



## Span Loss

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This chapter describes the Span Loss optical application for Cisco NCS 1020.

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### Span loss calculations

A span loss calculation is an optical network measurement that

- determines the signal power loss between NCS 1020 and NCS 1010 (amplifier) 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 the following values:

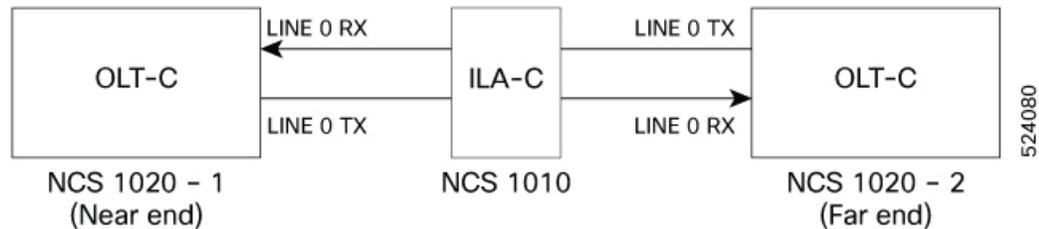
- **Span loss with pumps off:** This measurement is the difference in power values between the DFB-Tx/Rx of the remote node and the DFB-Rx/Tx of the local node. This measurement also includes a timestamp. When a Raman span is up, the span loss application latches on to the difference in power between 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.

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**



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.

## View span loss values

Use this procedure to display span loss measurements between NCS 1010 nodes. This process 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.

### Procedure

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

#### Example:

The following sample shows the output of the **show olc span-loss** command on a Raman span with Raman tuning enabled.

```
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
```

The following 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.

```
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
```

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

```
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 span loss thresholds.

## Procedure

**Step 1** Select the controller on which the span loss thresholds need to be configured 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** Configure the minimum and maximum span loss threshold values.

**Example:**

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

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.

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

The system raises a SPAN-LOSS-OUT-OF-RANGE alarm under following conditions:

- **Non-Raman Span/PID:** When Rx span loss is greater than the maximum threshold or lesser than the minimum threshold.
- **Raman Span/PID:** When Estimated Rx span loss is greater than the maximum threshold or lesser than the minimum threshold.

The system does not trigger a SPAN-LOSS-OUT-OF-RANGE alarm when Raman span loss is measured with Raman tuning disabled.

**Step 3** Configure the minimum and maximum difference thresholds between OSC and signal span loss values.

**Example:**

```
RP/0/RP0/CPU0:ios(config-olc-ots)#span-loss payload-osc-min-deviation 80
RP/0/RP0/CPU0:ios(config-olc-ots)#span-loss payload-osc-max-deviation 100
```

The above example sets the minimum threshold deviation to 8 dB and maximum threshold deviation to 10 dB.

The system raises a SIGNAL-OSC-SPAN-LOSS-DIFF-OUT-OF-RANGE alarm if the deviation between the received OSC span loss and the received signal span loss is greater than the maximum threshold or less than the minimum threshold.

**Step 4** Configure the bidirectional span loss mismatch threshold value for the span.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#span-loss bidir-mismatch-tolerance 400
```

This example sets the bidirectional span loss mismatch threshold value to 40 dB. The range is 0.0 dB to 42.0 dB.

The system raises a *SIGNAL-BIDIR-SPAN-LOSS-MISMATCH* alarm when the difference between Tx and Rx signal span loss is greater than the set tolerance value. For non-Raman spans, the difference is between Tx and Rx signal span loss. For Raman spans, it is between apparent Rx and Tx signal span loss.

**Note**

The configured tolerance value must always be greater than 0.5 dB, because a hysteresis of 0.5 dB is applied to prevent alarm toggling. The alarm will clear when the span loss difference decreases to, or below, a value that is 0.5 dB less than the configured tolerance.

**Step 5** 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
```

## Baseline threshold

*Table 1: Feature History*

Feature Name	Release Information	Description
Span Loss Baseline Deviation Monitoring	Cisco IOS XR Release 26.1.1	<p>You can now configure minimum and maximum deviation values to monitor the measured Rx signal span loss against the baselined value. The valid range is defined as <b>baselined span loss – minimum deviation</b> (lower limit) and <b>baselined span loss + maximum deviation</b> (upper limit). If the measured Rx span loss falls outside this calculated range, a <b>SPAN-LOSS-BASELINE-DEVIATION-OUT-OF-RANGE</b> alarm is raised.</p> <p>Commands added:</p> <ul style="list-style-type: none"> <li>• max-baseline-deviation</li> <li>• min-baseline-deviation</li> </ul>

After network turn-up, ALC saves the Rx and Tx span loss values on all nodes as a baseline. These values are then compared with the user-configured minimum and maximum threshold values.

The system subtracts the configured *min-baseline-deviation* value from the *baselined span loss* to determine the lower threshold, and adds the *max-baseline-deviation* value to determine the upper threshold.

If the measured Rx signal span loss falls outside the configured range, the **SPAN-LOSS-BASELINE-DEVIATION-OUT-OF-RANGE** alarm is raised. The range is defined by:

- Lower limit = baselined span loss – min-baseline-deviation
- Upper limit = baselined span loss + max-baseline-deviation

For example, if the baselined span loss is 20 dB, the minimum deviation is 1 dB, and the maximum deviation is 3 dB:

- Lower limit =  $20 - 1 = 19$  dB
- Upper limit =  $20 + 3 = 23$  dB

The alarm is raised only if the measured span loss drops below 19 dB or exceeds 23 dB.

### Threshold hysteresis

The hysteresis value for alarms is used to prevent frequent toggling when the threshold parameter fluctuates around the threshold value. The hysteresis value for the SPAN-LOSS-BASELINE-DEVIATION-OUT-OF-RANGE alarm is 0.5 dBm.

## Configure baseline threshold

Use this task to configure the minimum and maximum threshold values for baseline span loss.

### Procedure

**Step 1** Use the **optical-line-control** command to select the controller on which the baseline threshold must be configured.

#### 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
```

**Step 2** Use the **span-loss min-baseline-deviation** command to configure the minimum and maximum baseline span loss threshold values.

#### Example:

```
RP/0/RP0/CPU0:ios(config-olc-ots)#span-loss min-baseline-deviation 200
RP/0/RP0/CPU0:ios(config-olc-ots)#span-loss max-baseline-deviation 300
```

**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
```

**Step 4** Use the **show running-config optical-line-control controller Ots** command to verify the configured values.

The entries in bold display the configured minimum and maximum threshold values for baseline span loss.

#### Example:

```
RP/0/RP0/CPU0:NCS1020_P1D_04#show running-config optical-line-control controller Ots 0/0/0/0
Mon Sep  9 12:48:52.008 IST
optical-line-control
controller Ots0/0/0/0
  psd 1 -64
  psd 2 -63
  ...
  psd-min -226
  apc manual
```

```
otdr
  auto-scan enable
  !
  raman-tuning disable
  gain-estimator manual
  fiber-type SMF
  span-loss max-baseline-deviation 35
  span-loss min-baseline-deviation 0
  span-loss payload-osc-max-deviation 100
  span-loss payload-osc-min-deviation 80
  link-tuner spectrum-density 93
  link-tuner manual
  apc-span-mode RX
  apc-span-mode TX
  span-length 1005
  connector-loss rx 0.5
  connector-loss tx 0.5
  apc-span-loss-correction-threshold RX 5
  apc-span-loss-correction-threshold TX 5
```

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Baseline threshold values are configured on the nodes.

