 EITU card. You can only view the current and historical PM parameters for the panels. You cannot configure the PM parameters for these controllers.

This table lists the PM parameters, their descriptions, and precision levels.

Table 51: PM parameters for controllers

PM parameter (Unit of Measure)	Description	Resolution
OPT [dBM]	Total Tx(C+OSC) power	1/100
OPR [dBM]	Total Rx(C+OSC) power	1/100
OPT(C+L) [dBM]	Total Tx(C+L+OSC) power	1/100
OPR(C+L) [dBM]	Total Rx(C+L+OSC) power	1/100
OPR(S) [dBM]	C Band Received Signal Power	1/100
OPT(S) [dBM]	C Band Transmitted Signal Power	1/100
OPBR [dBM]	Back Reflection Power	1/100

EAGN [dB]	Egress Amplifier Gain	1/100
EATL [dB]	Egress Amplifier Tilt	1/100
IAGN [dB]	Ingress Amplifier Gain	1/100
IATL [dB]	Ingress Amplifier Tilt	1/100
RAMAN-TOT [mW]	Raman Total Pump power	1/10
RAMAN-1 [mW]	Raman 1 Pump power	1/10
RAMAN-2 [mW]	Raman 2 Pump power	1/10
RAMAN-3 [mW]	Raman 3 Pump power	1/10
RAMAN-4 [mW]	Raman 4 Pump power	1/10
RAMAN-5 [mW]	Raman 5 Pump power	1/10

The tables list the maximum and minimum thresholds that can be set for the PM parameters for OLT nodes

Table 52: PM thresholds for OLT OTS controller (0/0/0/0)

PM parameter	Minimum threshold	Maximum threshold
OPT	−2000	4000
OPR	−3000	1800
OPT(C+L)	−2000	6085
OPR(C+L)	−3000	3600
OPR(S)	−3000	1800
OPT(S)	−500	2800
OPBR	−3000	−1400
EAGN	1390	3100
EATL	−500	500
IAGN	1030	3800
IATL	−500	500
RAMAN-TOT	2000	14100
RAMAN-1	450	3900
RAMAN-2	400	3900
RAMAN-3	400	2200

| RAMAN-4 | 400 | 2200 |
| RAMAN-5 | 350 | 1900 |

Table 53: PM thresholds for OLT OTS controller (0/0/0/2 and 0/0/0/3)

PM parameter	Minimum threshold	Maximum threshold
OPT	−3000	1500
OPR	−2500	1800
IAGN	1300	1900
IATL	−500	500

Table 54: PM thresholds for OLT OTS controller (0/0/0/4 to 0/0/0/33)

PM parameter	Minimum threshold	Maximum threshold
OPT	−3000	1500
OPR	−1500	1000

Table 55: PM thresholds for OLT OTS-OCH controller

PM parameter	Minimum threshold	Maximum threshold
OPT	−3000	1500
OPR	−3000	1500

Table 56: PM Thresholds for OLT OSC controller (0/0/0/0)

Parameter	Minimum threshold	Maximum threshold
OPT	−2000	1200
OPR	−3000	0

Table 57: PM thresholds for OLT DFB controller (0/0/0/0)

PM Parameter	Minimum Threshold	MaximumThreshold
OPT	−2000	1000
OPR	−3000	1500

The tables list the maximum and minimum thresholds that can be set for the PM parameters for ILA nodes.

Table 58: PM thresholds for ILA OTS controller (0/0/0/0)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−3000	4000
OPR	−3000	2000
OPT(C+L)	−3000	6085
OPR(C+L)	−3000	4000
OPR(S)	−3000	2800
OPT(S)	−3000	2000
OPBR	−3000	−1400
EAGN	590	3600
EATL	−500	500
RAMAN-TOT	2000	14100
RAMAN-1	450	3900
RAMAN-2	400	3900
RAMAN-3	400	2200
RAMAN-4	400	2200
RAMAN-5	350	1900

Table 59: PM thresholds for ILA OTS controller (0/0/0/2)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−3000	4000
OPR	−3000	2000
OPT(C+L)	−3000	6085
OPR(C+L)	−3000	4000
OPR(S)	−3000	2800
OPT(S)	−3000	2000
OPBR	−3000	−1400
EAGN	590	3600
EATL	−500	500

RAMAN-TOT	2000	14100
RAMAN-1	450	3900
RAMAN-2	400	3900
RAMAN-3	400	2200
RAMAN-4	400	2200
RAMAN-5	350	1900

Table 60: PM thresholds for ILA OSC controller (0/0/0/0 and 0/0/0/2)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−2000	1200
OPR	−3000	0

Table 61: PM thresholds for ILA OTS-OCH controllers

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−3000	1500
OPR	−3000	1500

Table 62: PM thresholds for ILA DFB controllers (0/0/0/0 and 0/0/0/2)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−2000	1000
OPR	−3000	1500

This table lists the maximum and minimum thresholds that are set for the PM parameters for OCH controllers.

Table 63: PM thresholds for OCH controllers

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−30	15
OPR	−30	15

This table lists the maximum and minimum thresholds that are set for the PM parameters for OMS controllers.

Table 64: PM thresholds for OMS controllers

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−30	15

PM Parameter	Minimum Threshold	Maximum Threshold
OPR	−30	15

Photodiodes (PDs) refresh rate

Table 65: Feature History

Feature Name	Release Information	Feature Description
Improved Performance Monitoring	Cisco IOS XR Release 7.11.1	NCS 1010 now measures the power values of Photo Diodes (PDs) at various measurement points at a faster refresh rate to improve the node performance monitoring. With the upgraded FPDs, the refresh rate has reduced from 250 ms to 50 ms. This faster refresh rate applies to all the NCS 1010 PIDs for the following line card FPDs: • ILA • OLT • Raman-1 • Raman-2

NCS 1010 measures the power values of Photo Diodes (PDs) at various measurement points to provide values for PM parameters. The measured values are refreshed at a defined rate for the latest values.

From Release 7.11.1, the rate at which the values of specific PDs are refreshed is reduced from 250 ms to 50 ms. This faster refresh rate is applicable to all the NCS 1010 OLT and ILA PIDs.

The following table provides the list of photo diodes that support the new refresh rate of 50 ms.

Table 66: Line cards and impacted PDs

Line cards	PDs
OLT-C	PD1, PD9, PD14, PD20
OLT-L	PD1, PD9, PD11, PD15
ILA-C	PD1, PD3, PD5, PD7, PD13, PD14, PD21, PD22
ILA-L	PD1, PD3, PD5, PD7, PD9, PD10, PD17, PD18
OLT and ILA cards with RAMAN	PD2, PD7

In the OLT-C card, the newer refresh rate impacts the following PM parameters and controllers.

Photo diode	controller	PM parameter
PD1	OTS	OPR-S
PD9	OSC	OPR

Photo diode	controller	PM parameter
PD9	OTS	OPR
PD14	OTS	OPT-S
PD20	OSC	OPT
PD20	OTS	OPT

In the ILA-C card, the newer refresh rate impacts the following PM parameters and controllers.

Photo Ddodes	controller	PM parameter
PD1, PD3	OTS	OPR-S
PD5, PD7	OSC	OPR
PD13, PD14	OTS	OPT-S
PD21, PD22	OSC	OPT

Configure and view PM parameters

You can configure the performance monitoring parameters for the controllers. To configure PM parameters, use these commands in the configuration mode:

Table 67: Feature history

Feature Name	Release Information	Feature Description
Threshold Crossing Alert (TCA) for Span Loss	Cisco IOS XR Release 7.11.1	You can now activate TCA reporting and set specific minimum and maximum threshold values for both Tx and Rx span loss across all time intervals. This enhancement provides prompt notifications for deviations from normal span loss values, which can be viewed using the **show alarms brief system active** command. To implement this feature, two new parameters **slr-cl** and **slt-cl** have been introduced for the **pm** command. Additionally, the output of the **show controllers ots R/S/I/P pm** command now captures both the actual and configured threshold values for span loss.

Table 68: Feature History

Feature Name	Release Information	Feature Description
PM History Persistence	Cisco IOS XR Release 7.11.1	PM history parameters for Optics, Ethernet, and coherent DSP controllers are now retained even after the occurrence of an operation disruptive event like: • Various reloads • Power cycle • System upgrade This functionality maintains prolonged access to performance history for extended device health monitoring and assessment

controller *controllertype R/S/I/P* { **pm** { **15-min** | **24-hour** | **30-sec** | **flex-bin** } { **optics** | **ots** } { **report** | **threshold** } { **opr** | **opt** | **eagn** | **eatl** | **iagn** | **iatl** | **slr-cl** | **slt-cl** | **opbr** | **opr** | **opr-cl** | **opr-s** | **opt** | **opt-cl** | **opt-s** | **raman-1** | **raman-2** | **raman-3** | **raman-4** | **raman-5** | **raman-tot** } { **max-tca** | **min-tca** } {**enable** | *value* }

Examples

The following example enables the maximum and minimum Threshold Crossing Alert (TCA) reporting on the OTS controller for a 15 minute interval on a C+L band network. The sample also configures the maximum and minimum Rx span loss threshold to 36db and 33db respectively. These values are compared against the current maximum span loss value to determine if a TCA should be generated.

```
RP/O/RPO/CPUO:ios#config
RP/O/RPO/CPUO:ios(config)#controller pts 0/0/0/0 pm 15-min ots report slr-cl max-tca enable
RP/O/RPO/CPUO:ios(config)#controller pts 0/0/0/0 pm 15-min ots threshold slr-cl max 3600
RP/O/RPO/CPUO:ios(config)#controller pts 0/0/0/0 pm 15-min ots report slr-cl min-tca enable
RP/O/RPO/CPUO:ios(config)#controller pts 0/0/0/0 pm 15-min ots threshold slr-cl min 3300
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

The following example shows the TOT-SPAN-LOSS-TX-CL-MAX alert is triggered when the current TX span loss value exceeds the maximum TX span loss threshold:

```
RP/0/RP0/CPU0:P1D_DT_04#show alarms brief system conditions | include SPAN
Thu Oct  5 04:49:21.462 UTC
0/0            NotAlarmed   Controller      10/05/2023 04:49:00 UTC   Ots0/0/0/0 -
Threshold Crossing Alert For TOT-SPAN-LOSS-TX-CL-MAX In 30 Second Bucket
```

The following example sets the reporting status to maximum TCA for the eagn parameter of the OTS controller for a 15-minute interval.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0 pm 15-min ots report eagn max-tca enable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

The following example configures the maximum threshold for the eagn parameter of the OTS controller to 20 dB.

✎

Note The OTS controller commands accept PM parameter values in two decimal places. In this example, the *eagn* parameter is entered as *2000* to configure the *eagn* parameter to *20 dB*.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0 pm 15-min ots threshold eagn max 2000
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

To view the current PM parameters on an OTS controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 pm current 15-min optics 1
```

The following output shows the current PM parameters on an OTS controller for a 15-minute interval and highlights the *maximum threshold* set for the *eagn* parameter that is configured for *20 dB*.

```
Tue May 17 06:37:00.529 UTC

Optics in the current interval [06:30:00 - 06:37:00 Tue May 17 2022]

Optics current bucket type : Valid
              MIN        AVG        MAX    Operational  Configured    TCA    Operational
Configured   TCA
                                          Threshold(min)Threshold(min(min)
Threshold(max)Threshold(max(max)
OPT[dBm]     : 20.00      20.00      20.00     -20.00      NA          NO    40.00          NA
```

```
                NO
OPR[dBm]     : 20.00      20.00      20.00     -30.00     NA           NO    18.00     NA
                NO
OPT(C+L)[dBm]: 20.00      20.00      20.00     -20.00     NA           NO    60.85     NA
                NO
OPR(C+L)[dBm]: -10.00     -10.00     -10.00    -30.00     NA           NO    36.00     NA
                NO
OPT(S)[dBm]  : 20.00      20.00      20.00     -5.00      NA           NO    28.00     NA
                NO
OPR(S)[dBm]  : 20.00      20.00      20.00     -30.00     NA           NO    18.00     NA
                NO
OPBR[dBm]    : -30.00     -30.00     -30.00    -30.00     NA           NO    -14.09    NA
                NO
EAGN[dB]     : 30.00      30.00      30.00     16.00      NA           NO    20.00     20.00
           YES
EATL[dB]     : -4.80      -4.80      -4.80     -5.00      NA           NO    5.00      NA
                NO
IAGN[dB]     : 25.00      25.00      25.00     12.00      NA           NO    25.00     NA
                NO
IATL[dB]     : -2.40      -2.40      -2.40     -5.00      NA           NO    5.00      NA
                NO
RAMAN-TOT[mW]: 300.00     300.00     300.00    200.00     NA           NO    1410.00   NA
                NO
RAMAN-1 [mW] : 45.00      45.00      45.00     45.00      NA           NO    390.00    NA
                NO
RAMAN-2 [mW] : 40.00      40.00      40.00     40.00      NA           NO    390.00    NA
                NO
RAMAN-3 [mW] : 40.00      40.00      40.00     40.00      NA           NO    220.00    NA
                NO
RAMAN-4 [mW] : 40.00      40.00      40.00     40.00      NA           NO    220.00    NA
                NO
RAMAN-5 [mW] : 35.00      35.00      35.00     35.00      NA           NO    190.00    NA
                NO


Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters on an OTS controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 pm history 15-min optics  1 bucket 1
```

The following output shows the historical PM parameters on an OTS controller for a 15-minute interval.

```
Tue May 17 07:02:26.911 UTC

Optics in interval 1 [06:45:00 - 07:00:00 Tue May 17 2022]

Optics history bucket type : Valid
               MIN        AVG        MAX
OPT[dBm]    :   20.00      20.00      20.00
OPR[dBm]    :   20.00      20.00      20.00
OPT(C+L)[dBm]: 20.00      20.00      20.00
OPR(C+L)[dBm]: -10.00     -10.00     -10.00
OPT(S)[dBm] :  20.00      20.00      20.00
OPR(S)[dBm] :  20.00      20.00      20.00
OPBR[dBm]   :  -30.00     -30.00     -30.00
EAGN[dB]    :  30.00      30.00      30.00
EATL[dB]    :  -4.80      -4.80      -4.80
IAGN[dB]    :  25.00      25.00      25.00
IATL[dB]    :  -2.40      -2.40      -2.40
RAMAN-TOT[mW]: 300.00     300.00     300.00
RAMAN-1 [mW] : 45.00      45.00      45.00
RAMAN-2 [mW] : 40.00      40.00      40.00
RAMAN-3 [mW] : 40.00      40.00      40.00
```

```
RAMAN-4 [mW] : 40.00      40.00      40.00
RAMAN-1 [mW] : 35.00      35.00      35.00
```

To view the current PM parameters on an OTS-OCH controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och 0/0/0/0/1 pm current 15-min optics 1
```

The following output shows the current PM parameters on an OTS-OCH controller for a 15-minute interval.

```
Tue May 17 10:27:20.387 UTC

Optics in the current interval [10:15:00 - 10:27:20 Tue May 17 2022]

Optics current bucket type : Valid
         MIN  AVG   MAX Operational    Configured     TCA      Operational     Configured
     TCA
                          Threshold(min)  Threshold(min) (min)   Threshold(max)
Threshold(max) (max)
OPT[dBm] : 1.20 1.30   1.30    -30.00            NA            NO         15.00
NA     NO
OPR[dBm] :-12.31-12.25-12.20    -30.00            NA            NO         15.00
NA     NO
Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters on an OSC controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controller osc 0/0/0/0 pm current 15-min optics 1
```

The following output shows the current PM parameters on an OSC controller for a 15-minute interval.

```
Tue May 17 08:24:32.642 UTC

Optics in the current interval [08:15:00 - 08:24:32 Tue May 17 2022]

Optics current bucket type : Valid
            MIN        AVG        MAX     Operational     Configured     TCA   Operational
 Configured     TCA
                                          Threshold(min)   Threshold(min) (min)
Threshold(max)Threshold(max)(max)
OPT[dBm]    : -10.00    -10.00   -10.00   -20.00            NA            NO   12.00
     NA          NO
OPR[dBm]    : -30.00    -30.00   -30.00   -30.00            NA            NO   0.00
     NA          NO

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters on a DFB controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controller dfb 0/0/0/0 pm current 15-min optics 1
```

The following output shows the current PM parameters on a DFB controller for a 15-minute interval.

```
Tue May 17 08:28:37.455 UTC

Optics in the current interval [08:15:00 - 08:28:37 Tue May 17 2022]

Optics current bucket type : Valid
        MIN    AVG   MAX   Operational Configured    TCA   Operational Configured     TCA
                           Threshold  Threshold            Threshold  Threshold
                            (min)      (min)         (min)  (max)      (max)         (max)
OPT[dBm]: 20.00 20.00 20.00   -25.23     NA          NO    18.00        NA           NO
OPR[dBm]: 10.00 10.00 10.00   -30.00     NA          NO    12.00        NA           NO

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters for an OCH controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0 pm current 30-sec optics 1
```

The following output shows the current PM parameters for an OCH controller for a 30-second interval.

```
Tue May 10 11:28:29.896 UTC

Optics in the current interval [11:28:00 - 11:28:29 Tue May 10 2022]

Optics current bucket type : Valid
            MIN        AVG        MAX      Operational      Configured      TCA   Operational
       Configured      TCA
                                          Threshold(min)   Threshold(min)  (min) Threshold(max)
     Threshold(max) (max)
OPT[dBm]    : -50.00    -50.00    -50.00    -30.00           NA              NO   15.00
         NA               NO
OPR[dBm]    : -50.00    -50.00    -50.00    -30.00           NA              NO   15.00
         NA               NO

Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters on an OCH controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0 pm history 30-sec optics 1 bucket 1
```

The following output shows the historical PM parameters on an OCH controller for a 30-second interval.

```
Mon Jul 25 05:35:52.176 UTC

Optics in interval 1 [05:35:00 - 05:35:30 Mon Jul 25 2022]

Optics history bucket type : Valid
            MIN        AVG        MAX
OPT[dBm]    : -50.00    -50.00    -50.00
OPR[dBm]    : -50.00    -50.00    -50.00

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters for an OCH controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0 pm current 15-min optics 1
```

The following output shows the current PM parameters for an OCH controller for a 15-minute interval.

```
Tue May 10 11:28:50.952 UTC

Optics in the current interval [11:15:00 - 11:28:50 Tue May 10 2022]

Optics current bucket type : Valid
            MIN        AVG        MAX      Operational      Configured      TCA   Operational
       Configured      TCA
                                          Threshold(min)   Threshold(min)  (min) Threshold(max)
     Threshold(max) (max)
OPT[dBm]    : -50.00    -50.00    -50.00    -30.00           NA              NO   15.00
         NA               NO
OPR[dBm]    : -50.00    -50.00    -50.00    -30.00           NA              NO   15.00
         NA               NO

Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters for an OCH controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0 pm history 15-min optics 1 bucket 1
```

The following output shoes the historical PM parameters for an OCH controller for a 15-minute interval.

```
Mon Jul 25 05:36:12.167 UTC

Optics in interval 1 [05:15:00 - 05:30:00 Mon Jul 25 2022]

Optics history bucket type : Valid
              MIN         AVG         MAX
OPT[dBm]   : -50.00     -50.00     -50.00
OPR[dBm]   : -50.00     -50.00     -50.00

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters on an OCH controller for a 24-hour interval, use the following command:

RP/0/RP0/CPU0:ios#**show controllers och 0/1/0/0 pm current 24-hour optics 1**

The following output shoes the current PM parameters on an OCH controller for a 24-hour interval.

```
Tue May 10 11:29:09.270 UTC

Optics in the current interval [00:00:00 - 11:29:09 Tue May 10 2022]

Optics current bucket type : Invalid
               MIN        AVG        MAX      Operational      Configured     TCA    Operational
       Configured     TCA
                                             Threshold(min)   Threshold(min) (min) Threshold(max)
   Threshold(max)  (max)
OPT[dBm]      : -50.00    -50.00    -50.00    -30.00            NA              NO    15.00
        NA                NO
OPR[dBm]      : -50.00    -50.00    -50.00    -30.00            NA              NO    15.00
        NA                NO

Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters on an OCH controller for a 24-hour interval, use the following command:

RP/0/RP0/CPU0:ios#**show controllers och 0/1/0/0 pm history 24-hour optics 1**

he following output shows the historical PM parameters on an OCH controller for a 24-hour interval.

```
Mon Jul 25 05:36:35.165 UTC

Optics in interval 1 [00:00:00 - 24:00:00 Sun Jul 24 2022]

Optics history bucket type : Valid
              MIN         AVG         MAX
OPT[dBm]   : -50.00     -50.00     -50.00
OPR[dBm]   : -50.00     -50.00     -50.00

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters for an OMS controller for a 30-second interval, use the following command:

RP/0/RP0/CPU0:ios#**show controllers oms 0/3/0/8 pm current 30-sec optics 1**

The following output shows the current PM parameters for an OMS controller for a 30-second interval.

```
Mon Jul 25 07:24:38.319 UTC

Optics in the current interval [07:24:30 - 07:24:38 Mon Jul 25 2022]

Optics current bucket type : Valid
MIN AVG MAX Operational Configured TCA Operational Configured TCA
Threshold(min) Threshold(min) (min) Threshold(max) Threshold(max) (max)
OPT[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO
OPR[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO

Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters on an OMS controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8  pm history 30-sec optics 1 bucket 1
```

The following shows the historical PM parameters on an OMS controller for a 30-second interval.

```
Mon Jul 25 07:13:51.228 UTC

Optics in interval 1 [07:13:00 - 07:13:30 Mon Jul 25 2022]

Optics history bucket type : Valid
              MIN        AVG        MAX
OPT[dBm]   : -50.00     -50.00     -50.00
OPR[dBm]   : -50.00     -50.00     -50.00

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters for an OMS controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8 pm current 15-min optics 1
```

The following output shows the current PM parameters for an OMS controller for a 15-minute interval.

```
Mon Jul 25 07:25:00.183 UTC

Optics in the current interval [07:15:00 - 07:25:00 Mon Jul 25 2022]

Optics current bucket type : Valid
MIN AVG MAX Operational Configured TCA Operational Configured TCA
Threshold(min) Threshold(min) (min) Threshold(max) Threshold(max) (max)
OPT[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO
OPR[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO

Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters for an OMS controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8  pm history 15-min optics 1 bucket 1
```

The following output shows the historical PM parameters for an OMS controller for a 15-minute interval.

```
Mon Jul 25 07:14:03.090 UTC

Optics in interval 1 [06:45:00 - 07:00:00 Mon Jul 25 2022]

Optics history bucket type : Valid
              MIN        AVG        MAX
OPT[dBm]   : -50.00     -50.00     -50.00
OPR[dBm]   : -50.00     -50.00     -50.00

Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters on an OMS controller for a 24-hour interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8 pm current 24-hour optics 1
```

The following output shows the historical PM parameters for an OMS controller for a 15-minute interval.

```
Mon Jul 25 07:26:09.817 UTC

Optics in the current interval [00:00:00 - 07:26:09 Mon Jul 25 2022]

Optics current bucket type : Valid
MIN AVG MAX Operational Configured TCA Operational Configured TCA
Threshold(min) Threshold(min) (min) Threshold(max) Threshold(max) (max)
```

```
OPT[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO
OPR[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO

Last clearing of "show controllers OPTICS" counters never
```

To view the historical PM parameters on an OMS controller for a 24-hour interval, use the following command:

RP/0/RP0/CPU0:ios#**show controllers oms 0/3/0/8 pm history 24-hour optics 1**

The following output shows the historical PM parameters on an OMS controller for a 24-hour interval.

```
Mon Jul 25 07:18:13.532 UTC

Optics in interval 1 [00:00:00 - 24:00:00 Sun Jul 24 2022]

Optics history bucket type : Valid
             MIN         AVG         MAX
OPT[dBm]   : -50.00     -50.00     -50.00
OPR[dBm]   : -50.00     -50.00     -50.00

Last clearing of "show controllers OPTICS" counters never
```

PM history persistence

PM history parameters are retained even after a line card cold reload, line card warm reload, rack reload, RP reload, power cycle, or upgrade of the NCS 1010 chassis.

Note PM history persistence is not supported on NCS1K4-QXP-K9.

After a software upgrade to the latest release, you can view the history performance monitoring parameters from the previous release. The PM history persistence is supported for 30-second, 15-minute, and 24-hour bucket types. After upgrade from Release 7.11.1 to a higher version, if new PM parameters are available in the new version, below error is displayed while fetching PM data.

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/0/0/8 pm history 15-min ether 5
Tue Apr  5 22:05:56.750 UTC
pm_display_int_15min_ether_index: bag_decode failed ('bag' detected the 'fatal' condition
'An irresolvable version conflict prevented the specified bag from being decoded')
```

However, the following list describes the time that is required to fill all historical buckets of each bucket type, later while fetching PM historical data, no error appears.

- For 30-second bucket type, 15 minutes is required to fill 30 historical buckets.

- For 15-minute bucket type, 8 hours is required to fill 32 historical buckets.

- For 24-hour bucket type, 24 hours is required to fill 7 historical bucket.

PM counters are updated continuously in current bucket for all bucket types (flex, 30-second, 15-minute, and 24-hour). After the timer expires for the respective bucket type, the current PM data is moved to the historical PM bucket. This process of moving PM data to the historical bucket is called Rollover. After rollover, you can access the current PM data as historical PM data.

In case of deletion or removal of the controller, the PM data is persistent for 3 hours. Unless the controller is brought up within 3 hours, the PM data is cleared because the controller is considered to be not in use.

Limitations

If NCS 1010 reload or software upgrade happens during the rollover time, one of the following scenarios occurs:

- The complete PM bucket is missing and the next PM bucket is marked as *Invalid*.

- PM bucket expiry message appears as follows:

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/3/0/2 pm history 30-sec ether 29
Fri Apr  1 01:32:20.646 UTC
History data is empty, Verify at least one collection period is expired
```

- PM bucket interval is marked as *Invalid* and counters are updated as zero.

- PM bucket interval is marked as *Invalid* and counters are updated as nonzero.

7-day support for 15-Min PM bin

PM is enhanced for controllers to collect 15-min bin for 7 days extension.

Table 69: Feature History

Feature Name	Release Information	Feature Description
7-day 15-minute optics PM history	Cisco IOS XR Release 25.4.1	This enhancement enables the collection and storage of 15-minute performance monitoring samples, collecting up to 672 samples. Previously, the CLI bucket range was 1–32; now, it is increased to 1–672 as highlighted in the CLI command. **Updated CLI command parameter:** `show controllers `*`Controller-type R/S/I/P`*` pm history 15-min optics 1 bucket` **`<1-672>`** **New CLI command introduced:** `performance-mgmt controller 15-min extend days <0-7>` , where 0 stands for 8 hours. This enhancement provides comprehensive visibility into interface performance by recording 15-minute counters over a 7-day period. This allows users to effectively monitor and assess network interface health status.

The collection behavior depends on the controller Product ID (PID):

- For NCS1010-CTR2-B-K9, NCS1010-CTLR-B-K9, NCS1K14-CNTLR-B-K9, and NCS1K14-CNT-B-K9 controllers, the node automatically collects 672 samples (corresponding to 7 days of data).

- For NCS1010-CNTLR-K9, NCS1K14-CNTLR-K9, NCS1010-CTR2-K9 controllers, 32 samples are collected by default. To capture 672 samples, explicit configuration is required.

Note While troubleshooting, showtech can only collect 32 samples, and not the complete 672 samples, regardless of the configured sample collection.

Configure 7-day 15-minute performance monitoring sample collection

Use this task to extend sample collection beyond 32 samples.

Procedure

Step 1 Enter global configuration mode.

Example:

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

Step 2 Run the **performance-mgmt controller 15-min extend days** command to configure the number of days for 15-minute performance monitoring sample collection.

You can specify 0 for 8 hours of retention, or a number from 1 to 7 for the corresponding number of days.

Example:

```
RP/0/RP0/CPU0:ios(config)#performance-mgmt controller 15-min extend days 7
```

Step 3 Commit and exit the configuration mode.

Example:

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

Step 4 Run the **show controllers ots <interface> pm history 15-min optics 1 bucket extend day <0-7>** command to verify the configured sample collection.

The output should reflect the extended bucket range (for example, 1-672).

The controller is now configured to retain 15-minute performance monitoring samples for the specified duration (for example, up to 7 days or 672 samples).

Connection Verification

This chapter describes the tasks related to verify connection between NCS 1010 line cards, line card and breakout panel, and line card and Mux/Demux panel.

Photodiode monitors

Photodiode monitors are optical power devices that

- detect optical signal levels on device input and output ports,

- provide real-time feedback for system calibration and performance, and

- may incorporate tone-detection for advanced signal identification.

Calibrated port references for NCS 1000 passive modules

The tables specify port calibration details for different passive modules.

Table 70: NCS1K-BRK-8 calibrated port references

Photodiode	Port calibrated	Port label (Direction)	Minimum power	Maximum power	Dynamic range
PD 1 to PD 8	MPO-16 input ports	0 to 7 (TX)	–20	10	30
PD 9 to PD 16	MPO-16 output ports	0 to 7 (RX)	–20	10	30
PD 17	MPO input fiber 1	COM	–30	10	40

Table 71: NCS1K-BRK-24 calibrated port references

Photodiode	Port calibrated	Port label (Direction)	Minimum power	Maximum power	Dynamic range
PD 1 to PD 8	MPO-16 input ports	0 to 23 (TX)	−20	10	30
PD 9 to PD 11	MPO-16 output ports	0 to 2 (RX)	−20	10	30
PD 12 to PD 14		3 to 5 (RX)			
PD 15 to PD 17		6 to 8 (RX)			
PD 18 to PD 20		9 to 11 (RX)			
PD 21 to PD 23		12 to 14 (RX)			
PD 24 to PD 26		15 to 17 (RX)			
PD 27 to PD 29		18 to 20 (RX)			
PD 30 to PD 32		21 to 23 (RX)			
PD 33	MPO input fiber 1	COM	−30	10	40

Table 72: NCS1K-MD-32x-y Calibrated Port References

Photodiode	Port calibrated	Port label (Direction)	Minimum power	Maximum power	Dynamic range
PD 1 to PD 32	32 LC input ports	0 to 31 (RX)	−30	10	40
PD 33	COM-RX	COM (RX)	−10	23	33
PD 34	COM-TX	COM (TX)	−35.5	20	55.5
PD 35	COM-RX	COM (TX)	−40	0	40
PD 36[1]	COM-RX	COM (RX)	−24	5	30

[1] This Photo diode refers only to OOB (191.175GHz) frequency

Connection verification

Connection verification checks the connection between the OLT-C line card and all the other passive modules to avoid miscabling during the node installation. This task generates a specific probe signal from the dedicated Connection Verification Tunable Laser (CV-TL) available at COM-RX-2 (at a given frequency and power) and detects the probe signal on:

- The same OLT-C line card

- The passive modules (Mux/Demux panel or breakout panel) connected to the OLT-C line card

- A different unit (OLT-C line card or passive module) belonging to the same NE

- An optical interface (Router ports or Transponder) connected to the OLT-C line card

Connection verification uses a probe signal or adds a low frequency ON/OFF modulation tone transmitting a given tone pattern at 5 Hz (200 ms bit time). The tone pattern length ranges 4–32 bytes (including an alignment byte) and it includes the Cable-IDs of the cables in the connection and in case also the optical frequency of the specific connection.

✎

Note   The Connection Verification feature requires that 'tone-pattern' and 'tone-pattern-expected' be the same length.

The Cable-ID is generated by the Optical Node Controller supervising the complete NE.

The connection verification process uses the out-of-band (OOB) WSS frequencies (191.150–191.3375 THz) to reach the Optical Interfaces connected to the OLT-C line card via Mux/Demux panel.

Line card and passive modules connection verification

This section describes the connection verification between OLT-C line card and passive modules that are connected to ADD/DROP-i ports and the association between each passive modules and the related OLT-C line card USB management port.

Connection verification is performed using the OOB channel with CV-TL tuned at 191.175 THz. To univocally identify the optical path under test, the CV-TL is modulated with a low-frequency pattern including the Cable-ID of the connection.

For connection verification toward Mux/Demux panel, the CV-TL at COM-RX-2 port is routed to the DROP-1 or DROP-2 ports. The CV-TL is checked at the PD 36 inside the Mux/Demux panel. CV-TL verifies the correspondence between the specific module and management USB port. The connection verification loopback performs verification of the full optical path. The loopback checks the connection verification signal at PD 24/25 filtered monitors available on OLT-C line card ADD-1 or ADD-2 ports.

To detect the tone pattern on the connection verification signal, the following thresholds are set on the different monitors points:

- Mux/Demux panel at PD 36 ON-threshold = –3dBm

- Breakout panel loopback PD ON-threshold = –3dBm

- OLT-C line card ADD ports at PD 24/25 ON-threshold = –5dBm

- OLT-C line card COM-TX-2 port ON-threshold = –21dBm

For connection verification toward the breakout panels, the CV-TL at the COM-RX-2 port is routed to the first fiber of the specific MPO connector (port DROP-i with i=4, 12, 20, 28). The connection verification signal is checked at the monitors present in the breakout panels on the loopback path. This verifies the correspondence between the specific module and management USB port. The verification of the full optical path is performed by checking the connection verification signal at the COM-TX-2 port.

All the monitors receiving a connection verification signal detects and buffers the Cable-ID pattern encoded in the tone to allow the connection verification process by the node controller.

The connection verification signal loopback inside the breakout panel is replicated on all the output port on the MPO connector. In this way, it is possible to verify the loss of the MPO cable on the different fibers checking the connection verification signal power levels at the different ADD-i ports. This function requires a "diverse routing" between WSS Mux and Demux sections.

Side-to-side connection verification

This section describes the connection verification between the different OLT units that are deployed on different sides of a multidegree ROADM node. The interconnection between the different OLT faced on the different sides of a multidegree ROADM is performed via LC patch-cords interconnection between the MPO ports of NCS1K-BRK-8 modules. The following figure shows the Side-to-Side connection between the OLT nodes through NCS1K-BRK-8 modules.

Figure 29: NCS 1010 optical line system side-to-side connection
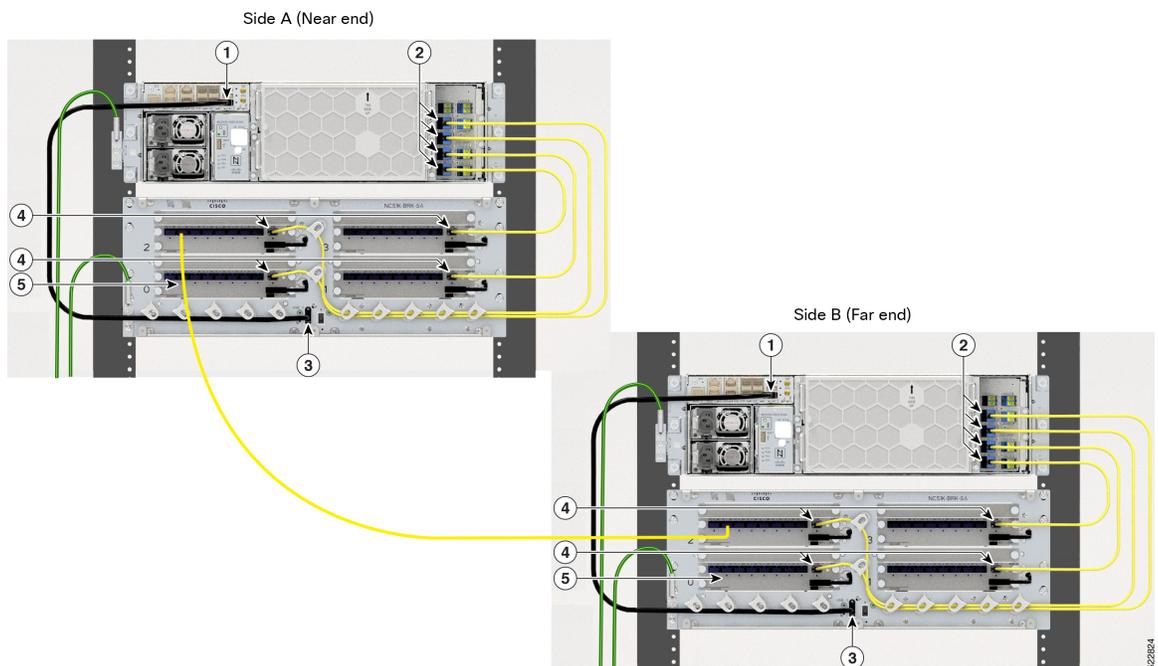
1	EITU USB 2.0 Port
2	OLT-C Line Card Add/Drop MPO Ports
3	NCS1K-BRK-8 USB 2.0 Port
4	NCS1K-BRK-8 MPO Ports
5	NCS1K-BRK-8 LC Cable

The connection verification process is performed using the OOB channel with CV-TL tuned at frequency 191.17 THz. To univocally identify the optical path under test, the CV-TL is modulated with a low-frequency pattern including the Cable-ID of the connection.

The connection verification signal that is generated by the CV-TL is routed to the specific WSS DROP-i ports used for the side-to-side interconnection. It is verified at the monitors available at the NCS1K-BRK-8 input ports that are connected to the OLT-C line card at the other side.

All the monitors receiving a connection verification signal detects and buffers the Cable-ID pattern encoded in the tone. This method allows the proper connection verification process by the node controller.

The side-to-side connection verification is performed after the connection verification between the OLT-passive units to have a complete view of the interconnection between the OLT and each specific NCS1K-BRK-8 module.

The side-to-side connection verification check is performed without any traffic present on the path.

To properly detect the tone pattern on the side-to-side connection verification signal, an ON-threshold of −5dBm is provisioned on all PDs at the DIR-i-RX ports of the NCS1K-BRK-8 module.

Verify the connection between side-to-side nodes

Ensure proper connectivity between NCS 1010 OLT nodes located on opposite sides of multidegree ROADM nodes by verifying optical connections using tone pattern generation and detection.

Follow these steps to verify connection between different NCS 1010 OLT nodes on different sides of the multidegree ROADM nodes.

Before you begin

Ensure the OTS, OMS, and OCH controllers are up and operational

Procedure

Step 1 Start tone-pattern on OTS controller.

```
RP/0/RP0/CPU0:ios#tone-pattern controller ots 0/0/0/5 start
Tue May 10 11:37:51.597 UTC
Tone pattern started
```

Note
The following alarm is raised after the tone-pattern is started.

```
0/0 Minor Controller 07/13/2022 21:21:02 UTC
Ots0/0/0/5 - Tone Generation In Progress
```

Step 2 Start tone-pattern-detect on OMS controller on one side.

```
RP/0/RP0/CPU0:ios#tone-pattern-detect controller oms 0/2/0/9 start
Tue May 10 11:38:03.775 UTC
Tone pattern detect started
```

Step 3 Start tone-pattern-detect on OCH controller on the other side.

```
RP/0/RP0/CPU0:ios#tone-pattern-detect controller och 0/2/0/1 start
Tue May 10 11:38:03.775 UTC
Tone pattern detect started
```

Step 4 Use the **tone-info** command to check for successful connection verification on OMS controller.

```
RP/0/RP0/CPU0:ios#show controllers oms 0/2/0/9 tone-info
```

Step 5 Use the **tone-info** command to check for successful connection verification on OCH controller.

```
RP/0/RP0/CPU0:ios#show controllers och 0/2/0/1 tone-info
```

Step 6 Stop the tone-pattern-detect on the OCH controller.

```
RP/0/RP0/CPU0:ios#tone-pattern-detect controller och 0/2/0/1 stop
Tue May 10 11:50:36.185 UTC
Tone pattern detect stoped
```

Step 7   Stop the tone-pattern-detect on the OMS controller.

```
RP/0/RP0/CPU0:ios#tone-pattern-detect controller oms 0/2/0/9 stop
Tue May 10 11:50:36.185 UTC
Tone pattern detect stoped
```

Step 8   Stop the tone-pattern-detect on the OTS controller.

```
RP/0/RP0/CPU0:ios#tone-pattern controller ots 0/0/0/5 stop
Tue May 10 11:50:45.837 UTC
Tone pattern stopped
```

Connectivity between side-to-side OLT nodes is successfully verified. The detection of the tone pattern on both the OMS and OCH controllers confirms that the optical connections through multidegree ROADM nodes are working correctly.

What to do next

If any expected results are missing or alarms persist after stopping tone generation/detection, investigate possible link or configuration issues. Record all verification outcomes for documentation.

Line card and optical interfaces connection verification

This section describes the connection verification between OLT nodes and the optical interfaces that are connected to Mux/Demux panel and breakout modules.

Verify Connection for NCS 1000 32-Channel mux/demux patch panel

The connection verification procedure checks the connection between OLT-C line card and the two Mux/Demux panels.

The OLT-C line card and the Mux/Demux panels are connected as shown in the following image:

Figure 30: NCS 1010 and NCS 1000 32-Channel Mux/Demux Patch Panel Connection
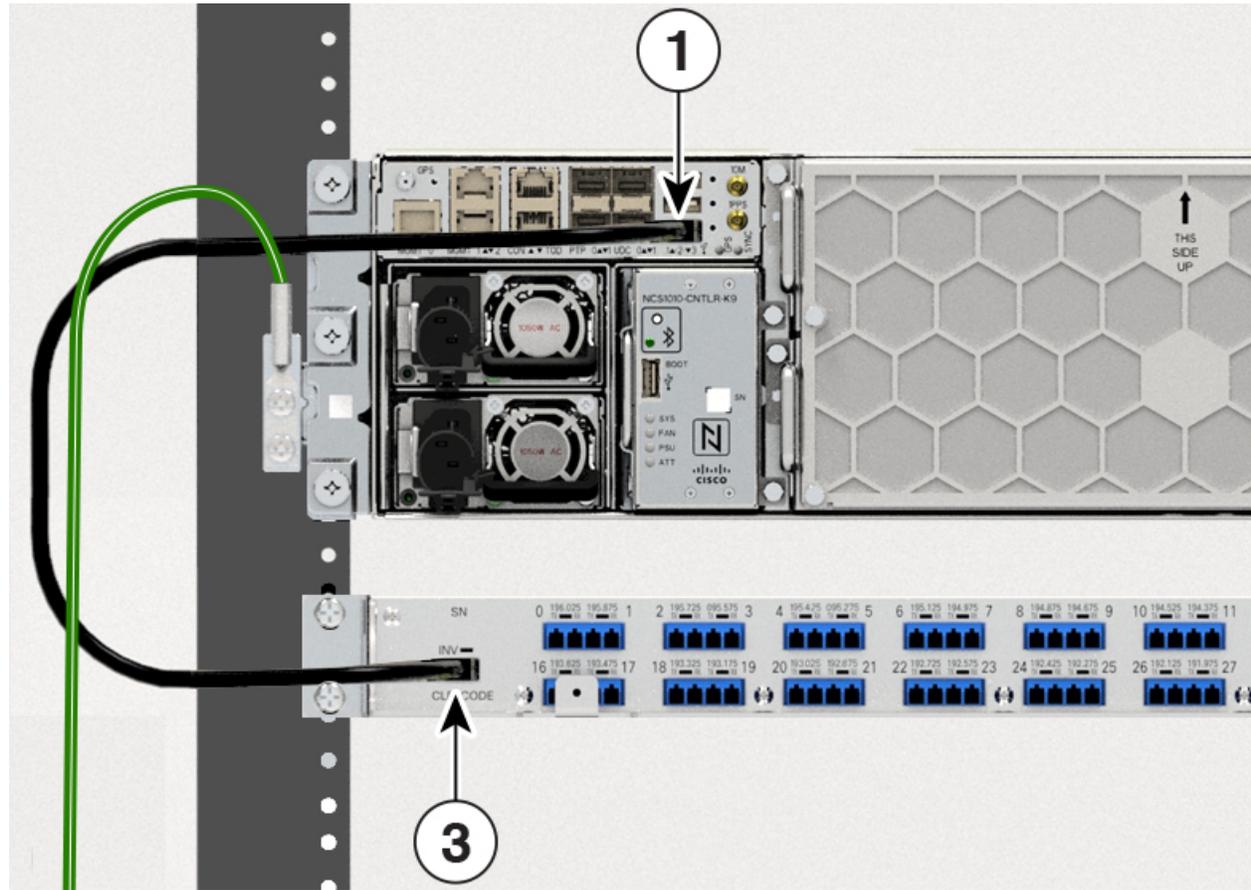
1	EITU USB 2.0 Port
2	OLT-C Line Card Add/Drop 3 LC Port
3	Mux/Demux Panel USB 2.0 Port
4	Mux/Demux Panel COM Port

. The identification/verification of the two Mux/Demux panels is performed by checking the connection verification signal at the monitor present on the OOB loop (PD 36 signal). The monitor detects and buffers the Cable-ID encoded in the tone pattern.

In Mux/Demux panel, the PD monitors available on the CH-i-RX ports of each module check the connection verification signal coming from the optical interfaces TX port on the Add path.

The tone detection capability is available on the PD monitors at the CH-i-RX ports and on the loopback path and it is "armed" provisioning on the Mux/Demux panels:

- ON threshold (to determine the "1" or "0" bit)

- the sampling rate

- the pattern lengths (number of bytes)

• the list of PD to be "armed"

Parallel tone acquisitions are allowed on whole ports of the Mux/Demux panel.

Once the bit-pattern encoded in the tone is detected, the information is stored to be retrieved by the node controller and the tone acquisition is stopped until the next "rearm".

Default ON-threshold to detect the tone pattern on the Mux/Demux signal are:

• –15dBm on all PDs at CH-i-RX ports

• –3dBm on the PD33 on the loopback path

This task describes on how to verify connection between the NCS 1010 OLT-C line card and Mux/Demux panel.

Procedure

Step 1   Configure the OTS controller to generate the tone for connection verification.

Example:

```
RP/0/RP0/CPU0:(config)#controller ots 0/0/0/3
RP/0/RP0/CPU0:(config-Ots)#tone-rate 25
RP/0/RP0/CPU0:(config-Ots)#tone-frequency 191.175    ( OOB frequency )
RP/0/RP0/CPU0:(config-Ots)#tone-pattern abcd1234
RP/0/RP0/CPU0:(config-Ots)#commit
```

tone-pattern length must be 4–32 hexadecimal characters.

Step 2   Configure the OMS controller to detect the tone for connection verification.

Example:

```
RP/0/RP0/CPU0:(config)#controller oms 0/2/0/32
RP/0/RP0/CPU0:(config-Oms)#tone-rate 25
RP/0/RP0/CPU0:(config-Oms)#tone-pattern-expected abcd1234
RP/0/RP0/CPU0:(config-Oms)#tone-detect-oob
RP/0/RP0/CPU0:(config-Oms)#commit
```

tone-pattern-expected value must be the same as the **tone-pattern** value.

tone-detect-oob must be configured on the OMS x/x/x/32 for Mux/Demux panel.

Step 3   Start **tone-pattern** on the OTS controller.

Example:

```
RP/0/RP0/CPU0:#tone-pattern controller ots 0/0/0/3 start
Tue May 10 11:37:51.597 UTC
Tone pattern started
```

When tone generation is in progress on the OTS interface, the tone generation on other OTS interfaces is not allowed until the current tone generation is stopped.

Step 4   Use the **tone-pattern-detect** command to start the detection of tone pattern.

Example:

The following is a sample on starting the tone pattern detection on the OMS controller.

```
RP/0/RP0/CPU0:#tone-pattern-detect controller oms 0/2/0/32 start
Tue May 10 11:38:03.775 UTC
Tone pattern detect started
```

**Step 5** Use the **tone-info** command to check for successful connection verification.

Example:

The following is a sample to view the Tone Info for successful connection verification on the OMS controller.

```
RP/0/RP0/CPU0:#show controllers oms 0/2/0/32 tone-info
Tue May 10 11:41:18.847 UTC

Tone Info:


Tone Rate : 25 bits/second

Tone Pattern Expected(Hex value) : abcd1234

Tone Pattern Received(Hex value) : abcd1234

Tone Detected OOB :  Enabled

Detection State: Success
```

Step 6 After successful connection verification, stop **tone-pattern-detect** on the OMS controller and **tone-pattern** on the OTS controller.

Example:

```
RP/0/RP0/CPU0:#tone-pattern-detect controller oms 0/2/0/32 stop
Tue May 10 11:50:36.185 UTC
Tone pattern detect stoped
```

```
RP/0/RP0/CPU0:#tone-pattern controller ots 0/0/0/3 stop
Tue May 10 11:50:45.837 UTC
Tone pattern stopped
```

Verify connection for NCS1K-BRK-8 panel

The connection verification procedure checks the connection between the OLT-C line card and each NCS1K-BRK-8 panel to match the different module instances with respect to the OLT-C MPO connectors.

The OLT-C line card and the NCS1K-BRK-8 module are connected as shown in the following image:

Figure 31: NCS 1010 and NCS1K-BRK-8 Connection
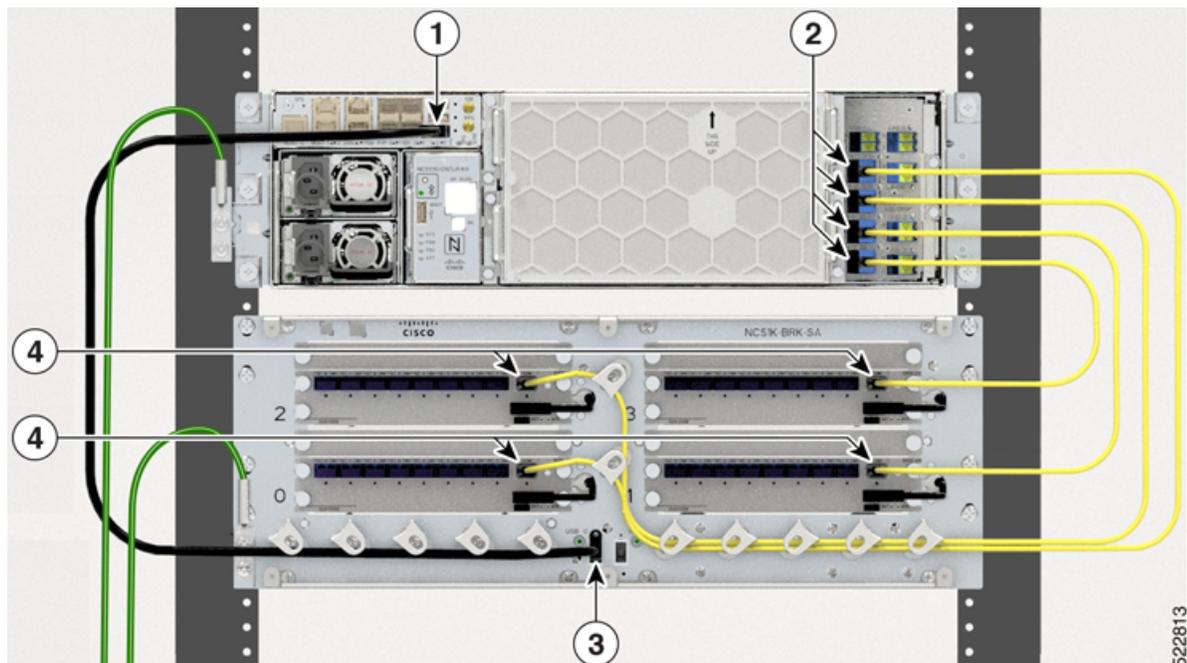
1	EITU USB 2.0 Port
2	OLT-C Line Card Add/Drop MPO Ports
3	NCS1K-BRK-8 USB 2.0 Port
4	NCS1K-BRK-8 MPO Ports

The OLT-C line card performs connection verification between the OLT-C Line Card and the NCS1K-BRK-8 panels as described in Line card and passive modules connection verification, on page 185.

The identification/verification of the NCS1K-BRK-8 panel is performed by checking the connection verification signal at the monitor present on the OOB loop (PD17 for the NCS1K-BRK-8 module).

Note Connection verification is not supported for NCS1K-BRK-16 and NCS1K-BRK-24 panels.

Each pair of OLT-C line cards that are deployed on two different sides of a multidegree ROADM performs connection verification on Side-to-Side interface as described in Side-to-side connection verification, on page 186. In this case, the PD monitors available on the DIR-i-RX ports of the NCS1K-BRK-8 module detect the connection verification signal coming from the OLT-C Line Card on the other side.

In the NCS1K-BRK-8 panel, the PD monitors available on the CH-i-RX ports of each NCS1K-BRK-8 panel checks the connection verification signal coming from the optical interfaces TX port on the Add path.

The tone detection capability is available on all the PD monitors present on the input and output ports and on the loopback path of the NCS1K-BRK-8 panel. It is "armed" provisioning on the modules:

- ON threshold (to determine the "1" or "0" bit)

- Sampling rate

- Pattern lengths (number of bytes)

- List of PD to be "armed"

Parallel tone acquisitions are allowed on whole ports of the modules.

Once the bit-pattern encoded in the tone is detected, the information is stored to be retrieved by the node controller and the tone acquisition is stopped until the next "rearm."

Default ON-threshold to detect the tone pattern on the connection verification signal are:

- −5dBm on all PDs at DIR-i-RX or CH-i-RX ports

- −3dBm on the PDs on the loopback path of each module

This task describes on how to verify the connection between the NCS 1010 OLT-C line card and NCS1K-BRK-8 panel.

Procedure

Step 1 Configure the OTS controller to generate the tone for connection verification.

Example:

```
RP/0/RP0/CPU0:(config)#controller ots 0/0/0/4
RP/0/RP0/CPU0:(config-Ots)#tone-rate 25
RP/0/RP0/CPU0:(config-Ots)#tone-frequency 191.175    ( OOB frequency )
RP/0/RP0/CPU0:(config-Ots)#tone-pattern abcd1234
RP/0/RP0/CPU0:(config-Ots)#commit
```

tone-pattern length must be 4–36 hexadecimal characters.

Step 2 Configure the OMS controller to detect the tone for connection verification.

Example:

```
RP/0/RP0/CPU0:(config)#controller oms 0/2/0/8
RP/0/RP0/CPU0:(config-Oms)#tone-rate 25
RP/0/RP0/CPU0:(config-Oms)#tone-pattern-expected abcd1234
RP/0/RP0/CPU0:(config-Oms)#tone-detect-oob
RP/0/RP0/CPU0:(config-Oms)#commit
```

tone-pattern-expected value must be same as the **tone-pattern** value.

tone-detect-oob must be configured on the OMS x/x/x/8 for NCS1K-BRK-8.

Step 3 Start **tone-pattern** on the OTS controller.

Example:

```
RP/0/RP0/CPU0:#tone-pattern controller ots 0/0/0/4 start
Tue May 10 11:37:51.597 UTC
Tone pattern started
```

When tone generation is in progress on the OTS interface, the tone generation on other OTS interfaces is not allowed until the current tone generation is stopped.

Step 4 Use the **tone-pattern-detect** command to start the detection of tone pattern.

Example:

The following is a sample on starting the tone pattern detection on the OMS controller.

```
RP/0/RP0/CPU0:#tone-pattern-detect controller oms 0/2/0/8 start
Tue May 10 11:38:03.775 UTC
Tone pattern detect started
```

Step 5 Use the **tone-info** command to check for successful connection verification.

Example:

The following is a sample to view the Tone Info for successful connection verification on the OMS controller.

```
RP/0/RP0/CPU0:#show controllers oms 0/2/0/8 tone-info
Tue May 10 11:41:18.847 UTC

Tone Info:


Tone Rate : 25 bits/second

Tone Pattern Expected(Hex value) : abcd1234

Tone Pattern Received(Hex value) : abcd1234

Tone Detected OOB :  Enabled

Detection State: Success
```

Step 6 After successful connection verification, stop **tone-pattern-detect** on the OMS controller and **tone-pattern** on the OTS controller.

Example:

```
RP/0/RP0/CPU0:#tone-pattern-detect controller oms 0/2/0/8 stop
Tue May 10 11:50:36.185 UTC
Tone pattern detect stoped

RP/0/RP0/CPU0:#tone-pattern controller ots 0/0/0/4 stop
Tue May 10 11:50:45.837 UTC
Tone pattern stopped
```

Verify connection on an OTS interface between OLT nodes

Verify the optical transport system (OTS) interface connectivity between OLT nodes using tone-pattern commands on the OTS controller.

Use this task when you need to confirm the physical or logical connectivity of OTS interfaces in your optical network. This verification helps ensure that links between OLT nodes and OTS controllers function correctly and can be confidently used for services or troubleshooting.

Follow these steps to check OTS interface connectivity on OLT nodes.

Before you begin

- Ensure you have administrative access to the OLT device CLI.

- Confirm that the OTS controller is properly installed and powered on.

- Identify the correct OTS controller slot and port identifiers (for example, 0/0/0/2).

Procedure

Step 1 Start tone-pattern on OTS controller.

Example:

```
RP/0/RP0/CPU0:ios#tone-pattern controller ots 0/0/0/2 start
Wed May 25 11:59:51.040 UTC
Tone pattern started
```

Step 2 Start tone-pattern-detect on OTS controller on one side.

Example:

```
RP/0/RP0/CPU0:ios#tone-pattern-detect controller ots 0/0/0/2 start
Wed May 25 12:00:03.271 UTC
Tone pattern detect started
```

Step 3 Check for successful connection verification on the Line 2 OTS controller.

Example:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/2 tone-info
Wed May 25 12:00:11.393 UTC

Tone Info:

Tone Frequency : 191.1750000 THz

Tone Rate : 20 bits/second

Tone Pattern(Hex value) : abcd1234

Tone Pattern Expected(Hex value) : abcd1234

Tone Pattern Received(Hex value) : abcd1234

Tone Detected OOB :  Enabled

 Detection State: Success
```

Step 4 Stop the tone-pattern-detect on the OTS controller.

Example:

```
RP/0/RP0/CPU0:ios#tone-pattern-detect controller ots 0/0/0/2 stop
Wed May 25 12:00:56.540 UTC
Tone pattern detect stoped
```

Step 5 Stop the tone-pattern on the OTS controller.

Example:

```
RP/0/RP0/CPU0:ios#tone-pattern controller ots 0/0/0/2 stop
Wed May 25 12:01:04.226 UTC
Tone pattern stopped
```

OTS interface connectivity is verified.

What to do next

- If the connection is not verified, review cabling and hardware status, then repeat the procedure as needed.

- Document the status of the connection for operational records or further troubleshooting.

Smart Licensing

This chapter describes the smart licensing configuration on Cisco NCS 1010.

Understanding Smart Licensing

Smart Licensing is a cloud-based, software license management solution that enables you to automate time-consuming, manual licensing tasks. The solution allows you to easily track the status of your license and software usage trends.

Smart Licensing helps you simplify three core functions:

- **Purchasing**: The software that you have installed in your network can be registered, without Product Activation Keys (PAKs).

- **Management**: You can automatically track activations against your license entitlements. Also, there is no need to install the license file on every node. You can create license pools (logical grouping of licenses) to reflect your organization structure. Smart Licensing offers you Cisco Smart Software Manager, a centralized portal that enables you to manage all your Cisco software licenses from one centralized website.

- **Reporting**: Through the portal, Smart Licensing offers an integrated view of the licenses you have purchased and what has been deployed in your network. You can use this data to make better purchasing decisions, based on your consumption.

Smart Licensing Features

- Your device initiates a call home and requests the licenses it needs.

- Pooled licenses - Licenses are company account-specific, and can be used with any compatible device in your company. You can activate or deactivate different types of licenses on the device without actually installing a license file on the device.

- Licenses are stored securely on Cisco servers.

- Licenses can be moved between product instances without license transfer. This greatly simplifies the reassignment of a software license as part of the Return Material Authorization (RMA) process.

- It provides a complete view of all the Smart Software Licenses used in the network using a consolidated usage report of software licenses and devices in one easy-to-use portal.

Cisco Smart Account

Cisco Smart Account is an account where all products enabled for Smart Licensing are deposited. Cisco Smart Account allows you to manage and activate your licenses to devices, monitor license use, and track Cisco license purchases. Through transparent access, you have a real-time view into your Smart Licensing products. IT administrators can manage licenses and account users within your organization's Smart Account through the Smart Software Manager.

When creating a Smart Account, you must have the authority to represent the requesting organization. After you submit the request, it goes through a brief approval process. Access http://software.cisco.com to learn about, set up, or manage Smart Accounts.

Cisco Smart Software Manager enables you to manage all your Cisco Smart software licenses from one centralized website. With Cisco Smart Software Manager, you organize and view your licenses in groups called virtual accounts (collections of licenses and product instances). Use the Cisco Smart Software Manager to do the following tasks:

- Create, manage, or view virtual accounts.

- Create and manage Product Instance Registration Tokens.

- Transfer licenses between virtual accounts or view licenses.

- Transfer, remove, or view product instances.

- Run reports against your virtual accounts.

- Modify your email notification settings.

- View overall account information.

Virtual Accounts

A Virtual Account exists as a subaccount tithing the Smart Account. Virtual Accounts are a customer-defined structure based on organizational layout, business function, geography, or any defined hierarchy. They are created and maintained by the Smart Account administrator. Smart Licencing allows you to create multiple license pools or virtual accounts within the Smart Software Manager portal. Using the Virtual Accounts option that you can aggregate licenses into discrete bundles that are associated with a cost center so that one section of an organization cannot use the licenses of another section of the organization. For example, if you segregate your company into different geographic regions, you can create a virtual account for each region to hold the licenses and product instances for that region.

All new licenses and product instances are placed in the default virtual account in the Smart Software Manager, unless you specify a different one during the order process. After you access the default account, you may choose to transfer them to any other account, provided you have the required access permissions.

Use the Smart Software Manager portal to create license pools or transfer licenses.

Product Instance Registration Tokens

A product requires a registration token until you have registered the product. On successful registration, the device receives an identity certificate. This certificate is saved and automatically used for all future communications with Cisco. Registration tokens are stored in the Product Instance Registration Token Table that is associated with your enterprise account. Registration tokens can be valid 1–365 days.

Product Instances

A product instance is an individual device with a unique device identifier (UDI) that is registered using a product instance registration token (or registration token). You can register any number of instances of a product with a single registration token. Each product instance can have one or more licenses residing in the same virtual account. Product instances must periodically connect to the Cisco Smart Software Manager servers during a specific renewal period. If you remove the product instance, its licenses are released and made available within the virtual account.

Smart Licensing Work Flow

The following figure depicts a working model of smart licensing.

Figure 32: Smart licensing work flow
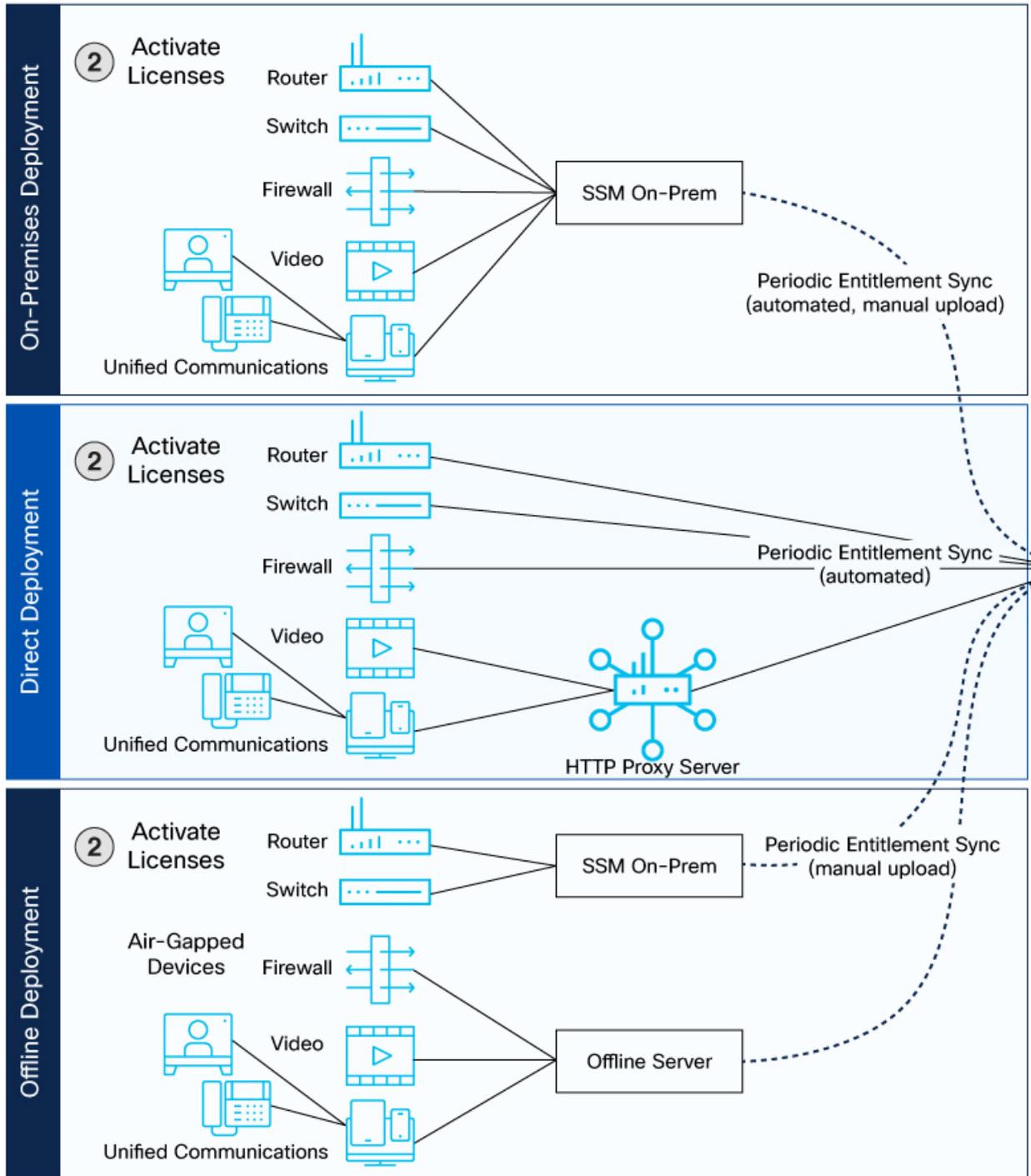
Benefits of smart licensing

- Licenses are not locked to perform configurations using Cisco NCS 1010 even if the license limit exceeds the paid license limit. You are notified with out-of-compliance notification to buy additional licenses when the license limit exceeds the paid license limit. This saves time with the ability to transfer licenses across the organization.

- Licenses can be pooled across the entire organization, enabling them to be reused across organizational boundaries.

- Provides software asset management information so that you can plan and track the licenses.

Available license entitlements for NCS 1010

Cisco NCS 1010 supports the Vortex model for smart licensing software. The available license entitlements are categorized as Essential and Advantage. Each category is designed to enable specific features and hardware support.

This is the list of license types and their applicability.

- ILA Essentials: One license per ILA card (maximum one license).

- OLT Essentials: One license per WSS port, per OLT card (maximum 32 licenses). For example, if on an WSS port, multiple cross connections are present, one essential license is consumed, and if multiple add/drop connections are present across multiple WSS ports, that number of ESS licenses are consumed.

- ILA Advantage: One license per ILA card. This license enables omnidirectional cross connections or OTDR access features (maximum one license).

- OLT Advantage: One license per WSS port, per OLT card. This type enables OTDR access, Connection Verification feature, Nyquist channel or omnidirectional cross connects (maximum 32 licenses).

- CCMD Essentials: One license per CCMD card (maximum one license).

Licensing behavior with Nyquist channels

When Nyquist channels are enabled, each cross connection created on a port consumes one Essentials license and one Advantage license.

License entitlement display names and descriptions

The table lists the license entitlements as displayed in Cisco Smart Software Manager (CSSM) and their descriptions:

Table 73: NCS 10q0 license entitlements

Display Name in CSSM Server	Description
NCS1010_ADV_ILA_RTU	NCS 1010 ILA Advantage Right-to-Use (RTU)
NCS1010_ADV_ILA_SIA	NCS 1010 ILA Advantage Software Innovation Access (SIA)

Display Name in CSSM Server	Description
NCS1010_ADV_OLT_RTU	NCS 1010 OLT Advantage RTU (per port)
NCS1010_ADV_OLT_SIA	NCS 1010 OLT Advantage SIA (per port)
NCS1010_ESS_ILA_RTU	NCS 1010 ILA Essentials RTU
NCS1010_ESS_ILA_SIA	NCS 1010 ILA Essentials SIA
NCS1010_ESS_OLT_RTU	NCS 1010 OLT Essentials RTU (per port)
NCS1010_ESS_OLT_SIA	NCS 1010 OLT Essentials SIA (per port)

Generate a token in Cisco Smart Software Manager

To create a new token using Cisco Smart Software Manager, perform the following tasks:

Before you begin

Procedure

Step 1   Log in to the Cisco Smart Software Manager.

https://software.cisco.com/software/csws/ws/platform/home#SmartLicensing-Inventory

Step 2   Click the **Inventory** tab, and select your virtual account from the **Virtual Account** drop-down list.

Step 3   Click the **General** tab, and click **New Token**.

The **Create Registration Token** window is displayed.

Step 4   Enter the token description. Specify the number of days the token must be active.

Step 5   Check the **Allow export-controlled functionality on the products registered with this token** check box.

Step 6   Click **Create Token**.

Step 7   Copy the token and register NCS1010 with the same token ID.

An example of the token ID: YzY2ZjYyNjktY2NlOS00NTc4LWIxNTAtMjZkNmNiNzMxMTY1LTE2NjAzNjQ3
%0ANzY4Njl8ZVJSckxKN2pFV2tIeHVoMUkxbGxTazFDVm9kc1B5MGlHQmlFWUJi%0Ac3VNRT0%3D%0A

Available Smart Licensing transport modes

The Smart Licensing software management solution supports four transport modes for license communication and reporting. The default transport mode is Cisco Smart Licensing Utility (CSLU), but you can configure other modes as needed.

The available transport modes are:

- Call-Home: Uses Cisco's Call-Home infrastructure to communicate license usage and status to Cisco Smart Software Manager (SSM).

- Smart transport: Establishes a secure, direct connection between the device and SSM over the internet.

- Cisco Smart Licensing Utility (CSLU): Allows communication with SSM through a local CSLU server, acting as an intermediary between devices and SSM.

- Offline: Enables manual transfer of license usage information via files instead of automated network connectivity.

Configure call home mode

Enable call home mode, configure domain name server and CRL options, set smart license transport to call home, and establish licensing trust on the device.

The Call Home mode will be deprecated in a future release.

Before you begin

Procedure

Step 1 Enable call home service and configure the call home profile.

Example:

```
RP/0/RP0/CPU0:ios#call-home
RP/0/RP0/CPU0:ios(config-call-home)#service active
RP/0/RP0/CPU0:ios(config-call-home)#contact smart-licensing
RP/0/RP0/CPU0:ios(config-call-home)#profile CiscoTAC-1
RP/0/RP0/CPU0:ios(config-call-home-profile)#active
RP/0/RP0/CPU0:ios(config-call-home-profile)#destination address http
https://tools.cisco.com/its/service/oddce/services/DDCEService
RP/0/RP0/CPU0:ios(config-call-home-profile)#reporting smart-call-home-data
RP/0/RP0/CPU0:ios(config-call-home-profile)#reporting smart-licensing-data
RP/0/RP0/CPU0:ios(config-call-home-profile)#destination transport-method email disable
RP/0/RP0/CPU0:ios(config-call-home-profile)#destination transport-method http
RP/0/RP0/CPU0:ios(config-call-home-profile)#commit
RP/0/RP0/CPU0:ios(config-call-home-profile)#end
```

Step 2 Configure the domain name and DNS server.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#domain name cisco.com
RP/0/RP0/CPU0:ios(config)#domain name-server 64.102.6.247
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 3 Configure the Certificate Revocation List (CRL) trustpoint.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#crypto ca trustpoint Trustpool crl optional
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 4   Set smart license transport to use call home.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#License smart transport callhome
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 5   Establish license trust using your ID token.

Example:

```
license smart trust idtoken Zesdf3243u48329fdfhsfhsfkjs1233j4h1j1j4j41n
```

Step 6   Synchronize smart license tokens.

Example:

```
license smart sync all
```

Step 7   Verify your call home and license configuration.

Example:

```
RP/0/RP0/CPU0:ios#show license all
Transport:   Type: Callhome
```

Your device is now configured for call home operation and smart licensing, with the specified DNS and CRL settings. The license transport uses call home, and trust is established.

Configure smart transport license registration

Use this procedure to configure smart transport that can be used as an alternative option to Call Home, to connect to the CSSM.

Procedure

Step 1   Enable Certificate Revocation List (CRL) configuration.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#crypto ca trustpoint Trustpool crl optional
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 2   Enable Call Home using smart transport .

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#License smart transport smart
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 3 Verify the smart transport configuration.

Example:

```
RP/0/RP0/CPU0:ios#show license all
Transport:
  Type: Smart
  URL: https://smartreceiver.cisco.com/licservice/license
  Proxy:
    Address: proxy.esl.cisco.com
    Port: 80
    Username: <empty>
    Password: <empty>
  VRF:
    Not Supported
```

Step 4 Establish trust using your Smart Account ID token.

Example:

```
license smart trust idtoken Zesdf3243u48329fdfhsfhsfkjs1233j4h1j1j4j41n
```

Step 5 Sync the token and licenses with CSSM.

Example:

```
license smart sync all
```

Smart transport is configured for license registration, device trust is established with CSSM, and license information is successfully synchronized. Your Cisco NCS 1010 is now registered and ready for smart license management.

Configure CSLU

You can configure CSLU as one of the transport modes, CSLU is the default mode for software licensing policy. To configure CSLU in Cisco NCS 1010, perform the following steps:

Procedure

Step 1 Use this sample configuration to configure the CSLU URL.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#license smart url cslu http://10.127.60.58:8182/cslu/v1/pi
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 2 Use this sample configuration to enable CRL Configuration.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#crypto ca trustpoint Trustpool crl optional
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 3 Use this sample configuration to enable CSLU.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#License smart transport cslu
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Verify whether CSLU is Configured.

```
RP/0/RP0/CPU0:ios#show license all
Transport:
  Type: cslu
  Cslu address: http://10.127.60.58:8182/cslu/v1/pi
  Proxy:
    Not Configured
  VRF:
    Not Supported
```

Step 4 Use this sample configuration to establish trust using id-token.

Example:

```
license smart trust idtoken Zesdf3243u48329fdfhsfhsfkjs1233j4h1j1j4j41n
```

Step 5 Use this sample configuration to sync the token with the licenses.

Example:

```
license smart sync all
```

Configure Offline

You can configure Offline as one of the options. To configure Offline in Cisco NCS 1010, perform these steps:

Procedure

Step 1 Use this sample configuration to disable transport.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#License smart transport off
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Step 2 Use this sample configuration to save the report.

Example:

```
RP/0/RP0/CPU0:ios#license smart save usage unreported /misc1/disk1/usage.txt
```

Step 3 Use this sample configuration to import the acknowledgment report.

Example:

```
RP/0/RP0/CPU0:ios#license smart import /misc/disk1/ACK_usage.txt
```

Reserve specific licenses for your NCS 1010 device.

Specific License Reservation (SLR) lets you reserve a license for your product instance from the CSSM. To reserve specific licenses for NCS 1010, perform the following steps:

Procedure

Step 1   Deregister the device, if it was already registered for the license, using the **license smart deregister** command.

Example:

```
RP/0/RP0/CPU0:iso#license smart deregister
Thu Jul 19 13:33:30.048 UTC
RP/0/RP0/CPU0:iso# Jul 19 13:17:33.126 UTC: http_client[232] %SECURITY-XR_SSL-6-CERT_VERIFY_INFO :
 SSL Certificate verification:
 Certificate can be used for purpose it was meant to be
License command "license smart deregister " completed successfully.
```

Step 2   Generate the request code using the **license smart reservation request** local command.

Example:

```
RP/0/RP0/CPU0:iso#license smart reservation request local
Thu Jul 19 13:33:47.241 UTC

Enter this request code in the Cisco Smart Software Manager portal:
CB-ZNCS1010-SA:FCB2546B08T-BBTQDthRu-BA
```

Step 3   Use the generated code and generate the authorization code through Cisco Smart Software Manager. See .

Step 4   Enter the **run** command to launch the iso XR Linux bash shell.

Example:

```
RP/0/RP0/CPU0:iso#run

RP/0/RP0/CPU0:Jul 19 13:35:20.236: run_cmd[67213]: %INFRA-INFRA_MSG.5-RUN_LOGIN : User Cisco logged
 into shell from con0/RP0/CP0
```

Step 5   Create a file using the **vim** *file name* command.

Example:

```
[node0_RP0_CPU0:~]$vim smart1
```

Step 6   Copy the authorization code in the file and type **:wq** to save and exit the file.

Step 7   Use the **exit** command to exit the shell.

Example:

```
[node0_RP0_CPU0:~]$exit
logout
RP/0/RP0/CPU0:Jul 19 13:45:21.146 UTC run-cmd[67213] %INFRA_MSG-5-LOGOUT : User cisco logged out
of shell from con0/RP0/CPU0
```

Step 8   Install the authorization code using the **license smart reservation install file** command.

Example:

```
RP/0/RP0/CPU0:iso#license smart reservation install file /disk0:/smart1
Thu Jul 19 13:46:22.877 UTC
RP/0/RP0/CPU0:Jul 19 13:46:22.946 UTC: plat_sl_client[368]: %LICENSE-PLAT_CLIENT-6-STATE_CHANGE :
Licensing platform state changing from UNREGISTERED to REGISTERED
RP/0/RP0/CPU0:Jul 19 13:46:22.946 UTC: smartlicserver[247]: %LICENSE-SMART_LIC-6-AGENT_REG_SUCCESS
 : Smart Agent for Licensing Registration successful. udi PID:NCS1010-SA,SN:FCB2546B08T
Reservation install file successful
Last Confirmation code 8572aa81
```

Note

You can verify the number of reservations in the Cisco smart software manger portal and can view the product instance name changed to a UDI.

Step 9   Verify the udi using the **show license udi** command.

Example:

```
RP/0/RP0/CPU0:iso#show license udi
Thu Jul 19 13:43:19.731 UTC
UDI: PID:NCS1010-SA,SN:FCB2546B08T
```

Step 10   Verify the license reservation using the command **show license status**.

Example:

```
RP/0/RP0/CPU0:P2A_DT_08#show license status
Thu Jul 19 15:45:27.137 UTC

Smart Licensing is ENABLED

Utility:
  Status: DISABLED
License Reservation is ENABLED

Data Privacy:
  Sending Hostname: yes
    Callhome hostname privacy: DISABLED
    Smart Licensing hostname privacy: DISABLED
  Version privacy: DISABLED

Transport:
  Type: Transport Off

Registration:
  Status: REGISTERED - SPECIFIC LICENSE RESERVATION
  Export-Controlled Functionality: ALLOWED
  Initial Registration: SUCCEEDED on Jul 19 2022 15:21:24 UTC

License Authorization:
  Status: AUTHORIZED - RESERVED on Jul 19 2022 15:21:24 UTC

Export Authorization Key:
  Features Authorized:
    <none>

Miscellaneous:
  Custom Id: <empty>
```

Reserve licenses using Cisco Smart Software Manager

To reserve the required number of licenses using the Cisco Smart Software Manager, perform the following steps:

Procedure

Step 1   Log in to the Cisco Smart Software Manager.

https://software.cisco.com/software/csws/ws/platform/home#SmartLicensing-Inventory

Step 2   Click the **Inventory** tab. From the **Virtual Account** drop-down list, select your smart account.

Step 3   Click **Licenses** and click **License Reservation**.

The **Smart License Reservation** wizard is displayed.

Step 4   In the **Enter Request Page** tab, paste the reservation code that you had generated from NCS 1010 in the **Reservation Request Code** area and click **Next**.

Step 5   In the **Select Licenses** tab, click the **Reserve a specific License** radio button.

The list of surplus licenses available in your virtual account is displayed.

Step 6   Enter the number of licenses that you want to reserve for the required license, in the **Quantity to Reserve** field, and click **Next**.

Step 7   In the **Review and Confirm** tab, click **Generate Authorization Code**.

Step 8   Click **Download as File** to download the authorization code and use the code to register the NCS 1010 device.

Reuse licenses with the SLR deactivation method

You can release some of the purchased licenses belonging to a common license pool, and reuse the same to upgrade new devices that are added into your network, for a temporary period. Later on, you must purchase the licenses for the new devices.

Procedure

Step 1   Deregister the device for which you want to release the licenses, and enable Flexible Consumption Model (FCM) (if not enabled)

Example:

```
RP/0/RP0/CPU0:ios#smart license deregister
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#license smart flexible-consumption enable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios#end
```

Step 2   Generate the request code using the **license smart reservation request** local command.

Example:

```
RP/0/RP0/CPU0:ios(config)#license smart reservation request local
Fri Jul  1 07:11:56.541 UTC
Enter this request code in the Cisco Smart Software Manager portal:
CC-ZNCS1010-SA:FCB2530B11E-BBTQDthRu-BE
```

Step 3   Use the generated code and generate the authorization code through Cisco Smart Software Manager. See .

Note
While reserving licenses in CSSM, under the **Select Licenses** tab, enter the number of licenses only for the RTU licenses, and leave the number of licenses as 0 for SIA licenses.

Step 4   Enter the **run** command to launch the iso XR Linux bash shell.

Example:

```
RP/0/RP0/CPU0:iso#run

RP/0/RP0/CPU0:Jul 1 7:35:20.281: run_cmd[67213]: %INFRA-INFRA_MSG.5-RUN_LOGIN : User Cisco logged
into shell from con0/RP0/CP0
```

Step 5   Create a file using the **vim** *file name* command.

Example:

```
[node0_RP0_CPU0:~]$vim smart1
```

Step 6   Copy the authorization code in the file and type **:wq** to save and exit the file.

Step 7   Use the **exit** command to exit the shell.

Example:

```
[node0_RP0_CPU0:~]$exit
logout
RP/0/RP0/CPU0:Jul 1 7:45:21.146 UTC run-cmd[67213] %INFRA_MSG-5-LOGOUT : User cisco logged out of
shell from con0/RP0/CPU0
```

Step 8   Install the authorization code using the **license smart reservation install file** command.

Example:

```
RP/0/RP0/CPU0:iso#license smart reservation install file /disk0:/smart1
Thu Jul 19 13:46:22.877 UTC
RP/0/RP0/CPU0:Jul 1 7:46:22.946 UTC: plat_sl_client[368]: %LICENSE-PLAT_CLIENT-6-STATE_CHANGE :
Licensing platform state changing from UNREGISTERED to REGISTERED
RP/0/RP0/CPU0:Jul 1 7:46:22.946 UTC: smartlicserver[247]: %LICENSE-SMART_LIC-6-AGENT_REG_SUCCESS :
 Smart Agent for Licensing Registration successful. udi PID:NCS1010-SA,SN:FCB2546B08T
Reservation install file successful
Last Confirmation code 8572aa81
```

Note
You can verify the number of reservations in the Cisco smart software manger portal.

Step 9   Verify the license reservation using the command **show license platform summary**.

Example:

```
RP/0/RP0/CPU0:test#show license platform summary
Fri Jul  1 07:24:07.016 UTC
Collection: LAST: Fri Jul 01 2022 07:48:34 UTC
            NEXT: Fri Jul 01 2022 07:48:34 UTC
Reporting:  LAST: Fri Jul 01 2022 07:48:34 UTC
```

```
              NEXT: Fri Jul 01 2022 07:48:34 UTC
  SIA Status: Node is in deactivated state
```

Step 10 After the node is deactivated and the licenses are freed on the CSSM server, use those licenses to perform software upgrade on another node for a temporary period.

Smart Licensing verification commands

After enabling Smart Licensing, you can use the **show** commands to verify the default Smart Licensing configuration. If any issue is detected, take corrective action before making further configurations.

- **show license all**

- **show license trace all**

- **show license status**

- **show license summary**

- **show license tech**

- **Show license udi**

- **show license usage**

- **show license platform detail**

- **show license platform summary**

- **show license platform trace**

- **Show license platform trace all**

- **show tech-support smartlic**

- **show call-home detail**

- **show call-home trace all**

- **show tech-support call-home**

The following table defines the available license authorization status in Cisco NCS 1010:

Table 74: License Authorization Status

License Authorization Status	Description
Unconfigured	Smart Software Licensing is not configured.
Unidentified	Smart Software Licensing is enabled but is not registered.
Registered	Device registration is completed and an ID certificate is received that is used for future communication with the Cisco licensing authority.
Authorized	Registration is completed with a valid Smart Account and license consumption has begun. This indicates compliance.

License Authorization Status	Description
Out of Compliance	Consumption exceeds available licenses in the Smart Account.
Authorization Expired	The device is unable to communicate with the Cisco Smart Software Manager for an extended period. This state occurs after 90 days of expiry. The device attempts to contact the CSSM every hour to renew the authorization until the registration period expires.

Example 1:

The following example shows the sample output of the **show license all** command.

```
RP/0/RP0/CPU0:iso#show license all
Fri Jul 15 05:32:02.678 UTC

Smart Licensing Status
======================

Smart Licensing is ENABLED

Registration:
  Status: REGISTERED
  Smart Account: InternalTestDemoAccount8.cisco.com
  Virtual Account: NCS1010-PROD
  Export-Controlled Functionality: ALLOWED
  Initial Registration: SUCCEEDED on Jul 15 2022 04:58:24 UTC
  Last Renewal Attempt: None
  Next Renewal Attempt: Jan 11 2023 04:58:23 UTC
  Registration Expires: Jul 15 2023 04:53:20 UTC

License Authorization:
  Status: AUTHORIZED on Jul 15 2022 04:58:40 UTC
  Last Communication Attempt: SUCCEEDED on Jul 15 2022 04:58:40 UTC
  Next Communication Attempt: Aug 14 2022 04:58:40 UTC
  Communication Deadline: Oct 13 2022 04:53:41 UTC

Export Authorization Key:
  Features Authorized:
    <none>

Utility:
  Status: DISABLED

Data Privacy:
  Sending Hostname: yes
    Callhome hostname privacy: DISABLED
    Smart Licensing hostname privacy: DISABLED
  Version privacy: DISABLED

Transport:
  Type: Callhome

Miscellaneous:
  Custom Id: <empty>

License Usage
=============

NCS1010 - Essentials - OLT RTU (NCS1010_ESS_OLT_RTU):
  Description: NCS1010 - Essentials Tier - Optical Line Terminal RTU (Per Port)
```

```
   Count: 2
   Version: 1.0
   Status: AUTHORIZED
   Export status: NOT RESTRICTED

NCS1010 - Essentials - OLT SIA (NCS1010_ESS_OLT_SIA):
   Description: NCS1010 - Essentials Subscription - Optical Line Terminal - SIA
              (Per Port)
   Count: 2
   Version: 1.0
   Status: AUTHORIZED
   Export status: NOT RESTRICTED

Product Information
===================
UDI: PID:NCS1010-SA,SN:FCB2546B08T

Agent Version
=============
Smart Agent for Licensing: 5.4.16_rel/63

Reservation Info
================
License reservation: DISABLED
```

Example 2:

The following example shows the sample output of the **show license platform detail** command.

```
RP/0/RP0/CPU0:iso#show license platform detail
Fri Jul 15 06:56:41.353 UTC
Collection: LAST: Fri Jul 15 2022 06:56:14 UTC
            NEXT: Fri Jul 15 2022 06:58:14 UTC
Reporting:  LAST: Fri Jul 15 2022 06:56:14 UTC
            NEXT: Fri Jul 15 2022 06:58:14 UTC
SIA Status: In Compliance
Parameters: Collection interval:          2 minute(s)
            Reporting  interval:          2 minute(s)
            Throughput gauge:        1000000 Kbps

==================================================
Feature/Area 'FCM'
   Name:  FCM
   Status:   ACTIVE
   Flags:


   [ 1] Name:  NCS1010 - Essentials Tier - In-Line Amplifier RTU
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ESS_ILA_RTU,1.0_9b4322b1-bff3-4ddf-944c-16ec9aaab1cc
        Count: Last reported:    0
               Next report:      0
   [ 2] Name:  NCS1010 - Essentials Subscription - In-Line Amplifier - SIA
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ESS_ILA_SIA,1.0_67243ac7-1a7c-41e4-a160-f13df80fd0e4
        Count: Last reported:    0
               Next report:      0
   [ 3] Name:  NCS1010 - Essentials Tier - Optical Line Terminal RTU (Per Port)
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ESS_OLT_RTU,1.0_e4309530-2085-40e6-9aa6-5f3137ff49b2
        Count: Last reported:    3
               Next report:      0
   [ 4] Name:  NCS1010 - Essentials Subscription - Optical Line Terminal - SIA (Per Port)
        Entitlement Tag:
```

```
regid.2022-05.com.cisco.NCS1010_ESS_OLT_SIA,1.0_b3c976c1-e509-474f-8cac-b9db62f28f2b
        Count: Last reported:     3
               Next report:       0
   [ 5] Name:  NCS1010 - Advantage Tier- In-Line Amplifier RTU
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ADV_ILA_RTU,1.0_cf1746b7-def4-4c0e-ab90-de30614507d8
        Count: Last reported:     0
               Next report:       0
   [ 6] Name:  NCS1010 - Advantage Subscription - In-Line Amplifier - SIA
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ADV_ILA_SIA,1.0_ea769b05-9363-47dd-9991-2122c37479eb
        Count: Last reported:     0
               Next report:       0
   [ 7] Name:  NCS1010 - Advantage Tier - Optical Line Terminal RTU (Per Port)
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ADV_OLT_RTU,1.0_7a6ce8f3-3336-4ce2-8803-431227dabfff
        Count: Last reported:     0
               Next report:       0
   [ 8] Name:  NCS1010 - Advantage Subscription - Optical Line Terminal - SIA (Per Port)
        Entitlement Tag:
regid.2022-05.com.cisco.NCS1010_ADV_OLT_SIA,1.0_5f283f1c-143e-4c6e-9af7-73e088fb77a5
        Count: Last reported:     0
               Next report:       0
```

Example 3:

The following example shows the sample output of the **show license status** command.

```
RP/0/RP0/CPU0:iso#show license status
Fri Jul 15 08:17:14.004 UTC

Smart Licensing is ENABLED

Utility:
  Status: DISABLED

Data Privacy:
  Sending Hostname: yes
    Callhome hostname privacy: DISABLED
    Smart Licensing hostname privacy: DISABLED
  Version privacy: DISABLED

Transport:
  Type: Callhome

Registration:
  Status: REGISTERED
  Smart Account: InternalTestDemoAccount8.cisco.com
  Virtual Account: NCS1010-PROD
  Export-Controlled Functionality: ALLOWED
  Initial Registration: SUCCEEDED on Jul 15 2022 04:58:24 UTC
  Last Renewal Attempt: None
  Next Renewal Attempt: Jan 11 2023 04:58:24 UTC
  Registration Expires: Jul 15 2023 04:53:21 UTC

License Authorization:
  Status: OUT OF COMPLIANCE on Jul 15 2022 07:01:00 UTC
  Last Communication Attempt: SUCCEEDED on Jul 15 2022 07:06:52 UTC
  Next Communication Attempt: Jul 15 2022 19:06:51 UTC
  Communication Deadline: Oct 13 2022 07:01:52 UTC

Export Authorization Key:
  Features Authorized:
    <none>
```

```
Miscellaneous:
  Custom Id: <empty>
RP/0/RP0/CPU0:P2A_DT_08#show license summary
Fri Jul 15 08:17:23.752 UTC

Smart Licensing is ENABLED

Registration:
  Status: REGISTERED
  Smart Account: InternalTestDemoAccount8.cisco.com
  Virtual Account: NCS1010-PROD
  Export-Controlled Functionality: ALLOWED
  Last Renewal Attempt: None
  Next Renewal Attempt: Jan 11 2023 04:58:23 UTC

License Authorization:
  Status: OUT OF COMPLIANCE
  Last Communication Attempt: SUCCEEDED
  Next Communication Attempt: Jul 15 2022 19:06:51 UTC

License Usage:
  License                 Entitlement Tag               Count Status
  --------------------------------------------------------------------------------
  NCS1010 - Essentials... (NCS1010_ESS_OLT_RTU)            32 OUT OF COMPLIANCE
  NCS1010 - Essentials... (NCS1010_ESS_OLT_SIA)            32 OUT OF COMPLIANCE
```

Example 4:

The following example shows the sample output of the **show license platform summary** command.

```
RP/0/RP0/CPU0:iso#show license platform summary
Tue Jul 19 14:09:06.919 UTC
Collection: LAST: Tue Jul 19 2022 14:08:07 UTC
            NEXT: Tue Jul 19 2022 14:10:07 UTC
Reporting:  LAST: Tue Jul 19 2022 14:08:07 UTC
            NEXT: Tue Jul 19 2022 14:10:07 UTC
**********************************IMPORTANT**************************************
SIA Status: Out of Compliance(Remaining Grace Period: 90 days, 0 hours)
            SIA license(s) status is Not Authorized.
            SW Upgrade will still be allowed as SIA Grace Period is remaining
********************************************************************************
                                                                    Count
Feature/Area    Entitlement                                     Last Next
============    ====================================================  ==== ====
FCM             NCS1010 - Essentials Tier - Optical Line Terminal R   3    0
FCM             NCS1010 - Essentials Subscription - Optical Line Te   3    0
FCM             NCS1010 - Advantage Tier - Optical Line Terminal RT   3    0
FCM             NCS1010 - Advantage Subscription - Optical Line Ter   3    0
```

Example 5:

The following example shows the sample output of the **show license summary** command.

```
RP/0/RP0/CPU0:iso#show license usage
Fri Jul 15 08:17:40.048 UTC

License Authorization:
  Status: OUT OF COMPLIANCE on Jul 15 2022 07:01:00 UTC

NCS1010 - Essentials - OLT RTU (NCS1010_ESS_OLT_RTU):
  Description: NCS1010 - Essentials Tier - Optical Line Terminal RTU (Per Port)
  Count: 32
  Version: 1.0
  Status: OUT OF COMPLIANCE
  Export status: NOT RESTRICTED
```

```
NCS1010 - Essentials - OLT SIA (NCS1010_ESS_OLT_SIA):
  Description: NCS1010 - Essentials Subscription - Optical Line Terminal - SIA
              (Per Port)
  Count: 32
  Version: 1.0
  Status: OUT OF COMPLIANCE
  Export status: NOT RESTRICTED
```

Example 6:

The following example shows the sample output of the **show license usage** command.

```
RP/0/RP0/CPU0:iso#show license usage
Fri Jul 15 08:17:40.048 UTC

License Authorization:
  Status: OUT OF COMPLIANCE on Jul 15 2022 07:01:00 UTC

NCS1010 - Essentials - OLT RTU (NCS1010_ESS_OLT_RTU):
  Description: NCS1010 - Essentials Tier - Optical Line Terminal RTU (Per Port)
  Count: 32
  Version: 1.0
  Status: OUT OF COMPLIANCE
  Export status: NOT RESTRICTED

NCS1010 - Essentials - OLT SIA (NCS1010_ESS_OLT_SIA):
  Description: NCS1010 - Essentials Subscription - Optical Line Terminal - SIA
              (Per Port)
  Count: 32
  Version: 1.0
  Status: OUT OF COMPLIANCE
  Export status: NOT RESTRICTED
```

License consumption use cases

In NCS 1010, advanced licenses are consumed based on the features configured.

- For an OLT card, the number of advanced licenses consumed equals the number of essential licenses present when certain advanced features are enabled.

- For an ILA card, only one advanced license is consumed regardless of the number of essential licenses present, when advanced features are enabled.

Examples of license consumption use cases:

License consumption when tone rate is configured for connection verification

When you configure tone rate for connection verification, license consumption is determined by the device type. The examples below show how the license summary output changes when the tone rate configuration is present or removed.

This sample shows the configuration of tone rate for connection verification.

```
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/3
RP/0/RP0/CPU0:ios(config-Ots)#tone-rate 25
RP/0/RP0/CPU0:ios(config-Ots)#tone-frequency 191.175
RP/0/RP0/CPU0:ios(config-Ots)#tone-pattern abcd1234
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

This sample displays the license summary output after configuring the tone rate. In addition to the essential licenses, there are the same number of advantage licenses consumed as essential licenses.

```
RP/0/RP0/CPU0:ios#show lic platform summary
Thu Aug 28 14:16:21.188 IST
Collection: LAST: Thu Aug 28 2025 14:15:23 IST
            NEXT: Thu Aug 28 2025 14:16:23 IST
Reporting:  LAST: Thu Aug 28 2025 14:15:23 IST
            NEXT: Thu Aug 28 2025 14:16:23 IST
SIA Status: In Compliance

                                                               Count
Feature/Area    Entitlement                                   Last Next
============ ==================================================== ==== ====
FCM 1        NCS1010 - Essentials Tier - Optical Line Terminal R   3    0
FCM 1        NCS1010 - Essentials Subscription - Optical Line Te   3    0
FCM 1        NCS1010 - Advantage Tier - Optical Line Terminal RT   3    0
FCM 1        NCS1010 - Advantage Subscription - Optical Line Ter   3    0
```

This sample displays the license summary after the tone rate configuration is removed. Only essential licenses are consumed when the tone rate is removed.

```
RP/0/RP0/CPU0:ios#show lic plat sum
Thu Aug 28 15:00:41.565 IST
Collection: LAST: Thu Aug 28 2025 15:00:22 IST
            NEXT: Thu Aug 28 2025 15:01:22 IST
Reporting:  LAST: Thu Aug 28 2025 15:00:22 IST
            NEXT: Thu Aug 28 2025 15:01:22 IST
SIA Status: In Compliance

                                                               Count
Feature/Area    Entitlement                                   Last Next
============ ==================================================== ==== ====
FCM 1        NCS1010 - Essentials Tier - Optical Line Terminal R   3    0
FCM 1        NCS1010 - Essentials Subscription - Optical Line Te   3    0
```

License consumption for overlapping Nyquist channels

When Nyquist channels are configured for omnidirectional cross-connection, both an Essentials license and an Advantage license are consumed for every overlapping Nyquist channel, one of each per channel.

Sample configuring the overlapping Nyquist channel.

```
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 191 centre-freq 192.3625 width 50
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#channel-id 192 centre-freq 192.4125 width 55
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#channel-id 193 centre-freq 192.4625 width 50
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#commit
```

This sample displays the overlapping channels highlighted.

```
RP/0/RP0/CPU0:IOS#show hw-module location 0/0/nXR0 terminal-ampli
Thu Aug 21 17:42:52.551 IST

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
PENDING_ACTIVATION - Data Channel pending transition to ACTIVE/FAIL

Location:             0/0/NXR0

Status:               Provisioned

ASE Total Power:      15.70 dBm

Flex Grid Info

Channel Number     Centre Frequency(THz)      Channel Width(GHz)    Channel Status
Overlapping Channels
1                  193.100000                 75.000                ACTIVE
- ,    -
2                  193.900000                 75.000                ACTIVE
- ,    -
3                  195.000000                 75.000                ACTIVE
- ,    -
4                  194.400000                 75.000                ACTIVE
- ,    -
5                  196.100000                 75.000                ACTIVE
- ,    -
6                  195.950000                 75.000                ACTIVE
- ,    -
7                  195.600000                 75.000                ACTIVE
- ,    -
8                  195.450000                 75.000                ACTIVE
- ,    -
191                192.362500                 50.000                NXC
- , 192
192                192.412500                 55.000                NXC
191 , 193
193                192.462500                 50.000                NXC
192 ,    -
```

This sample displays the license summary output after configuring the Nyquist channels. In addition to the essential licenses, an equal number of advantage licenses are consumed.

```
P/0/RP0/CPU0:ios#show lic platform summary
Thu Aug 21 17:45:11.120 IST
Collection: LAST: Thu Aug 21 2025 17:44:33 IST
            NEXT: Thu Aug 21 2025 17:45:33 IST
Reporting:  LAST: Thu Aug 21 2025 17:44:33 IST
            NEXT: Thu Aug 21 2025 17:45:33 IST
********************************IMPORTANT************************************
SIA Status: Out of Compliance(Remaining Grace Period: 87 days, 23 hours)
            Number of SIA license(s) used is more than available.
            SW Upgrade will still be allowed as Grace Period is remaining
****************************************************************************
                                                               Count
Feature/Area    Entitlement                                    Last Next
============ ================================================== ==== ====
FCM 1        NCS1010 - Essentials Tier - Optical Line Terminal R   8    0
FCM 1        NCS1010 - Essentials Subscription - Optical Line Te   8    0
FCM 1        NCS1010 - Advantage Tier - Optical Line Terminal RT   8    0
FCM 1        NCS1010 - Advantage Subscription - Optical Line Ter   8    0
FCM 1        Essentials Subscription - CCMD - SIA                  1    0
FCM 1        Essential Tier- CCMD RTU                              1    0
```

License consumption for OTDR scan data

When an OTDR scan status changes to **Data Ready**, the system determines license consumption based on device type. For each completed scan, the same number of Advantage licenses are consumed as Essential licenses.

This output shows a typical result when OTDR scan data status indicates "Data Ready".

```
RP/0/RP0/CPU0:P2B_DT_02_PTP0#show controllers ots 0/0/0/0 otdr-info tx
Tue Aug 26 16:06:56.896 IST
        Scan Direction: TX
        Scan Status: Data Ready
        Total Measured Loss: 0.000000 dB
        Total Measured Length: 9.640000 m
        Optical Return Loss: 23.0 dB
        SOR file: /harddisk:/otdr/P2B_DT_02_PTP0_OTDR_Ots0_0_0_0_TX_20250826-160640.sor
        Total Events detected: 2
        Scan Timestamp: Tue Aug 26 16:06:40 2025 UTC
        Event Type Legend:  NR:Non-Reflective  R:Reflective  FE:Fiber-End
ER:Excess-Reflection EA:Excess-Attenuation


        Event#       | Detected Event(s)        | Location(m)      | Accuracy(m)      |
Magnitude(dB)   | Attenuation/km(dB)
        1            |  R FE                    | 9.6400          | 2.00            |
-25.81          | 0.00


        2            |  NR FE                   | 9.6400          | 2.00            |
0.00            | 0.00
```

This output displays the license summary. The summary shows the consumption for Essentials and Advantage licenses.

```
 RP/0/RP0/CPU0:P2B_DT_02_PTP0#show lic platform sum
Tue Aug 26 16:11:14.273 IST
Collection: LAST: Tue Aug 26 2025 16:10:43 IST
            NEXT: Tue Aug 26 2025 16:11:43 IST
Reporting:  LAST: Tue Aug 26 2025 16:10:43 IST
            NEXT: Tue Aug 26 2025 16:11:43 IST
SIA Status: In Compliance

                                                               Count
Feature/Area    Entitlement                                  Last Next
============ ==================================================== ==== ====
FCM 1        NCS1010 - Essentials Tier - Optical Line Terminal R   3    0
FCM 1        NCS1010 - Essentials Subscription - Optical Line Te   3    0
FCM 1        NCS1010 - Advantage Tier - Optical Line Terminal RT   3    0
FCM 1        NCS1010 - Advantage Subscription - Optical Line Ter   3    0
```

These are sample outputs where the OTDR scan is stopped.

```
RP/0/RP0/CPU0:ios#otdr-stop controller ots 0/0/0/0 tx
Thu Aug 28 14:05:44.405 IST
OTS OTDR Scan Stopped at TX
RP/0/RP0/CPU0:ios#RP/0/RP0/CPU0:Aug 28 14:05:45.218 IST: osa_driver[271]:
%PLATFORM-OSA-6-OTDR_SCAN_STATUS_INFO : OTDR scan status changed: Ots0/0/0/0 direction: TX
 status: Otdr Scan Stopped scan mode: Auto

P/0/RP0/CPU0:ios#show controller ots 0/0/0/0 otdr-info tx
Thu Aug 28 14:08:09.117 IST
        Scan Direction: TX
        Scan Status: Stopped
        Total Measured Loss: 0.000000 dB
        Total Measured Length: 9.640000 m
        Optical Return Loss: 23.0 dB
```

```
        SOR file: /harddisk:/otdr/P2B_DT_02_PTP0_OTDR_Ots0_0_0_0_TX_20250826-160640.sor
        Total Events detected: 2
        Scan Timestamp: Tue Aug 26 16:06:40 2025 UTC
        Event Type Legend:  NR:Non-Reflective  R:Reflective  FE:Fiber-End
ER:Excess-Reflection EA:Excess-Attenuation

        Event# |  Detected Event(s)  |  Location(m)    |  Accuracy(m)    |  Magnitude(dB)
   |  Attenuation/km(dB)
        1      |  R FE               |  9.6400         |  2.00           |  -25.81
   |  0.00

        2      |  NR FE              |  9.6400         |  2.00           |  0.00
   |  0.00
```

This output displays the license summary. Only Essentials licenses are consumed, as shown in the summary.

```
 RP/0/RP0/CPU0:ios#show lic plat sum
Thu Aug 28 14:08:28.524 IST
Collection: LAST: Thu Aug 28 2025 14:08:22 IST
           NEXT: Thu Aug 28 2025 14:09:22 IST
Reporting:  LAST: Thu Aug 28 2025 14:08:22 IST
           NEXT: Thu Aug 28 2025 14:09:22 IST
SIA Status: In Compliance
                                                               Count
Feature/Area      Entitlement                              Last Next
============ ====================================================== ==== ====
FCM 1        NCS1010 - Essentials Tier - Optical Line Terminal R    3    0
FCM 1        NCS1010 - Essentials Subscription - Optical Line Te    3    0
```

Implementing Host Services and Applications

Cisco IOS XR software Host Services and Applications features on the router are used primarily for checking network connectivity and the route a packet follows to reach a destination, mapping a hostname to an IP address or an IP address to a hostname, and transferring files between routers and UNIX workstations.

Prerequisites for implementing Host Services and Applications

Ensure to install the relevant optional RPM package before using the host services or applications.

HTTP clients

A HTTP client is a network utility that

- transfers files and data from HTTP servers to devices over a network using the HTTP protocol,

- enables configuration of connection, security, and transport parameters via **http client** command, and

- and supports advanced features such as SSL/TLS options, source interface selection, and protocol versioning.

Configurable parameters for HTTP clients

HTTP client is available by default. You can configure http client settings or view and modify the existing settings. To configure the settings, use the **http client** command in XR configuration mode.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#http client ?
connection          Configure HTTP Client connection
response            How long HTTP Client waits for a response from the server
                    for a request message before giving up
secure-verify-host  Verify that if server certificate is for the server it is known as
secure-verify-peer  Verify authenticity of the peer's certificate
source-interface    Specify interface for source address
ssl                 SSL configuration to be used for HTTPS requests
tcp-window-scale    Set tcp window-scale factor for High Latency links
version             HTTP Version to be used in HTTP requests
vrf                 Name of vrf
```

Table 75: Commands used to configure HTTP client settings

Parameters	Description
connection	Configure HTTP Client connection by using either retry or timeout options.
response	How long HTTP Client waits for a response from the server for a request message before giving up.
secure-verify-host	Verify host in peer's certificate. To disable verifying this, you can use the command **http client secure-verify-host disable**
secure-verify-peer	Verify authenticity of the peer's certificate.
source-interface	Specifies the interface for source address for all outgoing HTTP connections. You can enter either an ipv4 or ipv6 address or both.
ssl version	SSL version (configuration) to be used for HTTPS requests.
tcp-window-scale scale	Set tcp window-scale factor for high latency links.
version version	HTTP version to be used in HTTP requests. • 1.0 - HTTP1.0 will be used for all HTTP requests. • 1.1 - HTTP1.1 will be used for all HTTP requests. • default libcurl - will use HTTP version automatically.
vrf name	Name of vrf.

This example shows how to set the tcp window-scale to 8.

```
RP/0/RP0/CPU0:ios(config)#http client tcp-window-scale 8
```

This example shows how to set the HTTP version to 1.0.

```
RP/0/RP0/CPU0:ios(config)#http client version 1.0
```

Note   HTTP client uses libcurl version 7.30

TCP Overview

TCP is a connection-oriented protocol that specifies the format of data and acknowledgments that two computer systems exchange to transfer data. TCP also specifies the procedures the computers use to ensure that the data arrives correctly. TCP allows multiple applications on a system to communicate concurrently, because it handles all demultiplexing of the incoming traffic among the application programs.

TCP Dump File Converter

TCP dump file converter is a tool that converts ios-xr dump-files in binary format to user-friendly format such as PCAP or text.

It proves especially useful when you disable Non-Stop Routing (NSR) or experience a session flap on your system. During such incidents, by default, the TCP process running on the NCS system promptly stores the latest 200 packet traces in binary format within a temporary folder.

TCP dump packet traces also includes data about the configured routing protocols and the overall network traffic traversing your system. This data equips you with the necessary insights to identify and resolve issues within your network infrastructure, facilitating proactive network troubleshooting.

You can view the packet traces binary files in the user-readable format using the following methods:

- You can use the **show tcp dump-file <binary filename>** command to view each binary file in text format manually. For more information, refer to View Binary Files in Text Format Manually, on page 223.

  This process consumes much time, as you have to view each file manually one after another.

- You can convert all stored packet traces in binary files into PCAP, text, or both using the **tcp dump-file convert** command. For more information, refer to Convert Binary Files to Readable Format Using TCP Dump File Converter, on page 224.

  This active approach greatly improves the efficiency and ease of packet analysis during network troubleshooting.

Limitations and Restrictions for TCP Dump File Converter

- The system only stores the most recent 200 message exchanges that occurred right before the session termination, when NSR is disabled, or during a session flap.

- You can view only one binary file in text format using the **show tcp dump-file <binary filename>** command.

- TCP dump files are generated by default for BGP, MSDP, MPLS LDP and SSH.

View Binary Files in Text Format Manually

Perform the following steps to view each packet traces binary file in text format without using the TCP dump file converter:

Procedure

Step 1   View the list of packet traces in binary files stored in the tcpdump folder using the **show tcp dump-file list all** command.

Example:

```
RP/0/RP0/CPU0:ios# show tcp dump-file list all
total 1176
-rw-r--r-- 1 root root 5927 Nov 22 12:42 31_0_0_126.179.20966.cl.1700656933
-rw-r--r-- 1 root root 5892 Nov 22 12:42 31_0_0_127.179.35234.cl.1700656933
-rw-r--r-- 1 root root 6148 Nov 22 12:42 31_0_0_149.179.54939.cl.1700656933
-rw-r--r-- 1 root root 5894 Nov 22 12:42 31_0_0_155.179.18134.cl.1700656933
-rw-r--r-- 1 root root 6063 Nov 22 12:42 31_0_0_156.179.25445.cl.1700656933
-rw-r--r-- 1 root root 5860 Nov 22 12:42 31_0_0_161.179.30859.cl.1700656933
-rw-r--r-- 1 root root 5832 Nov 22 12:42 31_0_0_173.179.36935.cl.1700656933
-rw-r--r-- 1 root root 5906 Nov 22 12:42 31_0_0_190.179.25642.cl.1700656933
```

Step 2   View each packet traces binary file in text format using the **show tcp dump-file <binary filename>** command.

Example:

```
RP/0/RP0/CPU0:ios# show tcp dump-file 10_106_0_73.179.34849.cl.1707424077 location 0/RP0/CPU0
Filename: 10_106_0_73.179.34849.cl.1707424077

=================================================================
Connection state is CLOSED, I/O status: 0, socket status: 103
PCB 0x00007f86bc05e3b8, SO 0x7f86bc05e648, TCPCB 0x7f86bc0c3718, vrfid 0x60000000,
Pak Prio: Medium, TOS: 192, TTL: 1, Hash index: 1593
Local host: 10.106.0.72, Local port: 179 (Local App PID: 11354)
Foreign host: 10.106.0.73, Foreign port: 34849
(Local App PID/instance/SPL_APP_ID: 11354/1/0)

Current send queue size in bytes: 0 (max 0)
Current receive queue size in bytes: 0 (max 0)  mis-ordered: 0 bytes
Current receive queue size in packets: 0 (max 0)

Timer           Starts     Wakeups        Next(msec)
Retrans         103448        8               0
SendWnd              0        0               0
TimeWait             1        0               0
AckHold         106815   106545               0
KeepAlive            1        0               0
PmtuAger             0        0               0
GiveUp               0        0               0
Throttle             0        0               0
FirstSyn             0        0               0

   iss: 161240548    snduna: 163206936    sndnxt: 163206936
sndmax: 163206936    sndwnd: 63104        sndcwnd: 18120
   irs: 3691232436   rcvnxt: 3693473072   rcvwnd: 26099    rcvadv: 3693499171
```

The above sample displays only a part of the actual output; the actual output displays more details.

Convert Binary Files to Readable Format Using TCP Dump File Converter

Perform the following steps to convert the dump packet traces in binary files into PCAP and text formats:

Procedure

Step 1   Execute the **tcp dump-file convert all-formats all** command to convert the dump packet traces in binary files into PCAP and text formats.

Example:

```
RP/0/RP0/CPU0:ios# tcp dump-file convert all-formats all
ascii file is saved at :
/harddisk:/decoded_dumpfiles/text_tcpdump_peer_all_node0_RP0_CPU0_2024_3_19_10_8_53.462070.txt
pcap file is saved at :
/harddisk:/decoded_dumpfiles/pcap_tcpdump_peer_all_node0_RP0_CPU0_2024_3_19_10_8_40.154838.pcap
[OK]
```

By default, the system stored the converted files in the "decoded_dumpfiles" folder on the "hard disk".

Using the **location node-id** and **file <file path>** keywords, you can save the converted TCP dump file to your desired location.

For example, **tcp dump-file convert all-formats all location** *0/RP0/CPU0* **file** */harddisk:/demo2*.

```
RP/0/RP0/CPU0:ios# tcp dump-file convert all-formats all location 0/RP0/CPU0 file /harddisk:/demo2
ascii file is saved at : /harddisk:/demo2.txt
```

```
pcap file is saved at : /harddisk:/demo2.pcap
[OK]
```

Step 2   To view the converted text file in the CLI, use the **run cat <text file path>** command.

Example:

```
RP/0/RP0/CPU0:ios# run cat
/harddisk:/decoded_dumpfiles/text_tcpdump_peer_all_node0_RP0_CPU0_2024_3_19_10_8_53.462070.txt
Filename: 2024_3_19_10_8_53.462070

================================================================
Connection state is CLOSED, I/O status: 0, socket status: 103
PCB 0x0000000000f47a80, SO 0xf476d0, TCPCB 0xf6a370, vrfid 0x60000000,
Pak Prio: Medium, TOS: 192, TTL: 255, Hash index: 563
Local host: 14:11:11::1, Local port: 47743 (Local App PID: 19579)
Foreign host: 14:11:11::2, Foreign port: 179
(Local App PID/instance/SPL_APP_ID: 19579/1/0)

Current send queue size in bytes: 0 (max 0)
Current receive queue size in bytes: 0 (max 0)  mis-ordered: 0 bytes
Current receive queue size in packets: 0 (max 0)

Timer          Starts     Wakeups        Next(msec)
Retrans          70         2                0
SendWnd           0         0                0
TimeWait          2         0                0
AckHold          66        61                0
KeepAlive         1         0                0
PmtuAger          0         0                0
GiveUp            0         0                0
Throttle          0         0                0
FirstSyn          1         1                0

   iss: 3113104891  snduna: 3113106213  sndnxt: 3113106213
sndmax: 3113106213  sndwnd: 31523       sndcwnd: 2832
   irs: 4250126727  rcvnxt: 4250128049  rcvwnd: 31448   rcvadv: 4250159497
```

The above sample displays only a part of the actual output; the actual output displays more details.

Step 3   Copy the converted packet traces from the system to your local computer using the **scp** command and view the converted PCAP file.

Cisco NCS 1010 Topologies

This appendix describes multidegree support on NCS 1010 and has examples of a few NCS 1010 topologies.

Multidegree Support

NCS1010 OLT devices support up to 8 degrees of ROADM express. You can set up multidegree connections using NCS1K-BRK-8 modules. Use BRK-8 modules for MPO breakout for express interconnect. For a multidegree topology, you must use as many BRK-8 modules and OLT devices as there are degrees. The BRK-8 modules help NCS 1010 nodes to achieve multidegree capability.

The following diagram represents a sample 3-degree topology. The diagram represents three point-to-point multispan optical networks - OLT-C_1A to OLT-C_1, OLT-C_2A to OLT-C_2, and OLT-C_3A to OLT-C_3. These multispan networks can have ILA nodes between the OLT endpoints. We connect OLT-C_1, OLT-C_2, and OLT-C_3 to each other using three BRK-8 modules. Each BRK-8 module must have connections to each of the other BRK-8 modules. This express interconnect enables multidegree support. Configure the optical cross-connects on each OLT device such that the signal gets to the target OLT.

Figure 33: Typical 3-Degree Topology
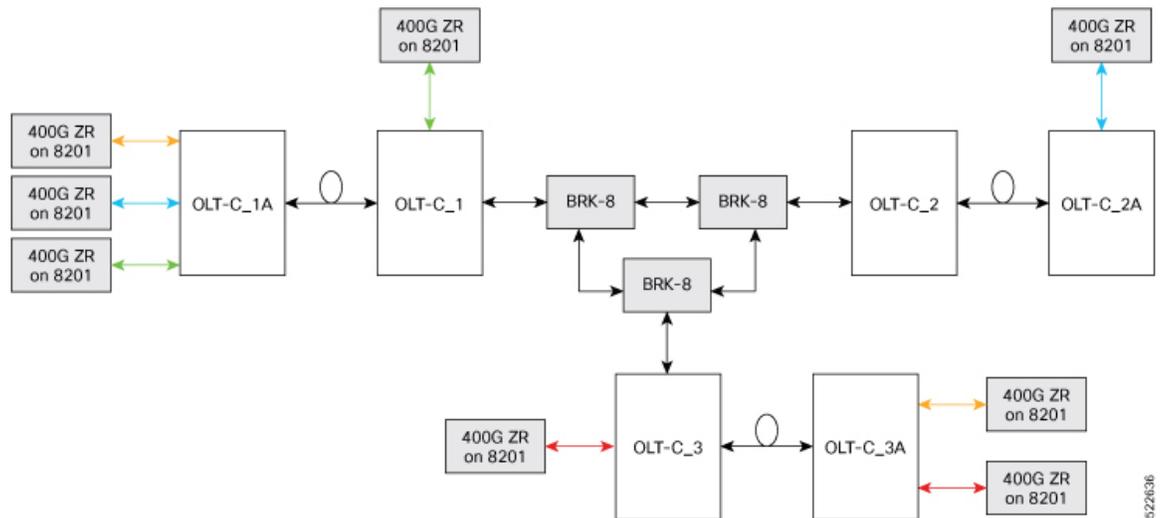
NCS 1010 Sample Topologies

The following section describes three sample topologies of specific hardware deployments.

- Point-to-point topology

- Multidegree topology: Colored solution

- Multidegree topology: Colorless solution

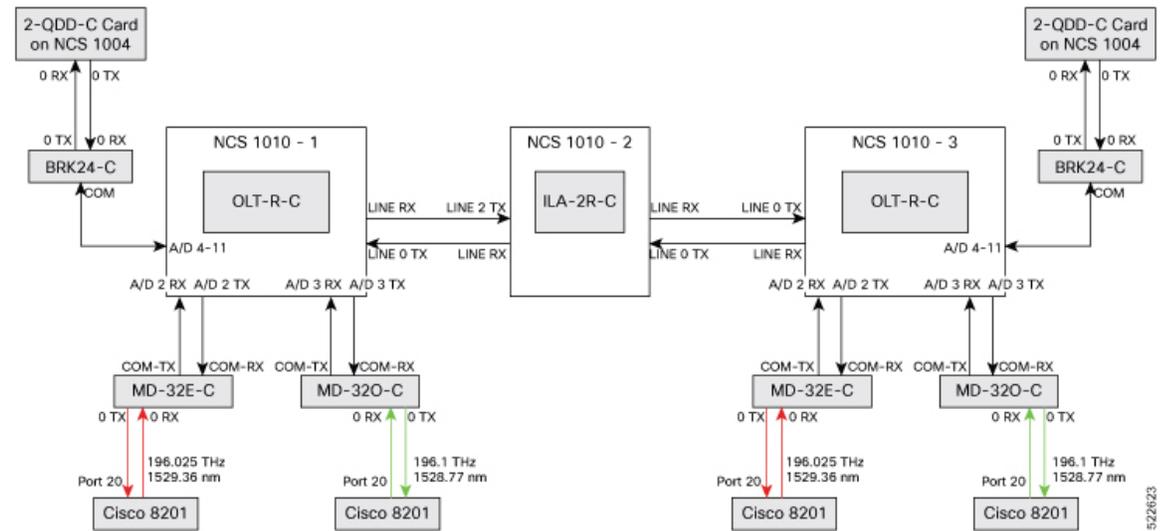- Multidegree topology: Hybrid solution

Point-to-point Topology

This sample topology is a simple point-to-point topology with no more than 2 degrees per site. You can use it for point-to-point optical links.

Topology Components

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices

- NCS1K-MD32E-C modules

- NCS1K-MD32O-C modules

- NCS1K-BRK-24 modules

- QDD-400G-ZR-S transceiver

- LC/LC cables

Figure 34: Point-to-point Topology

Multidegree Topology: Colored Solution

This sample topology is a three-degree topology. You can use similar topologies for multidegree optical links that have:

- Optical channels from low TX power transponders like the ZR or ZR+ pluggable optical modules

- Optical channels with TX power spectral density between -21dBm/12.5GHz and -14dBm/12.5GHz

Topology Components

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices

- NCS1K-MD32E-C modules

- NCS1K-MD32O-C modules

- NCS1K-BRK-8 modules

- Cisco 8201 routers

- QDD-400G-ZR-S transceivers

- LC/LC cables

- MPO cables

Figure 35: Colored Solution
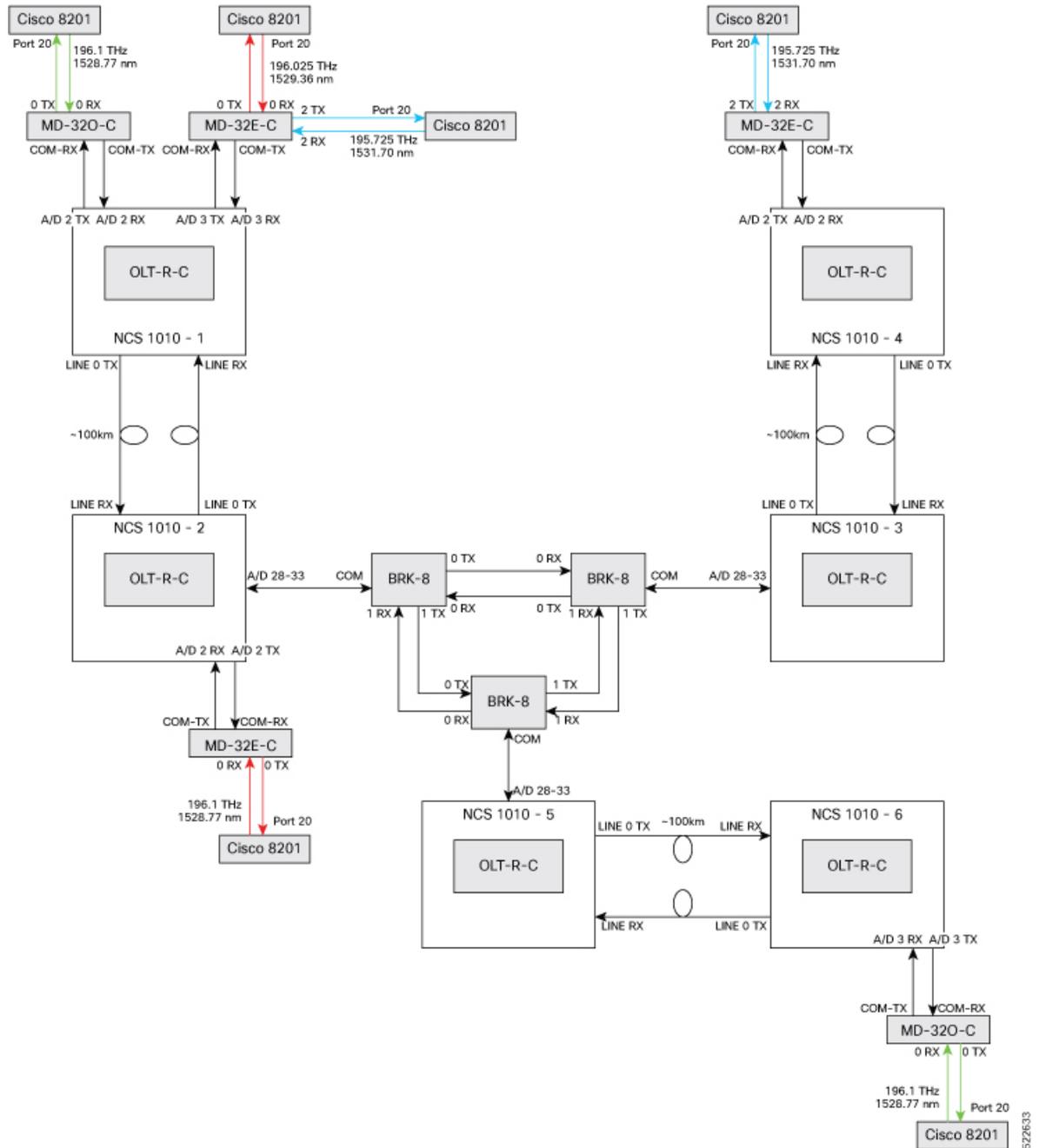
Multidegree Topology: Colorless Solution

This sample topology is a three-degree topology. You can use similar topologies for multidegree optical links that have:

- Optical channels from high TX power transponders like 1.2T line card on NCS 1004 or line cards with CFP2-400G-DCO as the trunk interface.
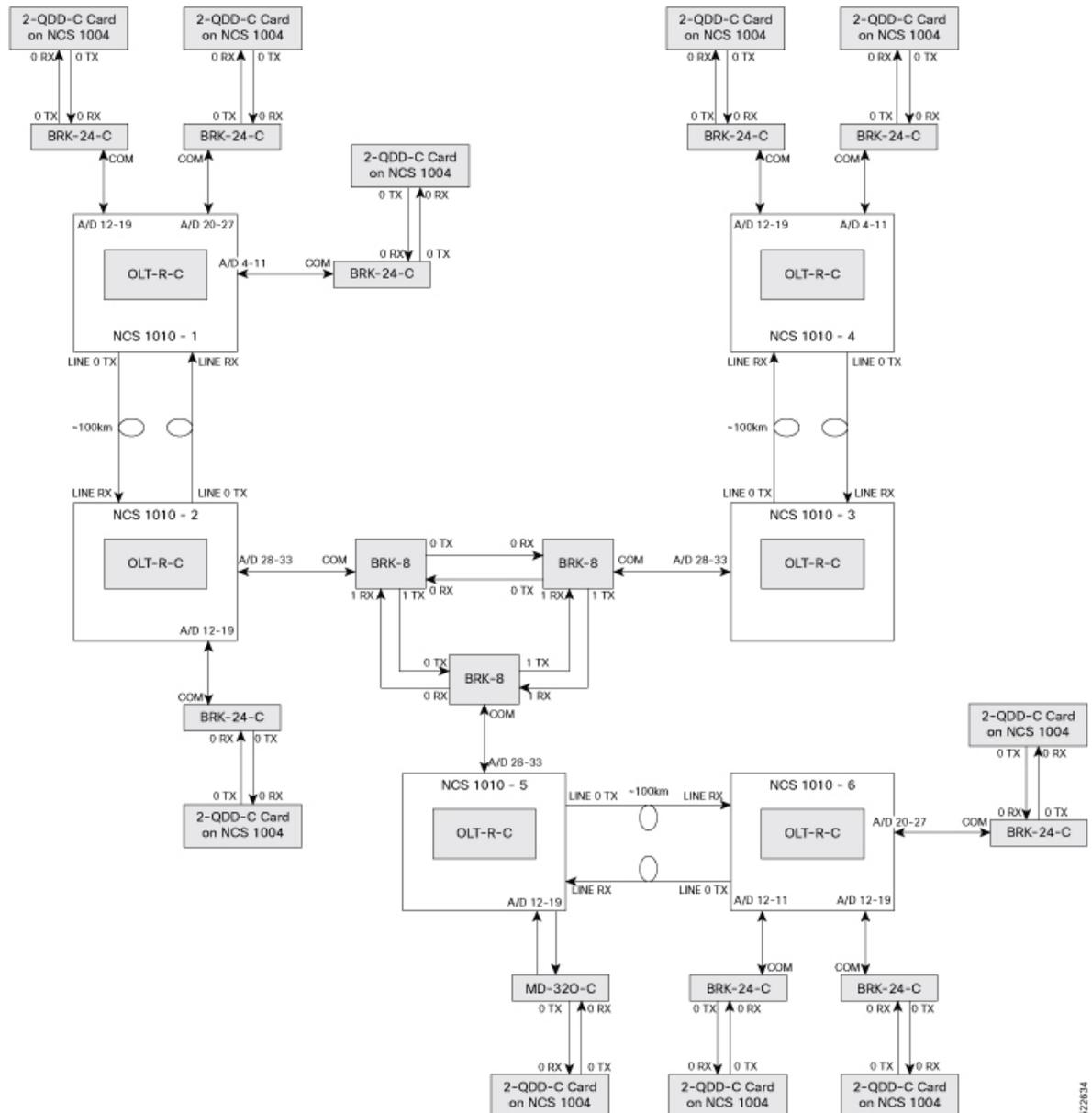
• Optical channels with TX power spectral density not lower than -7dBm/12.5GHz

Topology Components

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices

- NCS1K-BRK-8 modules

- NCS1K-BRK-24 modules

- CFP2-400G-DCO transceivers

- Cisco NCS 1004 devices

- NCS1K4-2-QDD-C-K9 line card

- LC/LC cables

- MPO cables

Figure 36: Colorless Solution

Multidegree Topology: Hybrid Solution

This sample topology is a three-degree topology. You can use similar topologies for multidegree optical links that have

- Optical channels from both high and low TX power transponders

- Optical channels with TX power spectral density that you use in both colored and colorless solutions

Topology Components

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices

- NCS1K-MD32E-C modules

- NCS1K-MD32O-C modules

- NCS1K-BRK-8 modules

- NCS1K-BRK-24 modules

- Cisco 8201 routers

- QDD-400G-ZR-S transceivers

- CFP2-400G-DCO transceivers

- Cisco NCS 1004 devices

- NCS1K4-2-QDD-C-K9 line card

- LC/LC cables

- MPO cables

Figure 37: Colorless Solution
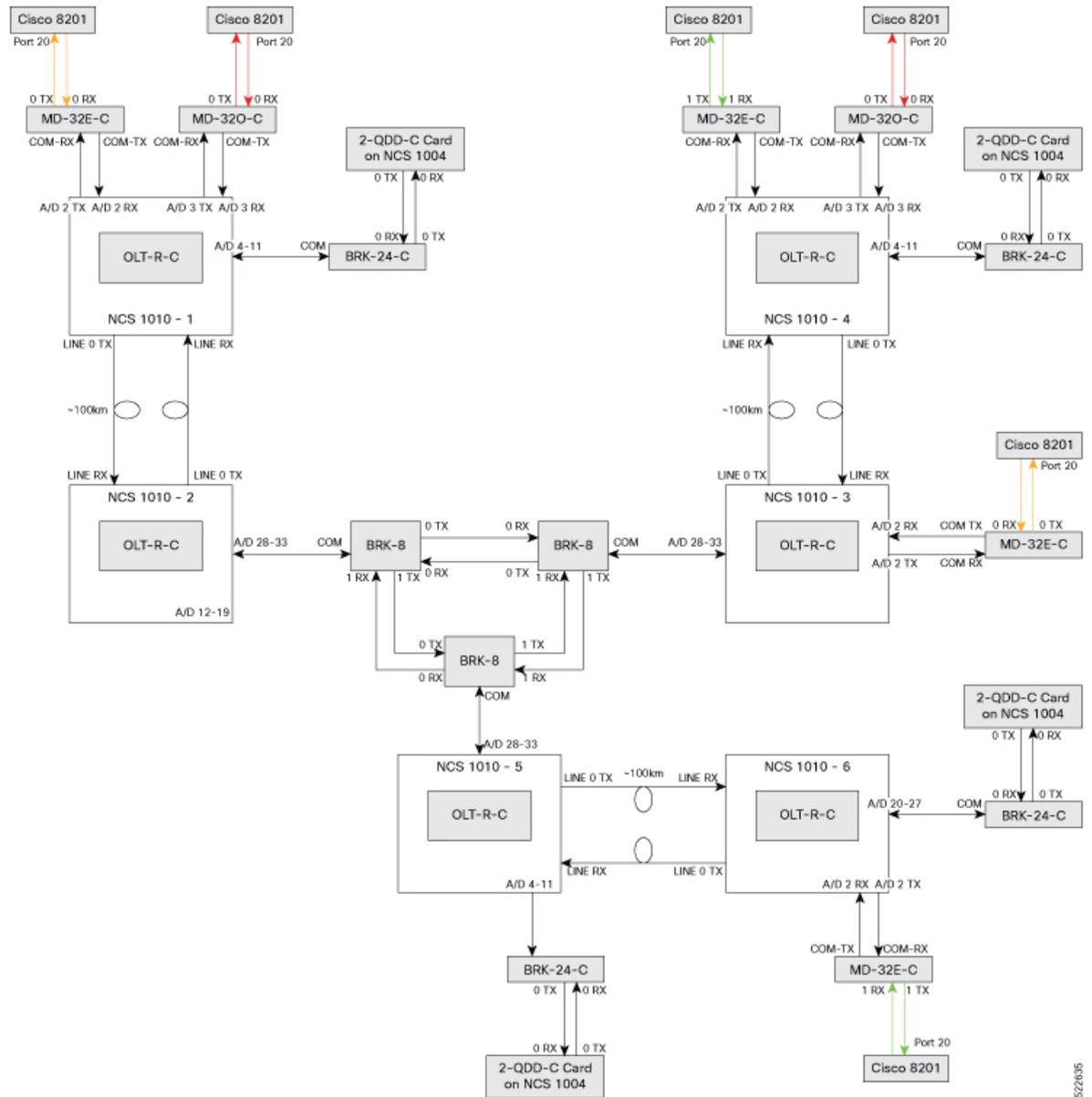
Omnidirectional Support

Table 76: Feature History

Feature Name	Release Information	Description
OLT Based Omnidirectional Add/Drop Topology	Cisco IOS XR Release 7.9.1	You can now set up pure OLT-based omnidirectional add/drop topology. This topology is supported over the C+L band and scalable beyond 4-degree nodes. Dual omnidirectional add/drop can be implemented on a node to provide redundancy or increased add/drop capacity. The omnidirectional setup provides the flexibility to the multidegree topology to route channels through any of the optical degrees during fiber cut without the need for physical fiber reconnections.

You can design multiple OLT-based omnidirectional add/drop stages. This configuration gives flexibility to the multidegree topology to route channels through any of the optical degrees during fiber cut without the need for changing the physical fiber connections.

NCS2K-MF-4x4-COFS Based Colorless Omnidirectional Topology

In Release 7.7.1, the omnidirectional add/drop stage is designed using the NCS 2000 passive module, 4x4 colorless omnidirectional flex spectrum (COFS) add/drop module (NCS2K-MF-4x4-COFS) and NCS2K-MF-MPO-8LC. The channels from different degrees are aggregated at the MF-MPO-8LC. The MF-4x4-COFS adds the channels. Similarly, the channels from the MF-4x4-COFS can be routed to any of the degree through the MF-MPO-8LC, thus achieving the omnidirectional functionality. This colorless omnidirectional topology gives flexibility to retune the frequency or wavelength of the channel coming from the transponder or muxponder without any physical changes.

Topology Components

To build this topology, you need the following hardware:

- NCS 1010 OLT devices

- NCS2K-MF-4x4-COFS modules

- NCS2K-MF-MPO-8LC modules

- NCS1K-BRK-8 modules

Following are the specific cable configurations for interconnecting the modules:

- The MF-4x4-COFS modules are interconnected using standard MPO 8 or 12 fibers (15454-MPO-MPO-x or ONS-12MPO-MPO-x)

• The MF-4x4-COFS modules and NCS1K-BRK-8 module are interconnected using standard LC-LC fibers.

Figure 38: MF-4x4-COFS Based Colorless Omnidirectional Topology
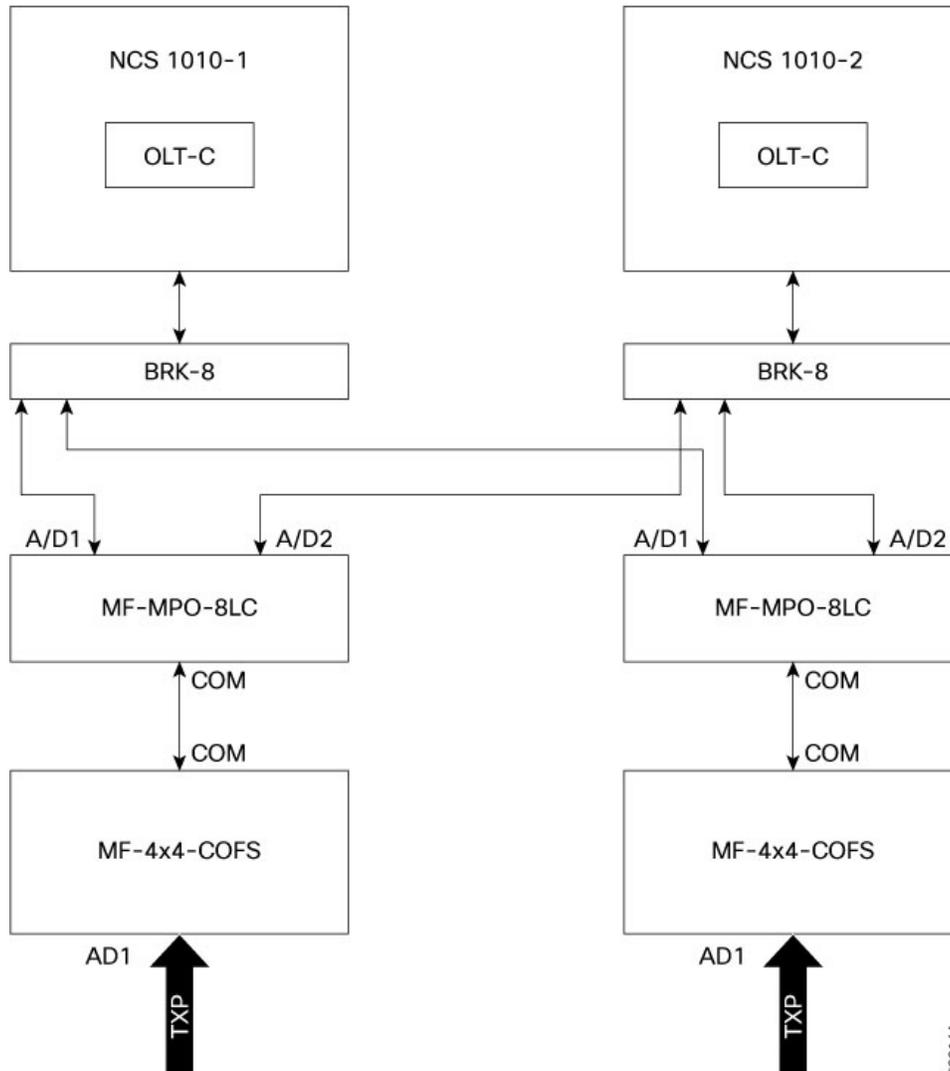
Limitations

• This configuration is supported only for C-band ROADM.

• This configuration is scalable only up to a maximum of 4 degrees. More OSNR penalty is induced by the MF-4x4-COFS as you add more degrees.

• One MF-4x4-COFS module can support up to only four channels. To scale up to 32 channels, you would require 8 MF-4x4-COFS modules.

• The terminal node in this configuration can be connected only to NCS 1004 line cards, line cards with CFP2-400G-DCO as a trunk interface, and DP04QSDD pluggable.

OLT Based Omnidirectional Add/Drop Topology

From the Release 7.9.1, the omnidirectional add/drop stage is implemented using two OLT-C nodes interconnected back-to-back at the LINE-TX/RX ports. You can have more than one omnidirectional add/drop stages in one ROADM site. You can also include OLT-L devices in this topology. Multiple transponders can be connected to the terminal OLT node including the low-power ZR+. There are no additional restrictions on the transponder or interface types that can be connected to the terminal OLT-C.

Topology Components

To build this topology, you need the following hardware:

- NCS 1010 OLT-C devices

- NCS 1010 OLT-L devices

- NCS1K-BRK-24 modules

- NCS1K-BRK-8 modules

- NCS1K-MD32-C modules

Following are the specific configurations and applications that are required for this configuration:

- The interconnection between the terminal OLT-C, where the traffic is terminated and the omnidirectional degree is managed as a 0dB span.

- OSC-C and OSC-L controllers can be used with unnumbered IP on OSC interfaces of the omni span.

- Link tuner and Gain estimator must be disabled on the Omni span.

- APC must be enabled on Omni span.

- ASE loading is enabled (both static and dynamic).

- Specific configuration for optical applications such as span length and fiber type are not required.

- To have the Preamplifier of OLT-C working in proper condition (minimum gain 12dB), the Line-Tx PSD must be set to −12.9 dBm/12.5 GHz (considering 80% CH_SD).

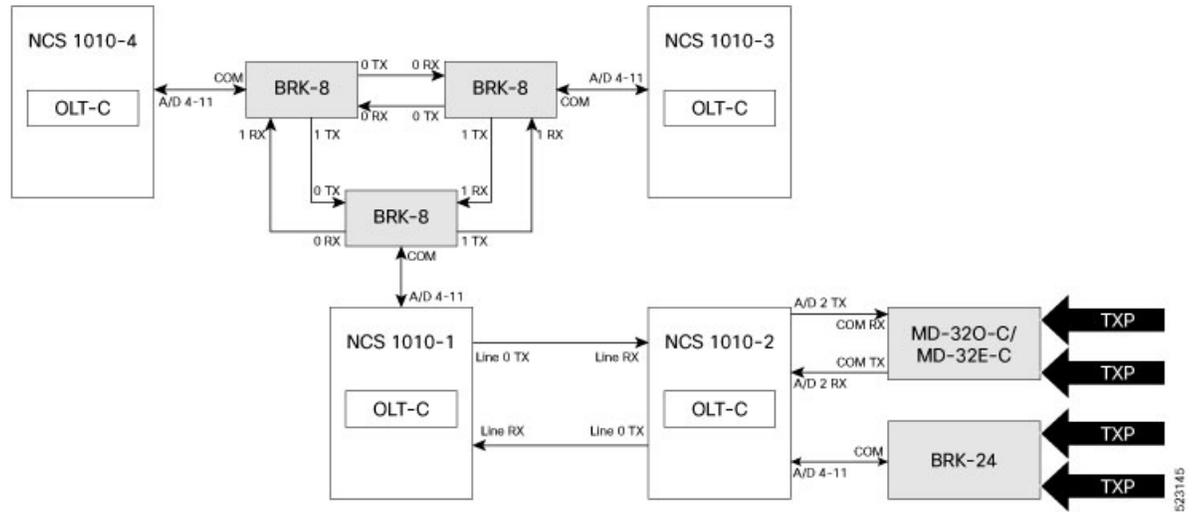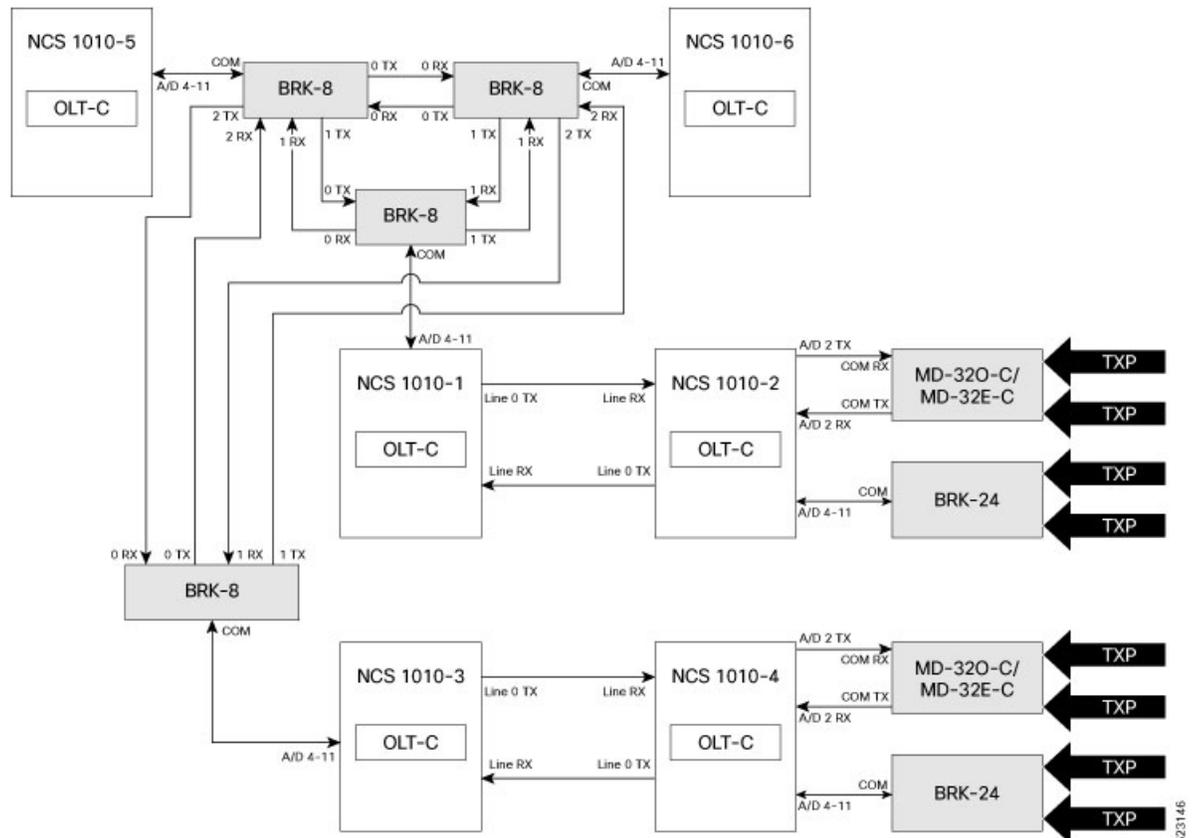*Figure 39: Omnidirectional Configuration with OLTs*

Figure 40: Dual Omnidirectional Configuration

Figure 41: C+L Omnidirectional Configuration

Multidegree ROADM networks with NCS1010 OLT devices

A multidegree ROADM network is a network capability that enables a single ROADM node to establish more than two degrees of connection.

A degree is a bidirectional physical fiber connection between two nodes in a network.

NCS 1010 multidegree ROADM express

ROADM express refers to the pass-through wavelengths that travel directly from one fiber degree to another inside a ROADM node, bypassing local add/drop without optical-electrical-optical (OEO) conversion.

NCS1010 OLT devices support up to eight degrees of ROADM express through NCS1K-BRK-8 (BRK-8) modules. The BRK-8 modules help in MPO breakout for express interconnect. For a multidegree network, use as many BRK-8 modules and OLT devices as there are degrees. The BRK-8 modules help NCS 1010 nodes to achieve multidegree capability.

BRK-8 modules are essential for scaling network degrees and supporting express interconnects in advanced optical networking scenarios.

Three-degree ROADM network using NCS 1010 devices

In this example, a three-degree ROADM network established an express interconnection among three different point-to-point multispan optical networks. The three point-to-point topologies are:

- OLT-C_1A to OLT-C_1
- OLT-C_2A to OLT-C_2
- OLT-C_3A to OLT-C_3

The three OLT nodes (OLT-C_1, OLT-C_2, OLT-C_3) are each connected using three BRK-8 modules. Each module must link to the other two, providing the necessary express interconnect. ptical cross-connects in each OLT ensure signals can traverse to any of the three endpoints, even across multiple spans including intermediate ILA nodes.

The three-degree ROAMD network with NCS 1010 devices contains

1. OLT-C_1, OLT-C_2, and OLT-C_3 nodes connected to each other using three BRK-8 modules.

2. Each BRK-8 module is connected to each of the other BRK-8 modules for express interconnect that enables multidegree support.

3. Each OLT device has optical cross-connection to each other to enable the signal to reach the target OLT.

Figure 42: Typical 3-Degree Topology

Types of NCS 1010 sample topologies

This section describes three sample topologies of specific hardware deployments.

Colored multidegree topologies

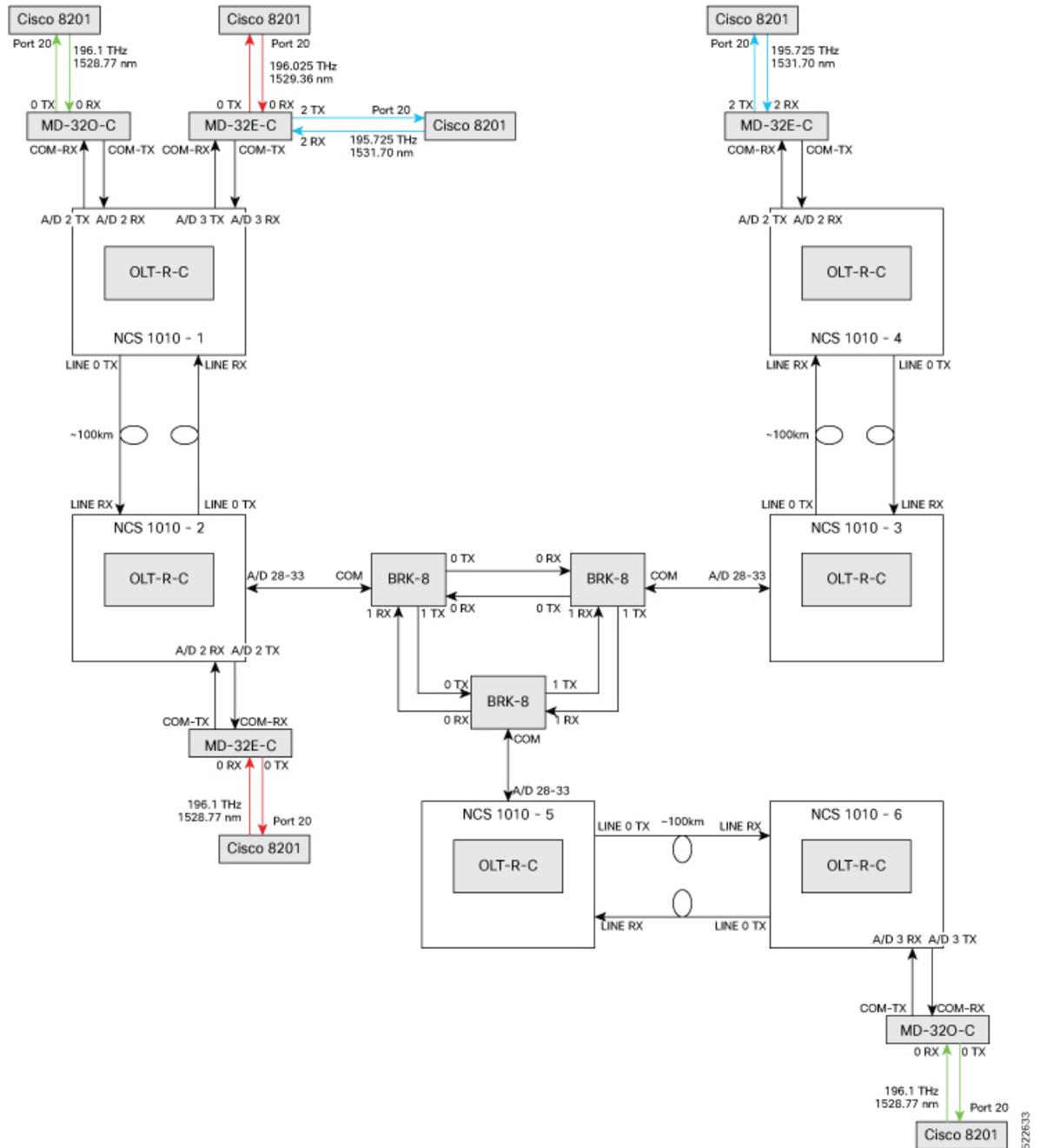A colored multidegree topology is a network design pattern that

- interconnects sites using multiple optical degrees,

- supports optical channels from transponders with low transmit (TX) power such as ZR or ZR+ pluggable modules, and

- operates with channel TX power spectral density between -21 dBm/12.5 GHz and -14 dBm/12.5 GHz.

Topology components

This topology typically requires:

- Cisco NCS 1010 devices

- NCS1K-MD32E-C modules

- NCS1K-MD32O-C modules

- NCS1K-BRK-8 modules

- Cisco 8201 routers

- QDD-400G-ZR-S transceivers

- LC/LC cables

- MPO cables

Figure 43: Colored solution

Colorless multidegree topologies

A colorless multidegree topology is a network design pattern that

- uses multi-degree site interconnections with flexible wavelength assignment,

- supports optical channels from high TX power transponders like 1.2T line cards or CFP2-400G-DCO trunk interfaces, and

• requires channel TX power spectral density not lower than -7 dBm/12.5 GHz.

Components required

Deployment typically includes:

- Cisco NCS 1010 devices

- NCS1K-BRK-8 modules

- NCS1K-BRK-24 modules

- CFP2-400G-DCO transceivers

- Cisco NCS 1004 devices

- NCS1K4-2-QDD-C-K9 line card

- LC/LC cables

- MPO cables

Figure 44: Colorless solution
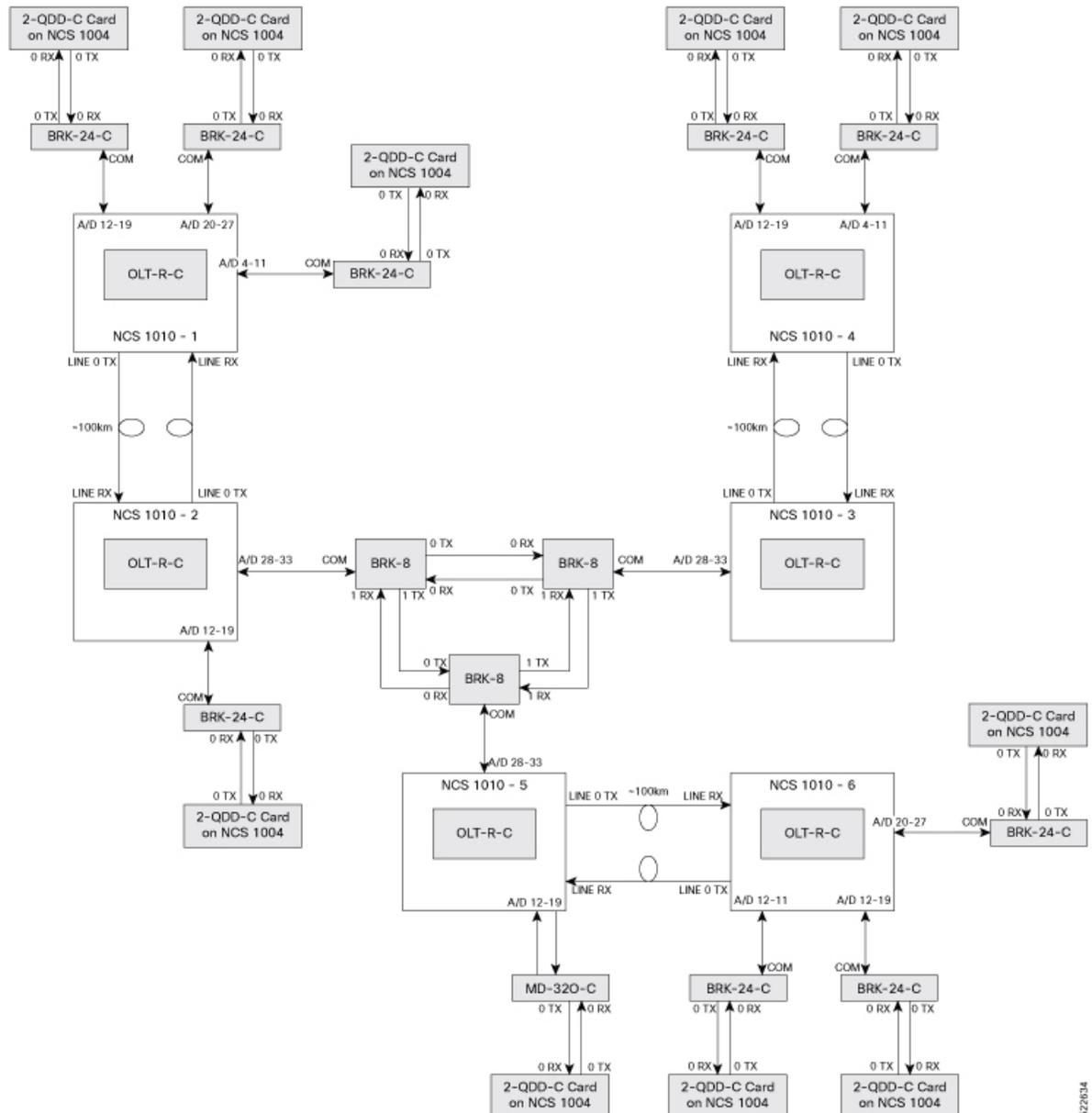
Hybrid multidegree topologies

A hybrid multidegree topology is a network design pattern that

- interconnects sites using both colored and colorless optical channels,

- accommodates a mix of high- and low-TX power transponders within the same deployment, and

- leverages the channel TX power spectral density ranges required for both colored and colorless topologies.

Components required

Supported hardware includes:

- Cisco NCS 1010 devices

- NCS1K-MD32E-C modules

- NCS1K-MD32O-C modules

- NCS1K-BRK-8 modules

- NCS1K-BRK-24 modules

- Cisco 8201 routers

- QDD-400G-ZR-S transceivers

- CFP2-400G-DCO transceivers

- Cisco NCS 1004 devices

- NCS1K4-2-QDD-C-K9 line card

- LC/LC cables

- MPO cable

Figure 45: Colorless solution
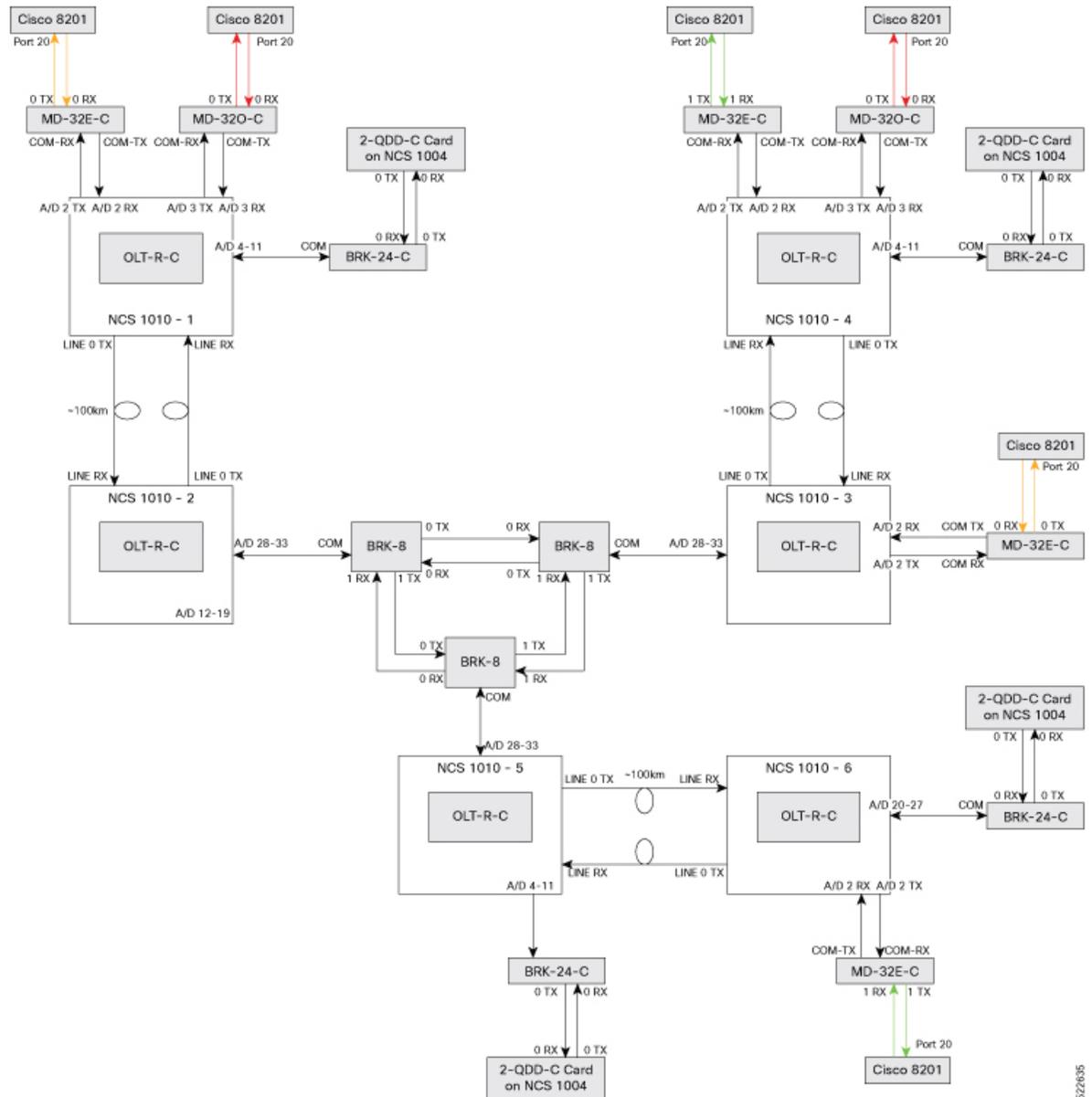
Point-to-point topologies

A point-to-point topology is a network design pattern that

- connects two network sites directly using optical links,

- limits the number of degrees per site to two or fewer, and

- enables simple deployment with minimal hardware requirements.

Components for point-to-point topology

To build this topology, you need these hardware components.

- Cisco NCS 1010 devices: OLT-R-C for and ILA-2R-C for inline amplication

- NCS1K-MD32E-C modules: Multiplex and demultiplex C-band signals in even channels.

- NCS1K-MD32O-C modules: Multiplex and demultiplex C-band signals in odd channels.

- NCS1K-BRK-24 modules: 24-degree MPO breakout modules for express interconnection.

- QDD-400G-ZR-S transceiver: QSFP-DD transceiver module, coherent DCO, 400G-ZR for transmiting 400G payload at 16QAM modulation

- MPO/MPO cables: Used for fiber-optic connectivity between NCS 1010 devices and BRK-24 modules.

- LC/LC cables: Used for fiber-optic connectivity between BRK-24 and mux/demux modules.

This image shows the point-to-point topology.

Figure 46: Point-to-point topology
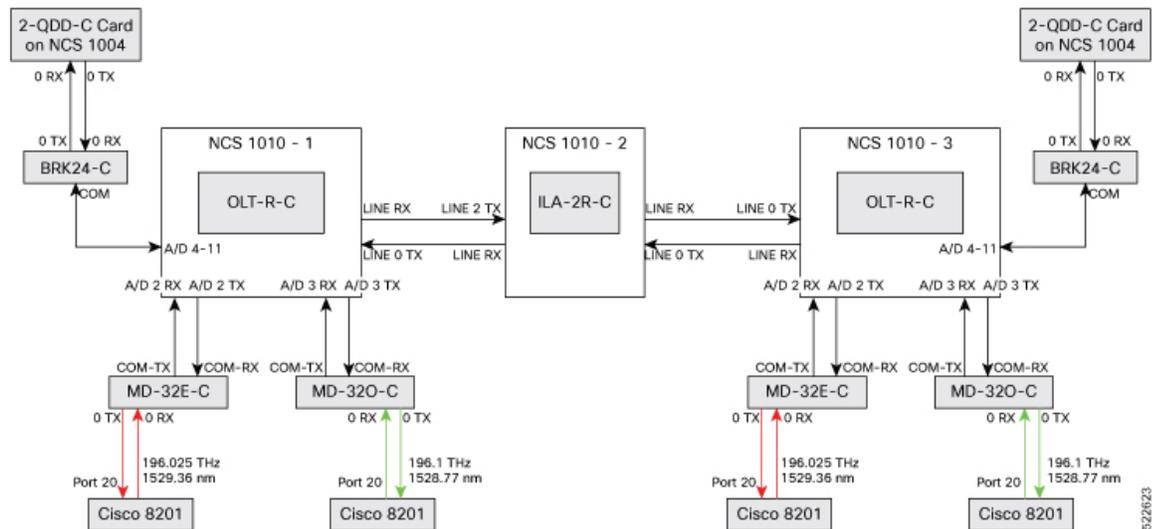
Omnidirectional topologies

An omnidirectional topology is a network architecture that

- enables each optical channel to be dynamically routed through any available degree of a multidegree node,

- allows channel rerouting after fiber cuts without requiring physical fiber reconnections, and

- supports flexible and scalable add/drop configurations for redundancy or increased capacity.

Omnidirectional topologies are often implemented in optical networks using open-line terminal (OLT) hardware and compatible passive modules. They are supported over C+L bands and can scale beyond four network degrees. Dual omnidirectional add/drop configurations provide increased reliability and add/drop bandwidth.

NCS2K-MF-4x4-COFS based colorless omnidirectional topologies

A colorless omnidirectional topology is an optical network configuration that

- uses colorless modules to add or drop channels without wavelength constraints,

- aggregates and routes channels from multiple degrees using compatible passive hardware assemblies, and

- enables retuning of channel frequencies or wavelengths from connected transponders or muxponders without physical cabling changes.

Topology Components

To build this topology, you need the following hardware:

- NCS 1010 OLT devices

- NCS2K-MF-4x4-COFS modules

- NCS2K-MF-MPO-8LC modules

- NCS1K-BRK-8 modules

Specific cable configurations for interconnecting the modules:

- The MF-4x4-COFS modules are interconnected using standard MPO 8 or 12 fibers (15454-MPO-MPO-x or ONS-12MPO-MPO-x)

- The MF-4x4-COFS modules and NCS1K-BRK-8 module are interconnected using standard LC-LC fibers.

This image shows the COFS-based colorless omnidirectional topology

Figure 47: MF-4x4-COFS based colorless omnidirectional topology
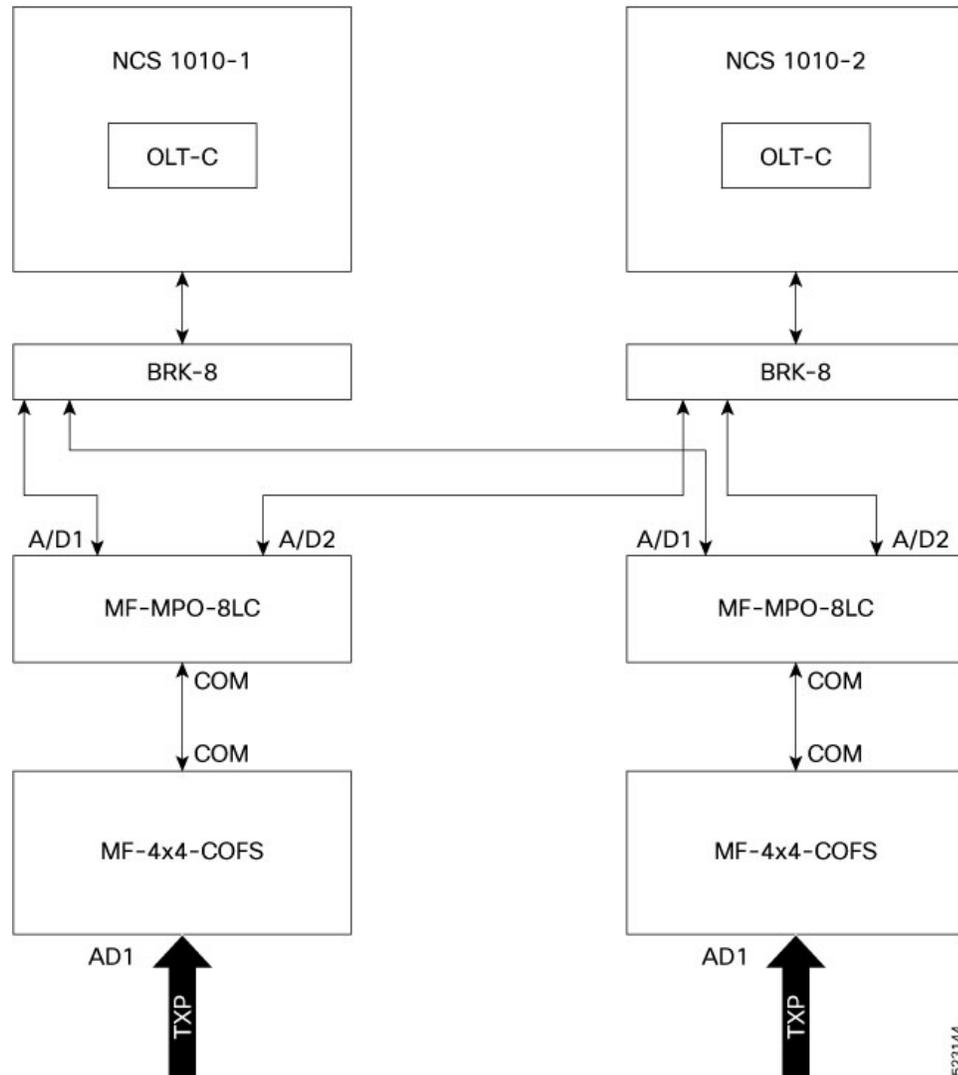
Limitations

- This configuration is supported only for C-band ROADM.

- This configuration is scalable only up to a maximum of 4 degrees. More OSNR penalty is induced by the MF-4x4-COFS as you add more degrees.

- One MF-4x4-COFS module can support up to only four channels. To scale up to 32 channels, you would require 8 MF-4x4-COFS modules.

- The terminal node in this configuration can be connected only to NCS 1004 line cards, line cards with CFP2-400G-DCO as a trunk interface, and DP04QSDD pluggable.

OLT-based omnidirectional add/drop topologies

OLT-based omnidirectional add/drop topologies are optical network designs that

- implement omnidirectional routing by interconnecting OLT devices such as OLT-C and OLT-L back-to-back,

- enable multiple add/drop stages within a single ROADM site, improving flexibility and scalability, and

- support integration with a variety of transponders and trunk interfaces without major restrictions.

Topology components

To build this topology, you need the following hardware:

- NCS 1010 OLT-C devices

- NCS 1010 OLT-L devices

- NCS1K-BRK-24 modules

- NCS1K-BRK-8 modules

- NCS1K-MD32-C modules

Specific configurations and applications that are required for this configuration:

- The interconnection between the terminal OLT-C, where the traffic is terminated and the omnidirectional degree is managed as a 0dB span.

- OSC-C and OSC-L controllers can be used with unnumbered IP on OSC interfaces of the omni span.

- Link tuner and Gain estimator must be disabled on the Omni span.

- APC must be enabled on Omni span.

- ASE loading is enabled (both static and dynamic).

- Specific configuration for optical applications such as span length and fiber type are not required.

- To have the Preamplifier of OLT-C working in proper condition (minimum gain 12dB), the Line-Tx PSD must be set to −12.9 dBm/12.5 GHz (considering 80% CH_SD).

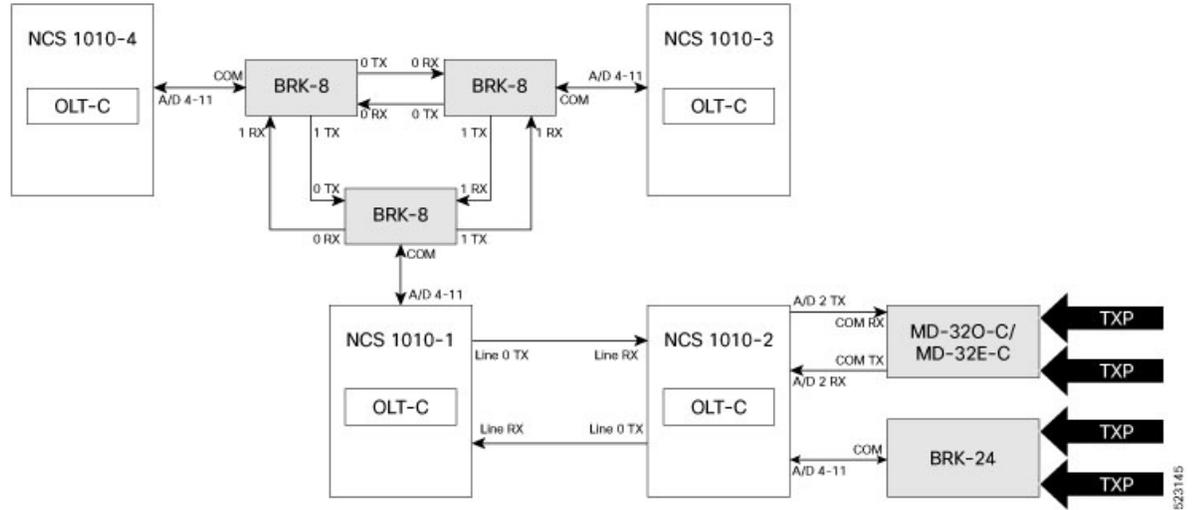Figure 48: Omnidirectional configuration with OLTs

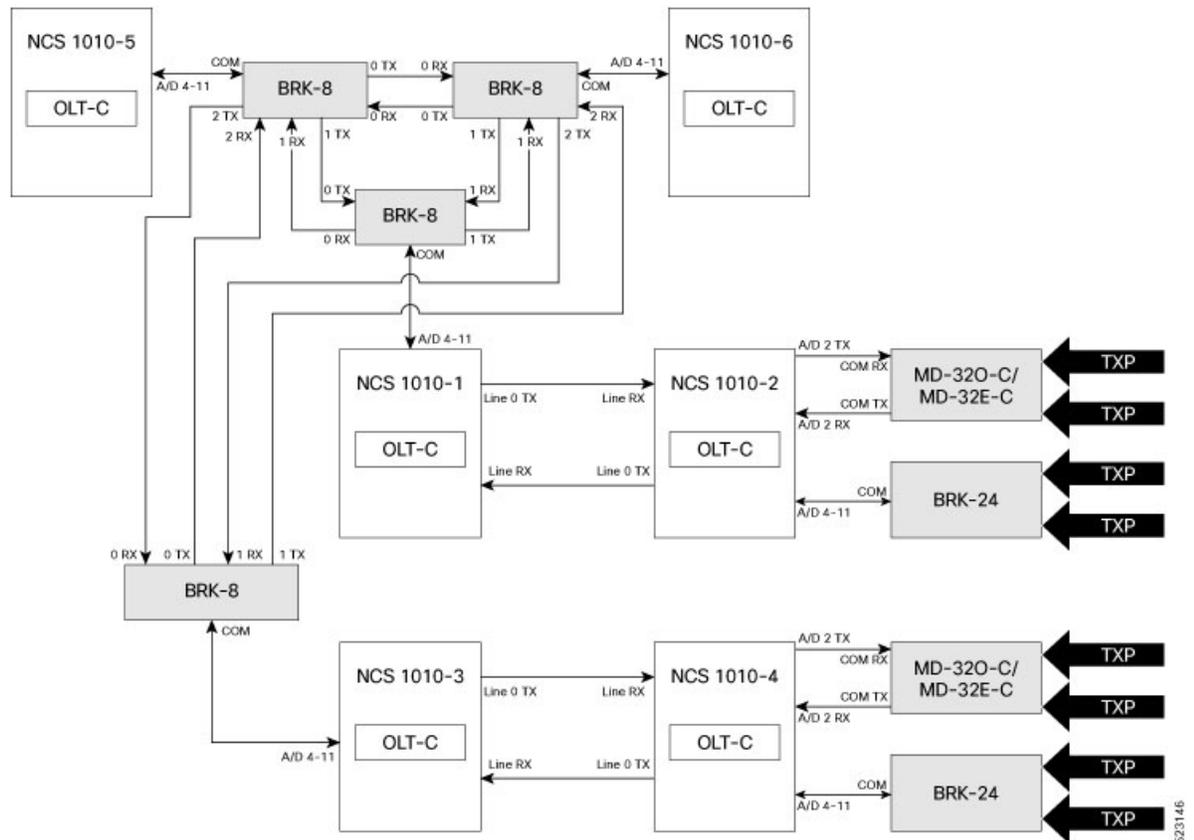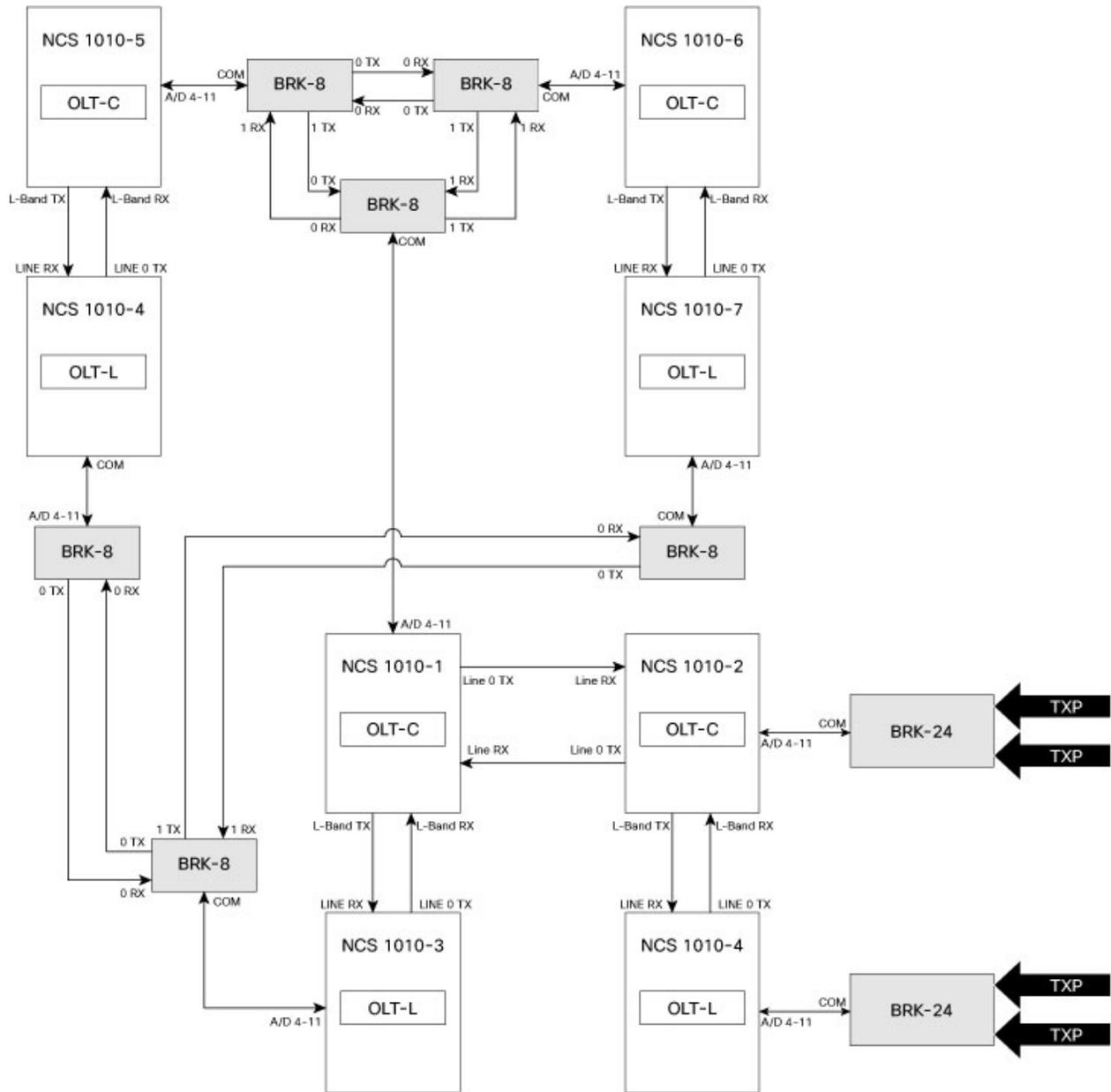Figure 49: Dual omnidirectional configuration

Figure 50: C+L omnidirectional configuration

Limitations

- Link tuner and gain estimator features must be disabled on Omni spans.

- Proper functioning of terminal OLT-C preamplifiers requires precise power spectral density (PSD) settings.

- Optical supervisory channel controllers (OSC-C and OSC-L) can be used with unnumbered IP addressing.

Configuring SNMP

Table 77: Feature History

Feature Name	Release	Description
SNMP MIB support is enabled in NCS 1010	Cisco IOS XR Release 7.9.1	The standard optical Simple Network Management Protocol (SNMP) Management Information Bases (MIBs) with Object Identifiers (OIDs) are now supported on the NCS 1010 platform. Also, from R7.9.1 release onwards specific support is enabled for the OTS SNMP MIB. See Cisco SNMP MIBs for details.
SNMP OLC MIB Support	Cisco IOS XR Release 7.10.1	NCS 1010 platform now supports a new Optical Line Control (OLC) MIB called CISCO-OPTICAL-OLC-MIB which is used for OLC based applications. See Cisco SNMP MIBs for more details.

The following MIBs are supported in NCS 1010.

SNMP MIB Name	OID
CISCO-FLASH-MIB	1.3.6.1.4.1.9.9.10
CISCO-ENHANCED-MEMPOOL-MIB	1.3.6.1.4.1.9.9.221
ENTITY-MIB	1.3.6.1.2.1.47
CISCO-ENTITY-FRU-CONTROL-MIB	1.3.6.1.4.1.9.9.117
CISCO-ENTITY-SENSOR-MIB	1.3.6.1.4.1.9.9.91
CISCO-IF-EXTENSION-MIB	1.3.6.1.4.1.9.9.27

SNMP MIB Name	OID
CISCO-ENTITY-ASSET-MIB	1.3.6.1.4.1.9.9.92
CISCO-PROCESS-MIB	1.3.6.1.4.1.9.9.109
CISCO-CONFIG-MAN-MIB	1.3.6.1.4.1.9.9.43
CISCO-ENTITY-REDUNDANCY-MIB	1.3.6.1.4.1.9.9.498
CISCO-SYSTEM-MIB	1.3.6.1.4.1.9.9.131
CISCO-SYSLOG-MIB	1.3.6.1.4.1.9.9.41
RMON-MIB	1.3.6.1.2.1.16.0
CISCO-ALARM-MIB	1.3.6.1.4.1.9.9.869
EVENT-MIB	1.3.6.1.2.1.88
DISMAN-EXPRESSION-MIB	1.3.6.1.2.1.90
CISCO-FTP-CLIENT-MIB	1.3.6.1.4.1.9.9.80
NOTIFICATION-LOG-MIB	1.3.6.1.2.1.92
CISCO-RF-MIB	1.3.6.1.4.1.9.9.176
UDP-MIB	1.3.6.1.2.1.7
CISCO-OPTICAL-MIB	1.3.6.1.4.1.9.9.828.0.1
CISCO-OPTICAL-OTS-MIB	1.3.6.1.4.1.9.9.834
CISCO-OPTICAL-OLC-MIB	1.3.6.1.4.1.9.9.1057

Note

- From R7.9.1 release onwards specific support is enabled for the OTS SNMP MIB.

- Each managed object is assigned an object identifier (OID).

- The OID is specified in a MIB file.

- An OID is represented as a sequence of integers separated by decimal points or by a text string.

  For example: *1.3.6.1.2.1.4.6*

For more information regarding SNMP MIBs refer to cfnng.cisco.com.

NCS 1010 SNMP OTS MIB Support

SNMP MIBS in the NCS 1010 platform support many controllers and parameters of different operational types which help in interacting with the rest of the system.

SNMP Traps

An SNMP trap refers to a type of SNMP Protocol Data Unit (PDU). An agent is able to send an unrequested message to the manager to notify about any important event with an SNMP trap, unlike other PDU types.

- Traps can be sent on SNMP version-2 (V2) or version-3 (V3) authentication.

- In version-2 (V2C) of SNMP, community public and UDP port are defined by default as 162.

- In version-3 (V3), user, group authentication methods like md5 and des56 are used and the UDP port needs to be mentioned.

Configuration on nodes is listed below.

- **Configuration of traps server as receiver**: A trap server listens only to both the protocols SNMP V3 and SNMP V2. For V3 traps, server IP, userid and UDP port are needed as in the example given below.

    - snmp-server host 10.65.41.209 traps version 3 priv nocUser1 udp-port 163

    For V2 traps, server IP, protocol 2c , community public and UDP ports are needed, as in the the example given below.

    - snmp-server host 64.104.134.47 traps version 2c public udp-port 12217

- **Configuration of user for SNMP V3 authentication**: Configure username with ID like nocUser1 and groups like nocGroup1 etc, followed by the authentication methods like md5 and privileged protocols like des56 followed by user and owner types as in the example given below.

    - snmp-server user nocUser1 nocGroup1 v3 auth md5 encrypted 0505090C145F4B1B48 priv des56 encrypted 082F434D3C0A000543 SystemOwner

- **Configuration for SNMP V3 View**: View includes the MIB starting point like given in the example below.

    - snmp-server view nocView1 1.3 included

- **Configuration for Community String**: Community string is public with read, write permission and system owner privileges like given in the example below.

    - snmp-server community public RW SystemOwner

- **Configuration for SNMP V3 Group**: Defines the group as name nocGroup1 with V3 protocol and privileges, notify view and view name as nocView1 and includes read and write operations similarly. The example is as given below.

    - snmp-server group nocGroup1 v3 priv notify nocView1 read nocView1 write nocView1

- **Configuration for Traps Requireing Customers Check**: Syslog as traps is enabled as given below.

    - snmp-server traps syslog

- **Configuration for Inventory**: For insert and remove and other control operations as given in the example below.

    - snmp-server traps fru-ctrl

- **Configuration for Traps**: For config change request use as the example given below.

- snmp-server traps config

- **Configuration for Entity Related Update**: Use as given in the example below.

  - snmp-server traps entity

- **Configuration for System Up/Down Related Traps**: Use as per the example given below.

  - snmp-server traps system

- **Configuration for Preserving the Ifindex Over Reload**: Use as per the example given below.

  - snmp-server ifindex persist

A few examples of SNMP traps are added below.

```
Received SNMPv2c Trap:
Community: public
From: 10.127.60.241
sysUpTimeInstance = 00:07:05.93
snmpTrapOID.0 = cefcFanTrayStatusChange
cefcFanTrayOperStatus.4097 = up(2)
entPhysicalDescr.4097 = NCS1010 - Shelf Fan
entPhysicalName.4097 = 0/FT0

Received SNMPv2c Trap:
Community: public
From: 10.127.60.241
sysUpTimeInstance = 00:07:05.86
snmpTrapOID.0 = clogMessageGenerated
clogHistFacility.1 = MGBL-exec
clogHistSeverity.1 = error(4)
clogHistMsgName.1 = LOGIN_AUTHEN
clogHistMsgText.1 = Login Authentication failed. Exiting...
clogHistTimestamp.1 = 00:50:36.81
Received
```

Note   From R7.9.1 release onwards the SNMP trap snmp-server traps alarm is available for use.

NCS 1010 SNMP OLS MIB Support

From R7.10.1 onwards, SNMP support is enabled on the NCS 1010 platform for OLS. This Optical Line Control (OLC) MIB is introduced to support all OLC based applications in NCS 1010 and is as given below.

CISCO-OPTICAL-OLC-MIB with OID value of 1.3.6.1.4.1.9.9.1057.

Supporting Controllers of SNMP MIBs in NCS 1010

The following controllers support the various operational parameters of the NCS 1010 SNMP MIBs.

Table 78: Supporting Controllers of SNMP MIBs in NCS 1010

SNMP MIB	Controllers
CISCO-OPTICAL-OTS-MIB	• OTS • OTS-OCH • OMS • OCH • DFB • OSC

NCS 1010 SNMP MIB Controller Parameters

The controller specific parameters for NCS 1010 controllers are given below.

Table 79: NCS 1010 SNMP MIB Controller Parameters

SNMP MIB	Controller Parameters
CISCO-OPTICAL-OTS-MIB	• RxSpanLoss
	• TxSpanLoss
	• TxSignalPower
	• RxSignalPower
	• TxVoaAttenuation
	• ControllerState
	• TransportAdminState
	• TotalTxPower
	• TotalRxPower
	• IngressAmpliGain
	• IngressAmpliTilt
	• IngressAmpliGainRange
	• EgressAmpliGain
	• EgressAmpliTilt
	• EgressAmpliGainRange
	• IngressAmpliOsri
	• EgressAmpliOsri
	• IngressAmpliSafetyControlMode
	• EgressAmpliSafetyControlMode
	• TotalLCTxPower
	• TotalLCRxPower
	• IngressAmpliForceApr
	• EgressAmpliForceApr
	• BrPower
	• LedState
	• SpectrumInfo
	• OtsControllerPortType
	• LineTxBrRatio

NCS 1010 SNMP MIB Performance Monitoring Parameters

The NCS 1010 SNMP MIB performance monitoring parameters are given below.

Table 80: NCS 1010 SNMP MIB Performance Monitoring Parameters

SNMP MIB	Performance Monitoring Parameters
CISCO-OPTICAL-OTS-MIB	• Tx Power(min, max, avg) • Rx Power(min, max, avg) • Ingress Ampli Gain(min, max, avg) • Ingress Ampli Tilt(min, max, avg) • Egress Ampli Gain(min, max, avg) • Egress Ampli Tilt(min, max, avg) • Tx Power(C+L)(min, max, avg) • Rx Power(C+L)(min, max, avg) • Tx Power[S](min, max, avg) • Rx Power[S](min, max, avg) • Opbr (min, max, avg)

NCS 1010 SNMP MIB Raman Parameters

The NCS 1010 OTS raman parameters are given below.

Table 81: NCS 1010 SNMP MIB Raman Parameters

SNMP MIB	Raman Parameters
CISCO-OPTICAL-OTS-MIB	• Raman-1 Power • Raman-1 Wavelength • Raman-2 Power • Raman-2 Wavelength • Raman-3 Power • Raman-3 Wavelength • Raman-4 Power • Raman-4 Wavelength • Raman-5 Power • Raman-5 Wavelength • Raman Osri • Raman Safety Control Mode • Raman Force Apr • Raman Br Power • Composite Raman Power • Raman Br Ratio

NCS 1010 SNMP MIB Supported Operations

NCS 1010 SNMP MIB Supported Operations are given below.

Table 82: NCS 1010 SNMP MIB Supported Operations

SNMP MIB	SNMP Operation
CISCO-OPTICAL-OTS-MIB	• snmpwalk • Get Exact • Get One • Get Many
CISCO-OPTICAL-OLC-MIB	• snmpwalk • Get One • Get Many • Get Next

Note
- Both version-2 (V2) and version-3 (V3) SNMP operations are supported in NCS 1010.
- The transmit VOA attenuation value is measured in 1/100 dB and 1/10 dB on line systems devices in NCS 1010.

NCS 1010 SNMP MIB Application Parameters

The NCS 1010 SNMP MIB application parameters are given below.

Table 83: NCS 1010 SNMP MIB Application Parameters

SNMP MIB	Application Parameters
CISCO-OPTICAL-OLC-MIB	

SNMP MIB	Application Parameters
	• RxSpanLoss
	• ApparentRxSpanLoss
	• RxSpanLossPumpsOff
	• RxSpanLossPumpsOffTimeStamp
	• EstimatedRxSpanLoss
	• TxSpanLoss
	• ApparentTxSpanLoss
	• TxSpanLossPumpsOff
	• TxSpanLossPumpsOffTimeStamp
	• EstimatedTxSpanLoss
	• RamanTuningStatus
	•
	• RamanTuningBlockedReason
	• RamanTuningFailedReason
	• TuningCompleteTimeStamp
	• EstimatedMaxPossibleGain
	• RamanGainTarget
	• GainAchievedOnTuningComplete
	• EgressGainEstStatus
	• EgressEstimatedGain
	• EgressEstimatedGainMode
	• EgressGainEstTimeStamp
	• IngressGainEstStatus
	• IngressEstimatedGain
	• IngressEstimatedGainMode
	• IngressGainEstTimeStamp
	• ApcDomainManager
	• ApcDomainManagerState
	• ApcInternalState
	• ApcPsdMin
	• ApcGainRange

SNMP MIB	Application Parameters
	• ApcLastCorrectionTimeStamp
	• NbrIpAddr
	• NbrInterface
	• PartnerIpAddr
	• PartnerInterface
	• PathLoss
	• PatchcordLos
	• LossMeasurementTimeStamp
	• NodeRID
	• BandStatus
	• BandPSD