Configuring Controllers

This chapter describes the Optics Controller for the 36-port QSFP56-DD 400 GbE and 48-port QSFP28 100 GbE Line Cards. This chapter also describes the procedures used to configure the controllers.

Note When two MACsec enabled Cisco 8000 Series Routers with Coherent Line Cards are connected, there is no compatibility between Coherent Line Cards of IOS XR Release.

Following controller configuration options are supported on the router:

- breakout - Configure breakout mode (‘breakout 4x10’ only.)
- clear - Clear the uncommitted configuration.
- commit - Commit the configuration changes to running.
- do - Run an exec command.
- end - Exit from configure mode.
- exit - Exit from this submode.
- ext-description - Set ext-description for this controller.
- no - Negate a command or set its defaults.
- pwd - Commands used to reach current submode.
- root - Exit to the global configuration mode.
- show - Show contents of configuration.

How to Configure Controllers

This section contains the following procedures:

Configuring Optics Controller

Configuring optics controller of breakout 4x10:

```
RP/0/RP0/CPU0:uut#configure
Fri Oct 11 16:22:31.222 UTC
RP/0/RP0/CPU0:uut(config)#controller optics 0/1/0/28
RP/0/RP0/CPU0:uut(config-Optics)#breakout 4x10
RP/0/RP0/CPU0:uut(config-Optics)#commit
Fri Oct 11 16:23:26.868 UTC
RP/0/RP0/CPU0:uut(config-Optics)#end
RP/0/RP0/CPU0:uut#
RP/0/RP0/CPU0:uut#show running-config controller optics 0/1/0/28
Fri Oct 11 16:23:41.273 UTC
controller Optics0/1/0/28
breakout 4x10
!
```

Disabling Optical Modules

This feature provides the ability to disable and re-enable an optical module through CLI, which simulates online insertion and removal (OIR) by disabling power to the transceiver port.

Typical troubleshooting procedures for optical modules can include performing OIR by removing and re-installing the module, which requires onsite personnel to physically reseat the optical module. The ability to remotely disable and enable an optical module can significantly reduce operational expenses.

Example

The following output shows a QSFP28 module powered on and in UP state:

```
Router# show controllers optics 0/0/0/0

Controller State: Up

Transport Admin State: In Service

Laser State: Off

LED State: Not Applicable

FEC State: FEC ENABLED

 Optics Status

         Optics Type:  QSFP28 100G FR
         Wavelength = 1311.00 nm

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

```
        LOS/LOL/Fault Status:

        Laser Bias Current = 26.2 mA
        Actual TX Power = 0.73 dBm
        RX Power = -0.68 dBm

        Performance Monitoring: Disable

        THRESHOLD VALUES
        ----------------

        Parameter                High Alarm  Low Alarm  High Warning  Low Warning
        -----------------------  ----------  ---------  ------------  -----------
        Rx Power Threshold(dBm)         7.4      -10.4           4.5         -6.3
        Tx Power Threshold(dBm)         7.0       -6.3           4.0         -2.4
        LBC Threshold(mA)            100.00       8.00         83.00        10.00
        Temp. Threshold(celsius)      75.00      -5.00         70.00         0.00
        Voltage Threshold(volt)        3.63       2.97          3.46         3.13

        Polarization parameters not supported by optics

        Temperature = 27.92 Celsius
        Voltage = 3.24 V

Transceiver Vendor Details

        Form Factor           : QSFP28
        Optics type           : QSFP28 100G FR
        Name                  : CISCO-CISCO
        OUI Number            : 00.00.0c
        Part Number           : 10-3248-01
        Rev Number            : 01
        Serial Number         : FBN2331A114
        PID                   : QSFP-100G-FR-S
        VID                   : ES0
        Date Code(yy/mm/dd)   : 19/09/19
```

To disable the module, use the **transceiver disable** command in controller optics configuration mode:

```
Router(config)# controller optics 0/0/0/0
Router(config-Optics)# transceiver disable
Router(config-Optics)# commit
Router(config-Optics)# end
```

The following example shows the QSFP28 module disabled and powered down:

```
Router# show controllers optics 0/0/0/0

Controller State: Down

Transport Admin State: In Service

Laser State: Off

 Optics Status

        Optics Type:  Unknown optics
        Wavelength = 0.00 nm

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

```
        LOS/LOL/Fault Status:

        TX Power = N/A
        RX Power = N/A

        Performance Monitoring: Disable

        THRESHOLD VALUES
        ----------------

        Parameter                 High Alarm  Low Alarm  High Warning  Low Warning
        ------------------------  ----------  ---------  ------------  -----------
        Rx Power Threshold(dBm)          7.4      -10.4           4.5         -6.3
        Tx Power Threshold(dBm)          7.0       -6.3           4.0         -2.4
        LBC Threshold(mA)             100.00       8.00         83.00        10.00
        Temp. Threshold(celsius)       75.00      -5.00         70.00         0.00
        Voltage Threshold(volt)         3.63       2.97          3.46         3.13

        Polarization parameters not supported by optics

        Temperature = 0.00 Celsius
        Voltage = 0.00 V

Transceiver Vendor Details
```

To re-enable the module, use the **no transceiver disable** command in controller optics configuration mode.

Diagnostic Parameters for Optical Transceivers

Table 1: Feature History Table

Feature Name	Release Information	Description
Diagnostic Parameters for Optical Transceivers	Release 7.5.5	

Feature Name	Release Information	Description
		You can analyze the diagnostic parameters for optical transceivers installed on a network device and detect potential issues with the optical transceivers, such as excessive power levels, abnormal temperature readings, or degradation of the optical signal. Such analysis is possible because the **show controllers optics** command now displays the following diagnostic parameters: • Effective Signal to Noise Ratio (eSNR) • Pulse Amplitude Modulation with Four Levels (PAM4) Level Transition Parameter (LTP) • Pre-Forward Error Correction (FEC) and Post-FEC Bit Error Rate (BER) • Frame Error Count (FERC) • Laser age • Thermoelectric Cooler (TEC) current • Laser frequency • Laser temperature For additional information on VDM (Versatile Diagnostics Monitoring), see the Common Management Interface Specification. The feature introduces these changes: **CLI:** • The **observable-info** keyword is added to the show controller optics command. **YANG Data Model:** • New XPath for `Cisco-IOS-XR-controller-optics-oper.yang`

Feature Name	Release Information	Description
		(see GitHub, YANG Data Models Navigator)

In order to monitor and report the performance of an optical transceiver and thereby enhancing the troubleshooting capabilities of the optical transceiver, the **observable-info** keyword is added to the **show controllers optics** command to display the diagnostics parameters. These parameters help in monitoring the health of the network when the optical transceiver heats up, when the link is down, when alarms are raised, or when there's traffic loss in the network. This improvement in the **show controllers optics** command now displays the following diagnostic parameters:

- Effective Signal to Noise Ratio (eSNR)
- Pulse Amplitude Modulation with Four Levels (PAM4) Level Transition Parameter (LTP)
- Pre-Forward Error Correction (FEC) and Post-FEC Bit Error Rate (BER)
- Frame Error Count (FERC)
- Laser age
- Thermoelectric Cooler (TEC) current
- Laser frequency
- Laser temperature

Note Not all optical transceivers support the **observable-info** keyword. Also, the parameters that are displayed depend on what the optical transceiver supports, that is, not all optical transceivers display the same parameters. For additional information on VDM (Versatile Diagnostics Monitoring), see the Common Management Interface Specification.

Verification

The following **show controllers optics observable-info** command displays the monitoring parameters of the optical transceiver present in the 0/0/0/9 location ID. The 0/0/0/9 location ID represents rack/slot/instance/port. Based on the requirement, the network administrators can use the displayed values of this command for monitoring and troubleshooting.

```
Router#show controllers optics 0/0/0/9 observable-info
Observable Information

[eSNR Media Input]
 Unit: dB
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Lane0    21.30              0.00                0.00                0.00
0.00                n   n     n   n
 Lane1    22.05              0.00                0.00                0.00
0.00                n   n     n   n
 Lane2    22.62              0.00                0.00                0.00
0.00                n   n     n   n
 Lane3    22.05              0.00                0.00                0.00
```

```
0.00                n   n     n   n

[PAM4 Level Transition Parameter Media Input]
 Unit: dB
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Lane0    47.79              0.00                0.00                0.00
0.00                n   n     n   n
 Lane1    54.70              0.00                0.00                0.00
0.00                n   n     n   n
 Lane2    64.34              0.00                0.00                0.00
0.00                n   n     n   n
 Lane3    59.64              0.00                0.00                0.00
0.00                n   n     n   n

[Pre-FEC BER Minimum Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00          0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Minimum Host Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00          0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Maximum Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00          0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Maximum Host Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00          0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Average Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00          0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Average Host Input]
 Unit: n/a
```

```
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Current Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[Pre-FEC BER Current Host Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Minimum Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Minimum Host Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Maximum Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Maximum Host Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Average Media Input]
 Unit: n/a
 Id       Value              LowThreshWarn       HighThresWarn       LowThreshAlarm
```

```
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Average Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Current Media Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n

[FERC Current Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn       LowThreshAlarm
HighThreshAlarm     TCAWarn   TCAAlarm

                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
0.000E+00           n   n     n   n
```

Loopback on Optical Transceivers

Table 2: Feature History Table

Feature Name	Release Information	Description
Loopback on Optical Transceivers	Release 7.5.5	

Feature Name	Release Information	Description
		You can now easily detect link failures between the optical transceiver and an external device such as a router by creating a loopback within the transceiver itself. Enabling loopback detects the fault in the physical or network connections, such as, traffic loss or a faulty optical transceiver. The loopback configuration allows incoming traffic within the transceiver to be redirected back to its source. By analyzing the loopback signals received at the source, it becomes possible to detect physical connectivity failures or network issues, such as packet loss or a malfunctioning transceiver. The feature introduces these changes: **CLI:** Modified the controller optics command by adding the following keywords: • **host loopback internal** • **host loopback line** • **loopback internal** • **loopback line** The **information loopback** keyword is added to the show controller optics command. **YANG Data Model:** • New XPaths for `Cisco-IOS-XR-controller-optics-cfg.yang` (see GitHub, YANG Data Models Navigator)

You can now enable loopback functionality on the optical transceivers. Loopback is the process of redirecting inbound traffic or data signals from an optical transceiver back to the module itself. Re-routing traffic to its source enables utilization of the received data for diagnostic purposes, particularly in the identification and

resolution of physical connectivity issues or network-related problems, such as traffic loss or a faulty optical transceiver.

The optical transceiver is divided into two sides, the host side, which is positioned towards the router, and the media side, which is positioned towards the wire or cable media. It is possible to enable loopback on both the host side and media side of the optical transceiver.

Note Loopback can be performed only when the controller state is active (UP) and in the maintenance mode.

There are four types of loopback:

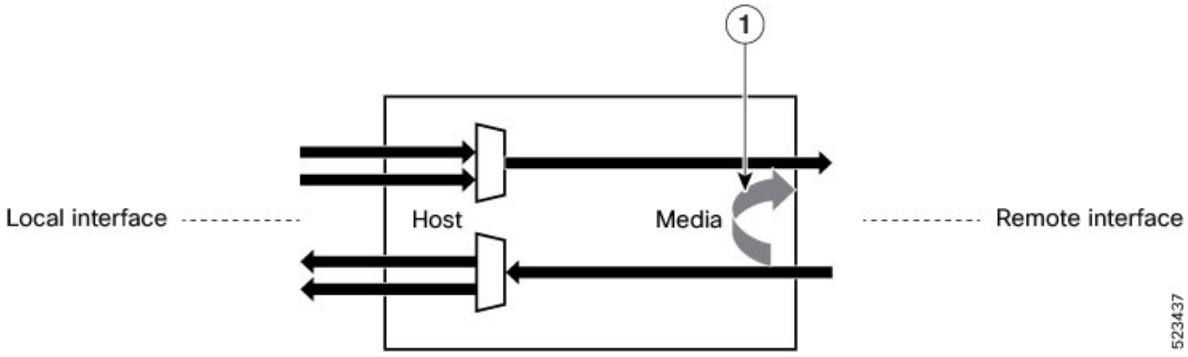
- Loopback Internal or Media Side Output Loopback
- Loopback Line or Media Side Input Loopback
- Host Loopback Internal or Host Side Input Loopback
- Host Loopback Line or Host Side Output Loopback

Note Configuring the internal loopback brings up the host interface and configuring the line loopback brings up the remote interface.

Media Side Input Loopback Configuration

In loopback line or media side input loopback, the signals received at the media side are looped back to the media side, indicating that the received data on the media is transmitted back to the media, that is, towards the remote interface. This is indicated by the arrow labeled as 1 in the illustration.

Figure 1: Media Side Input Loopback on the Optical Transceiver



Configuration Example

This example shows how to enable media side input loopback on the optical transceiver:

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#loopback line
```

```
Loopback is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

Running Configuration

This example shows the running configuration of the media side input loopback on the optical transceiver:

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 loopback line
!
```

Verification

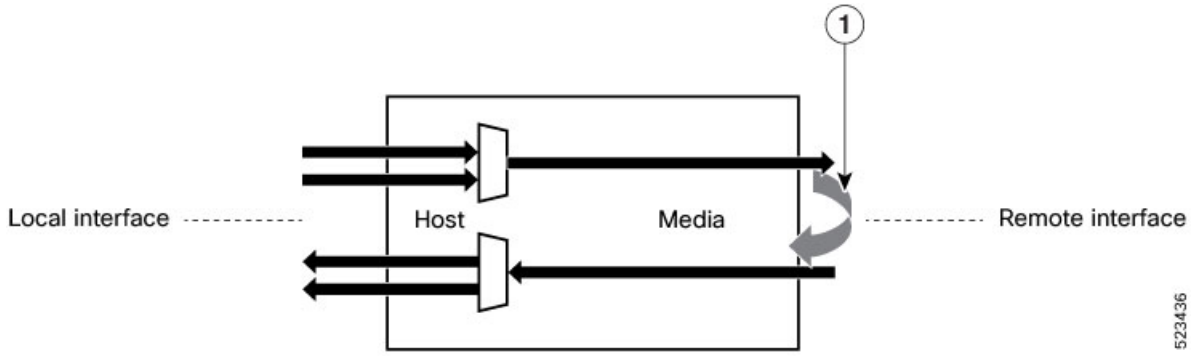
This example shows how to verify the media side input loopback configuration on the optical transceiver:

```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: None
Loopback Media: Line

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

Media Side Output Loopback

In loopback internal or media side output loopback, the loopback signal originating from the NPU is looped back to the same NPU on the media or line side, towards the remote interface. This is indicated by the arrow labeled as 1 in the illustration.

Figure 2: Media Side Output Loopback on the Optical Transceiver



Configuration Example

This example shows how to enable media side output loopback on the optical transceiver:

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#loopback internal
Loopback is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

Running Configuration

This example shows the running configuration of the media side output loopback on the optical transceiver:

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 loopback internal
!
```

Verification

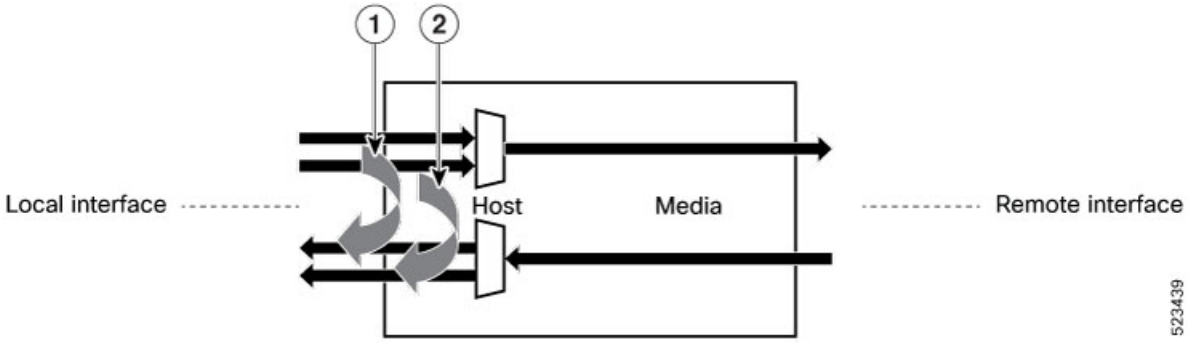
This example shows how to verify the media side output loopback configuration on the optical transceiver:

```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: None
Loopback Media: Internal

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

Host Side Input Loopback Configuration

In host loopback internal or host side input loopback, the loopback signal coming from the NPU is looped back to the NPU on the host, that is, towards the local interface. This is indicated by the arrows labeled as 1 and 2 in the illustration.

Figure 3: Host Side Input Loopback on the Optical Transceiver



Configuration Example

This example shows how to enable host side input loopback on the optical transceiver:

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#host loopback line
Loopback host is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

Running Configuration

This example shows the running configuration of the host side input loopback on the optical transceiver:

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 host loopback line
!
```

Verification

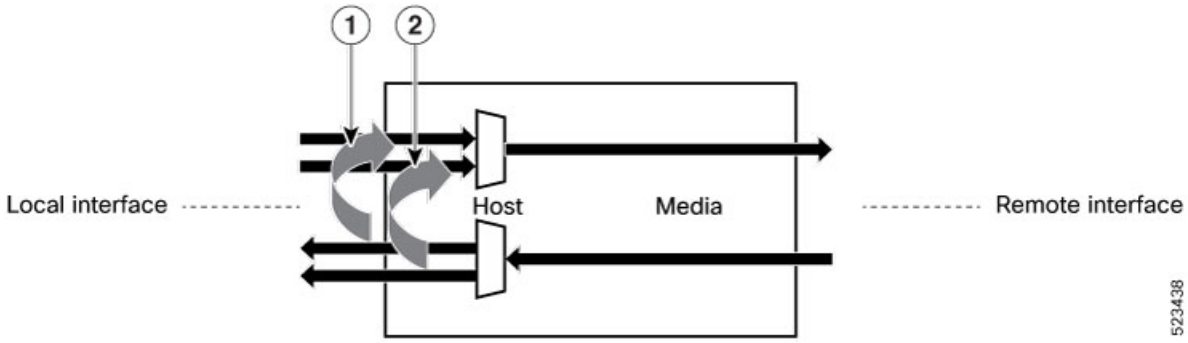
This example shows how to verify the host side input loopback configuration on the optical transceiver:

```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: Line
Loopback Media: None

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

Host Side Output Loopback Configuration

In host loopback line or host side output loopback, the signals received at the host side are looped back to the host side, indicating that the received data on the host is transmitted back to the host, that is, towards the local interface. This is indicated by the arrows labeled as 1 and 2 in the illustration.

Figure 4: Host Side Output Loopback on the Optical Transceiver



Configuration Example

This example shows how to enable host side output loopback on the optical transceiver:

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#host loopback internal
Loopback host is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

Running Configuration

This example shows the running configuration on the optical transceiver:

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 host loopback internal
!
```

Verification

This example shows how to verify the host side output loopback configuration on the optical transceiver:

```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: Internal
Loopback Media: None

Alarm Status:
```

```
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```