Span Loss

Span loss

A span loss 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

  For a Raman span, the span loss application uses this span loss value to raise the *Span Loss Value Out Of Range* alarm.

- **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. The span loss application starts reporting the span loss value after 10 seconds once span comes up. If span loss changes, for example when a change in fiber loss occurs, the span loss application typically takes 9010 seconds to update the span loss.

Figure 1: Sample two node topology of NCS 1010 nodes
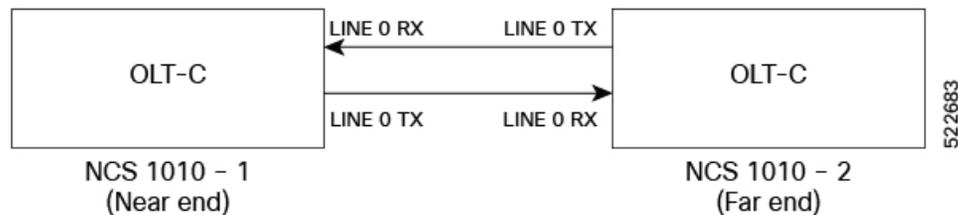
For example, in the previous figure, the **Tx Span Loss** on NCS 1010-1 is the difference in signal power between LINE 0 TX on NCS 1010-1 and LINE 0 RX on NCS 1010-2.

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.

Table 1: Feature History

Feature Name	Release Information	Description
OSC spanloss and signal spanloss support	Cisco IOS XR Release 26.1.1	The span loss application now separately reports C band and Optical Supervisory Channel (OSC) span loss values. Additionally, you can configure deviation thresholds for span loss monitoring. If the difference between *Rx OSC span loss* and *Rx signal span loss* exceeds the set minimum or maximum thresholds, the *Signal OSC Span Loss Diff Out of Range* alarm is raised. This feature supports threshold configuration for both Raman and non-Raman nodes.
		This enhancement enables individual span loss measurements for the C band and OSC, instead of a combined total span loss measurement.
		Span loss payload configuration is specific to each controller within the optical-line-control configuration.
		Commands added:
		• span-loss payload-osc-min-deviation
		• span-loss payload-osc-max-deviation
Enhanced span loss reporting frequency	Cisco IOS XR Release 26.1.1	The span loss application now reports the span loss value for a span every 10 seconds. Previously, the interval was 90 seconds.

Follow these steps to configure span loss deviation thresholds:

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.

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

- **Non-Raman Span or PID**: when Rx span loss is greater than the maximum threshold or less than the minimum threshold.

- **Raman Span or PID**: when the estimated Rx span loss is greater than the maximum threshold or less than the minimum threshold.

The system does not raise 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
```

This 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 2: Feature History

Feature Name	Release Information	Description
Span Loss Baseline Deviation Monitoring	Cisco IOS XR Release 26.1.1	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 **baselined span loss – minimum deviation** (lower limit) and **baselined span loss + maximum deviation** (upper limit). If the measured Rx span loss falls outside this calculated range, a SPAN-LOSS-BASELINE-DEVIATION-OUT-OF-RANGE alarm is raised. Commands added: • max-baseline-deviation • min-baseline-deviation

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
```

Baseline threshold values are configured on the nodes.

Configure baseline threshold