



Cisco NCS 1010 Optical Applications Configuration Guide, IOS XR Releases 25.x.x

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Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883



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CHAPTER 1

NCS 1010 Overview and Optical Applications

This chapter gives a brief overview of the optical applications on NCS 1010. See [NCS 1010 Overview](#) for the product overview.

NCS 1010 software has multiple optical applications to help bring up the link and maintain traffic on the link.

- [Document objective, on page 1](#)
- [Document organization, on page 1](#)

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

This document is organized into these chapters.

Chapter	Description
Internode Topology Discovery and Communication, on page 3	The NCS 1010 platform enables topology discovery by using OSPF.
Span Loss, on page 7	The span loss application measures span loss between two nodes for a given direction. It also verifies whether the span loss is within the configured range.
Raman Tuning, on page 13	The Raman tuning application sets Raman pump powers for optimum gain and spectral gain flatness.

Chapter	Description
Gain Estimator, on page 25	The gain estimator application computes the power transmitted from the upstream node. It analyzes incoming span loss, adjusts the gain mode of the EDFA amplifier, and provides the initial target gain.
Link Tuner, on page 29	The link tuner application uses actual optical measurements such as span loss to compute and configure the target power spectral density (PSD) for each span.
Automatic Power Control, on page 35	The Automatic Power Control (APC) configures amplifier and attenuator set points to achieve target PSD across the link.
Upgrade C-Band to C+L Band Without Affecting Traffic Flow, on page 57	Upgrade from C-band to the C+L band network to avoid affecting network traffic flow.
Automatic Network Turn Up, on page 63	All the optical applications work together to bring up the DWDM link. This chapter describes the process of bringing up the link, and how these applications operate together.
Configure OTDR , on page 69	The Optical Time Domain Reflectometer (OTDR) application scans and determines loss in signal power and identifies where the loss occurs on the fiber path.



CHAPTER 2

Internode Topology Discovery and Communication

This chapter describes how internode topology discovery and communication between NCS 1010 nodes takes place using Open Shortest Path First (OSPF).

- [Internode topology discovery and communication, on page 3](#)

Internode topology discovery and communication

Optical applications on the NCS 1010 and NCS 1020 nodes must discover the OLT-OLT link topology. Span-level applications must discover the adjacent nodes. Link-level applications must learn the complete OLT-OLT link topology. NCS 1010 and NCS 1020 use OSPF to discover and communicate link topology information.

The networking devices running OSPF detect topological changes in the network, flood link-state updates to neighbors, and quickly converge on a new view of the topology. Each OSPF router in the network quickly updates its topological view to match the network.

Optical applications on NCS 1010 and NCS 1020 must discover the link topology. They also need to identify the nodes, node types, and the optical spectral band on which the nodes operate. NCS 1010 and NCS 1020 use an enhanced version of OSPF. This version supports a new link-state advertisement attribute that advertises the node type and spectral band.

Configure OSPF

Use this task to include NCS 1010 and NCS 1020 in OSPF enabled networks.



Important You must configure the router ID during OSPF configuration on NCS 1010 nodes.

See [Implementing OSPF](#) for description of the concepts and tasks necessary to implement OSPF on Cisco IOS XR.

Procedure

Step 1 Use these commands to configure OSPF on an NCS 1010 OLT node.

Example:

```
configure
router ospf process-name
router-id router-id
distribute link-state
nsf
network point-to-point
redistribute connected
area area-id
interface Loopback1
interface GigabitEthernet0/0/0/0
```

Step 2 Use these commands to configure OSPF on an NCS 1010 ILA node.

Example:

```
configure
router ospf process-name
router-id router-id
distribute link-state
nsf
network point-to-point
redistribute connected
area area-id
interface Loopback1
interface GigabitEthernet0/0/0/0
interface GigabitEthernet0/0/0/2
```

Step 3 Use these commands to configure OSPF on an NCS 1020 OLT node.

Example:

```
configure
router ospf process-name
router-id router-id
distribute link-state
network point-to-point
area area-id
interface Loopback0
interface GigabitEthernet0/0/0/0
```

Step 4 Use these commands to configure OSPF on an NCS 1020 ILA node.

Example:

```
configure
router ospf process-name
router-id router-id
distribute link-state
network point-to-point
area area-id
interface Loopback0
```

```
interface GigabitEthernet0/0/0/0
interface GigabitEthernet0/0/0/2
```

NCS 1010 and NCS 1020 nodes will participate in OSPF routing, which enables inter-node topology discovery and communication.

Configure OSPF cost

Use this task to identify the best route when there are two equal-cost routes to the same destination.

Table 1: Feature History

Feature Name	Release Information	Description
Configure OSPF cost	Cisco IOS XR Release 7.11.1	To identify the best route, OSPF path computation uses the link cost. The system calculates the cost based on the available interface bandwidth. From this release onwards, you can set a user-defined cost value using the costvariable in the router ospf command. As a result, this feature enables you to set a specific route when there are two equal-cost routes to the same destination.

Cost is the metric used by OSPF. You can use the **cost** command to explicitly specify the network interface for OSPF path calculation.



Note The cost of the link is inversely proportional to the bandwidth of the link.

Procedure

Use these commands to configure OSPF cost.

Example:

```
configure
router ospf process-name
router-id router-id
area area-id
interface Loopback1
interface GigabitEthernet0/0/0/0
cost cost
```

See [cost \(OSPF\)](#) for different command modes and usage guidelines to implement **cost** OSPF on Cisco IOS XR software.

The interface cost used by OSPF for path calculation is explicitly specified.



CHAPTER 3

Span Loss

This chapter describes the span loss optical application for Cisco NCS 1010.

- [Span loss calculations, on page 7](#)

Span loss calculations

A span loss calculation is an optical network measurement that

- determines the signal power loss between two nodes in an optical transmission network,
- compares the power measurements at transmitter (Tx) and receiver (Rx) ports at the near and far ends of a fiber span, and
- automatically raises the *Span Loss Value Out Of Range* alarm when the calculated loss does not fall within configured thresholds.

On a Raman span with Raman tuning enabled, span loss verification reports these values:

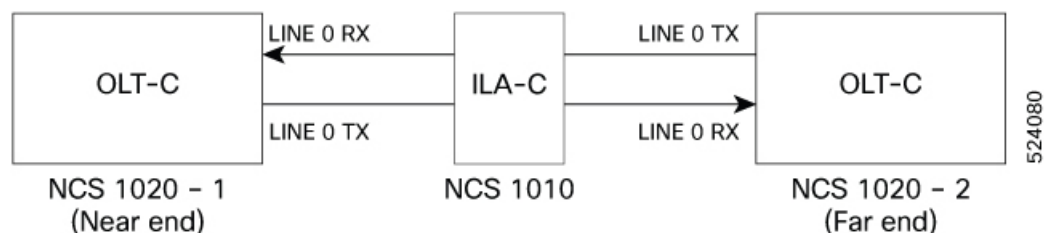
- **Span loss with pumps off:** This measurement is the difference in power values between the DFB-Tx/Rx of the remote node and the DFB-Rx/Tx of the local node. This measurement also includes a timestamp. When a Raman span is up, the span loss application latches on to the difference in power between DFB-Tx and DFB-Rx before Raman tuning turns the Raman pumps on.
- **Apparent span loss:** This measurement is based on the power values of C band, L band and Optical Service Channel (OSC). For a Raman span, the span loss application uses this span loss value to raise the *Span Loss Value Out Of Range* alarm.
- **Estimated span loss:** This value is based on Raman gain that is achieved by Raman tuning application. Estimated span loss value is based on Raman gain that is achieved when safety loop was closed and tuning was performed. Raman tuning application reports the Raman gain measurement. When you disable Raman tuning, the span loss application does not compute the Estimated span loss.

Estimated span loss = Apparent span loss + Raman gain

- **OSC span loss:** This measurement is the difference in OSC power values between the Tx/Rx of the remote node and the Rx/Tx of the local node.
- **Signal span loss:** This measurement is the difference in the received C band signal power values between the Tx/Rx of the remote node and the Rx/Tx of the local node.

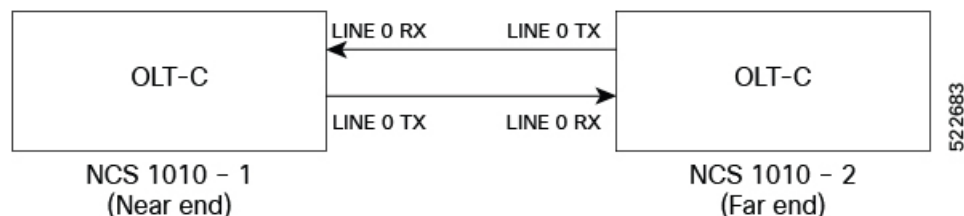
Span loss calculations are performed automatically between nodes to continuously monitor the condition of the optical span. The span loss application reports the span loss value for a span every 90 seconds. If span loss changes, for example when a change in fiber loss occurs, the span loss application typically takes 90 seconds to update the span loss.

Figure 1: Sample two node topology of NCS 1020 nodes



For example, in the previous figure, the **Tx Span Loss** on NCS 1020-1 is the difference in signal power between LINE 0 Tx on NCS 1020-1 and LINE 0 Rx on NCS 1010.

Figure 2: Sample two node topology of NCS 1010 nodes



For example, in the previous figure, the **Tx Span Loss** on NCS 1010-1 is the difference in signal power between LINE 0 TX on NCS 1010-1 and LINE 0 RX on NCS 1010-2.

View span loss values

Use this task to display span loss measurements between two nodes. This task helps verify optical signal integrity and diagnose network issues.



Note Rx span loss values are not available on a network where one NCS 1010 node is upgraded to R25.3.1 while other nodes are on an earlier software version.

From Release 24.1.1, span loss measurements include OSC span loss and Signal span loss.

Procedure

Use the **show olc span-loss** command to view the Tx span loss and Rx span loss.

Example:

This sample shows the Tx span loss and Rx span loss on a Raman span with Raman tuning enabled.

This sample is applicable for NCS 1010 node until Release 7.11.1.

```
RP/0/RP0/CPU0:ios#show olc span-loss
Mon Jun 20 04:21:34.543 IST
controller name           : Ots0/0/0/0
Neighbour RID             : 10.1.1.2
Apparent Rx Span Loss     : 7.7 dB
Rx Span Loss (with pumps off) : 23.2 dB
Rx Span Loss (with pumps off) measured at : 2022-04-11 07:42:26
Estimated Rx Span Loss    : 23.5 dB
Apparent Tx Span Loss     : 17.5 dB
Tx Span Loss (with pumps off) : 33.3 dB
Tx Span Loss (with pumps off) measured at : 2022-04-11 07:42:56
Estimated Tx Span Loss    : 33.5 dB
```

This is a sample output that includes OSC span loss and Signal span loss measurements.

```
RP/0/RP0/CPU0:ios#show olc span-loss
Sat Nov 2 00:38:53.498 IST

Controller                : Ots0/0/0/0
Neighbour RID             : 25.1.1.4
Apparent Rx Span Loss     : 6.88 dB
Apparent Rx OSC Span Loss : 12.65 dB
Apparent Rx Signal Span Loss : 6.82 dB
Rx Span Loss (with pumps off) : 18.80 dB
Rx Span Loss (with pumps off) measured at : 2024-10-29 20:19:28
Estimated Rx Span Loss    : 20.08 dB
Apparent Tx Span Loss     : 8.84 dB
Apparent Tx OSC Span Loss : 15.20 dB
Apparent Tx Signal Span Loss : 8.78 dB
Tx Span Loss (with pumps off) : 23.50 dB
Tx Span Loss (with pumps off) measured at : 2024-10-29 20:19:36
Estimated Tx Span Loss    : 24.74 dB
```

This sample shows the output of the **show olc span-loss** command on a Raman span with Raman tuning disabled. In this sample output, Raman tuning is disabled on both Ots0/0/0/0 and Ots0/0/0/2 on the near end node. The far end nodes have Raman tuning enabled.

This sample is applicable for NCS 1010 node until Release 7.11.1.

```
RP/0/RP0/CPU0:ios#show olc span-loss
Mon Jun 20 06:51:58.601 UTC

Controller name           : Ots0/0/0/0
Neighbour RID             : 10.1.1.5
Apparent Rx Span Loss     : 16.3 dB
Rx Span Loss (with pumps off) : 16.4 dB
Rx Span Loss (with pumps off) measured at : 2022-06-20 05:53:52
Estimated Rx Span Loss    : NA
Apparent Tx Span Loss     : 5.8 dB
Tx Span Loss (with pumps off) : 21.6 dB
Tx Span Loss (with pumps off) measured at : 2022-06-20 05:54:08
Estimated Tx Span Loss    : 18.6 dB

Controller name           : Ots0/0/0/2
Neighbour RID             : 10.1.1.3
Apparent Rx Span Loss     : 27.1 dB
Rx Span Loss (with pumps off) : 30.3 dB
Rx Span Loss (with pumps off) measured at : 2022-06-20 06:51:22
Estimated Rx Span Loss    : NA
Apparent Tx Span Loss     : 6.4 dB
Tx Span Loss (with pumps off) : 19.2 dB
Tx Span Loss (with pumps off) measured at : 2022-06-20 05:54:08
Estimated Tx Span Loss    : 19.6 dB
```

This is a sample output that includes OSC span loss and Signal span loss measurements.

```
RP/0/RP0/CPU0:ios#show olc span-loss
Mon Sep  9 17:14:26.149 IST

Controller                               : Ots0/0/0/0
Neighbour RID                           : 24.1.1.2
Apparent Rx Span Loss                   : 23.9 dB
Apparent Rx OSC Span Loss                : 26.8 dB
Apparent Rx Signal Span Loss            : 23.9 dB
Rx Span Loss (with pumps off)           : 23.8 dB
Rx Span Loss (with pumps off) measured at : 2024-09-06 19:01:50
Estimated Rx Span Loss                  : NA
Apparent Tx Span Loss                   : 24.7 dB
Apparent Tx OSC Span Loss                : 27.9 dB
Apparent Tx Signal Span Loss            : 24.7 dB
Tx Span Loss (with pumps off)           : 24.4 dB
Tx Span Loss (with pumps off) measured at : 2024-09-06 15:57:12
Estimated Tx Span Loss                  : NA
```

This sample shows the output of the **show olc span-loss** command on a non-Raman span.

This sample is applicable for NCS 1010 node until Release 7.11.1.

```
RP/0/RP0/CPU0:ios#show olc span-loss
Mon Apr 11 09:37:31.950 UTC

Controller name                         : Ots0/0/0/0
Neighbour RID                           : 10.91.1.90
Rx Span Loss                           : 10.2 dB
Rx Span Loss (with pumps off)           : NA
Rx Span Loss (with pumps off) measured at : NA
Estimated Rx Span Loss                  : NA
Tx Span Loss                           : 9.7 dB
Tx Span Loss (with pumps off)           : NA
Tx Span Loss (with pumps off) measured at : NA
Estimated Tx Span Loss                  : NA
```

This is a sample output that includes OSC span loss and Signal span loss measurements.

```
RP/0/RP0/CPU0:ios#show olc span-loss
Tue Nov  5 11:09:06.736 IST

Controller                               : Ots0/0/0/0
Neighbour RID                           : 24.1.1.3
Rx Span Loss                           : 4.56 dB
Rx OSC Span Loss                        : 4.50 dB
Rx Signal Span Loss                    : 4.57 dB
Rx Span Loss (with pumps off)           : NA
Estimated Rx Span Loss                  : NA
Tx Span Loss                           : 6.13 dB
Tx OSC Span Loss                       : 6.54 dB
Tx Signal Span Loss                    : 6.12 dB
Tx Span Loss (with pumps off)           : NA
Estimated Tx Span Loss                  : NA

Controller                               : Ots0/0/0/2
Neighbour RID                           : 24.1.1.5
Rx Span Loss                           : 5.84 dB
Rx OSC Span Loss                        : 6.02 dB
Rx Signal Span Loss                    : 5.84 dB
Rx Span Loss (with pumps off)           : NA
Estimated Rx Span Loss                  : NA
Tx Span Loss                           : 5.65 dB
```


Tx OSC Span Loss	: 6.08 dB
Tx Signal Span Loss	: 5.64 dB
Tx Span Loss (with pumps off)	: NA
Estimated Tx Span Loss	: NA

Configure span loss thresholds

Use this task to configure the minimum and maximum span loss threshold values for optical spans between nodes.

Procedure

- Step 1** Enter the optical applications configuration mode and select the controller on which the span loss thresholds must be configured.

Example:

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

- Step 2** Configure the minimum and maximum span loss threshold values for the span.

Example:

```
RP/0/RP0/CPU0:ios(config)#span-loss min 100
RP/0/RP0/CPU0:ios(config)#span-loss max 200
```

This example sets the minimum threshold to 10 dB and maximum threshold to 20 dB.

The system raises a *SPAN-LOSS-OUT-OF-RANGE* alarm if span loss is greater than the maximum threshold or less than the minimum threshold.

- Step 3** Commit the changes and exit all the configuration modes.

Example:

```
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc)#exit
RP/0/RP0/CPU0:ios(config)#exit
```



CHAPTER 4

Raman Tuning

This chapter describes the Raman tuning optical application for Cisco .

Table 2: Feature History

Feature Name	Release Information	Description
Raman Tuning Manual Mode	Cisco IOS XR Release 7.11.1	You can now configure Raman Tuning in manual mode to not initiate tuning automatically. You can initiate tuning manually. This feature gives you the flexibility to initiate tuning and not have Raman Tuning run every time there is a span-up event in the network.

- [Raman tuning, on page 13](#)
- [Configure Raman Tuning in Automatic or Manual Mode, on page 17](#)
- [Manually configure Raman tuning parameters, on page 18](#)
- [Verify Raman Tuning Configuration, on page 19](#)
- [View Detailed Raman Tuning Status, on page 19](#)
- [View Individual Raman Pump Values, on page 20](#)
- [Raman Tuning and OTDR Lock and OSRI, on page 22](#)

Raman tuning

Raman tuning involves adjusting the power and wavelength of Raman pump lasers to optimize the amplification of optical signals traveling through an optical fiber.

Purpose of Raman tuning

The primary goal of Raman tuning is to achieve the desired Raman Gain over a specific span of optical fiber, ensuring optimal signal performance.

The process of Raman tuning involves specific steps to ensure optimal signal amplification:

- Raman tuning is performed independently in both directions of the span at the node level.

- Communication between peer nodes is required to coordinate the tuning process and achieve the desired gain over the optical fiber span.

Automatic Raman tuning

When Raman tuning is set to automatic mode, the NCS 1010 autonomously initiates the Raman tuning process under specific conditions to ensure optimal signal amplification.

Conditions that trigger automatic Raman tuning

The NCS 1010 performs automatic Raman tuning in these scenarios:

- After an initial link bring-up for the first time.
- After a fiber cut.
- After a device undergoes a power cycle event.
- After a line card undergoes a cold reload.
- During a Distributed Feedback (DFB) shut or unshut event.
- After an OTS controller is shut or unshut on either the near-end or far-end node.
- After the span length configuration is modified.
- After high Back Reflection is cleared and returns to acceptable levels.
- During a span loss check at system startup.

Raman tuning parameters

The Raman tuning algorithm uses Target Raman Gain, Raman Pump Powers, and DFB VOA Attenuation to optimize Raman amplifier performance in optical fiber communication systems.

This table provides an overview of the Raman tuning parameters in signal amplification.

Table 3: Raman Tuning Parameters

Raman Tuning Parameters	Description	Usage
Target Raman Gain (dB)	It is the desired level of amplification the Raman amplifier aims to achieve. This gain is the increase in optical signal power resulting from Raman scattering when the signal passes through the medium with co-propagating or counter-propagating pump lasers.	The desired Raman gain is typically used for compensating for signal losses in the optical fiber, ensuring signal integrity and strength over long distances.

Raman Tuning Parameters	Description	Usage
Raman Pump Powers (mW)	<p>It is the power levels of the Raman pump lasers used in the Raman amplification process.</p> <p>Higher pump power results in a higher gain but also increases the risk of fiber damage.</p>	The power from Raman pumps is used to inject laser at specific wavelengths into the fiber, which then interacts with the signal through the Raman scattering effect to amplify it.
DFB VOA Attenuation (dB)	<p>It is the attenuation settings of the Variable Optical Attenuator (VOA) used with Distributed Feedback (DFB) lasers.</p> <p>DFB lasers provide high-precision, stable-wavelength light emission, commonly used in telecommunications.</p>	<p>DFB VOA attenuation is used to fine-tune the signal power levels to ensure the amplified signal meets the target gain requirements.</p> <p>Adjusting the attenuation helps balance the pump power and signal power.</p>

Raman tuning modes

Raman tuning in NCS 1010 can be performed through various modes, each offering different levels of control and automation.

The table provides an overview of the modes in which Raman tuning can be configured.

Table 4: Raman tuning modes

Raman tuning modes	Description
Enable (Automatic mode)	<p>In this mode, the system automatically initiates Raman tuning when a link goes down and comes back up. Raman tuning calculates and sets the values of the following parameters automatically:</p> <ul style="list-style-type: none"> • Raman target gain • Raman power • DFB VOA attenuation <p>However, this mode also allows you to manually set the target gain, which triggers Raman tuning to adjust pump powers and DFB VOA attenuation values to achieve the target gain.</p> <p>For more details about the conditions that trigger Raman tuning automatically, see Raman Tuning Initiation Conditions, on page 16.</p>

Raman tuning modes	Description
Disable	<p>In this mode, you must manually set the values Raman tuning parameters. After configuring these values, you must manually initiate Raman tuning.</p> <p>It may be necessary to manually configure these parameters to troubleshoot network issues or fine-tune the system for improved performance.</p>
Manual	<p>In this mode, Raman tuning must be manually initiated when a link goes down and comes back up.</p> <p>Once initiated, the system automatically calculates the desired gain and adjusts both pump powers and DFB VOA attenuation to achieve the specified target gain.</p>

Raman Tuning Initiation Conditions

When Raman tuning is set to automatic mode, the NCS 1010 automatically initiates Raman tuning after:

- an initial link bring up for the first time
- after a fiber cut
- a device undergoes a power cycle event
- a line card undergoes a cold reload
- a Distributed Feedback (DFB) shut or unshut event
- an OTS controller shut or unshut event on either the near-end or far-end node
- a modification in the span length configuration
- a high Back Reflection is cleared and returns to acceptable levels, and
- a span loss check at system start up.

Raman tuning status

The Raman tuning status shows whether the system is measuring, calculating, optimizing, or has completed the tuning. It also indicates any conditions that prevent tuning.

This table describes the various Raman tuning status:

Table 5: Raman tuning status

Raman Tuning Status	Description
WORKING—MEASUREMENT	Raman tuning is measuring the span loss on the link.
WORKING—CALCULATION	Raman tuning is calculating the gain target and required pump powers.

Raman Tuning Status	Description
WORKING—OPTIMIZATION	Raman tuning is optimizing the pump powers.
TUNED	Raman tuning is complete.
BLOCKED	The system cannot perform Raman tuning because the link is down or there is a high Raman Back Reflection.
DISABLED	Raman tuning is disabled.

Configure Raman Tuning in Automatic or Manual Mode

Configuring Raman Tuning in automatic or manual mode allows you to choose how Raman tuning is applied in your network. In automatic mode, the system automatically triggers Raman tuning and adjusts its parameters. In manual mode, you must manually initiate Raman tuning, while the system still automatically adjusts the parameters.

Use this task to configure Raman tuning in automatic or manual mode on a NCS 1010 node.

Procedure

- Step 1** Select the controller on which Raman tuning needs to be enabled after entering into the optical applications configuration mode.

Example:

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

- Step 2** Enable Raman tuning in the automatic or manual mode.

raman-tuning {enable | manual}

- Step 3** Commit the changes and exit the optical applications and configuration modes.

Example:

```
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#exit
RP/0/RP0/CPU0:ios(config-olc-ots)#exit
```

- Step 4** Initiate Raman tuning if it is configured in the *Manual* mode.

Example:

```
RP/0/RP0/CPU0:ios#olc start-raman-tuning controller ots 0/0/0/0
```

When configured in automatic mode, Raman tuning starts automatically. Once Raman tuning is completed successfully, certain actions such as soft reloads, Route Processor (RP) reloads, changes to the Raman OSRI settings, and forced Automatic Power Reduction (APR) changes do not cause the Raman tuning process to be retrIGGERED. This means that the tuning settings are retained through these events.

Manually configure Raman tuning parameters

Manually configuring Raman tuning parameters allows you to troubleshoot network issues or optimize system performance by directly adjusting key settings. To configure Raman tuning parameters manually, disable Raman tuning and then configure the required parameters.

Follow these steps to manually configure Raman tuning parameters on a NCS 1010 node.

Procedure

-
- Step 1** Select the controller on which Raman tuning needs to be enabled after entering into the optical applications configuration mode.
- optical-line-control**
controller ots R/S/I/P
- Step 2** Disable Raman tuning.
- raman-tuning** *disable*
- Step 3** Configure the Raman tuning parameters: Raman gain target, pump powers, and DFB VOA attenuation.
- raman-tuning { raman-gain-target } value**
raman-tx-power pump pump value value
- Step 4** Commit the changes and exit the optical applications and other configuration modes.
- commit**
exit
- Step 5** Initiate Raman tuning if configured in the *manual* mode.
- olc start-raman-tuning controller ots R/S/I/P**
-

Example

```
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#raman-tuning raman-gain-target 180
RP/0/RP0/CPU0:ios(config-olc-ots)#raman-tx-power 1 value 21100
RP/0/RP0/CPU0:ios(config-olc)#controller DFB 0/0/0/0
RP/0/RP0/CPU0:ios(config-Dfb)#tx-voa-attenuation 100
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#exit
RP/0/RP0/CPU0:ios(config-olc-ots)#exit
RP/0/RP0/CPU0:ios#olc start-raman-tuning controller ots 0/0/0/0
```


Verify Raman Tuning Configuration

Use this task to verify the Raman tuning status to check the current state of the Raman tuning process and the values of its parameters.

Procedure

Verify the Raman tuning status.

The entries highlighted in bold show the status of Raman tuning and the Raman tuning parameter values.

Example:

```
/*Verify Raman tuning status if All Controllers*/
RP/0/RP0/CPU0:ios#show olc raman-tuning
Tue Mar 21 06:11:36.944 UTC
Controller : Ots0/0/0/0
Raman-Tuning Status : TUNED
Tuning Complete Timestamp : 2023-03-20 07:54:00
Estimated Max Possible Gain : 19.8 dB
Raman Gain Target : 16.0 dB
Gain Achieved on Tuning Complete : 15.7 dB

/*Verify Raman tuning status on a specific controller*/
RP/0/RP0/CPU0:ios#show olc raman-tuning controller ots 0/0/0/0
Tue Mar 21 06:13:26.535 UTC
Controller : Ots0/0/0/0
Raman-Tuning Status : TUNED
Tuning Complete Timestamp : 2023-03-20 07:54:00
Estimated Max Possible Gain : 19.8 dB
Raman Gain Target : 16.0 dB
Gain Achieved on Tuning Complete : 15.7 dB
```

For more details about the Raman tuning status, see [Raman tuning status, on page 16](#), and for details about Raman tuning parameters, see [Raman tuning parameters, on page 14](#).

View Detailed Raman Tuning Status

Use this task to view the detailed Raman tuning status, such as:

- Last Run Fail Reason
- Last Run Fail Timestamp
- Last Successful Tuning Gain
- Last Successful Tuning Timestamp

Procedure

View the detailed status of Raman tuning.

The entries highlighted in bold show the previous Raman tuning fail reason and timestamps.

Example:

```
/*View Detailed Raman tuning status of all controllers*/
RP/0/RP0/CPU0:ios#show olc raman-tuning details
Tue Mar 21 06:27:13.302 UTC

Controller : Ots0/0/0/0
Raman-Tuning Status : TUNED
Tuning Complete Timestamp : 2023-03-20 07:54:00
Estimated Max Possible Gain : 19.8 dB
Raman Gain Target : 16.0 dB
Gain Achieved on Tuning Complete : 15.7 dB
Last Run Fail Reason : [ Peer node is unreachable ]
Last Run Fail Timestamp : 2023-03-19 12:20:37
Last Successful Tuning Gain : 15.7 dB
Last Successful Tuning Timestamp : 2023-03-20 07:54:00

/*View Raman tuning status of a specific controller*
/RP/0/RP0/CPU0:ios#show olc raman-tuning details controller Ots 0/0/0/0
Tue Mar 21 06:27:58.213 UTC
Controller : Ots0/0/0/0
Raman-Tuning Status : TUNED
Tuning Complete Timestamp : 2023-03-20 07:54:00
Estimated Max Possible Gain : 19.8 dB
Raman Gain Target : 16.0 dB
Gain Achieved on Tuning Complete : 15.7 dB
Last Run Fail Reason : [ Peer node is unreachable ]
Last Run Fail Timestamp : 2023-03-19 12:20:37
Last Successful Tuning Gain : 15.7 dB
Last Successful Tuning Timestamp : 2023-03-20 07:54:00
```

View Individual Raman Pump Values

Use this task to view the individual Raman pump values and other parameter details, including the status of safety lock and OSRI.

Use this task to view the individual Raman pump values and other parameter details:

- Raman parameter status
- Raman pump details
- Raman configured parameters status

Procedure

View the Raman pump values.

The entries highlighted in bold show the status of Raman tuning parameters and the values of Raman pump power.

Example:

```
/*View Raman pump values and other parameter details*/

RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 raman-info
Fri Apr 1 06:40:33.849 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 = 1
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 = 886.60 mW

RAMAN Pump Info:
-----
Instance           Wavelength (nm)   Power (mW)
1                 1424.00           257.60
2                 1438.00           255.10
3                 1457.00           71.60
4                 1470.00           127.50
5                 1495.00           170.10

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

Raman Tuning and OTDR Lock and OSRI

Table 6: Feature History

Feature Name	Release Information	Description
Raman Tuning with OTDR Lock	Cisco IOS XR Release 7.10.1	<p>If the OTDR scan and Raman tuning are performed on the same fiber simultaneously, the OTDR reports unexpected results.</p> <p>In this release, a check is being implemented to prevent both operations from running simultaneously. The Raman tuning application imposes an OTDR lock at both ends of the fiber before the process starts and releases the same after the tuning is completed.</p>

Table 7: Feature History

Feature Name	Release Information	Description
Raman Tuning with OTDR Lock	Cisco IOS XR Release 7.10.1	<p>If the OTDR scan and Raman tuning are performed on the same fiber simultaneously, the OTDR reports unexpected results.</p> <p>In this release, a check is being implemented to prevent both operations from running simultaneously. The Raman tuning application imposes an OTDR lock at both ends of the fiber before the process starts and releases the same after the tuning is completed.</p>
Raman Tuning with OTDR Lock	Cisco IOS XR Release 7.10.1	<p>If the OTDR scan and Raman tuning are performed on the same fiber simultaneously, the OTDR reports unexpected results.</p> <p>In this release, a check is being implemented to prevent both operations from running simultaneously. The Raman tuning application imposes an OTDR lock at both ends of the fiber before the process starts and releases the same after the tuning is completed.</p>

Concurrent Operation of OTDR and Raman Tuning

The OTDR Lock prohibits the concurrent operation of Optical Time-Domain Reflectometer (OTDR) scanning and Raman tuning on a single fiber. This ensures that the Raman pump lasers do not interfere with the OTDR measurements during the tuning process, which could introduce noise and affect the accuracy of the OTDR measurements.

To address this limitation, Raman tuning locks OTDR at both ends of the fiber before the tuning process starts and then releases the lock after the tuning is complete. If Raman tuning is in progress, any request to start an OTDR scan is rejected.

When the OTDR scan is in progress, these conditions apply.

- Any lock requested by Raman tuning is rejected and Raman tuning retries every minute to acquire the OTDR lock.
- The Raman tuning only starts once the OTDR lock is acquired at both ends of the fiber.

For more details about initiating OTDR, see [Configure OTDR](#).

Raman Tuning with OSRI

Raman tuning is a sensitive operation that requires careful handling to avoid disrupting service and to maintain network integrity. Optical Safety Remote Interlock (OSRI) feature is used to safely disable the amplifier on the corresponding node (peer node) during the Raman tuning process. This is done to prevent any accidental exposure to high-power laser light.



Note While Raman tuning is underway and traffic is blocked, only the OSC remains active.

At the transmission end of the span, a dedicated Raman probe laser, typically a distributed feedback (DFB) laser operating at a specific frequency (e.g., 191.1 THz), is combined with the outgoing optical channels. This DFB laser serves as a continuity check to ensure optical safety during the Raman tuning process.

At the receiving end, several wavelengths in the range of 1424 nm to 1495 nm are injected in the direction opposite to the signal propagation. These wavelengths are used to provide Raman amplification for both C-band and L-band optical channels.



CHAPTER 5

Gain Estimator

This chapter describes the gain estimator optical application for Cisco .

- [Gain estimator, on page 25](#)
- [Enable or disable gain estimator, on page 26](#)
- [Start gain estimator, on page 26](#)
- [View gain estimator status, on page 27](#)

Gain estimator

Gain estimator

- analyzes the span loss,
- sets the gain mode of the EDFA amplifier, and
- provides the initial target gain for the amplifier.

Modes of gain estimator

EDFA amplifiers are present in both OLT and ILA line cards of NCS 1010 and NCS 1020. These EDFA amplifiers are variable-gain optical amplifiers that can operate in two gain modes: normal and extended. Extended mode provides higher gain than normal mode. Running the gain estimator can impact traffic.

Parameters used by gain estimator

The gain estimator uses these parameters to estimate the gain necessary on a span:

- Ingress span loss
- Span length
- Transmitter (Tx) connector loss
- Spectrum density
- Fiber type
- Raman gain (only on Raman spans)

The gain estimator uses the estimated gain to set the gain range.

Automatic start of gain estimator

automatically starts gain estimator

- during automatic link bring-up,
- after line card cold reload, and
- after device power cycle.

Enable or disable gain estimator

Use this task to control whether the gain estimator feature on the optical line controller is activated or deactivated.

Procedure

Use the **gain-estimator enable** command to enable the gain estimator.

Example:

```
RP/0/RP0/CPU0:ios#configure terminal
Mon Jun 13 05:35:20.510 UTC
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#gain-estimator enable
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
```

Use the **gain-estimator disable** command to disable the gain estimator.

Start gain estimator

Use this task to analyze the span loss and set the gain mode of the EDFA amplifier. This task provides the initial target gain for the amplifier.

Procedure

Use the **olc start-gain-estimation controller ots *Rack/Slot/Instance/Port*** command to start the gain estimator.

Example:

```
RP/0/RP0/CPU0:ios# olc start-gain-estimation controller ots 0/0/0/0
Thu May 12 09:32:05.414 UTC

Gain Estimation: is running
```


The gain estimation operation runs, then the system calculates the estimated gain and gain mode for the EDFA amplifier on the specified controller.

View gain estimator status

Use this task to view the gain estimation details of the optical line controller.

Procedure

Step 1 Use the **show olc gain-estimator** command to view the gain estimation details.

Example:

```
RP/0/RP0/CPU0:ios#show olc gain-estimator
Thu May 12 09:30:39.987 UTC
Controller                               : Ots0/0/0/0
Egress Gain Estimator Status              : IDLE
Egress Estimated Gain                     : 25.9 dB
Egress Estimated Gain Mode                 : Extended
Egress Gain Estimation Timestamp          : 2022-05-07 09:16:53

Controller                               : Ots0/0/0/2
Egress Gain Estimator Status              : IDLE
Egress Estimated Gain                     : 11.7 dB
Egress Estimated Gain Mode                 : Normal
Egress Gain Estimation Timestamp          : 2022-05-07 10:13:53
```

Step 2 Use the **show olc gain-estimator controller ots Rack/Slot/Instance/Port** command to view the gain estimation details for a specific controller.

Example:

```
RP/0/RP0/CPU0:ios#show olc gain-estimator controller Ots 0/0/0/0
Fri Jun 10 05:47:21.119 UTC
Controller                               : Ots0/0/0/0
Ingress Gain Estimator Status             : IDLE
Ingress Estimated Gain                     : 21.7 dB
Ingress Estimated Gain Mode                 : Normal
Ingress Gain Estimation Timestamp          : 2022-06-10 05:46:48
```

The output displays the gain estimator status, estimated gain, gain mode, and the timestamp of the gain estimation for each controller or for a specific controller.



CHAPTER 6

Link Tuner

This chapter describes the link tuner optical application for Cisco .

- [Link tuner parameters and operational status, on page 29](#)

Link tuner parameters and operational status

This section describes the link tuner, the parameters it uses, and its operational status states.

Link tuner computes the target Power Spectral Densities (PSD) for APC by calculating the optimal PSDs for a span. PSD represents the power for each 12.5 GHz segment of the spectrum. Link tuner is enabled if automatic link bring up is enabled. It is specific to the span and computes the target PSDs for channels entering the span.

Parameters used by link tuner

Link tuner uses these parameters to compute the target PSD:

- Fiber type
- Span loss measurement
- Spectral density
- Connector losses
- Span length, and
- Raman gain (only on Raman spans).

Link tuner status

This table describes the different link tuner status values.

Status	Description
Operational	The link tuner is active and operational.
Blocked	The link tuner is active but unable to com
Disabled	The link tuner is disabled.

Operational considerations

The link tuner application finds the target PSD for the best performance for channels entering a span. You have to manually configure **drop-psd**. The **drop-psd** is the target PSD for OLT drop ports.

Link tuner monitors the span loss and total noise in the link. When the link tuner detects changes in span loss, span length, or connector loss, it recomputes the target PSDs. However, it applies the new target PSDs only if it detects a change of 0.1 dB or more in the total noise value.

Link tuner computes the target PSDs and total noise whenever a link goes down and comes back up. Any action that impacts traffic triggers the link tuner.

Enable or disable link tuner

Use this task to control whether the link tuner application on the optical line controller is activated or deactivated.

Procedure

Use the **link-tuner enable** command to enable the link tuner.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#link-tuner enable
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Use the **link tuner disable** command to disable the link tuner.

Configure link parameters

Use this task to set the necessary parameters for accurate link tuning in the link tuner application.

Use the **fiber-type** command to configure the fiber type. SMF is the default fiber type.

You can configure these fiber types using the **fiber-type** command:

- E-LEAF
- FREE-LIGHT
- METRO-CORE
- SMF
- SMF-28E
- TERA-LIGHT
- TW-RS

- TW-Reach
- TW-minus
- TW-plus
- ULL-SMF28

Use the **link-tuner spectrum-density** command to configure the spectrum density. You can configure a spectrum density as a percentage value from 1 to 100. The default value is 81.

Use the **connector-loss** command to configure the connector loss for both the Tx and Rx ports. The supported range for each port is 0 to 20 dB.

The default connector loss is

- 0.25 dB for ports without Raman module.
- 0.3 dB for ports with Raman module.

Use the **span-length** command to configure the span length. You can specify a value from 0.1 km to 200 km in increments of 0.1 km. If you do not configure the span length, the link tuner calculates the span length based on span loss.

Procedure

Use these commands to configure the link tuner parameters.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#fiber-type SMF
RP/0/RP0/CPU0:ios(config-olc-ots)#link-tuner spectrum-density 80
RP/0/RP0/CPU0:ios(config-olc-ots)#connector-loss rx 1
RP/0/RP0/CPU0:ios(config-olc-ots)#connector-loss tx 1
RP/0/RP0/CPU0:ios(config-olc-ots)#span-length 100
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

When you configure the fiber type, spectrum density, connector losses, and span length, the link tuner calculates the target PSDs for the span. This calculation helps optimize channel performance by selecting the best PSD values based on your settings.

View link tuner information

Use this task to view the link tuner status, PSD computation information, computed total noise, and target PSDs configured for all the setpoints.

Procedure

Step 1 Use the **show olc link-tuner** command to view the link tuner status and PSD computation information.

Example:

```
RP/0/RP0/CPU0:ios#show olc link-tuner
Controller      : Ots0/0/0/0
Link Tuner Status : OPERATIONAL
Last PSD computation: 2022-05-06 10:59:51
```

```
-----
Setpoint      : Computed PSD
                (dBm/12.5 GHz)
-----
```

```
-----s-----
01             -5.7
02             -5.6
03             -5.6
04             -5.5
05             -5.5
06             -5.4
07             -5.4
08             -5.3
09             -5.3
10             -5.2
11             -5.2
12             -5.1
13             -5.1
14             -5.0
15             -5.0
16             -4.9
17             -4.9
18             -4.8
19             -4.8
20             -4.7
21             -4.7
22             -4.6
23             -4.6
24             -4.5
25             -4.4
26             -4.4
27             -4.3
28             -4.3
29             -4.2
30             -4.2
31             -4.1
32             -4.1
33             -4.0
```

Note

When an NCS 1020 network is not fully up and the complete topology is not discovered, the **show olc link tuner** command displays the default PSD value (-4.1dB) because the link tuner is blocked by partial topology discovery. APC uses the configured value to perform power correction. After the topology is fully discovered, the link tuner performs the PSD computation. When all nodes are operational and the topology state updates, APC uses the PSD values computed by the link tuner. The **show olc link tuner** command displays the values computed by the link tuner.

Step 2 Use the **show olc link-tuner detail** command to view the link tuner status, PSD computation information, and computed total noise.

Example:

```
RP/0/RP0/CPU0:ios#show olc link-tuner detail
Controller      : Ots0/0/0/0
Link Tuner Status : OPERATIONAL
Last PSD computation: 2022-05-06 10:59:51
Computed Total Noise: -35.4 dB
```

```
-----
Setpoint        : Computed PSD
                  (dBm/12.5 GHz)
-----
```

```
01      -5.7
02      -5.6
03      -5.6
04      -5.5
05      -5.5
06      -5.4
07      -5.4
08      -5.3
09      -5.3
10      -5.2
11      -5.2
12      -5.1
13      -5.1
14      -5.0
15      -5.0
16      -4.9
17      -4.9
18      -4.8
19      -4.8
20      -4.7
21      -4.7
22      -4.6
23      -4.6
24      -4.5
25      -4.4
26      -4.4
27      -4.3
28      -4.3
29      -4.2
30      -4.2
31      -4.1
32      -4.1
33      -4.0
```

Step 3 Use the **show olc apc-local target-psd-profile** command to view the target PSDs configured for all the setpoints. The output also shows the source of the PSD configuration. The target PSD source can be link tuner or configuration.

```
RP/0/RP0/CPU0:ios#show olc apc-local target-psd-profile
Mon Jun 20 06:40:32.779 UTC
Controller      : Ots0/0/0/0
Target PSD source : Link Tuner
```

```
-----
Setpoint        Frequency          Target PSD
                  (THz)              (dBm/12.5 GHz)
-----
01      191.337494      -6.3
02      191.488495      -6.3
03      191.639496      -6.2
04      191.790497      -6.2
05      191.941498      -6.2
06      192.092499      -6.1
07      192.243500      -6.1
08      192.394501      -6.1
```

09	192.545502	-6.0
10	192.696503	-6.0
11	192.847504	-5.9
12	192.998505	-5.9
13	193.149506	-5.8
14	193.300507	-5.8
15	193.451508	-5.8
16	193.602493	-5.7
17	193.753494	-5.7
18	193.904495	-5.7
19	194.055496	-5.6
20	194.206497	-5.6
21	194.357498	-5.5
22	194.508499	-5.5
23	194.659500	-5.5
24	194.810501	-5.4
25	194.961502	-5.4
26	195.112503	-5.3
27	195.263504	-5.3
28	195.414505	-5.3
29	195.565506	-5.2
30	195.716507	-5.2
31	195.867493	-5.1
32	196.018494	-5.1
33	196.169495	-5.1



CHAPTER 7

Automatic Power Control

This chapter describes the Automatic Power Control (APC) optical application for Cisco NCS 1010.

Table 8: Feature History

Feature Name	Release Information	Feature Description
APC enhancements	Cisco IOS XR Release 7.9.1	APC (Automatic Power Control) on NCS 1010 now supports C+L band networks in addition to C band only networks. Also, APC is enhanced to perform power correction even when it doesn't have end-to-end network visibility. This ensures that the operational section of the network always has power at the target PSD profile, and when the network comes up, the traffic restoration is faster.
Span-mode APC	Cisco IOS XR Release 7.11.1	Span-mode APC is a decentralized approach to APC.Span-mode APC Span-mode APC allows for faster network convergence as power correction is performed independently for each span.

- [Automatic Power Control, on page 36](#)
- [PSD regulation states of APC channels, on page 37](#)
- [Operation of span-mode APC, on page 38](#)
- [APC status and internal states, on page 39](#)
- [View APC status and information, on page 41](#)
- [Configure the target PSDs, on page 48](#)
- [Disable APC, on page 49](#)
- [Configure centralized APC, on page 50](#)
- [Configure target drop PSD and minimum PSD, on page 51](#)
- [View patchcord loss and path loss, on page 52](#)
- [Configure APC alarm hold-off timer and discrepancy threshold, on page 53](#)
- [Configure APC in span mode, on page 54](#)
- [Pause APC in span mode, on page 55](#)
- [Switch between APC modes, on page 55](#)

Automatic Power Control

On a fiber, the power level may vary between channels. Over long distances and with multiple amplifications, these power level differences can reduce the quality of some channels. APC corrects the power level differences and ensures that power for different channels is according to the target power profile for the spectrum. APC compensates for the degradation of the network over time. APC activates if automatic link bringup is enabled.

Automatic Power Control (APC) is a network-level feature that is distributed among different nodes. An APC domain is a set of nodes that is controlled by the same instance of APC at the network level. An APC domain identifies a portion of the network that can be independently regulated. The source OLT node acts as the APC Manager or Domain Manager for all the nodes in the path. The subsequent nodes in the path act as APC agent nodes.

The manager node enables APC on agent nodes, monitors discrepancy, and initiates regulation if correction is required. To avoid large power fluctuations, APC adjusts power levels incrementally. APC performs power correction in steps of plus or minus 0.8 dB. This incremental correction continues until the optimal power level is reached.

Starting with R7.11.1, you can use APC as a span-level application by using span-mode APC.

APC is direction-specific. You can enable APC for each direction at the transmitting OLT node. The source node enables and controls different parameters in all ILA nodes on the path and the far-end OLT ingress EDFA.

Parameters configured by APC

This table lists the parameters that APC configures and controls in different nodes.

Node	Parameters
Transmitting OLT	EDFA Gain EDFA Tilt VOA Attenuation WSS Attenuation
ILA	EDFA Gain EDFA Tilt VOA Attenuation DGE Attenuation
Receiving OLT	EDFA Gain EDFA Tilt WSS Attenuation

When you enable APC, APC controls these parameters. APC overrides any manual configuration. When you disable APC, user configuration is applied.

Functions of APC

APC divides the C band spectrum into 32 equal parts. APC uses 33 frequencies across the C band to perform this division. We call these 33 frequencies, **setpoints**. Each setpoint is 150 GHz apart from the adjacent setpoints. You can configure a power profile across the spectrum using these setpoints. You can configure the target PSD for each OLT and ILA node on a link.

APC applies amplification and attenuation as required at channel level and composite signal level to ensure that the channels are at the target power level. You can configure the target power spectral densities for 33 points across the band. If you enable link tuner, link tuner sets the target PSDs for APC on all nodes in the path.

APC performs these functions:

- Monitors the current PSD against the target PSD for each channel (ASE and user channel) and changes the amplifier parameters including VOA, WSS, and DGE to achieve the target PSD.
- Detects optical network changes on the path and alters the amplifier parameters on the nearest nodes to compensate for the changes. APC performs these alterations in multiple steps.
- Collects measurements from other link nodes at the transmitting OLT to precisely locate optical network changes.

From Cisco IOS XR Release 7.9.1, NCS 1010 supports C+L band networks. Before Cisco IOS XR Release 7.9.1, APC did not start regulating the power levels in a link until the full topology was discovered by OSPF. From Cisco IOS XR Release 7.9.1, APC regulation begins as soon as it discovers any part of the topology. At a transmitting OLT, APC starts power correction at the OLT and subsequent ILA nodes even if the complete OLT-OLT link has not been discovered. When APC detects a partial topology, the NCS 1010 raises the PARTIAL-TOPOLOGY alarm. APC moves to BLOCKED state after regulation is complete.



Note

- If the input slice power of a channel is below psd-min and APC is unable to bring the channel above psd-min even after setting the WSS attenuation to 0dB, APC declares the channel as failed.
- After APC regulation, all channel powers must be above psd-min (-24 dBm default) and at least one channel should be within 0.5 dB of psd-min.

PSD regulation states of APC channels

The APC channel PSD regulation feature operates in these ways:

- **Monitoring:** The APC system periodically checks the Power Spectral Density (PSD) discrepancy for each channel.
- **Trigger:** If the measured discrepancy exceeds the configured PSD correction tolerance, the regulation process is initiated.
- **Regulation action:** The Line Controller (LC) applies changes to reduce the discrepancy below the defined tolerance, ensuring a flat spectrum before the Erbium-Doped Fiber Amplifier (EDFA) at the LINE port.
- **Status states:** During regulation, the APC status transitions through various states before reaching the final state, IDLE.

- **Command usage:** The **show olc channel-apc controller Ots0/0/0/0 regulation-info** command displays the LC state.
- **State interpretation:** When regulation is in progress, some displayed values may represent final values, while others may not yet be updated.

Operation of span-mode APC

Starting with R7.11.1, you can configure APC in span-mode. span-mode APC is a decentralized automatic power control method used in optical networks, where each node independently adjusts its power levels based on changes in span loss.

If there is a discrepancy in the network without any change in span-loss, instead of triggering APC regulation, the system raises the corresponding alarm. For centralized APC, the power correction threshold is 0.7 dB. The threshold for span-mode APC is 0.5 dB.

Unlike centralized power control mode, where the manager node controls power adjustments across the network, each node in span-mode adjusts its own power based on the conditions of its direct connections or spans. There are no APC manager nodes in span-mode. Regulation in span-mode APC takes place when a node detects a change in Rx span loss. Span-mode APC does not perform regulation when there is a change in Rx power as a result of other changes. There are two exceptions to this:

- Span-mode APC compensates for power changes in the channels that an OLT receives on the ADD ports.
- Span-mode APC performs power correction when you change the DROP PSD configuration

When a node is unable to compensate for changes that require power correction, it raises the OOR (Out-of-Range) alarm and informs the receiving node of the discrepancy. The receiving node then performs power correction to address the issue.

If there is a power change in the network due to another cause, APC does not perform power correction. However, APC raises the APC-TARGET-PSD-NOT-MET alarm after a configured interval. You can investigate the cause of the change in the network and fix the issues.

APC behavior before R7.11.1 is Centralized APC.

Restrictions for span-mode APC

- Do not delete channels when APC is in span mode.
- Do not disable or enable APC, link tuner, or gain estimator after the ALC process is complete and span-mode APC is active.
- Do not initiate gain estimator application using exec CLI after ALC process is complete and span-mode APC is active.
- You must configure channel maps on all ILA nodes. Use **hw-module location 0/0/NXR0 grid-mode flex[inline-ampli | terminal-ampli] channel-ididcentre-freqfrequencywidthwidth** command to configure the channel map for all 32 channels.
- You must pause span-mode APC before deleting or creating cross-connects.

APC status and internal states

APC status refers to the current state of APC throughout the entire path.

Description of APC status

This table lists and describes the APC status.

Table 9: Description of APC status

APC status	Description
BLOCKED	APC moves to the BLOCKED state if: <ul style="list-style-type: none">• there is an event in the network which resulted in topology failure,• an amplifier safety event like APR or OSRI has been triggered in the network, and• APC is locally disabled on the agent node.
PAUSED	APC is paused using the apc-pause command.
IDLE	APC regulation has been completed successfully. All channels in the network have achieved the target PSD provided by the link tuner or configured by the user.
WORKING	When APC detects a discrepancy between the current and target PSD, it regulates to converge the power to the target PSD.
DISABLED	APC is disabled.
PARTIAL-TOPOLOGY NODE-BLOCKED	APC has limited visibility. APC manager does not have visibility to the full OLT-OLT topology. APC manager tries to correct the power levels on the agent nodes that are reachable and after the regulation is complete, APC moves to BLOCKED state.

Description of APC internal states

Internal state is the state of APC on each individual node.

This table lists and describes the internal states of APC.

Table 10: Description of APC internal states

APC internal state	Description
--------------------	-------------

DISCREPANCY	The APC manager flags an agent node which needs correction when there is a discrepancy between target PSD and current PSD. This state is temporary and lasts until APC starts power correction and goes into CORRECTING state.
CORRECTING	APC correction is in progress on the node.
OOR	<p>APC-OUT-OF-RANGE condition is raised on an agent node when APC fails to regulate and achieve the target PSD power level because the requested gain or attenuation setpoint cannot be set due to one of these conditions:</p> <ul style="list-style-type: none"> • Amplifier gain is exhausted in the current gain range. • WSS range (0 to 25dB) is exhausted for a single or multiple channels. • DGE range (0 to 3dB) is exhausted for a single or multiple channels. • Span loss has increased, and amplifier gain is insufficient to achieve the target PSD.
IDLE	APC regulation has been completed successfully. All channels in the network have achieved the target PSD, either provided by the link tuner or configured by the user.
BLOCKED	<p>APC is unable to perform for these reasons:</p> <ul style="list-style-type: none"> • OSRI has shut down the amplifier: AMPLI-SHUT. • APC is disabled locally on the node: USER-DISABLED. • Gain Estimation is in progress: GAIN-ESTIMATION-IN-PROGRESS. • Amplifier auto power reduction is enabled: AMPLI-APR-ENABLED. • Amplifier is shut because of loss of input power: AMPLI-SHUT. • An event in the network resulted in topology failure. • APC is BLOCKED as Band Failure Recovery sets Safe mode because of a band failure event in C+L network: BAND-FAILURE.

View APC status and information

Use this task to verify whether APC is working, blocked, idle, or paused. You can also view detailed parameters such as target PSDs, amplifier gain, attenuation settings, and discrepancies between current and target power levels for each node in the APC domain.

Procedure

Step 1 Use the **show olc apc** command to view the APC status.

This sample shows the output of the **show olc apc** command when APC is in Centralized mode

Example:

```
RP/0/RP0/CPU0:OLT1#show olc apc
```

```
Controller      : Ots0/0/0/0
APC Status      : WORKING
```

```
Node RID        : 10.1.1.1
Internal State   : IDLE
```

```
Node RID        : 10.99.1.2
Internal State   : IDLE
```

```
Node RID        : 10.99.2.2
Internal State   : IDLE
```

```
Node RID        : 10.99.4.1
Internal State   : IDLE
```

```
Node RID        : 10.1.1.5
Internal State   : DISCREPANCY
```

This sample shows the output of the **show olc apc** command when APC is in span-mode.

Example:

```
RP/0/RP0/CPU0:ios#show olc apc
```

```
Controller      : Ots0/0/0/0
APC Status      : MANUAL
```

For information about APC statuses and APC internal states, see [APC status and internal states, on page 39](#).

This sample shows the output of the **show olc apc** command when OSRI has shut down an amplifier in the link.

Example:

```
RP/0/RP0/CPU0:ios#sh olc apc
Thu Jul 7 13:21:05.807 UTC
```

```
Controller      : Ots0/0/0/0
APC Status      : BLOCKED
```

```
Node RID        : 10.1.1.1
Internal State   : IDLE
```

```
Node RID      : 10.1.1.2
Internal State : BLOCKED
Blocked Reason : [ AMPLI-SHUT ]
```

```
Node RID      : 10.1.1.3
Internal State : DISCREPANCY
```

```
Node RID      : 10.1.1.4
Internal State : DISCREPANCY
```

```
Node RID      : 10.1.1.5
Internal State : DISCREPANCY
```

This sample shows the output of the **show olc apc** command when APC is disabled locally on a node.

Example:

```
RP/0/RP0/CPU0:ios#sh olc apc
Thu Jul  7 13:22:44.145 UTC
```

```
Controller      : Ots0/0/0/0
APC Status      : BLOCKED
```

```
Node RID        : 10.1.1.1
Internal State   : IDLE
```

```
Node RID        : 10.1.1.2
Internal State   : BLOCKED
Blocked Reason   : [ USER-DISABLED ]
```

```
Node RID        : 10.1.1.3
Internal State   : DISCREPANCY
```

```
Node RID        : 10.1.1.4
Internal State   : DISCREPANCY
```

```
Node RID        : 10.1.1.5
Internal State   : DISCREPANCY
```

This sample shows the output of the **show olc apc** command when Gain Estimation is in progress on a node.

Example:

```
RP/0/RP0/CPU0:ios#sh olc apc
Tue Jun  7 11:43:10.801 UTC
```

```
Controller      : Ots0/0/0/0
APC Status      : BLOCKED
```

```
Node RID        : 10.1.1.1
Internal State   : DISCREPANCY
```

```
Node RID        : 10.1.1.2
Internal State   : DISCREPANCY
```

```
Node RID        : 10.1.1.3
Internal State   : BLOCKED
Blocked Reason   : [ GAIN-ESTIMATION-IN-PROGRESS ]
```

This sample shows the output of the **show olc apc** command when amplifier auto power reduction is enabled on a node.

Example:

```
RP/0/RP0/CPU0:ios#sh olc apc
Thu Jul  7 13:21:49.530 UTC
```

```
Controller      : Ots0/0/0/0
```



```

APC Status      : BLOCKED

Node RID        : 10.1.1.1
Internal State  : IDLE

Node RID        : 10.1.1.2
Internal State  : BLOCKED
Blocked Reason  : [ AMPLI-APR-ENABLED ]

Node RID        : 10.1.1.3
Internal State  : DISCREPANCY

Node RID        : 10.1.1.4
Internal State  : DISCREPANCY

Node RID        : 10.1.1.5
Internal State  : DISCREPANCY

```

This sample shows the output of the **show olc apc** command when band failure has occurred and the APC manager has visibility only to a partial topology.

Example:

```

RP/0/RP0/CPU0:ios#show olc apc
Wed Jan 18 12:21:28.195 UTC

Controller      : Ots0/0/0/0
APC Status      : BLOCKED
Blocked Reason  : [ PARTIAL-TOPOLOGY  NODE-BLOCKED ]

Node RID        : 10.1.1.1
Internal State  : IDLE

Node RID        : 10.1.1.2
Internal State  : BLOCKED
Blocked Reason  : [ BAND-FAILURE ]

```

Step 2 Use the **show olc apc-local** command to view the local status of APC on each node.

This command shows if APC is enabled or disabled on the node.

This sample shows the output of the **show olc apc-local** command.

Example:

```

RP/0/RP0/CPU0:ios#show olc apc-local
Mon Apr 11 06:59:14.679 UTC

Controller : Ots0/0/0/0

TX Status : ENABLED
RX Status : ENABLED

```

Step 3 Use the **show olc apc-local target-psd-profile** command to view the target PSDs configured for all the setpoints.

This sample shows the output of the **show olc apc-local target-psd-profile** command on a C band node. The output also displays the PSD configuration source and indicates whether the target PSD source is the link tuner or a configuration.

Example:

```

RP/0/RP0/CPU0:ios#show olc apc-local target-psd-profile
Tue Apr 26 10:19:24.910 UTC
Controller      : Ots0/0/0/0
Target PSD source : Configuration

```

Setpoint	Frequency (THz)	Target PSD (dBm/12.5 GHz)
01	191.337494	15.0
02	191.488678	15.0
03	191.639847	-4.1
04	191.791016	-4.1
05	191.942184	-4.1
06	192.093353	-4.1
07	192.244537	-4.1
08	192.395706	-4.1
09	192.546875	-4.1
10	192.698044	-4.1
11	192.849213	-4.1
12	193.000397	-4.1
13	193.151566	-4.1
14	193.302734	-4.1
15	193.453903	-4.1
16	193.605072	-4.1
17	193.756256	-4.1
18	193.907425	-4.1
19	194.058594	-4.1
20	194.209763	-4.1
21	194.360931	-4.1
22	194.512115	-4.1
23	194.663284	-4.1
24	194.814453	-4.1
25	194.965622	-4.1
26	195.116791	-4.1
27	195.267975	-4.1
28	195.419144	-4.1
29	195.570312	-4.1
30	195.721481	-4.1
31	195.872650	-4.1
32	196.023834	-4.1
33	196.175003	-4.1

This sample shows the output of the **show olc apc-local target-psd-profile** command on an L band node.

Example:

```
RP/0/RP0/CPU0:ios#sh olc apc-local target-psd-profile
Wed Jan 18 12:12:02.236 UTC
Controller       : Ots0/0/0/0
Target PSD source : Configuration
```

Setpoint	Frequency (THz)	Target PSD (dBm/12.5 GHz)
01	186.050000	-6.4
02	186.201000	-6.3
03	186.352000	-6.2
04	186.503000	-6.2
05	186.654000	-6.1
06	186.805000	-6.1
07	186.956000	-6.0
08	187.107000	-6.0
09	187.258000	-5.9
10	187.409000	-5.9
11	187.560000	-5.9
12	187.711000	-5.8
13	187.862000	-5.7
14	188.013000	-5.7
15	188.164000	-5.6

16	188.315000	-5.5
17	188.466000	-5.5
18	188.617000	-5.4
19	188.768000	-5.4
20	188.919000	-5.3
21	189.070000	-5.2
22	189.221000	-5.2
23	189.372000	-5.1
24	189.523000	-5.1
25	189.674000	-5.0
26	189.825000	-5.0
27	189.976000	-4.9
28	190.127000	-4.9
29	190.278000	-4.8
30	190.429000	-4.7
31	190.580000	-4.7
32	190.731000	-4.6
33	190.882000	-4.6

Step 4 Use the **show olc apc-local regulation-info** command to view the detailed information about APC on each node.

This command provides this information:

- Controller
- APC Domain Manager
- Internal status
- Minimum PSD
- Last correction timestamp
- Gain range
- Amplifier and attenuation parameters: configured and current values and available ranges
- Detailed information on the channels

This command also provides detailed information on the channels:

- Center frequency of each channel
- Channel width
- Channel ID
- Channel source (ASE or user channel)
- Slice number of the center frequency of the channel in the WSS
- PSD of the channel at the input of the amplifier
- Target and current PSD for the channel
- Discrepancy between current and target PSD
- The configured attenuation on the WSS (OLT) or DGE (ILA) for the channel

Step 5 Use the **tx|rx** keyword with the **show olc apc-local regulation-info controller ots R/S/I/P** command to view the APC information for only the Tx or Rx direction.

This sample shows the output of the `show olc apc-local regulation-info` command.

Example:

```
RP/0/RP0/CPU0:ios#show olc apc-local regulation-info controller ots 0/0/0/0 tx
Wed Jul  6 05:01:45.177 UTC
Controller           : Ots0/0/0/0
Domain Manager       : 10.1.1.1
Internal Status      : OOR
Direction            : TX
PSD Minimum          : -24.0 (dBm/12.5 GHz)
Gain Range           : Normal
Last Correction      : 2022-07-06 05:01:28
```

Device Parameters		Min	Max	Configuration	Operational
=====					
Egress Ampli Gain (dB)		:15.4	29.4	19.5	19.5
Egress Ampli Tilt (dB)		:-5.0	3.1	-2.2	-2.2
TX Ampli Power (dBm)		: -	22.4	-	21.4
TX VOA Attenuation (dB)		:0.0	20.0	0.0	0.0
Egress WSS/DGE Attenuation (dB)		:0.0	25.0	-	-

Channel Center	Channel	Channel	Channel	Spectrum	Ampli-Input	Target	Current	Discrepancy
Channel Slice								
Frequency	Width	ID	Source	Slice Num	PSD	PSD	PSD	
Attn Config								
(THz)	(GHz)				(dBm/12.5 GHz)	(dBm/12.5 GHz)	(dBm/12.5 GHz)	(dB)
(dB)								
=====								
191.375000	75.00	1	OCh	13	-23.2	-4.6	-4.9	0.2
7.1								
191.449997	75.00	-	ASE	37	-23.0	-4.6	-4.7	0.1
9.2								
191.524994	75.00	-	ASE	61	-23.1	-4.6	-4.7	0.1
9.3								
191.600006	75.00	4	OCh	85	-23.1	-4.5	-4.7	0.1
8.0								
191.675003	75.00	-	ASE	109	-23.0	-4.5	-4.5	0.0
9.1								
191.750000	75.00	6	OCh	133	-23.0	-4.4	-4.6	0.1
8.0								
191.824997	75.00	-	ASE	157	-23.1	-4.4	-4.6	0.1
9.3								
191.899994	75.00	8	OCh	181	-23.0	-4.4	-4.4	0.0
8.0								
191.975006	75.00	-	ASE	205	-23.0	-4.3	-4.5	0.1
9.1								
192.050003	75.00	10	OCh	229	-23.0	-4.3	-4.5	0.1
8.2								
192.125000	75.00	-	ASE	253	-22.9	-4.3	-4.3	0.0
9.0								
192.199997	75.00	12	OCh	277	-22.8	-4.2	-4.3	0.0
8.3								
192.274994	75.00	-	ASE	301	-22.9	-4.2	-4.4	0.1
9.0								
192.350006	75.00	14	OCh	325	-22.6	-4.2	-4.2	0.0
8.3								
192.425003	75.00	-	ASE	349	-22.8	-4.2	-4.3	0.1
8.7								
192.500000	75.00	16	OCh	373	-22.4	-4.1	-3.9	-0.2
8.1								
192.574997	75.00	-	ASE	397	-22.7	-4.1	-4.2	0.1
8.6								

192.649994 8.1	75.00	18	OCh	421	-22.6	-4.1	-4.2	0.1
192.725006 8.6	75.00	-	ASE	445	-22.7	-4.0	-4.2	0.1
192.800003 7.9	75.00	20	OCh	469	-22.7	-4.0	-4.1	0.1
192.875000 8.4	75.00	-	ASE	493	-22.6	-4.0	-4.0	0.0
192.949997 7.6	75.00	22	OCh	517	-22.6	-3.9	-4.1	0.1
193.024994 8.2	75.00	-	ASE	541	-22.5	-3.9	-4.0	0.1
193.100006 7.5	75.00	24	OCh	565	-22.7	-3.8	-4.0	0.1
193.175003 8.2	75.00	-	ASE	589	-22.7	-3.8	-4.0	0.1
193.250000 7.2	75.00	26	OCh	613	-22.5	-3.8	-3.9	0.1
193.324997 8.1	75.00	-	ASE	637	-22.6	-3.8	-4.0	0.2
193.399994 7.2	75.00	28	OCh	661	-22.7	-3.7	-3.9	0.1
193.475006 8.0	75.00	-	ASE	685	-22.5	-3.7	-3.8	0.1
193.550003 7.0	75.00	30	OCh	709	-22.7	-3.7	-3.8	0.1
193.625000 8.1	75.00	-	ASE	733	-22.7	-3.6	-3.8	0.1
193.699997 6.7	75.00	32	OCh	757	-22.7	-3.6	-3.7	0.1
193.774994 8.2	75.00	-	ASE	781	-22.7	-3.5	-3.7	0.1
193.850006 6.6	75.00	34	OCh	805	-22.7	-3.5	-3.7	0.1
193.925003 8.1	75.00	-	ASE	829	-22.7	-3.5	-3.6	0.1
194.000000 6.6	75.00	36	OCh	853	-22.8	-3.5	-3.7	0.2
194.074997 8.3	75.00	-	ASE	877	-22.8	-3.4	-3.6	0.1
194.149994 10.9	75.00	38	OCh	901	-22.7	-3.4	-3.5	0.1
194.225006 8.2	75.00	-	ASE	925	-22.8	-3.3	-3.5	0.1
194.300003 7.1	75.00	40	OCh	949	-22.9	-3.3	-3.5	0.1
194.375000 8.4	75.00	-	ASE	973	-22.8	-3.3	-3.4	0.1
194.449997 7.3	75.00	42	OCh	997	-22.9	-3.2	-3.5	0.2
194.524994 8.4	75.00	-	ASE	1021	-22.9	-3.2	-3.4	0.1
194.600006 7.2	75.00	44	OCh	1045	-22.8	-3.2	-3.3	0.1
194.675003 8.4	75.00	-	ASE	1069	-22.8	-3.2	-3.3	0.1
194.750000 7.3	75.00	46	OCh	1093	-22.9	-3.1	-3.4	0.2
194.824997 8.2	75.00	-	ASE	1117	-22.8	-3.1	-3.2	0.1
194.899994 6.9	75.00	48	OCh	1141	-22.8	-3.0	-3.3	0.2
194.975006 8.3	75.00	-	ASE	1165	-22.9	-3.0	-3.2	0.1

195.050003 6.6	75.00	50	OCh	1189	-22.8	-3.0	-3.1	0.1
195.125000 8.3	75.00	-	ASE	1213	-22.9	-3.0	-3.1	0.1
195.199997 6.3	75.00	52	OCh	1237	-22.9	-2.9	-3.1	0.1
195.274994 8.1	75.00	-	ASE	1261	-23.0	-2.9	-3.0	0.1
195.350006 6.4	75.00	54	OCh	1285	-23.1	-2.8	-3.0	0.1
195.425003 8.3	75.00	-	ASE	1309	-23.2	-2.8	-3.0	0.1
195.500000 6.2	75.00	56	OCh	1333	-23.1	-2.8	-2.9	0.1
195.574997 8.2	75.00	-	ASE	1357	-23.4	-2.8	-3.0	0.2
195.649994 6.4	75.00	58	OCh	1381	-23.4	-2.7	-2.9	0.1
195.725006 8.5	75.00	-	ASE	1405	-23.4	-2.7	-2.8	0.1
195.800003 6.6	75.00	60	OCh	1429	-23.6	-2.7	-2.8	0.1
195.875000 8.7	75.00	-	ASE	1453	-23.7	-2.6	-2.9	0.2
195.949997 6.9	75.00	62	OCh	1477	-23.7	-2.6	-2.8	0.2
196.024994 9.0	75.00	-	ASE	1501	-23.6	-2.5	-2.7	0.1
196.100006 7.1	75.00	64	OCh	1525	-23.7	-2.5	-2.7	0.1

ASE - Noise Loaded Channel

OCh - Optical Channel

Note

- In the previous sample output, the channel source is ASE for channels that are empty and for channels that failed due to power level dropping below psd-min. ASE or a noise loader fills noise across the spectrum at intervals of 75 GHz wherever optical cross connects are not present. For dropped channels, the channel ID is present, and the channel source is ASE.
- When APC is in span-mode, the apc regulation info output does not show the channel source on ILA nodes

You can assess and monitor the power regulation and discrepancies across the network nodes for effective optical network management.

Configure the target PSDs

Use this task to configure the PSD profiles that manage the optical power levels.

If you enable link tuner, it sets the target PSDs for APC on all nodes in the path.

You can configure the target power spectral densities at 33 points across the band. Each PSD value divides the spectrum into 150-GHz steps. APC uses the PSD value when a channel frequency matches a configured point. If not, APC calculates the target PSD for a channel based on the two nearest steps.

Procedure

Step 1 Use the **psd <1-33> value** command to set the target PSDs for single-band for each node on a C-band network.

This sample configuration sets the PSD value to 15 dBm or 12.5 GHz for setpoints 1 and 2.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#psd 1 150
RP/0/RP0/CPU0:ios(config-olc-ots)#psd 2 150
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Step 2 (Only for NCS 1010) Use the **dual-band-psd <1-33> value** command to set the target PSDs for dual-band for each node on a C+L band network.

This sample configuration sets the dual-band PSD values to -50 and -49 on setpoints 1 and 2 respectively, on the 0/0/0/0 controller.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#dual-band-psd 1 -50
RP/0/RP0/CPU0:ios(config-olc-ots)#dual-band-psd 2 -49
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

The target PSD profiles are now configured for the selected band on all nodes in the path.

Disable APC

Use this task to manually disable APC, allowing user configuration to take effect instead of APC's automatic power regulation.

Procedure

Use the **apc disable** command to disable APC for a link on the transmitting OLT node.

Example:

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

Important

- When you disable APC, the device sets all the setpoints to values in the configuration. If there is no configuration, the device sets all setpoints to their default values. Disabling APC affects traffic.
- (Only for NCS 1010) For BFR to work, APC must be enabled on both C and L-band devices. We recommend to pause BFR before running the **apc-pause** or **apc disable** commands.

User configuration is applied instead of APC. All setpoints are set to either configured values or default values.

Configure centralized APC

Use this task to manage APC by enabling and disabling APC domains.

Procedure

Step 1 Use the **apc enable** command on the transmitting OLT node to enable APC for a link.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc enable
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Step 2 Use the **apc pause** command on the transmitting OLT node to modify the network without APC compensating for the changes.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc pause
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Note

- If you run the **apc-pause** command when APC is in idle state, APC remains in the idle state until changes in the network require power correction. The status changes to paused after changes are detected, but the system does not perform power correction.
- Running the **apc-pause** command does not pause channel startup.

Step 3 Use the **apc-local [RX | TX] disable** command on an ILA node to disable APC locally.

Example:

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



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

Consider a scenario where the headend OLT encounters a headless event. If power correction is required at agent nodes, the APC manager is unavailable to initiate regulation. When APC is enabled, adjustments cannot be performed, and user configuration of **target-psd** does not take effect. Disabling APC locally on an agent node allows manual adjustment of parameters. Use the **apc-local disable** command to disable APC on an agent node.

Configure target drop PSD and minimum PSD

Use this task to manually configure the target PSD for drop ports. You can also set the minimum PSD threshold. These actions ensure that channel power levels meet the required target and maintain optimal channel quality across the network.

The link tuner does not set the target PSD for drop ports. The default target PSD for drop ports is -8.0 dBm/12.5 GHz. The device applies drop PSD configuration for channels with cross connect settings. Use the **drop-psd** command to set the desired drop PSD.

If the PSD of a channel with minimal attenuation at the amplifier input on an OLT is less than the minimum PSD, APC marks the channel as failed. APC then replaces the channel using the ASE source. The default minimum PSD is -24 dBm/2.5 GHz. Use the **psd-min** command to set the desired minimum PSD.

Procedure

Step 1 Use the **drop-psd** command to set the desired drop PSD.

This sample configuration sets the target PSD at drop ports to -25 dBm/12.5 GHz.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#drop-psd -250
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
Tue Apr 26 09:50:12.055 UTC
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Step 2 Use the **psd-min** command to set the desired minimum PSD.

This sample configuration sets the minimum PSD to -25 dBm/12.5 GHz.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#psd-min -250
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
```

```
Tue Apr 26 09:50:12.055 UTC
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Channel power levels meet the required target power profile.

View patchcord loss and path loss

(Only on NCS 1010) Use this task to obtain data about the loss between the LINE-TX port of the L-band device and the LINE-TX port of the C-band device. This is essential to launch the correct power into the transmission fiber and ensure accurate power level adjustments in the optical network.

In a C+L band configuration, optical applications require data about loss between the LINE-TX port of the L-band device to the LINE-TX port of the C-band device to launch correct power into the transmission fiber.

This data, also known as path loss, is calculated from these components:

- patchcord loss between the LINE-TX port of the L-band device and the L-Band-RX port of the C-band device.
- insertion loss between the L-Band-RX port of the C-band device and the LINE-TX port of the C-band device.
- insertion loss due to the Raman modules inside the C-band device.

Procedure

Step 1 Use the **show olc partner-band-loss** command to view the patchcord loss and path loss values.

This sample is an output of the **show olc partner-band-loss** when executed on a C-band device.

Example:

```
RP/0/RP0/CPU0#show olc partner-band-loss
Wed Feb 1 12:51:59.605 UTC

Controller                               : Ots0/0/0/0
Partner IP address                       : 10.1.1.2
Partner Controller                       : Ots0/0/0/0
L-LINE-TX Path Loss at C-LINE-TX        : 2.3 dB
L-LINE-TX Patchcord Loss                 : 1.0 dB
Loss Measurement Timestamp               : 2023-02-01 12:51:54
```

This sample is an output of the **show olc partner-band-loss** when executed on a L-band device.

```
RP/0/RP0/CPU0#show olc partner-band-loss
Wed Feb 1 12:51:59.605 UTC

Controller                               : Ots0/0/0/0
Partner IP address                       : 10.1.1.3
Partner Controller                       : ots0/0/0/0
L-LINE-TX Path Loss at C-LINE-TX        : 2.3 dB
L-LINE-TX Patchcord Loss                 : 1.0 dB
Loss Measurement Timestamp               : 2023-02-01 12:51:54
```

Step 2 Use the **show olc partner-band-loss controller ots** *R/S/I/P* command to view the patchcord loss and path loss values for individual controllers.

This sample is an output of the **show olc partner-band-loss controller ots** *R/S/I/P* when executed on a C-band device.

Example:

```
RP/0/RP0/CPU0#show olc partner-band-loss controller Ots 0/0/0/0
Wed Feb 1 12:51:59.605 UTC

Controller                               : Ots0/0/0/0
Partner IP address                       : 10.1.1.2
Partner Controller                       : Ots0/0/0/0
L-LINE-TX Path Loss at C-LINE-TX       : 1.9 dB
L-LINE-TX Patchcord Loss               : 1.2 dB
Loss Measurement Timestamp               : 2023-02-01 12:51:54
```

This sample is an output of the **show olc partner-band-loss controller ots** *R/S/I/P* when executed on a L-band device.

```
RP/0/RP0/CPU0#show olc partner-band-loss controller Ots 0/0/0/0
Wed Feb 1 12:51:59.605 UTC

Controller                               : Ots0/0/0/0
Partner IP address                       : 10.1.1.3
Partner Controller                       : Ots0/0/0/0
L-LINE-TX Path Loss at C-LINE-TX       : 1.9 dB
L-LINE-TX Patchcord Loss               : 1.2 dB
Loss Measurement Timestamp               : 2023-02-01 12:51:54
```

You can accurately monitor and manage optical power levels in the network.

Configure APC alarm hold-off timer and discrepancy threshold

Use this task to configure APC alarm sensitivity and timing. You can avoid false or premature alarms during APC.

Procedure

Step 1 Use the **apc-alarm-hold-off-timer** *time* command to configure the timer.

You can configure the time interval that must pass after APC detects a discrepancy before the APC-TARGET-PSD-NOT-MET alarm is raised. The default value is 30 seconds.

This sample configuration sets the APC alarm hold-off timer to 45 seconds.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc-alarm-hold-off-timer 45
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
Tue Apr 26 09:50:12.055 UTC
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Step 2 Use the **apc-alarm-discrepancy-threshold** *discrepancy* command to configure the discrepancy threshold.

You can configure the allowed discrepancy threshold before APC-TARGET-PSD-NOT-MET alarm is raised. The default value is 1 dB.

This sample configuration sets the APC alarm discrepancy threshold to 1.5 dB.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc-alarm-discrepancy-threshold 15
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
Tue Apr 26 09:50:12.055 UTC
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

The APC alarm parameters are configured, reducing false or premature alarms during APC operation.

Configure APC in span mode

Use this task to configure APC in span mode.

Procedure

Step 1 Use these commands to configure APC in span mode on an OLT node.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc-span-mode RX
RP/0/RP0/CPU0:ios(config-olc-ots)#apc-span-mode TX
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Step 2 Use these commands to configure APC in span mode on an ILA node.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc-span-mode TX
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

APC operates in centralized mode during automatic link calibration. After ALC completes, it saves a system baseline. If span mode configurations are present, ALC switches APC mode to span mode.

Pause APC in span mode

Use this task to pause APC in span mode.

Procedure

Use these commands to pause APC in span mode.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#apc-span-mode-pause tx
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Switch between APC modes

Use this task to switch from centralized APC to span mode APC operation and vice versa.

Procedure

Step 1

Switch from centralized APC to span mode APC.

- a) Configure APC in manual mode on the OLT nodes.
- b) Configure apc-span-mode on all nodes.
- c) Initiate ALC and wait for the ALC process to complete.

After saving the ALC baseline, APC switches to span mode.

Step 2

Switch from span mode APC to centralized APC using one of these methods:

- **commit replace**

- a. Reset all the nodes to their default configuration by using the **commit replace** command.
- b. Reload all the nodes.
- c. Configure the nodes with the required settings for link bringup.
- d. Configure automatic link bringup or enable APC.

APC starts regulation in centralized mode.

- **no** configuration of optical applications

- a. Remove the optical applications configurations by using the **no** form of APC, link tuner, and gain estimator.

- b. Configure the nodes with required configuration for link bring up.
- c. Configure automatic link bringup or enable APC.

APC starts regulation in centralized mode.



CHAPTER 8

Upgrade C-Band to C+L Band Without Affecting Traffic Flow

This chapter describes how to upgrade a C-band only network to C+L band network for Cisco NCS 1010 without affecting the traffic in the existing network.

- [Upgrade a C-band network to C+L band without impacting traffic, on page 57](#)

Upgrade a C-band network to C+L band without impacting traffic

Use this task to upgrade an existing C-band network to a C+L band network without impacting traffic. This upgrade allows the network to accommodate more bands and boost bandwidth while maintaining uninterrupted service.

Table 11: Feature History

Feature Name	Release Information	Description
Nontraffic Affecting C+L Band Upgrade	Cisco IOS XR Release 7.10.1	Upgrading an existing C-band network to a C+L band network is now possible without impacting the traffic flow. Cisco Optical Network Planner (CONP) computes the values for relevant parameters in C+L network configuration. The upgrade benefits even those networks that were not planned for a future L-band upgrade. C+L band upgrade enables you to accommodate more bands to your network to boost network bandwidth.



Note Use the Cisco Optical Network Planner (CONP) to compute these values for C-band and L-band devices in C+L network configuration:

1. Single band and dual band target PSD values
2. Gain range for amplifiers

Follow these steps to bring up the L-band node while upgrading a C-band only network to a C+L network.

Procedure

Step 1 Configure the required gain and gain-range settings for each L-band node to ensure accurate amplification.

Note

Gain-Estimator (GE) must be in `DISABLED` state.

Example:

This sample configuration disables gain estimator.

```
RP/0/RP0/CPU0:ios#configure terminal
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#gain-estimator disable
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
```

Step 2 Configure single band PSD on all L-band nodes.

Note

Link Tuner (LT) must be in `DISABLED` state.

Example:

This sample configuration disables link tuner.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#optical-line-control
RP/0/RP0/CPU0:ios(config-olc)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-olc-ots)#link-tuner disable
RP/0/RP0/CPU0:ios(config-olc-ots)#commit
RP/0/RP0/CPU0:ios(config-olc-ots)#end
```

Step 3 Configure the dual band PSD set points obtained from CONP and the partner-band configuration on all L-band nodes.

For more information on L-band dual band PSD configuration, see [Modify L-Band Amplifier Properties](#).

Step 4 Manually configure the gain and gain-range values computed by the gain-estimator application on all C-band nodes, and then disable the gain-estimator.

Note

Disabling Gain estimator causes traffic impact if there is a mismatch between the gain-range configured by the user and the gain-range configured by the gain-estimator.

Step 5 Manually configure the single band PSD set points obtained from the link tuner on all C-band nodes, and then disable the link tuner.

Note

Link tuner is in *Enabled* state in the C-band network. Configure the same PSD values that are obtained from the link tuner and then disable the link tuner. Any mismatch between the PSD value configured by the user and the PSD value configured by the link tuner leads to traffic impact.

Step 6 Configure the dual band PSD set points obtained from CONP and the partner-band configuration on all C-band nodes.

For more information on C-Band dual band PSD configuration, see [Modify C-Band Amplifier Properties](#).

Note

Ensure that dual band configurations are present (dual band PSD and partner-band) on all the C- and L-band nodes during L-band device addition. If either configuration is missing, BFR does not work properly, and the bands start in an uncontrolled manner. This may impact traffic.

Step 7 Bring up the connectivity between C-band and L-band devices.

- a) Bring up the interlink connectivity between C-band and L-band devices by enabling the management interfaces for partner-band communication between C-band and L-band nodes.
- b) Bring up the fiber connectivity between C-band and L-band devices and enable Gigabit Ethernet interfaces.

Note

Fiber connectivity is the connection between the L-band port on the C-band nodes and the Line port on the L-band nodes.

- c) Verify that the connectivity is fine and there are no alarms present on OSC and OTS controller.
- d) After completing the connectivity to the last terminal node, verify that the topology is *UP*, and APC has cleared the *PARTIAL TOPOLOGY* alarm on all OLT C-band and L-band nodes.

Example:

This sample is an output of **show olc apc** command.

```
RP/0/RP0/CPU0:OLT1#show olc apc

Controller          : Ots0/0/0/0
APC Status : WORKING
```

Step 8 On the L-band BFR manager, band status remains *NA* until end-to-end connectivity is up. After the end-to-end terminal (OLT-OLT) is discovered, the band status is updated on all the agent nodes. BFR initiates the BRING UP (RECOVERY) procedure and recovers node one at a time.

Example:

This example shows the output of the **show olc band-status** command where the L-Band recovery is not initiated and *BFR status* is *NA*.

```
RP/0/RP0/CPU0:#show olc band-status

Thu Dec 15 13:54:25.703 UTC

Controller          : Ots0/0/0/0
Self-Band           : None
BFR status          : NA
```

This example shows the output of the **show olc band-status** command where the L-Band recovery is in progress and *BFR status* is *Running*.

```
RP/0/RP0/CPU0:#show olc band-status

Thu Dec 15 13:54:25.703 UTC

Controller          : Ots0/0/0/0
Self-Band           : None
BFR status          : Running
Node RID            : 10.1.1.1
Self IP address     : 10.9.1.2
Self Controller     : Ots0/0/0/0
Partner IP address  : 10.9.1.1
Partner Controller  : Ots0/0/0/0
Partner link status : UP
C-Band status       : ACTIVE
C-Band PSD          : Dual Band
L-Band status       : ACTIVE
```

```

L-Band PSD          : Dual Band
Node RID            : 10.2.1.2
Self IP address     : 10.9.2.2
Self Controller     : Ots0/0/0/0
Partner IP address  : 10.9.2.1
Partner Controller  : Ots0/0/0/2
Partner link status : UP
C-Band status       : RECOVERING
C-Band PSD          : NA
L-Band status       : RECOVERING
L-Band PSD          : NA
Node RID            : 10.2.1.3
Self IP address     : 10.9.3.2
Self Controller     : Ots0/0/0/0
Partner IP address  : 10.9.3.1
Partner Controller  : Ots0/0/0/2
Partner link status : UP
C-Band status       : RECOVERING
C-Band PSD          : NA
L-Band status       : RECOVERING
L-Band PSD          : NA
Node RID            : 10.2.1.4
Self IP address     : 10.9.4.2
Self Controller     : Ots0/0/0/0
Partner IP address  : 10.9.4.1
Partner Controller  : Ots0/0/0/0
Partner link status : UP
C-Band status       : RECOVERING
C-Band PSD          : NA
L-Band status       : RECOVERING
L-Band PSD          : NA

Node RID            : 10.2.1.5
Self IP address     : 10.9.5.2
Self Controller     : Ots0/0/0/0
Partner IP address  : 10.9.5.1
Partner Controller  : Ots0/0/0/0
Partner link status : UP
C-Band status       : RECOVERING
L-Band status       : RECOVERING

```

Step 9 Wait for recovery to complete on all nodes. After recovery, verify the PSD status of the C-band and partner L-band nodes to confirm the PSD profile is *DUAL BAND PSD*.

Step 10 Verify that BFR converged on all nodes and the state on the agent nodes are *ACTIVE* with *DUAL BAND PSD*. Check the traffic status on C-band nodes and verify that traffic was not impacted during the L-band addition.

Example:

This example shows the output of the **show olc band-status** command where the L-Band bring up is complete, PSD profile is *DUAL BAND PSD*, and band status of all the agent nodes is *Active*.

```

RP/0/RP0/CPU0:#show olc band-status

Thu Dec 15 13:54:25.703 UTC

Controller          : Ots0/0/0/0
Self-Band           : None
BFR status          : Running

Node RID            : 10.2.1.1
Self IP address     : 10.9.1.2
Self Controller     : Ots0/0/0/0
Partner IP address  : 10.9.1.1

```

```

Partner Controller      : Ots0/0/0/0
Partner link status    : UP

```

```

C-Band status        : ACTIVE
C-Band PSD           : Dual Band
L-Band status        : ACTIVE
L-Band PSD           : Dual Band

```

```

Node RID               : 10.2.1.2
Self IP address        : 10.9.2.2
Self Controller        : Ots0/0/0/0
Partner IP address     : 10.9.2.1
Partner Controller     : Ots0/0/0/2
Partner link status    : UP

```

```

C-Band status        : ACTIVE
C-Band PSD           : Dual Band
L-Band status        : ACTIVE
L-Band PSD           : Dual Band

```

```

Node RID               : 10.2.1.3
Self IP address        : 10.9.3.2
Self Controller        : Ots0/0/0/0
Partner IP address     : 10.9.1.1
Partner Controller     : Ots0/0/0/2
Partner link status    : UP

```

```

C-Band status        : ACTIVE
C-Band PSD           : Dual Band
L-Band status        : ACTIVE
L-Band PSD           : Dual Band

```

```

Node RID               : 10.2.1.4
Self IP address        : 10.9.4.2
Self Controller        : Ots0/0/0/0
Partner IP address     : 10.9.4.1
Partner Controller     : Ots0/0/0/0
Partner link status    : UP

```

```

C-Band status        : ACTIVE
C-Band PSD           : Dual Band
L-Band status        : ACTIVE
L-Band PSD           : Dual Band

```

```

Node RID               : 10.2.1.5
Self IP address        : 10.9.5.2
Self Controller        : Ots0/0/0/0
Partner IP address     : 10.9.5.1
Partner Controller     : Ots0/0/0/0
Partner link status    : UP

```

```

C-Band status        : ACTIVE
L-Band status        : ACTIVE

```

The network now supports simultaneous operation of C-band and L-band wavelengths, resulting in improved bandwidth. This maintains continuous service and ensures that uninterrupted traffic during the upgrade.



CHAPTER 9

Automatic Network Turn Up

This chapter describes the automatic network turn up workflow for Cisco .

- [Features and configuration of automatic link bringup, on page 63](#)
- [How optical applications work during automatic link bringup, on page 65](#)
- [Enable or disable automatic link bringup, on page 67](#)

Features and configuration of automatic link bringup

You can bring up an DWDM link without using any external tools. The device measures optical parameters for all spans at power-up. Each device then computes setpoints for every span to ensure optimal link performance and to allow end-to-end traffic.

Applications enabling automatic link bringup

These optical applications enable automatic link bringup:

- Span loss measurement
- Gain estimator
- Link tuner
- Automatic power control
- Raman tuning

Configurations used by automatic link bringup

Automatic link bringup uses these user configurations if they are available:

- Measured span loss
- Fiber type
- Spectral density
- Span length.

Assumptions of automatic link bringup

Automatic link bringup works under these assumptions:

- The fiber connections are proper. There are no fiber cuts or faulty connectors blocking link bring up.
- OSC link comes up without need for Raman gain. If the span length is high and the device is not able to turn up the OSC without Raman Gain, you must disable Raman tuning and manually configure Raman amplification.

DHCP and ZTP considerations

You need automatic link bring up after physically installing your device and connecting the fibers as necessary. The automatic link bringup process starts when you turn on a device. A newly powered device has no configuration. First, the device joins the network and obtains an IP address.

The devices use DHCP to get an IP address. After receiving an IP address, the device retrieves a ZTP configuration file from either the DHCP server or a separate ZTP server. [Configure the DHCP server](#) with the desired IP address and configuration file for each device you want to configure. The device uses the configuration file and configures itself.

The ZTP configuration file must contain these configurations:

- Host configuration
- DHCP relay configuration only if there are nodes further down the link
- Interface configuration
- OSPF configuration
- SSH configuration

See [Boot Using Zero Touch Provisioning](#) for more information on configuring and using ZTP.

This example shows a sample ZTP configuration file with the minimum required configuration.

```
!! IOS XR Configuration
!
hostname ios
username cisco
group root-lr
group cisco-support
secret 10
$6$7motIAh93vG/I...$iM64ZfsZ5ciicdcsdsewHdEivLTq0YEc1G1NmpauwJUiEnkv8LwMJUDZnnTkVj9RPgf4wffWJYelPN7jqIN3q/

dhcp ipv4
profile r1 relay
  helper-address vrf default 10.33.0.51 giaddr 10.7.3.2
!
profile r2 relay
  helper-address vrf default 10.33.0.51 giaddr 10.7.2.2
!
interface GigabitEthernet0/0/0/0 relay profile r2
interface GigabitEthernet0/0/0/2 relay profile r1
!
call-home
service active
contact smart-licensing
profile CiscoTAC-1
  active
```

```
destination transport-method email disable
destination transport-method http
!
!
interface Loopback0
ipv4 address 10.3.3.13 255.255.255.255
!
interface GigabitEthernet0/0/0/0
ipv4 address 10.7.2.2 255.255.255.0
!
interface GigabitEthernet0/0/0/2
ipv4 address 10.7.3.2 255.255.255.0
!
router ospf 1
router-id 10.3.3.13
distribute link-state
nsf
network point-to-point
redistribute connected
area 0
    interface Loopback0
    !
    interface GigabitEthernet0/0/0/0
    !
    interface GigabitEthernet0/0/0/2
    !
!
!
ssh server v2
ssh server vrf default
ssh server netconf vrf default
!
end
```

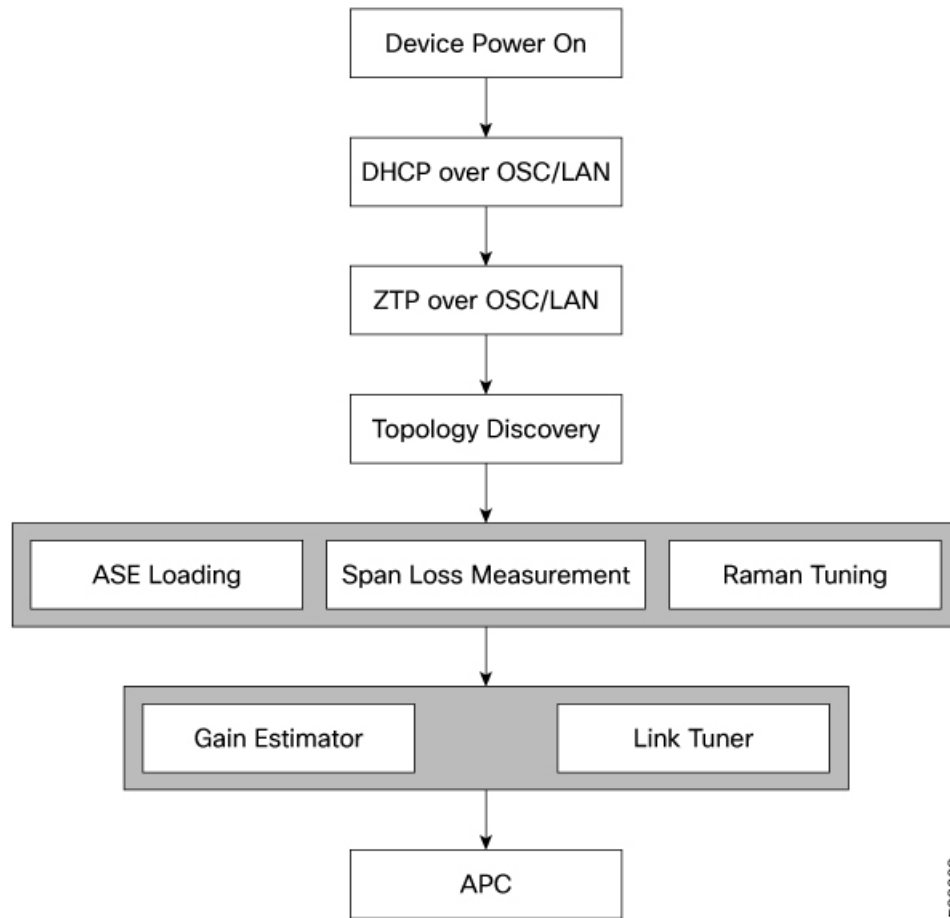
How optical applications work during automatic link bringup

Summary

The automatic link bringup process uses integrated optical applications to measure span loss, estimate amplifier gain, tune the link, and control power. This enables automated DWDM optical link activation without manual intervention.

Workflow

Figure 3: Sequence of optical applications during automatic link bringup



These stages describe how optical applications work during automatic link bringup.

1. After you complete ZTP configuration, the devices use OSPF to perform topology discovery. Each node identifies its adjacent node and learns the network topology.
2. After discovering neighbor nodes, the device initiates span loss measurement.
3. The device initiates Raman tuning if the span is a Raman span.
4. The OLT begins ASE loading to load all the channels with noise.
5. After ASE loading, span loss measurement, and Raman tuning finish, the device begins startup gain estimation and link tuner operations.

The startup gain estimation sets the target gain and gain mode for the EDFA amplifier. The link tuner provides the target PSDs for the channels.



Note The startup gain estimation analyzes the span loss. It sets the gain mode of the EDFA amplifier and provides the initial target gain for the amplifier. These EDFA amplifiers are variable-gain optical amplifiers capable of working at two different gain ranges or modes. The modes are normal mode and extended mode. Extended mode provides higher gain than the normal mode. Changing the gain mode of an amplifier is impacting traffic. Therefore, Automatic Power Correction (APC) is unable to change the gain mode of an amplifier.

6. After startup gain estimation and link tuner operations finish, the device initiates APC.
APC uses the target PSDs set by the link tuner and regulates power output for all channels.

Result

The automatic link bringup process is complete. The optical link is active, and all the noise channels loaded with ASE have their target PSDs set by the link tuner.

What's next

Create and configure optical cross-connects so that traffic runs on the link.

Enable or disable automatic link bringup

Use this task to automatically bring up the DWDM optical link without manual intervention.

Procedure

Use these commands to enable automatic link bringup.

Example:

```
configure
optical-line-control
automatic-link-bringup
commit
end
```

Use the **no automatic-link-bringup** command to disable automatic link bringup.



Configure OTDR

This chapter describes how to configure the Optical Time Domain Reflectometer (OTDR) module in NCS 1010.

Table 12: Feature History

Feature Name	Release Information	Feature Description
OTDR enhancements	Cisco IOS XR Release 25.4.1	<p>These enhancements have been made to OTDR functionality:</p> <ul style="list-style-type: none">• OTDR results now include total measured loss and total measured length alongside existing measurements.• Unique names can be assigned to SOR files for easier identification.• SOR files from automatic and manual OTDR scans are organized into separate folders to differentiate between file types. <p>CLI:</p> <p>The keyword label string is added to the command otdr-start controller ots R/S/I/P direction.</p>

- [OTDR, on page 70](#)
- [OTDR modes , on page 70](#)
- [Configure the OTDR scan parameters, on page 71](#)
- [Start the OTDR scan, on page 73](#)
- [Stop the OTDR scan, on page 77](#)
- [Automatic OTDR scans, on page 77](#)
- [OTDR scan measurement results, on page 84](#)
- [OTDR scan status, on page 84](#)

OTDR

An Optical Time Domain Reflectometer (OTDR) is a fiber optic measurement device that

- captures real-time data on loss and back reflection across fiber links,
- performs bidirectional analysis by connecting to both transmitter (TX) and receiver (RX) ports, and
- enables assessment and ongoing monitoring of fiber quality and performance.

The NCS 1010 OLT and ILA nodes feature in-built bidirectional OTDR functionality, allowing them to measure loss and back reflection in real time for fiber pairs linked to the TX and RX ports. For the OLT device, the OTDR port can switch between LINE-TX and LINE-RX ports. For the ILA device, the OTDR port can switch among LINE-1-TX, LINE-1-RX, LINE-2-TX, and LINE-2-RX ports.

SOR file

You can view OTDR measurement results in a Standard OTDR Record (SOR) file. The SOR file includes fiber trace details such as distance, reflectance, loss, and fiber attenuation measurements.

You can export the SOR file from NCS 1010 using the command: **scp username@device-ip:filename_with_source_location destination-location**.

Example:

```
scp test@192.168.0.1:/harddisk:/otdr/ios_OTDR_Ots0_0_0_0_RX_20230301-101927.sor /users/test/
```

From Release 25.4.1, SOR files from manual and automatic scans are stored in separate folders within the OTDR directory. Automatically generated SOR files are saved in `/harddisk:/otdr/auto/`, while manually triggered SOR files are stored in the existing `/harddisk:/otdr/` folder.

Benefits

The OTDR offers several key benefits, including:

- Assess the quality of the fiber during system installation, before any live traffic run.
- Monitor the fiber link during operation, including live traffic. You can also monitor the fiber link during troubleshooting after cable cuts or repairs.
- Measure attenuation over the entire fiber link and across individual fiber sections.
- Determine the distance and magnitude of insertion loss and reflection loss.
- Detect fiber events, including concentrated loss events, reflection events, end-of-fiber events, and discontinuities or defects such as pinches or cuts. The OTDR pluggable can also detect loss events from splicing, patch panel connections, and couplers.

OTDR modes

OTDR modes are operational configurations that

- determine how scan parameters (like pulse width and scan duration) are selected and applied,
- optimize measurements for different user needs or fiber types, and

- support both automated and manual control for various operational scenarios.

An OTDR can operate in several modes to suit different network testing requirements. Selecting the appropriate mode helps ensure efficient, accurate fiber characterization by adapting OTDR performance to the specific task or fiber segment.

These modes are designed to address different testing needs and operational preferences:

1. Auto: The device automatically selects the optimal values for OTDR pulse width, scan duration, capture start time, and capture end time parameters. This is the default mode and does not require explicit configuration. However, you can manually configure the other scan parameters if needed.
2. Expert: You must manually configure all OTDR scan parameters with the valid values that are required for the OTDR measurement. Automatic adjustments are not performed in this mode.

Configure the OTDR scan parameters

Use this procedure to configure the parameters for the OTDR scan. If you do not configure the parameters, the NCS 1010 device uses the default values.

Procedure

- Step 1** Enter the OTS controller configuration mode for the port where you want to configure the OTDR parameters.

Example:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
```

- Step 2** Enter the OTDR mode.

If you want to configure the	then run this command
Expert mode	RP/0/RP0/CPU0:ios(config-Ots)#otdr scan-mode expert
Auto mode	Auto mode is the default and you do not need to configure it

- Step 3** Set the required parameters for the OTDR scan. For a complete list of OTDR parameters, refer to [OTDR scan parameters, on page 72](#).

Example:

```
RP/0/RP0/CPU0:ios(config-Ots)#otdr rx auto reflectance-threshold -50
RP/0/RP0/CPU0:ios(config-Ots)#otdr rx auto splice-loss-threshold 200
RP/0/RP0/CPU0:ios(config-Ots)#otdr rx expert pulse-width 6000
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

- Step 4** Commit the changes and exit the configuration mode.

Example:

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

What to do next

[Start the OTDR scan, on page 73.](#)

OTDR scan parameters

This table provides an overview of key OTDR parameters, including their definitions, measurement units, range of values, and the default values.

Table 13: OTDR scan parameters in Auto mode

Parameter	Description	Unit	Range	Default
otdr { rx tx } auto reflectance-threshold <value>	Threshold beyond which a reflective anomaly is reported as an event in the Rx or Tx direction.	dB	–50 to –10	–40
otdr { rx tx } auto splice-loss-threshold <value>	Threshold beyond which a loss anomaly is reported as an event in Rx or Tx direction.	dB	0.2 to 5	0.35
otdr { rx tx } auto excess-reflection-threshold <value>	Threshold beyond which a reflective event is reported as an excessive reflection event in the Rx or Tx direction.	dB	–50 to –10	–20
otdr { rx tx } auto back-scattering <value>	The back scattering value in the Rx or Tx direction.	dB	–90 to –70	–81.87
otdr { rx tx } auto refractive-index <value>	The refractive-index value in the Rx or Tx direction.	-	1.000 to 2.000	1.4682
otdr { rx tx } auto excess-orl-threshold <value>	Threshold below which OTDRABSORL EXCEEDED alarm is reported in the Rx or Tx direction.	dB	10–60	60

Parameter	Description	Unit	Range	Default
otdr { rx tx } auto excess-attenuation-threshold <value>	Threshold beyond which a Non-Reflective event is reported as an excessive attenuation event in the Rx or Tx direction.	dB	0.5 to 5	5
otdr { rx tx } auto end-of-fiber-loss-threshold <value>	Threshold based on which the OTDR identifies the fiber's end, distinguishing it from other components like splices or connectors.	dB	5–99	5.5

Table 14: OTDR scan parameters in Expert mode

Parameter	Description	Unit	Range	Default
otdr { rx tx } expert pulse-width <value>	Pulse width to be used during the expert scan in the Rx or Tx direction.	ns	5–20000	20
otdr { rx tx } expert capture-end <value>	OTDR capture endpoint during the expert scan in the Rx or Tx direction.	cm	0–15000000	15000000
otdr { rx tx } expert capture-start <value>	OTDR capture start point during the expert scan in the Rx or Tx direction	cm	0–10000000	0
otdr { rx tx } expert scan duration <value>	OTDR scan duration during the expert scan in the Rx or Tx direction.	Seconds	0–180	60

Start the OTDR scan

Manually initiate the OTDR scan to diagnose fiber defects, check fiber quality, or verify proper installation.



Note The Raman tuning application locks the OTDR scan at both fiber ends before the tuning starts, and releases the lock after the tuning completes. Therefore, when you try to start the OTDR scan when Raman tuning is running, your request gets rejected.

From Release 25.4.1, you can use the `label` keyword to append a custom substring as a prefix to the SOR file name. This substring helps you identify and retrieve specific SOR files stored in the directory.

Procedure

Step 1 Use the **otdr-start controller ots** *R/S/I/P direction* to start the OTDR scan manually.

Example:

```
RP/0/RP0/CPU0:ios#otdr-start controller ots 0/0/0/0 rx
Wed Feb 9 05:49:39.178 UTC
OTS OTDR Scan Started at RX
RP/0/RP0/CPU0:ios#
```

This example illustrates a rejected OTDR start request. Once an OTDR scan request has been rejected, it will not automatically run after the lock is released. You will need to create a new request to start the OTDR scan again. These examples show that OTDR scan is locked by Raman tuning:

```
RP/0/RP0/CPU0:ios#otdr-start controller ots 0/0/0/0 rx
Tue Feb 28 10:25:43.379 UTC
OTDR Scan cannot be started as it is locked by Another Entity/Application.
RP/0/RP0/CPU0:ios#
```

Step 2 Use the **label string** keyword, to append a custom substring as a prefix to the SOR file name.

Example:

```
RP/0/RP0/CPU0:ios#otdr-start controller ots 0/0/0/0 rx label Site1.ABC_xyz-1
Mon Nov 3 09:56:23.278 UTC
OTS OTDR Scan Started at RX
RP/0/RP0/CPU0:ios#
```

This example appends the string *Site1.ABC_xyz-1* to the SOR file name. For example:

```
/harddisk:/otdr/Site1.ABC_xyz-1_ios_OTDR_Ots0_0_0_0_RX_20250306-110133.sor.
```

The OTDR label must adhere to these limitations: Only the special characters dot, hyphen, and underscore are permitted. The maximum file name length is 255 characters. The maximum label length is 55 characters.

The OTDR scan initiates and begins analyzing the fiber. If the scan cannot start, an error message states the reason.

What to do next

Review scan results to identify defects and assess fiber quality.

View the OTDR measurements

Use this procedure to view the OTDR scan measurement results.

Table 15: Feature History

Feature Name	Release Information	Description
Optical Return Loss Reporting	Cisco IOS XR Release 7.11.1	<p>The Optical Return Loss (ORL) is now calculated during the OTDR scan and displayed as part of the OTDR results. You can also set the ORL threshold value.</p> <p>The ORL represents the total reflected optical power from a complete fiber link while accounting for fiber attenuation. When the ORL falls below a user-configured threshold value, the OTDR-ABS-ORL-EXCEEDED-TX or OTDR-ABS-ORL-EXCEEDED-RX alarm is raised. You can troubleshoot fiber transmission issues using the ORL value and OTDR results.</p> <p>To set the ORL threshold value, these keywords are added to the controller ots command:</p> <ul style="list-style-type: none"> • <code>otdr rx auto excess-orl-threshold <i>value</i></code> • <code>otdr tx auto excess-orl-threshold <i>value</i></code>

From Release 25.4.1, the OTDR scan measurement results show Total Measured Loss and Total Measured Length.

From Release 7.11.1, Optical Return Loss (ORL) is measured during the OTDR scan and displayed as part of the OTDR results. ORL represents the total reflected optical power from a complete fiber link, while considering the attenuation.

This measurement includes the natural backscattered power of the fiber and the reflected power coming from optical connectors, fiber splicing, or other discontinuities along the link. ORL is expressed with a positive number.



Note Higher ORL values are desirable for the fiber because they indicate lower back reflection. For example, an ORL of 40 dB is better than 20 dB.

Procedure

Use the command **show controllers ots R/S/I/P otdr-info direction** to view the OTDR scan measurements.

Example:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 otdr-info rx
Wed Feb  9 05:55:19.791 UTC
  Scan Direction: RX
  Scan Status: Data Ready
  SOR file: /harddisk:/otdr/IOS_NCS1010_OTDR_Ots0_0_0_0_RX_20220209-055045.sor
  Total Events detected: 11
  Scan Timestamp: Wed Feb  9 05:50:45 2022 UTC
  Event Type Legend: NR:Non-Reflective R:Reflective FE:Fiber-End ER:Excess-Reflection
```

Event#	Detected Event(s)	Location(km)	Accuracy(m)	Magnitude(dB)	Attenuation/km(dB)
1	R	50.4709	52.47	-39.87	0.18
2	NR	50.4709	52.47	1.17	0.18
3	R	100.9261	102.92	-37.73	0.21
4	NR	100.9261	102.92	1.01	0.21
5	R	105.9500	107.94	-38.52	0.24
6	NR	105.9500	107.94	0.85	0.24
7	R	112.7458	114.74	-40.56	0.00
8	NR	112.7458	114.74	1.48	0.00
9	NR	117.9873	119.98	0.66	-0.02
10	R FE	120.1206	122.12	-35.55	0.00
11	NR FE	120.1206	122.12	21.65	0.00

Example:

These are the sample OTDR measurement results displaying Total Measured Loss, Total Measured Length and SOR file with appended OTDR label.

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/2 otdr-info tx
Thu Dec  4 09:28:25.136 IST
  Scan Direction: TX
  Scan Status: Data Ready
  Total Measured Loss: 11.04 dB
  Total Measured Length: 50746.3000 m
  Optical Return Loss: 25.0 dB
  SOR file: /harddisk:/otdr/auto/ios_OTDR_Ots0_0_0_2_TX_20251203-122210.sor
  Total Events detected: 4
  Scan Timestamp: Wed Dec  3 12:22:10 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)
1	NR	0.6800	2.00	0.66
2	R	10.4800	2.01	-33.66
3	R FE ER	50746.3000	52.74	-15.28
4	NR FE	50746.3000	52.74	11.04

Note

The output shows Total measured loss and Total measured length only if a Fiber-End (FE) event is detected.

After you upgrade the FPD of the line card, you may not be able to view the previous OTDR scan results using the **show controllers ots** *Rack/Slot/Instance/Port* *otdr-info direction*. To access results from earlier OTDR scans, locate the .SOR files on the hard disk.

You can dynamically raise or clear Excessive Reflection (ER) and Excess Attenuation (EA) events and alarms by modifying their respective threshold values. In contrast, to raise or clear Fiber End (FE) and Reflectance (R) events, change the relevant thresholds and rerun the OTDR scan.

See [OTDR scan measurement results, on page 84](#) for various examples.

Stop the OTDR scan

Use this procedure to stop the OTDR scan manually.

Procedure

Enter the command **otdr-stop controller ots** *R/S/I/P direction* to stop the OTDR scan.

Example:

```
RP/0/RP0/CPU0:ios#otdr-stop controller ots 0/0/0/0 rx
Wed Feb  9 06:03:37.406 UTC
OTS OTDR Scan Stopped at RX
RP/0/RP0/CPU0:ios#
```

Automatic OTDR scans

An automatic OTDR scan is a fiber diagnostics feature that

- automatically triggers OTDR tests in response to specific events such as span fault, span restoration, device power cycling, and line card cold reload that affect the optical span,
- enables RX directionscanning for comprehensive fault detection and prevents scan collisions, and
- provides rapid fault localization by monitoring and raising relevant alarms during scan execution.

Table 16: Feature History

Feature Name	Release Information	Feature Description
Automatic OTDR Scan	Cisco IOS XR Release 7.11.1	<p>An OTDR scan is automatically triggered on Rx direction, whenever events such as span fault, span restore, device power cycle, and line card cold reload occur. The automatic scan lets you quickly identify fiber failure type and fault location.</p> <p>Commands added to enable and view OTDR results:</p> <pre>otdr auto-scan [enable disable] show olc otdr-status [details]</pre>

Autoscan direction and duration

In Release 7.11.1, autoscan is performed only in the Rx direction, regardless of whether the span fault is unidirectional or bidirectional.

In both span up and span down events, the bidirectional OTDR scan process terminates after both Rx and Tx scans have been completed successfully. You can stop the scan sequence by disabling the autoscan feature.

The OTDR autoscan takes less than three minutes to complete. During the autoscan, the OTDR-SCAN-IN-PROGRESS-RX alarm is raised and gets cleared once the scan is finished.

Autoscan behavior

Autoscan manages OTDR scanning by coordinating access to scanning resources and responding to interactions with manual and application-triggered scans:

Autoscan manages OTDR scanning operations in these ways:

- Autoscan locks the OTDR resource to prevent manual scan triggers using the **otdr-start** command. However, if a manual scan is already in progress, autoscan waits for its completion before proceeding.
- Autoscan terminates any ongoing scan that was triggered by other applications, such as Raman turn-up.
- During autoscan, if a change in Span Status is detected, it terminates the ongoing scan and automatically initiates a new autoscan.

Criteria for span fault and restoration events

This table lists the detection criteria for span fault and restoration events.

Table 17: Definition of span up and span down events

Events	Non-Raman span	Raman span	Raman span with dual safety configured
Span Down	Raise of RX-LOS-P alarm at OSC controller	Raise of RX-LOS-P alarm at DFB controller	Raise of RX-LOS-P alarm at both OSC and DFB controllers
Span Up	Clearing of RX-LOS-P alarm at OSC controller	Clearing of RX-LOS-P alarm at DFB controller	Clearing of RX-LOS-P alarm at both OSC and DFB controllers

Configure automatic OTDR scan

Use this task to enable OTDR scan to run automatically during certain events.

Procedure

Step 1 Enter OTS controller configuration mode for the port on which you want to enable automatic OTDR scan.

Example:

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

Step 2 Enable automatic OTDR scan.

Example:

```
RP/0/RP0/CPU0:ios(config-olc-ots)#otdr auto-scan enable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#exit
```

If you want to disable the automatic OTDR scan, use the **otdr auto-scan disable** command.

Automatic OTDR scans are enabled for the selected port. The system will now run OTDR scans automatically during applicable events, allowing you to proactively monitor fiber links and detect faults without manual intervention.

Verify autoscan status

Use this procedure to verify the status of the autoscan.

Procedure

View the automatic OTDR scan results using the command **show olc otdr-status [details]**.

Example:

This sample display the status of autoscan triggered due to a span fault. See [Automatic OTDR scan results, on page 80](#) for more examples.

```
RP/0/RP0/CPU0:ios#show olc otdr-status details
Mon Sep 18 13:16:16.461 UTC
Controller                               : Ots0/0/0/0
Auto-scan Start Time                     : NA
OTDR Auto-scan Status                   : RUNNING
Status Detail                           : Starting on Span Down
Optical Span Status                      : Down
Trigger Event                           : Span Fault
Last Trigger Event                       : Span Restore

RP/0/RP0/CPU0:ios#show olc otdr-status details
Mon Sep 18 13:16:33.304 UTC
Controller                               : Ots0/0/0/0
Auto-scan Start Time                     : 2023-09-18 13:16:27
OTDR Auto-scan Status                   : RUNNING
Status Detail                           : Waiting Scan Completion on Span Down
Optical Span Status                      : Down
Trigger Event                           : Span Fault
Last Trigger Event                       : Span Restore

RP/0/RP0/CPU0:ios#show olc otdr-status details
Mon Sep 18 13:18:54.154 UTC
Controller                               : Ots0/0/0/0
Auto-scan Start Time                     : 2023-09-18 13:16:27
OTDR Auto-scan Status                   : COMPLETED
Status Detail                           : Completed on Span Down
Optical Span Status                      : Down
Trigger Event                           : Span Fault
Last Trigger Event                       : Span Fault
```

What to do next

If events indicate potential fiber issues, review the SOR file or perform additional analysis as needed.

Automatic OTDR scan results

This table presents automatic OTDR scan results observed across different network scenarios.

Table 18: Automatic scan results

Network scenarios	Sample OTDR scan results
Non-Raman span	<pre> RP/0/RP0/CPU0:ios#show olc otdr-status Mon Sep 18 13:10:57.733 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : NA OTDR Auto-scan Status : DISABLED Status Detail : NA Optical Span Status : UP Trigger Event : NA RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 13:11:00.565 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : NA OTDR Auto-scan Status : DISABLED Status Detail : NA Optical Span Status : UP Trigger Event : NA Last Trigger Event : NA </pre>
Raman span	<pre> RP/0/RP0/CPU0:ios#show olc otdr-status Mon Sep 18 13:41:05.088 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : NA OTDR Auto-scan Status : DISABLED Raman Turn Up Fiber Check : NA Status Detail : NA Optical Span Status : UP Trigger Event : NA RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 13:41:08.825 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : 2023-09-20 13:58:17 OTDR Auto-scan Status : DISABLED Status Detail : NA Raman Turn Up Fiber Check : NA Optical Span Status : UP Trigger Event : NA Last Raman Turn Up Scan Time : NA Last Raman Turn Up Fiber Check : NA Last Trigger Event : NA </pre>

Network scenarios	Sample OTDR scan results
Span restore	<pre> RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 13:12:40.430 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : NA OTDR Auto-scan Status : RUNNING Status Detail : Starting on Span Up Optical Span Status : Up Trigger Event : Span Restore Last Trigger Event : NA RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 13:15:06.153 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : 2023-09-18 13:12:42 OTDR Auto-scan Status : RUNNING Status Detail : Waiting Scan Completion on Span Up Optical Span Status : Up Trigger Event : Span Restore Last Trigger Event : NA RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 13:15:06.153 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : 2023-09-18 13:12:42 OTDR Auto-scan Status : COMPLETED Status Detail : Completed on Span Up Optical Span Status : Up Trigger Event : Span Restore Last Trigger Event : Span Restore </pre>
Autoscan is unable to lock the OTDR resource	<pre> RP/0/RP0/CPU0:ios# show olc otdr-status details Wed Sep 20 14:09:37.011 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : 2023-09-20 13:58:17 OTDR Auto-scan Status : COMPLETED Status Detail : Failed due to Timeout Raman Turn Up Fiber Check : NA Optical Span Status : UP Trigger Event : Span Restore Last Raman Turn Up Scan Time : NA Last Raman Turn Up Fiber Check : NA Last Trigger Event : NA </pre>

Network scenarios	Sample OTDR scan results
Autoscan on one port is waiting for the OTDR resource, because the autoscan is running on another port.	<pre>RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 15:57:43.671 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : 2023-09-18 15:57:43 OTDR Auto-scan Status : COMPLETED Status Detail : Waiting for OTDR Resource Raman Turn Up Fiber Check : NA Optical Span Status : UP Trigger Event : Span Restore Last Raman Turn Up Scan Time : NA Last Raman Turn Up Fiber Check : NA Last Trigger Event : NA</pre>
<p>Autoscan is enabled and Raman turnup is disabled on a Raman span</p> <p>In this case</p> <ul style="list-style-type: none"> • On the span down event, the autoscan is triggered. • On the span up event, autoscan is not triggered and OTDR Autoscan Status will be IDLE, because Raman pumps are turned on before the start of autoscan. • On the span up event, autoscan is triggered and <i>OTDR Autoscan Status</i> is displayed as RUNNING. 	<pre>RP/0/RP0/CPU0:ios#show olc otdr-status details Sat Sep 23 12:42:11.304 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : NA OTDR Auto-scan Status : IDLE Status Detail : NA Raman Turn Up Fiber Check : NA Optical Span Status : UP Trigger Event : Span Fault Last Raman Turn Up Scan Time : NA Last Raman Turn Up Fiber Check : NA Last Trigger Event : Span Restore</pre>
Ongoing autoscan is stopped by the user	<pre>RP/0/RP0/CPU0:ios#show olc otdr-status details Mon Sep 18 15:08:27.370 UTC Controller : Ots0/0/0/0 Auto-scan Start Time : 2023-09-18 15:08:09 OTDR Auto-scan Status : COMPLETED Status Detail : Stopped by User Raman Turn Up Fiber Check : NA Optical Span Status : DOWN Trigger Event : Span Fault Last Raman Turn Up Scan Time : 2023-09-18 14:55:40 Last Raman Turn Up Fiber Check : Success Last Trigger Event : Span Restore</pre>

See [OTDR scan status](#), on page 84 for a list of the different OTDR scan statuses and their definitions.

OTDR scan measurement results

This sample displays the ORL value as part of OTDR status:

```
RP/0/RP0/CPU0:ios#show controllers Ots 0/0/0/2 otdr-info rx
Mon Oct 2 11:55:48.552 UTC
Scan Direction: RX
Scan Status: Data Ready
Optical Return Loss: 39.0 dB
SOR file: /harddisk:/otdr/ios_OTDR_Ots0_0_0_2_RX_20231001-110754.sor
Total Events detected: 8
Scan Timestamp: Sun Oct 1 11:07:54 2023 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      | NR EA             | 4.4100      | 2.00         | 0.69           | 0.00
2      | NR                | 664.3200    | 2.66         | 0.21           | 0.00
3      | R ER              | 18222.3900  | 20.22        | -33.78         | 0.19
4      | NR                | 18222.3900  | 20.22        | 0.35           | 0.19
5      | R ER              | 68674.4800  | 70.67        | -32.25         | 0.20
6      | NR                | 68674.4800  | 70.67        | 0.36           | 0.20
7      | R FE ER           | 118765.2600 | 120.76       | -28.55         | 0.23
8      | NR FE             | 118765.2600 | 120.76       | 25.86          | 0.23
```

OTDR scan status

This section describes and explains the various OTDR statuses that appear when using the **show olc controller ots R/S/I/P otdr-status** and **show controller ots R/S/I/P otdr-info** commands.

Table 19: OTDR scan status

Scan status	Description
Measuring	OTDR scan is currently in progress.
Data Processing	OTDR scan has completed, and the data is ready for review
Data Ready	OTDR scan is stopped by the user, when it is in progress.
Stopped	OTDR is processing data just before populating the event table.
Error	The OTDR status may occasionally enter an Error state for various unpredictable reasons. One possible cause is a timeout event, which occurs if the scan is not completed within five minutes. In such cases, no SOR files or event table is generated. It is important to note that this is a rare occurrence. You can still initiate the OTDR scan to obtain the scan results.

This table explains the various OTDR scan statuses that are applicable for manual and autoscan.

Table 20: OTDR scan status applicable for manual and autoscan

Type of OTDR scan	Scan Status	
	show olc controller ots R/S/I/P otdr-status	show controller ots R/S/I/P otdr-info
Manual	NA	<ul style="list-style-type: none">• Measuring• Data Processing• Data Ready• Stopped• Error
Autoscan	<ul style="list-style-type: none">• Measuring• Data Processing• Data Ready• Stopped• Error	<ul style="list-style-type: none">• Measuring• Data Processing• Data Ready• Stopped• Error

