Configuring Controllers

There are three types of controllers for the line card. The controllers are the optics controller, the ethernet controller, and the coherent DSP controller. This chapter describes the procedures used to configure these controllers.

Note Unless otherwise specified, “line cards” refers to 1.2T and 1.2TL line cards.

AINS

The Automatic-In-Service (AINS) feature allows the controller to automatically move to the automatic-in-service state after the maintenance window is completed. A soak time period is associated with the AINS state. The controller automatically moves to the In-Service state after the soak time period is completed. During the AINS maintenance window, alarms are not propagated to the EMS/NMS monitoring system.

You can configure AINS on the client ports of the card.

AINS States

The following table lists the AINS states.

State	Description
None	AINS is not enabled on the controller or the soak time period is complete.
Pending	AINS is configured on the controller. However, the soak time period has not started because either the primary state of controller is in Shutdown, Admin down, or Not ready state or the secondary state is in Maintenance state. AINS can also move to Pending state if alarms are raised during the soak time period.
Running	AINS is enabled on the controller. The primary state of the controller is Up and the secondary state is AINS.

If there are any service-affecting alarms when AINS is runring on ethernet or optics controllers, the AINS state moves to Pending state. When the alarms are cleared, the AINS state moves to Running state.

The AINS soak time period restarts when there are line card reloads, XR reloads, line card warm reloads, power cycles, or alarm conditioning.

Soak Time Period

You can configure the soak time period to be between 1 minute to 48 hours.

All alarms are suppressed during the AINS state. When the optical and ethernet alarms are raised on the port during the soak time period, the AINS state moves to Pending. These alarms are not displayed in the output of the **show alarms brief card location 0/RP0/CPU0 active** command but in the output of the **show alarms brief card location 0/RP0/CPU0 conditions** command. When all the alarms clear, the soak time period starts, and the AINS state moves to Running. When the soak time period expires, the port moves to IS state.

Configuring AINS

To configure AINS on a muxponder, use the following command:

configure

hw-module location *location* **mxponder client-port-ains-soak hours** *hours* **minutes** *minutes*

commit

The following is a sample in which all client ports are configured with AINS with soak time period specified to be 15 minutes.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3 mxponder client-port-ains-soak hours 0
minutes 15
RP/0/RP0/CPU0:ios(config)#commit
```

To configure AINS on a muxponder slice, use the following command:

configure

hw-module location *location* **mxponder-slice** *slice-number* **client-port-ains-soak hours** *hours* **minutes** *minutes*

commit

The following is a sample in which slice 0 client ports are configured with AINS with soak time period specified to be 40 minutes.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3 mxponder-slice 0 client-port-ains-soak
hours 0 minutes 40
RP/0/RP0/CPU0:ios(config)#commit
```

Disabling AINS

To disable AINS on all muxponder client ports, set the hours and minutes to 0. Use the following commands:

configure

hw-module location *location* **mxponder client-port-ains-soak hours** *hours* **minutes** *minutes*

commit

The following is a sample in which AINS is disabled on all client ports.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3 mxponder client-port-ains-soak hours 0
minutes 0
RP/0/RP0/CPU0:ios(config)#commit
```

To disable AINS on a muxponder slice, set the hours and minutes to 0. Use the following command:

configure

hw-module location *location* **mxponder-slice** *slice-number* **client-port-ains-soak hours** *hours* **minutes** *minutes*

commit

The following is a sample in which AINS is disabled on all client ports of slice 0.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3 mxponder-slice 0 client-port-ains-soak
hours 0 minutes 0
RP/0/RP0/CPU0:ios(config)#commit
```

Displaying the AINS Configuration

The AINS Soak field in the output indicates the current state of AINS. The current state can be None, Pending, or Running. The Total Duration field indicates the total soak time period that is configured. The Remaining Duration field indicates the soak time that remains, after which, the AINS state moves to None.

This example displays the ethernet controller statistics with AINS Soak in running state.

```
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/1/0/2

Thu Feb 21 19:52:55.001 UTC
Operational data for interface HundredGigECtrlr0/1/0/2:

State:
```

```
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: Running
      Total Duration: 0 hour(s) 15 minute(s)
      Remaining Duration: 0 hour(s) 5 minute(s) 37 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Holdoff Time: 0ms
```

This example displays the ethernet controller statistics with AINS Soak in pending state.

```
RP/0/RP0/CPU0:ios#show controllers HuC 0/0/0/2
Thu Mar 12 13:52:12.129 UTC
Operational data for interface HundredGigECtrlr0/0/0/2:

State:
    Administrative state: enabled
    Operational state: Down (Reason: State undefined)
    LED state: Red On
    Maintenance: Disabled
    AINS Soak: Pending
      Total Duration: 0 hour(s) 30 minute(s)
      Remaining Duration: 0 hour(s) 30 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known
    Alarms:
        Current:
            Local Fault
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 9

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 0ms
```

This example displays the optics controller statistics with AINS Soak in running state.

```
RP/0/RP0/CPU0:ios#show controller optics 0/1/0/3
```

```
Thu Feb 21 19:45:41.088 UTC

 Controller State: Up

 Transport Admin State: Automatic In Service

 Laser State: On

 LED State: Green

 Optics Status

         Optics Type:  Grey optics

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


         LOS/LOL/Fault Status:

         Alarm Statistics:

         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 0
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 0
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0

         Performance Monitoring: Enable

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

         Parameter                High Alarm  Low Alarm  High Warning  Low Warning
         -----------------------  ----------  ---------  ------------  -----------
         Rx Power Threshold(dBm)          4.9      -12.0           0.0          0.0
         Tx Power Threshold(dBm)          3.5      -10.1           0.0          0.0
         LBC Threshold(mA)                N/A        N/A          0.00         0.00

         LBC High Threshold = 98 %
         Polarization parameters not supported by optics

        Total TX Power = 6.39 dBm

        Total RX Power = 5.85 dBm

         Lane  Laser Bias    TX Power    RX Power  Output Frequency
         ----  ----------  ----------  ----------  ----------------
           1      75.0 %    0.59 dBm    0.63 dBm  230.43 THz
           2      68.6 %    0.06 dBm   -0.68 dBm  230.43 THz
           3      69.0 %    0.26 dBm   -0.63 dBm  230.43 THz
           4      69.1 %    0.56 dBm   -0.10 dBm  230.43 THz

 Transceiver Vendor Details

         Form Factor            : QSFP28
         Name                   : CISCO-FINISAR
         Part Number            : FTLC1152RGPL-C2
         Rev Number             : CISCO-FINISAR
         Serial Number          : FNS22150LEC
```

```
        PID                   : QSFP-100G-CWDM4-S
        VID                   : V02
        CISCO-FINISAR
        Date Code(yy/mm/dd)   : 18/04/11
        Fiber Connector Type: LC
        Sonet Application Code: Not Set
        Ethernet Compliance Code: 100GBASE-CWDM4

 Transceiver Temperature : 32 Celsius


 AINS Soak               : Running
 AINS Timer              : 0h, 15m
 AINS remaining time     : 771 seconds
```

When the soak time expires, AINS state changes from Running to None. The Transport Admin State of optics controller changes from Automatic In Service to In Service.

```
RP/0/RP0/CPU0:ios# show controllers optics 0/1/0/3

Thu Feb 21 20:02:34.126 UTC

 Controller State: Up

 Transport Admin State: In Service

 Laser State: On

 LED State: Green

 Optics Status

        Optics Type:  Grey optics

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


        LOS/LOL/Fault Status:

        Alarm Statistics:

        -------------
        HIGH-RX-PWR = 0            LOW-RX-PWR = 0
        HIGH-TX-PWR = 0            LOW-TX-PWR = 0
        HIGH-LBC = 0               HIGH-DGD = 0
        OOR-CD = 0                 OSNR = 0
        WVL-OOL = 0                MEA  = 0
        IMPROPER-REM = 0
        TX-POWER-PROV-MISMATCH = 0

        Performance Monitoring: Enable

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

        Parameter                High Alarm  Low Alarm  High Warning  Low Warning
        -----------------------  ----------  ---------  ------------  -----------
        Rx Power Threshold(dBm)          4.9      -12.0           0.0          0.0
        Tx Power Threshold(dBm)          3.5      -10.1           0.0          0.0
        LBC Threshold(mA)                N/A        N/A          0.00         0.00
```

```
        LBC High Threshold = 98 %
        Polarization parameters not supported by optics

       Total TX Power = 6.41 dBm

       Total RX Power = 5.85 dBm

        Lane  Laser Bias    TX Power    RX Power  Output Frequency
        ----  ----------  ----------  ----------  ----------------
          1      74.9 %    0.60 dBm    0.63 dBm  230.43 THz
          2      68.6 %    0.06 dBm   -0.70 dBm  230.43 THz
          3      69.0 %    0.30 dBm   -0.63 dBm  230.43 THz
          4      69.1 %    0.57 dBm   -0.11 dBm  230.43 THz

Transceiver Vendor Details

        Form Factor            : QSFP28
        Name                   : CISCO-FINISAR
        Part Number            : FTLC1152RGPL-C2
        Rev Number             : CISCO-FINISAR
        Serial Number          : FNS22150LEC
        PID                    : QSFP-100G-CWDM4-S
        VID                    : V02
        CISCO-FINISAR
        Date Code(yy/mm/dd)    : 18/04/11
        Fiber Connector Type: LC
        Sonet Application Code: Not Set
        Ethernet Compliance Code: 100GBASE-CWDM4

Transceiver Temperature : 32 Celsius


AINS Soak               : None
AINS Timer              : 0h, 0m
AINS remaining time     : 0 seconds
```

Configuring AINS on OTN-XP Card

You can configure the default AINS settings for all controllers on the OTN-XP card using the shared plane configuration. The configuration is applied to any line card that is installed in the NCS 1004. Use the following commands:

configure

ains-soak hours *hours* **minutes** *minutes*

commit

The following is a sample in which all the controllers on the OTN-XP card are configured with AINS with soak time period specified to be two minutes.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#ains-soak hours 0 minutes 2
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#do show controllers optics 0/1/0/0
Tue Apr 28 11:50:15.431 UTC

Controller State: Down

Transport Admin State: Automatic In Service
```

```
Laser State: On

LED State: Red

 Optics Status

         Optics Type:  100G QSFP28 LR4

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


         LOS/LOL/Fault Status:

         Alarm Statistics:

         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 0
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 0
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0

         Performance Monitoring: Enable

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

         Parameter                High Alarm  Low Alarm  High Warning  Low Warning
         -----------------------  ----------  ---------  ------------  -----------
         Rx Power Threshold(dBm)          4.9      -12.0           0.0          0.0
         Tx Power Threshold(dBm)          3.5      -10.1           0.0          0.0
         LBC Threshold(mA)                N/A        N/A          0.00         0.00

         LBC High Threshold = 98 %
         Polarization parameters not supported by optics

        Total TX Power = 7.74 dBm

        Total RX Power = -40.00 dBm

         Lane  Laser Bias    TX Power    RX Power  Output Frequency
         ----  ----------  ----------  ----------  ----------------
           1      67.2 %    1.85 dBm  -40.00 dBm  231.39 THz
           2      67.9 %    1.55 dBm  -40.00 dBm  230.59 THz
           3      67.5 %    1.58 dBm  -40.00 dBm  229.79 THz
           4      66.8 %    1.89 dBm  -40.00 dBm  230.25 THz

 Transceiver Vendor Details

         Form Factor            : QSFP28
         Name                   : CISCO-FINISAR
         Part Number            : 10-3204-01
         Rev Number             : B
         Serial Number          : FNS20510YUB
         PID                    : ONS-QSFP28-LR4
         VID                    : V01
         Date Code(yy/mm/dd)    : 16/12/15
         Fiber Connector Type: LC
         Otn Application Code: 4I1-9D1F
         Sonet Application Code: Not Set
```

```
        Ethernet Compliance Code: 100GBASE-LR4

Transceiver Temperature : 27 Celsius


AINS Soak               : Pending
AINS Timer              : 0h, 2m
AINS remaining time     : 120 seconds
```

To override the default AINS settings on a specific controller, use the following commands:

automatic-in-service controller optics *R/S/I/P* **hours** *hours* **minutes** *minutes*

Note This configuration does not persist after an RP reload operation.

The following is a sample in which the optics controller on the OTN-XP card is configured with a soak time period of 45 minutes.

```
RP/0/RP0/CPU0:ios#automatic-in-service controller optics 0/1/0/0 hours 0 minutes 45
Tue Apr 28 11:55:15.666 UTC
RP/0/RP0/CPU0:ios#show controllers optics 0/1/0/0
Tue Apr 28 11:55:30.323 UTC

Controller State: Down

Transport Admin State: Automatic In Service

Laser State: On

LED State: Red

 Optics Status

         Optics Type:  100G QSFP28 LR4

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


         LOS/LOL/Fault Status:

         Alarm Statistics:

         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 0
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 0
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0

         Performance Monitoring: Enable

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

         Parameter                High Alarm  Low Alarm  High Warning  Low Warning
```

```
 ------------------------  ----------  ---------  ------------  -----------
 Rx Power Threshold(dBm)          4.9      -12.0           0.0          0.0
 Tx Power Threshold(dBm)          3.5      -10.1           0.0          0.0
 LBC Threshold(mA)                N/A        N/A          0.00         0.00

 LBC High Threshold = 98 %
 Polarization parameters not supported by optics

Total TX Power = 7.74 dBm

Total RX Power = -40.00 dBm

 Lane  Laser Bias    TX Power    RX Power  Output Frequency
 ----  ----------  ----------  ----------  ----------------
   1      67.2 %    1.85 dBm  -40.00 dBm  231.39 THz
   2      67.9 %    1.55 dBm  -40.00 dBm  230.59 THz
   3      67.5 %    1.58 dBm  -40.00 dBm  229.79 THz
   4      66.8 %    1.89 dBm  -40.00 dBm  230.25 THz

Transceiver Vendor Details

        Form Factor            : QSFP28
        Name                   : CISCO-FINISAR
        Part Number            : 10-3204-01
        Rev Number             : B
        Serial Number          : FNS20510YUB
        PID                    : ONS-QSFP28-LR4
        VID                    : V01
        Date Code(yy/mm/dd)    : 16/12/15
        Fiber Connector Type: LC
        Otn Application Code: 4I1-9D1F
        Sonet Application Code: Not Set
        Ethernet Compliance Code: 100GBASE-LR4

Transceiver Temperature : 27 Celsius



AINS Soak               : Pending
AINS Timer              : 0h, 45m
AINS remaining time     : 2700 seconds
```

FEC

Forward error correction (FEC) is a feature that is used for controlling errors during data transmission. This feature works by adding data redundancy to the transmitted message using an algorithm. This redundancy allows the receiver to detect and correct a limited number of errors occurring anywhere in the message, instead of having to ask the transmitter to resend the message.

FEC States for Ethernet Controller

The following table lists the FEC states for the Ethernet controller.

State	Description
None	FEC is not enabled on the Ethernet controller.

State	Description
Standard	Standard (Reed-Solomon) FEC is enabled on the Ethernet controller.

FEC configuration is automatically enabled for only the pluggables that support Auto-FEC. If you manually configure FEC, the manual configuration overrides the Auto-FEC.

The supported pluggables for Auto-FEC are:

- QSFP-100G-SR4-S
- QSFP-100G-CWDM4-S
- QSFP-100G-SM-SR
- QSFP-100G-AOC-1M
- QSFP-100G-AOC-3M
- QSFP-100G-AOC-10M
- QDD-400-AOC15M
- QDD-400G-FR4-S
- QSFP-100G-ER4L
- QDD-400G-DR4-S
- QDD-400G-LR8-S

The LR4 pluggable is a 1310nm long range band pluggable that does not require you to enable FEC.

The software automatically enables FEC mode on the pluggables installed in the Cisco NCS 1004. When you upgrade the software of an NCS 1004 with pluggables in the FEC disabled mode, traffic is affected.

The following sample shows the running FEC configuration on the LR4 pluggable:

```
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/0/0/4
Thu Aug  8 15:41:20.857 IST
Operational data for interface HundredGigECtrlr0/0/0/4:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Enabled

Phy:
    Media type: Not known

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
```

```
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Holdoff Time: 0ms
```

The following sample shows the running FEC configuration on the non LR4 pluggable:

```
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/0/0/2
Thu Aug  8 15:41:56.457 IST
Operational data for interface HundredGigECtrlr0/0/0/2:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 66

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 0ms
```

Configuring FEC on the Ethernet Controller

Note The FEC configuration is not required for the supported pluggables. The configuration is required only in the case of non-Cisco qualified non-LR4 pluggables.

To configure FEC on the Ethernet controller, use the following command:

configure

controller HundredGigECtrlr *R/S/I/P* **fec { none | standard }**

commit

The following sample shows how to configure FEC on the Ethernet controller:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/1/0/10 fec standard
RP/0/RP0/CPU0:ios(config)#commit
```

The following sample shows the running FEC configuration on the Ethernet controller:

```
RP/0/RP0/CPU0:BH-SIT2#show controller HundredGigECtrlr 0/1/0/10
Tue Jul 16 15:30:30.165 IST
Operational data for interface HundredGigECtrlr0/1/0/10:

State:
    Administrative state: enabled
    Operational state: Down (Reason: State undefined)
    LED state: Red On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known
    Alarms:
        Current:
            Loss of Frequency Sync Data
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 0

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 0ms
```

FEC States for CoherentDSP Controller

The following table lists the FEC states for the coherentDSP controllers.

Table 1: FEC State for CoherentDSP Controllers

State	Description
EnhancedSD15	FEC Soft-Decision 15.
EnhancedSD27	FEC Soft-Decision 27. Default.

Configuring FEC on CoherentDSP Controllers

To configure FEC on the CoherentDSP controller, use the following command:

configure

controller coherentDSP *R/S/I/P*

fec {**EnhancedSD15** | **EnhancedSD27**}

commit

The following sample shows how to configure FEC on the CoherentDSP controller:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/0
RP/0/RP0/CPU0:ios(config-CoDSP)#fec EnhancedSD15
Tue Feb 25 11:25:52.670 UTC
WARNING! Changing FEC mode can impact traffic
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

Verifying FEC on CoherentDSP Controllers

The following sample shows the FEC configuration on the CoherentDSP controller:

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

Tue Feb 25 11:26:08.235 UTC


Port                                        : CoherentDSP 0/0/0/0
Controller State                            : Up
Inherited Secondary State                   : Normal
Configured Secondary State                  : Normal
Derived State                               : In Service
Loopback mode                               : None
BER Thresholds                              : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                      : Enable
Bandwidth                                   : 50.0Gb/s
Alarm Information:
LOS = 1 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                             : None
Bit Error Rate Information
PREFEC  BER                                 : 0.00E+00
POSTFEC BER                                 : 0.00E+00
Q-Factor                                    : 0.00 dB
Q-Margin                                    : -5.00dB
Instantaneous Q_margin                     :  0 dB


TTI :
        Remote IP addr                      : 0.0.0.0
FEC mode                                    : Soft-Decision 15

AINS Soak                                   : None
AINS Timer                                  : 0h, 0m
AINS remaining time                         : 0 seconds
```

Laser Squelching

You can enable laser squelching on Ethernet controllers. When laser squelching is enabled, the laser is shut down in the event of trunk faults (LOS, LOF), and a SQUELCHED alarm is raised on the mapped client port.

To configure laser squelching on the Ethernet controllers, use the following commands:

configure

controller HundredGigECtrlr *Rack/Slot/Instance/Port*

laser-squelch

commit

The following is a sample where laser squelching is enabled on the Ethernet controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/1/0/10
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#laser-squelch
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following is a sample to view the laser squelch status on the controller.

```
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/1/0/10
Fri Feb 22 15:18:47.011 UTC
Operational data for interface HundredGigECtrlr0/1/0/10:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Enabled

Phy:
    Media type: Not known
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 0

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 0ms
```

Configuring Laser Squelching on OTN-XP Card

From R7.2.1 onwards, laser squelching is supported on 10GE controllers for the OTN-XP card.

Configuring Laser Squelching on 10GE Controllers

To configure laser squelching on the 10GE controllers for the OTN-XP card, use the following commands:

configure

controller tenGigECtrlr *Rack/Slot/Instance/Port/Lanenumber*

laser-squelch

commit

The range of *Lanenumber* is from 1 to 4.

The following is a sample where laser squelching is enabled on the 10GE controller for the OTN-XP card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller tenGigECtrlr 0/0/0/4/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#laser-squelch
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following is a sample to view the laser squelch status on the 10GE controller.

```
P/0/RP0/CPU0:ios#show controllers tenGigECtrlr 0/0/0/4/1
Wed May 6 06:28:29.603 UTC
Operational data for interface TenGigECtrlr0/0/0/4/1:

State:
Administrative state: enabled
Operational state: Up
LED state: Green On
Maintenance: Disabled
AINS Soak: None
Total Duration: 0 hour(s) 0 minute(s)
Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Enabled

Phy:
Media type: Not known

Autonegotiation disabled.

Operational values:
Speed: 10Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
Inter-packet gap: standard (12)
BER monitoring:
Not supported
Holdoff Time: 0ms
```

Idle Insertion

When a fault occurs on the trunk port, you can hold the propagation of local faults using the idle insertion feature. This feature is enabled on the ethernet controller by configuring the hold-off timer.

When the fault occurs on the trunk, idles are inserted in the traffic stream from the trunk port to the client port for the duration of the configured holdoff-time. If the trunk port remains faulty beyond the configured holdoff-time, a local fault is transmitted towards the client device. If the trunk recovers from the fault before the holdoff-time expires, traffic resumes.

This feature can be used on customer deployments to prevent reset of client ports during a PSM switchover.

You can enable the idle insertion feature by using the following commands:

configure

controller HundredGigECtrlr *Rack/Slot/Instance/Port*

holdoff-time trunk-fault *time-value*

The range of *timevalue* is from 0 ms to 3000 ms.

The following is a sample for enabling the hold off -timer in 100GE controllers:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/1/0/10
RP/0/RP0/CPU0:ios (config-eth-ctrlr)#holdoff-time trunk-fault 3000
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

To view the hold-off time that is configured on 100GE controller, use the following command:

show controllers hundredGigECtrlr *Rack/Slot/Instance/Port*

Example

```
RP/0/RP0/CPU0:ios#show controllers HundredGigECtrlr 0/1/0/10
Fri Feb 22 18:58:06.888 UTC
Operational data for interface HundredGigECtrlr0/1/0/10:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 0

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
```

```
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 3000ms
```

Enabling Idle Insertion on OTN-XP Card

From R7.2.1 onwards, you can enable the idle insertion feature on the 10GE controller for OTN-XP card.

To enable idle insertion on the 10GE controller, enter the following commands:

configure

controller tenGigECtrlr *Rack/Slot/Instance/Port/Lanenumber*

holdoff-time trunk-fault *time-value*

commit

The range of *Lanenumber* is from 1 to 4 and the range of holdoff-time trunk-fault *time-value* is from 0 to 3000 ms.

The following is a sample for enabling the idle insertion feature in 10GE controllers:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller tenGigECtrlr 0/0/0/4/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#holdoff-time trunk-fault 2000
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

To view the hold-off time that is configured on 10GE controllers, use the following command:

show controllers tenGigECtrlr *Rack/Slot/Instance/Port/Lanenumber*

Example

```
RP/0/RP0/CPU0:ios#show controllers TenGigECtrlr 0/0/0/4/1
Thu Mar 26 12:46:16.543 UTC
Operational data for interface TenGigECtrlr0/0/0/4/1:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known

Autonegotiation disabled.

Operational values:
    Speed: 10Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    Inter-packet gap: standard (12)
    BER monitoring:
        Not supported
    Holdoff Time: 2000ms
```

LLDP Drop

Link Layer Discovery Protocol (LLDP) Snooping is enabled by default on all ethernet controllers.

To verify the LLDP neighbors, use the following commands:

```
RP/0/RP0/CPU0:ios#show lldp neighbors detail
Tue Mar 12 11:49:20.819 IST
Capability codes:
        (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
        (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

------------------------------------------------
Local Interface: HundredGigECtrlr0/1/0/7
Chassis id: 008a.96cd.34e1
Port id: Hu0/0/0/4
Port Description - not advertised
System Name: ncs5500_node

System Description:
 6.1.4, NCS-5500

Time remaining: 116 seconds
Hold Time: 120 seconds
System Capabilities: R
Enabled Capabilities: R
Management Addresses - not advertised
Peer MAC Address: 00:8a:96:cd:34:10


------------------------------------------------
Local Interface: HundredGigECtrlr0/1/0/13
Chassis id: 008a.96cd.34e1
Port id: Hu0/0/0/5
Port Description - not advertised
System Name: ncs5500_node

System Description:
 6.1.4, NCS-5500

Time remaining: 90 seconds
Hold Time: 120 seconds
System Capabilities: R
Enabled Capabilities: R
Management Addresses - not advertised
Peer MAC Address: 00:8a:96:cd:34:14


Total entries displayed: 2


RP/0/RP0/CPU0:ios#show lldp neighbors
Tue Mar 12 16:17:56.713 IST
Capability codes:
        (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
        (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID       Local Intf              Hold-time  Capability     Port ID
ncs5500_node    HundredGigECtrlr0/1/0/7  120        R               Hu0/0/0/4
ncs5500_node    HundredGigECtrlr0/1/0/13 120        R               Hu0/0/0/5

Total entries displayed: 2
```

When you enable LLDP drop on the client controller ports of the muxponder or muxponder slice, the LLDP frames drop on the ports without forwarding.

Configuring LLDP Drop

You can configure the LLDP drop for a muxponder or muxponder slice. By default, the LLDP drop status is set to False. On enabling the LLDP Drop, the status is set to True.

To configure LLDP drop on a muxponder use the following command:

configure

hw-module location *location* **mxponder drop-lldp**

Note Use the **no** form of the command to disable LLDP drop.

commit

Limitation

- When you disable LLDP globally, the LLDP gets disabled on all the interfaces.

Note By default, LLDP is enabled for NCS 1004. But when you enable and disable LLDP in the global configuration mode, LLDP gets disabled on all the interfaces.

Workaround: You must enable LLDP globally or reload the Router.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios#hw-module location 0/1 mxponder drop-lldp
RP/0/RP0/CPU0:ios#commit
```

configure

hw-module location *location* **mxponder-slice** *slice-number* **drop-lldp**

Note Use the **no** form of the command to disable LLDP drop.

To configure LLDP drop on a muxponder slice, use the following command:

commit

The following is a sample in which slice 0 client ports are enabled with LLDP drop.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 drop-lldp
RP/0/RP0/CPU0:ios(config)#commit
```

Verifying the Status of LLDP Drop

To verify the LLDP drop enabled status, use the following command.

```
RP/0/RP0/CPU0:ios#show hw-module location all mxponder
Fri Feb 22 13:22:19.281 UTC

Location:             0/0
Client Bitrate:       NONE
Trunk  Bitrate:       NONE
Status:               Not Provisioned


Location:             0/1
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/1/0/0
                               Traffic Split Percentage

HundredGigECtrlr0/1/0/2        ODU40/1/0/0/0                      100
HundredGigECtrlr0/1/0/3        ODU40/1/0/0/1                      100
HundredGigECtrlr0/1/0/4        ODU40/1/0/0/2                      100
HundredGigECtrlr0/1/0/5        ODU40/1/0/0/3                      100
HundredGigECtrlr0/1/0/6        ODU40/1/0/0/4                      100


Location:             0/1
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/1/0/1
                               Traffic Split Percentage

HundredGigECtrlr0/1/0/8        ODU40/1/0/1/0                      100
HundredGigECtrlr0/1/0/9        ODU40/1/0/1/1                      100
HundredGigECtrlr0/1/0/10       ODU40/1/0/1/2                      100
HundredGigECtrlr0/1/0/11       ODU40/1/0/1/3                      100
HundredGigECtrlr0/1/0/12       ODU40/1/0/1/4                      100


Location:             0/2
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/2/0/0
                               Traffic Split Percentage

HundredGigECtrlr0/2/0/2        ODU40/2/0/0/0                      100
HundredGigECtrlr0/2/0/3        ODU40/2/0/0/1                      100
HundredGigECtrlr0/2/0/4        ODU40/2/0/0/2                      100
HundredGigECtrlr0/2/0/5        ODU40/2/0/0/3                      100
HundredGigECtrlr0/2/0/6        ODU40/2/0/0/4                      100


Location:             0/2
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/2/0/1
```

```
                                Traffic Split Percentage

HundredGigECtrlr0/2/0/8         ODU40/2/0/1/0                       100
HundredGigECtrlr0/2/0/9         ODU40/2/0/1/1                       100
HundredGigECtrlr0/2/0/10        ODU40/2/0/1/2                       100
HundredGigECtrlr0/2/0/11        ODU40/2/0/1/3                       100
HundredGigECtrlr0/2/0/12        ODU40/2/0/1/4                       100


Location:             0/3
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    TRUE
Client Port                     Mapper/Trunk Port          CoherentDSP0/3/0/0
                                Traffic Split Percentage

HundredGigECtrlr0/3/0/2         ODU40/3/0/0/0                       100
HundredGigECtrlr0/3/0/3         ODU40/3/0/0/1                       100
HundredGigECtrlr0/3/0/4         ODU40/3/0/0/2                       100
```

Link Layer Discovery Protocol (LLDP) Support on Management Interface

The LLDP support on management interface feature requires a system to form LLDP neighborship over the system management interface, through which it advertises and learns LLDP neighbor information. This information about neighbors used to learn about the neighbors and in turn the topology of the devices for Operations, Administration, and Maintenance (OAM) purposes.

Advantages of LLDP

- Provides support on non-Cisco devices.
- Enables neighbor discovery between non-Cisco devices.

Limitation

- When you disable LLDP globally, the LLDP gets disabled on all the interfaces.

Note By default, LLDP is enabled for NCS 1004. But when you enable and disable LLDP in the global configuration mode, LLDP gets disabled on all the interfaces.

Workaround: You must enable LLDP globally or reload the Router.

Cisco Discovery Protocol (CDP) vs LLDP

The CDP is a device discovery protocol that runs over Layer 2. Layer 2 is also known as the data link layer that runs on all Cisco devices, such as routers, bridges, access servers, and switches. This protocol allows the network management applications to automatically discover and learn about other Cisco devices that connect to the network.

The LLDP is also a device discovery protocol that runs over Layer 2. This protocol allows the network management applications to automatically discover and learn about other non-Cisco devices that connect to the network.

Interoperability between non-Cisco devices using LLDP

LLDP is also a neighbor discovery protocol that is used by network devices to advertise information about themselves to other devices on the network. This protocol runs over the data link layer, which allows two systems running different network layer protocols to learn about each other.

With LLDP, the user can also access the information about a particular physical network connection. If the user uses a non-Cisco monitoring tool (through SNMP), LLDP helps you identify the Object Identifiers (OIDs) that the system supports. The following OIDs are supported:

- 1.0.8802.1.1.2.1.4.1.1.4
- 1.0.8802.1.1.2.1.4.1.1.5
- 1.0.8802.1.1.2.1.4.1.1.6
- 1.0.8802.1.1.2.1.4.1.1.7
- 1.0.8802.1.1.2.1.4.1.1.8
- 1.0.8802.1.1.2.1.4.1.1.9
- 1.0.8802.1.1.2.1.4.1.1.10
- 1.0.8802.1.1.2.1.4.1.1.11
- 1.0.8802.1.1.2.1.4.1.1.12

Neighbor Discovery

System advertises the LLDP TLV (Type Length Value) details over the management network using which other devices in the management network can learn about this device.

Configuring LLDP

- LLDP full stack functionality is supported on all three management interfaces supported in NCS 1004.
- You can selectively enable or disable LLDP on any of the management interfaces on demand.
- You can selectively enable or disable LLDP transmit or receive functionality at the management interface level.
- Information gathered using LLDP can be stored in the device Management Information Database (MIB) and queried with the Simple Network Management protocol (SNMP).
- LLDP operational data are available in both Command Line Interface and netconf-yang interface.

Enabling LLDP Globally

When you enable LLDP globally, all interfaces that support LLDP are automatically enabled for both transmit and receive operations.

Note You can override this default operation at the interface to disable receive or transmit operations.

The following table describes the global LLDP attributes that the user can configure:

Table 2:

Attribute	Default	Range	Description
Holdtime	120	0–65535	Specifies the hold time (in sec). Hold time refers to the time or duration that an LLDP device maintains the neighbor information before discarding.
Reinit	2	2–5	Delay (in sec) for LLDP initialization on any interface
Timer	30	5-65534	Specifies the rate at which LLDP packets are sent (in sec)

The following example shows the commands to configure LLDP globally. The global LLDP configuration enables LLDP on all the three management interfaces.

```
RP/0/RP0/CPU0:regen#configure terminal
RP/0/RP0/CPU0:regen(config)#lldp management enable
RP/0/RP0/CPU0:regen(config)#lldp holdtime 30
RP/0/RP0/CPU0:regen(config)#lldp reinit 2
RP/0/RP0/CPU0:regen(config)#commit
```

Verification

You can verify the LLDP configuration using the **show running-config lldp** command.

The output of **show running-config lldp** command is as follows:

```
RP/0/RP0/CPU0:regen#show running-config lldp
Tue Dec 10 10:36:11.567 UTC
lldp
timer 30
reinit 2
holdtime 120
management enable
!
```

You can verify the LLDP data using the **show lldp interface** and **show lldp neighbors** commands.

The output of **show lldp interface** command is as follows:

```
RP/0/RP0/CPU0:regen#show lldp interface
Thu Nov  7 08:45:22.934 UTC


MgmtEth0/RP0/CPU0/0:
        Tx: enabled
        Rx: enabled
        Tx state: IDLE
        Rx state: WAIT FOR FRAME


MgmtEth0/RP0/CPU0/1:
```

```
        Tx: enabled
        Rx: enabled
        Tx state: IDLE
        Rx state: WAIT FOR FRAME
```

The output of **show lldp neighbors** command is as follows:

```
RP/0/RP0/CPU0:M-131#show lldp neighbors
Mon Dec  2 11:01:20.143 CET
Capability codes:
        (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
        (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID       Local Intf              Hold-time  Capability     Port ID
[DISABLED]      MgmtEth0/RP0/CPU0/0     120        B               gi19
MYS-130         MgmtEth0/RP0/CPU0/1     120        R               MgmtEth0/RP0/CPU0/1
```

where [DISABLED] shows that the LLDP is disabled on the interface MgmtEth0/RP0/CPU0/0.

Enabling LLDP per Management Interface

The following example shows the commands to configure LLDP at the management interface level.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp enable
RP/0/RP0/CPU0:ios(config-if)#commit
```

Disabling LLDP Transmit and Receive Operations

The following example shows the commands to disable the LLDP transmit operations at the specified management interface.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp transmit disable
RP/0/RP0/CPU0:ios(config-if)#commit
```

The following example shows the commands to disable the LLDP receive operations at the specified management interface.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp receive disable
RP/0/RP0/CPU0:ios(config-if)#commit
```

Debugging LLDP Issues

The following commands are used for debugging issues in the LLDP functionality.

- **show lldp traffic**
- **debug lldp all**
- **debug lldp errors**
- **debug lldp events**
- **debug lldp packets**
- **debug lldp tlvs**
- **debug lldp trace**
- **debug lldp verbose**

MAC Address Snooping on Client Ports

MAC address snooping allows you to learn the MAC address of the neighbor, that is connected to the client ports. You can enable ARP snooping on all client ports and learn the MAC address of neighbors through CLI.

This feature overcomes the limitation, where LLDP (Link Layer Discovery protocol) cannot be enabled in some networks.

Limitations

- When you enable or disable MAC address snooping on any slice, few packets are dropped during configuration.
- Open config interface for enabling or disabling MAC address snooping is not supported.
- SNMP MIB is not supported for the MAC address attribute.

Note When you enable MAC address snooping on client ports, it overrides LLDP.

Configuring MAC Address Snooping on Client Ports

You can configure MAC address or ARP snoop on slice in Muxponder slice mode using the following commands.

configure

hw-module location *location* **mxponder-slice** *slice-number*

client-rate 100GE

trunk-rate 600G { 100G | 150G | 200G | 250G | 300G | 350G | 400G | 450G | 500G | 550G | 600G }

arp-snoop

commit

Example

The following is a sample in which, MAC address or ARP snoop is configured on the client ports of slice 0 in Muxponder slice mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 16 19:30:33.933 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-rate 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 600G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#arp-snoop
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Mon Mar 16 19:30:52.636 UTC
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

The following is a sample in which, MAC address or ARP snoop is configured in Muxponder mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 16 19:08:17.154 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder arp-snoop
RP/0/RP0/CPU0:ios(config)#commit
```

The following sample shows the output of **show controllers hundredGigEctrlr** command, before configuring MAC address or ARP snoop on client ports.

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/1/0/2
Mon Mar 16 19:40:37.434 UTC
Operational data for interface HundredGigECtrlr0/1/0/2:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Holdoff Time: 0ms
```

Viewing Neighbor MAC Address

You can view the neighbor's physical address after enabling MAC address or ARP snoop using the following command. MAC address snoop output is enabled after ARP packets are received on the respective 100G client.

show controllers hundredGigEctrlr *R/S/I/P*

The following sample shows the neighbor's MAC address after configuring MAC address or ARP snoop on client ports.

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/1/0/2
Mon Mar 16 19:41:08.047 UTC
Operational data for interface HundredGigECtrlr0/1/0/2:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled
    Neighbor Address:
    0010.9400.5502
```

```
Phy:
    Media type: Not known

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
```

Loopback

You can configure the loopback on the CoherentDSP, FC, OTU, and Ethernet controllers to identify connection problems. The loopback can be configured only in the maintenance mode. Use the **controller** ***controller-type*** and the **secondary-admin-state maintenance** commands to place the controllers in the maintenance mode.

Note Internal and line loopbacks are supported on the FC, OTU, and Ethernet controllers whereas only internal loopbacks are supported on the CoherentDSP controllers.

Configuring Loopback on the 1.2T Card

To configure the loopback, use the following commands:

configure

controller *controllertype Rack/Slot/Instance/Port*

sec-admin-state maintenance

loopback [**line** | **internal**]

commit

Example 1

The following example shows how a line loopback is configured on the Ethernet controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 1/0/1/10 secondary-admin-state
maintenance
RP/0/RP0/CPU0:ios(config)#commit
Fri Feb 22 19:49:46.504 UTC
RP/0/RP0/CPU0:ios(config)#exit
```

The following example shows how to verify a line loopback configured on the Ethernet controller.

```
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/1/0/10
Fri Feb 22 19:50:08.328 UTC
Operational data for interface HundredGigECtrlr0/1/0/10:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Enabled
    AINS Soak: Pending
```

```
      Total Duration: 0 hour(s) 30 minute(s)
      Remaining Duration: 0 hour(s) 30 minute(s) 0 second(s)
    Laser Squelch: Enabled

Phy:
    Media type: Not known
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 0

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 0ms
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/1/0/10 loopback line
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/1/0/10
Fri Feb 22 20:01:00.521 UTC
Operational data for interface HundredGigECtrlr0/1/0/10:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Enabled
    AINS Soak: Pending
      Total Duration: 0 hour(s) 30 minute(s)
      Remaining Duration: 0 hour(s) 30 minute(s) 0 second(s)
    Laser Squelch: Enabled

Phy:
    Media type: Not known
    Statistics:
        FEC:
            Corrected Codeword Count: 0
            Uncorrected Codeword Count: 6

Autonegotiation disabled.

Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: Line
    BER monitoring:
        Not supported
    Forward error correction: Standard (Reed-Solomon)
    Holdoff Time: 0ms
```

Example 2

The following example shows how to verify an internal loopback configured on the coherent DSP controller.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP  0/0/0/0
Fri Mar 13 22:00:20.951 UTC

Port                                          : CoherentDSP 0/0/0/0
Controller State                              : Up
Inherited Secondary State                     : Normal
Configured Secondary State                    : Maintenance
Derived State                                 : Maintenance
Loopback mode                                 : Internal
BER Thresholds                                : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                        : Enable
Bandwidth                                     : 200.0Gb/s

Alarm Information:
LOS = 0 LOF = 1 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 3 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                               : None

Bit Error Rate Information
PREFEC  BER                                   : 0.00E+00
POSTFEC BER                                   : 0.00E+00
Q-Factor                                      : 16.70 dB

Q-Margin                                      : 0.99dB

TTI :
        Remote hostname                       : ios
        Remote interface                      : CoherentDSP 0/0/0/0
        Remote IP addr                        : 0.0.0.0

FEC mode                                      : Soft-Decision 27

AINS Soak                                     : None
AINS Timer                                    : 0h, 0m
AINS remaining time                           : 0 seconds
```

Configuring Loopback on OTN-XP Card

From R7.2.1 onwards, OTN-XP card supports loopback on the OTU2, OTU2e, OTU4, 10GE, and CoherentDSP controllers.

From R7.3.2 onwards, OTN-XP card supports loopback on the 100GE and 400GE controllers.

The CoherentDSP controller supports both line and internal.

To configure the loopback on the controllers, use the following commands:

configure

controller *controller type Rack/Slot/Instance/Port/Lane number*

sec-admin-state maintenance

loopback [**line** | **internal**]

commit

The range of *Lane number* is 1–4.

Example 1

The following example shows how an internal loopback is configured on the 10GE controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller tenGigECtrlr 0/0/0/5/2
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#loopback internal
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following example shows how to verify an internal loopback configured on the 10GE controller.

```
RP/0/RP0/CPU0:ios#show controllers tenGigECtrlr 0/0/0/5/2
Thu Apr 23 10:47:48.020 UTC
Operational data for interface TenGigECtrlr0/0/0/5/2:

State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Enabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled

Phy:
    Media type: Not known

Autonegotiation disabled.

Operational values:
    Speed: 10Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: Internal
    Inter-packet gap: standard (12)
    BER monitoring:
        Not supported
    Holdoff Time: 0ms
```

Example 2

The following example shows how a line loopback is configured on the OTU2e controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller otu2e 0/0/0/11/3
RP/0/RP0/CPU0:ios(config-otu2e)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-otu2e)#loopback line
RP/0/RP0/CPU0:ios(config-otu2e)#commit
Thu Apr 23 10:55:19.319 UTC
RP/0/RP0/CPU0:ios(config-otu2e)#end
```

The following example shows how to verify a line loopback configured on the OTU2e controller.

```
RP/0/RP0/CPU0:ios#show controllers otu2e 0/0/0/11/3
Thu Apr 23 10:55:28.014 UTC

Port                                          : OTU2E 0/0/0/11/3
Controller State                              : Up
Inherited Secondary State                     : Normal
Configured Secondary State                    : Maintenance
Derived State                                 : Maintenance
Loopback mode                                 : Line
BER Thresholds                                : SF = 1.0E-5  SD = 1.0E-7
```

```
Performance Monitoring                          : Enable
Bandwidth                                       : 10.0Gb/s

Alarm Information:
LOS = 0 LOF = 1 LOM = 0
OOF = 1 OOM = 1 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
PREFEC  BER                                     : 0.00E+00
POSTFEC BER                                     : 0.00E+00

TTI :
        Remote hostname                         : ios
        Remote interface                        : OTU2E 0/0/0/11/3
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : STANDARD

AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds
```

Example 3

The following example shows how an internal loopback is configured on the OTU2 controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller otu2 0/0/0/5/1
RP/0/RP0/CPU0:ios(config-otu2)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-otu2)#loopback internal
RP/0/RP0/CPU0:ios(config-otu2)#commit
Thu Apr 23 11:01:00.562 UTC
RP/0/RP0/CPU0:ios(config-otu2)#end
```

The following example shows how to verify an internal loopback configured on the OTU2 controller.

```
RP/0/RP0/CPU0:ios#show controllers otU2 0/0/0/5/1
Thu Apr 23 11:01:04.126 UTC

Port                                            : OTU2 0/0/0/5/1
Controller State                                : Up
Inherited Secondary State                       : Normal
Configured Secondary State                      : Maintenance
Derived State                                   : Maintenance
Loopback mode                                   : Internal
BER Thresholds                                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                          : Enable
Bandwidth                                       : 10.0Gb/s

Alarm Information:
LOS = 0 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
```

```
PREFEC  BER                                     : 0.00E+00
POSTFEC BER                                     : 0.00E+00

TTI :
        Remote hostname                         : SM-TRC SAPI-SECSM-TRC DA
        Remote IP addr                          : 192.0.2.67

FEC mode                                        : STANDARD

AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds
```

Example 4

The following example shows how an internal loopback is configured on the OTU4 controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller otu4 0/0/0/0
RP/0/RP0/CPU0:ios(config-otu4)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-otu4)#loopback internal
RP/0/RP0/CPU0:ios(config-otu4)#commit
Thu Apr 23 11:05:22.429 UTC
RP/0/RP0/CPU0:ios(config-otu4)#end
```

The following example shows how to verify an internal loopback configured on the OTU4 controller.

```
RP/0/RP0/CPU0:ios#show controllers otu4 0/0/0/0
Thu Apr 23 11:05:30.281 UTC

Port                                            : OTU4 0/0/0/0
Controller State                                : Up
Inherited Secondary State                       : Normal
Configured Secondary State                      : Maintenance
Derived State                                   : Maintenance
Loopback mode                                   : Internal
BER Thresholds                                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                          : Enable
Bandwidth                                       : 100.0Gb/s

Alarm Information:
LOS = 1 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
PREFEC  BER                                     : 0.00E+00
POSTFEC BER                                     : 0.00E+00

TTI :
        Remote hostname                         : ios
        Remote interface                        : OTU4 0/0/0/0
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : STANDARD

AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds
```

Restore Factory Settings

Note Perform this operation only on the console port.

You can restore the factory settings on the NCS 1004. The entire system configuration, including usernames, passwords, and IP addresses, is removed. You can perform this operation only through the console port and not on the management interface. To restore NCS 1004 to factory settings, use the **commit replace** command. After the **commit replace** operation completes, you must perform the IOS XR reload operation.

The **commit best-effort** command merges the target configuration with the running configuration and commits only valid changes (best effort). Some configuration changes might fail due to semantic errors.

Example

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#commit replace
Tue Sep 24 09:36:59.430 UTC

This commit will replace or remove the entire running configuration. This
operation can be service affecting.
Do you wish to proceed? [no]: yes
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#reload
Tue Sep 24 09:38:12.881 UTC

Standby card not present or not Ready for failover. Proceed? [confirm]

Preparing system for backup. This may take a few minutes especially for large configurations.

        Status report: node0_RP0_CPU0: BACKUP INPROGRESS

        Status report: node0_RP0_CPU0: BACKUP HAS COMPLETED SUCCESSFULLY
[Done]

Proceed with reload?  [confirm]
Reloading node  0/RP0/CPU0

RL: Reboot initiated with code 1, cause User initiated graceful reload reboot_timeout 30
shutdown delay 0
RL: Shutdown initiated
Query the node to be reloaded
 NODE_IP of noded to be reloaded 192.0.2.4
sending stop hb
Cause: User initiated graceful reload
VM IP addr sent for reload 192.0.2.4

Received ack from sdrmgr for reload request.Returncode:0
successful disconnection from service
wd_disconnect_cb 548 CMP-WD disconnected successfully
Invmgr successful disconnection from service

RP/0/RP0/CPU0:ios#
Disconnecting from 'default-sdr--1' console. Continue(Y/N)?


Connecting to 'default-sdr--1' console
```

```
ÿûÿûÿûÿýbootlogd: ioctl(/dev/pts/2, TIOCCONS): Device or resource busy
/sbin/restorecon:  lstat(/etc/adjtime) failed:  No such file or directory
Configuring network interfaces... done.
Starting system message bus: dbus.
Starting OpenBSD Secure Shell server: sshd
sshd start/running, process 1739
Starting rpcbind daemon...done.
Starting random number generator daemonUnable to open file: /dev/tpm0
.
Starting system log daemon...0
Starting kernel log daemon...0
tftpd-hpa disabled in /etc/default/tftpd-hpa
Starting internet superserver: xinetd.
net.ipv4.ip_forward = 1
Libvirt not initialized for container instance
Starting crond: OK
SIOCADDRT: File exists

DBG_MSG: platform type is 0
[*] ima_policy have loaded, or IMA policy file does not exist
Start serial incoming on , Clearing ..
RP/0/RP0/CPU0:Sep 24 09:38:44.284 UTC: fpd-serv[256]: %PKT_INFRA-FM-3-FAULT_MAJOR :
ALARM_MAJOR :FPD-NEED-UPGRADE :DECLARE :0/PM0:

This (D)RP Node is not ready or active for login /configuration
.......
........
........

ios con0/RP0/CPU0 is now available

Press RETURN to get started.

!!!!!!!!!!!!!!!!!!! NO root-system username is configured. Need to configure root-system
username. !!!!!!!!!!!!!!!!!!!
```

Headless Mode

During process restarts, CPU reload, or removal of CPU, the NCS 1004 operates in headless mode for up to 72 hours. During this time, traffic is not impacted, although the control plane is not up and running. Fault propagation continues to operate for failures on client and trunk ports. However, you cannot provision anything nor view operational data with a non-functional CPU. Performance monitoring data based on 15 minutes and 24 hour intervals is not supported with a non-functional CPU.

Trail Trace Identifier

The Trail trace identifier (TTI) feature helps you to identify the signal from the source to the destination within the network. You can configure the TTI sent or expected string only in ASCII string format. When the expected TTI string does not match the received TTI trace string, the controller goes down and the OTUK-TIM alarm is raised. To configure TTI on the coherent DSP controllers, use the following commands:

configure

controller coherentDSP *R/S/I/P* **tti** {**sent | expected**} **ascii** *tti-string*

commit

Note The *tti-string* can have a maximum of 64 characters.

The following sample displays how to configure TTI on a coherent DSP controller with the sent and expected strings set to the same ASCII string. The state of the controller is up.

```
RP/0/RP0/CPU0:ios#config
Fri Mar 15 08:03:02.094 UTC
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/1/0/1 tti sent ascii 1234
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/1/0/1 tti expected ascii 1234
RP/0/RP0/CPU0:ios(config)#commit
Fri Mar 15 08:03:49.725 UTC
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/1
Fri Mar 15 08:04:06.290 UTC

Port                                        : CoherentDSP 0/1/0/1
Controller State                            : Up
Inherited Secondary State                   : Normal
Configured Secondary State                  : Normal
Derived State                               : In Service
Loopback mode                               : None
BER Thresholds                              : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                      : Enable

Alarm Information:
LOS = 0 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 1 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                             : None

Bit Error Rate Information
PREFEC  BER                                 : 7.7E-03
POSTFEC BER                                 : 0.0E+00

OTU TTI Sent
     OPERATOR SPECIFIC  ASCII               : 1234
                                            :
     OPERATOR SPECIFIC HEX                  : 31323334000000000000000000000000
                                            : 00000000000000000000000000000000
OTU TTI Received
     OPERATOR SPECIFIC  ASCII               : 1234
                                            :
     OPERATOR SPECIFIC HEX                  : 31323334000000000000000000000000
                                            : 00000000000000000000000000000000
OTU TTI Expected
     OPERATOR SPECIFIC  ASCII               : 1234
                                            :
     OPERATOR SPECIFIC HEX                  : 31323334000000000000000000000000
                                            : 00000000000000000000000000000000
FEC mode                                    : Soft-Decision 27

AINS Soak                                   : None
AINS Timer                                  : 0h, 0m
AINS remaining time                         : 0 seconds
```

The following example shows how to configure TTI on a coherent DSP controller with the sent and expected strings set to different ASCII strings. The state of the controller goes down and the TIM alarm is raised.

```
RP/0/RP0/CPU0:ios#config
Fri Mar 15 08:54:29.780 UTC
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/1/0/1 tti sent ascii 1234
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/1/0/1 tti expected ascii 5678
RP/0/RP0/CPU0:ios(config)#commit
Fri Mar 15 08:56:12.293 UTC
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/1
Fri Mar 15 08:56:33.910 UTC

Port                                          : CoherentDSP 0/1/0/1
Controller State                              : Down
Inherited Secondary State                     : Normal
Configured Secondary State                    : Normal
Derived State                                 : In Service
Loopback mode                                 : None
BER Thresholds                                : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                        : Enable

Alarm Information:
LOS = 1 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 3 TIM = 1
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                               : BDI TIM

Bit Error Rate Information
PREFEC  BER                                   : 8.2E-03
POSTFEC BER                                   : 0.0E+00

OTU TTI Sent
     OPERATOR SPECIFIC  ASCII                 : 1234
                                              :
     OPERATOR SPECIFIC HEX                    : 31323334000000000000000000000000
                                              : 00000000000000000000000000000000
OTU TTI Received
     OPERATOR SPECIFIC  ASCII                 : 1234
                                              :
     OPERATOR SPECIFIC HEX                    : 31323334000000000000000000000000
                                              : 00000000000000000000000000000000
OTU TTI Expected
     OPERATOR SPECIFIC  ASCII                 : 5678
                                              :
     OPERATOR SPECIFIC HEX                    : 35363738000000000000000000000000
                                              : 00000000000000000000000000000000
FEC mode                                      : Soft-Decision 27

AINS Soak                                     : None
AINS Timer                                    : 0h, 0m
AINS remaining time                           : 0 seconds
```

Chromatic Dispersion

You can configure chromatic dispersion on optics controllers. When you configure the maximum and minimum values for chromatic dispersion for any data rate, ensure the minimum difference between the configured values is equal to or greater than 1500 ps/nm.

The following table lists the default CD search range.

Data Rate	BPS	Card Support	Default CD Search Range
200G to 500G	BPS < = 3	1.2T, 1.2TL	-10,000 to 100,000 ps/nm
	3 < BPS <= 4	1.2T, 1.2TL	-10,000 to 80,000 ps/nm
	4 < BPS <=5	1.2T	-5,000 to 20,000 ps/nm
600G	BPS=5.2578125	1.2T	-2000 to 2,000 ps/nm

Note The cd-min and cd-max values must be set for BPS values that are greater than 4 in the 1.2T card.

Note When the user provisions the cd-min and cd-max values that are outside the range through CLI, the provisioned values are accepted; however, only the actual values supported by the hardware are applied.

The following is a sample where chromatic dispersion is configured on the optics controller.

```
RP/0/RP0/CPU0:ios#configure
Mon Aug 19 19:31:42.115 UTC
RP/0/RP0/CPU0:ios(config)#controller  optics 0/1/0/1
RP/0/RP0/CPU0:ios(config-Optics)#cd-max 4000
RP/0/RP0/CPU0:ios(config-Optics)#cd-min -1000
RP/0/RP0/CPU0:ios(config-Optics)#commit
Mon Aug 19 19:35:24.697 UTC
RP/0/RP0/CPU0:ios(config-Optics)#exit
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#show run controller optics 0/1/0/*
Mon Aug 19 19:57:41.859 UTC
controller Optics0/1/0/0
 transmit-power -15
 dwdm-carrier 50GHz-grid itu-ch 55
 enh-sop-tol-mode 1
 cross-pol-gain-mode 10
 lbc-high-threshold 5
!
controller Optics0/1/0/1
 description trunk power UP
 cd-min -1000
 cd-max 4000
 enh-colorless-mode 2
 enh-sop-tol-mode 3
 nleq-comp-mode 4
 cross-pol-gain-mode 2
 cross-pol-weight-mode 3
 cpr-win-mode 3
 cpr-ext-win-mode 8
 rx-voa fixed-ratio 1200
 filter-roll-off-factor 0.035
!
controller Optics0/1/0/5
 soak-time 10
!
```

Frequency

You can configure the frequency on trunk ports of the line card.

The following table lists the frequency range with grid spacing supported on the line card:

Line Card	Frequency Range (THz)	Default Frequency (THz)	Grid Spacing
1.2T	191.25 to 196.1	193.1	50GHz and 100MHz
1.2TL [1]	186.1 to 190.85	188.5	100MHz

[1] Only non-ITU channels are supported

To configure the wavelength, use the following commands:

configure

controller optics *Rack/Slot/Instance/Port*

dwdm-carrier {**100MHz-grid frequency** *frequency*} | {**50GHz-grid** [**frequency** *frequency*}

commit

Pseudo Random Binary Sequence

The Pseudo Random Binary Sequence (PRBS) feature allows you to perform data integrity checks between the NCS1004 trunk links without enabling the actual client traffic.

You need to enable PRBS feature on both the transmitting and receiving NCS 1004 trunk ports. The transmitting trunk port generates a bit pattern and sends it to the peer NCS 1004 device. The device detects if the sent bit pattern is received.

You can configure NCS 1004 trunk port in any one of the following modes for PRBS on the 1.2T card:

- **Source mode —** The NCS 1004 at trunk port generates PRBS signal on the line continuously as per the configured PRBS pattern.
- **Sink mode —** The NCS 1004 at trunk port gets locked to the ingress signal according to the configured pattern, analyzes and reports the errors.
- **Source-Sink mode —** The NCS 1004 at trunk port acts as both the PRBS transmitter and receiver, that is, it generates PRBS signal as per the configured pattern, and also gets locked to the ingress signal with the same pattern, and reports the errors.

NCS 1004 trunk port supports the following PRBS patterns:

- **PRBS31 —** Sequence length is from 2^31 -1 bits.
- **PRBS23 —** Sequence length is from 2^23 -1 bits.
- **PRBS15 —** Sequence length is from 2^15 -1 bits.
- **PRBS7 —**Sequence length is from 2^7 -1 bits.

Limitations of PRBS

There are following limitations with the PRBS feature:

- There is no SNMP support to fetch the PRBS status or Performance Monitoring (PM).
- TTI functionality is not supported with PRBS.
- Loopback and PRBS configurations cannot coexist on a coherentDSP controller. Loopback configuration will be rejected if PRBS is already configured.

PRBS on OTN-XP Card

From R7.2.1 onwards, the OTN-XP card supports PRBS on the mapper optical data unit (ODU2e).

Note ODU2e PRBS is not supported for OTU2E client rates.

NCS 1004 with the OTN-XP card, supports the following PRBS mode:

- **Source mode —** The NCS 1004 at trunk port generates PRBS signal on the line continuously as per the configured PRBS pattern.
- **Sink mode —** The NCS 1004 at trunk port gets locked to the ingress signal according to the configured pattern, analyzes and reports the errors.
- **Source-Sink mode —** The NCS 1004 at trunk port acts as both the PRBS transmitter and receiver, that is, it generates PRBS signal as per the configured pattern, and also gets locked to the ingress signal with the same pattern, and reports the errors.
- **invertedpn31 —**Inverted pattern. Sequence length is from 2^31 -1 bits.

NCS 1004 trunk port supports the following PRBS patterns:

- **PRBS31 —** Sequence length is from 2^31 -1 bits.
- **PRBS23 —** Sequence length is from 2^23 -1 bits.
- **PRBS15 —** Sequence length is from 2^15 -1 bits.
- **PRBS7 —**Sequence length is from 2^7 -1 bits.

Configuring Pseudo Random Binary Sequence

To enable the PRBS on the trunk port, use the following configuration command at the coherentDSP controller:

controller coherentDSP *R/S/I/P* **prbs mode** {**source | sink | source-sink**} **pattern** {**pn31 | pn23 | pn15 | pn7**}

When the PRBS is enabled on the trunk ports, you can view the following impacts in the corresponding client ports:

- Client traffic is dropped in the direction of source to sink as the frames are overwritten by the PRBS pattern.
- Remote fault is raised on the client ports nearer to the PRBS sink.

Verifying PRBS

R/S/I/P **prbs-details**

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/0 prbs-details
Wed Nov  6 23:12:22.464 UTC

----------------------PRBS details------------------
PRBS Test               : Enable
PRBS Mode               : Source
PRBS Pattern            : PN7
PRBS Status             : Not Applicable

----------------------------------------------------
```

- You cannot view any details, if the PRBS is not enabled on the trunk.
- PRBS status is shown as **Not Applicable**, when the mode is **Source**.
- PRBS status is shown as **unlocked**, when the signal is not locked on the receiving side in the **Sink** or **Source-Sink** mode.

Viewing PRBS Performance Monitoring Parameters

PRBS PM parameters are not available for the controllers in Source mode. PRBS PM parameters are reset when PRBS configuration changes on the controller.

To view the PRBS PM parameters on the coherentDSP controller, use the following command:

show controllers coherentDSP | ODU4 *R/S/I/P* **pm** {**current | history** }{**15-min|24-hour**} **prbs**

The following tables describes the fields of PRBS PM parameters.

Table 3: PRBS PM Parameters

PM Parameter	Description
EBC	Cumulative count of PRBS bit errors in the sampling interval (15-minute or 24-hour). PRBS bit errors are accumulated only if PRBS signal is locked.
FOUND-COUNT	Number of state transitions from signal unlocked state to signal locked state in the sampling interval. If state change is not observed in the interval, the count is 0.
LOST-COUNT	Number of state transitions from signal locked state to signal unlocked state in the sampling interval. If state change is not observed in the interval, the count is 0.
FOUND-AT-TS	Latest timestamp when the PRBS state moves from unlocked state to locked state in the sampling interval. If state change is not observed in the interval, the value is null.
CONFIG-PTRN	Configured PRBS pattern on the port.

```
RP/0/RP0:ios#show controllers coherentDSP 0/0/0/1 pm current 15-min prbs
Mon Feb 13 00:58:48.327 UTC

PRBS in the current interval [00:45:00 - 00:58:48 Mon Feb 13 2019]
PRBS current bucket type : Valid
EBC                      : 40437528165
FOUND-COUNT              : 1 FOUND-AT-TS : 00:51:22 Mon Feb 13 2019
LOST-COUNT               : 1 LOST-AT-TS  : 00:52:52 Mon Feb 13 2019
CONFIG-PTRN              : PRBS_PATTERN_PN31
Last clearing of "show controllers OTU" counters never
```

Configuring PRBS on OTN-XP Card

To configure PBRS mode on the ODU2e controller, you must configure Optical Channel Payload Unit (OPU) on the ODU2e controller followed by the PRBS mode and the pattern. The PRBS supported pattern on the OTN-XP card is invertedPN31.

From R7.3.1 onwards, you can configure PRBS on client or mapper ODU4 and ODU flex controllers.

Note ODU2e PRBS is not supported for OTU2E client rates.

To configure PRBS mode on the ODU2e controller, enter the following commands:

configure

controller *R/S/I/P/client-port/lane-number*

secondary-admin-state maintenance

opu

prbs mode {**source | sink | source-sink**} **pattern invertedpn31** {**direction {system | line}**}

end

commit

The following example shows how to configure PRBS mode as source-sink with pattern as invertedpn31:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller odu2e0/2/0/12/3/2
RP/0/RP0/CPU0:ios(config-odu2e)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-odu2e)#opu
RP/0/RP0/CPU0:ios(config-Opuk)#prbs mode source-sink pattern invertedpn31
RP/0/RP0/CPU0:ios(config-Opuk)#end
RP/0/RP0/CPU0:ios(config-odu2e)#commit
```

The following is a sample output of **show controller odu2e** command.

```
RP/0/RP0/CPU0(config-odu2e)#show controller odu2e 0/2/0/12/3/2 prbs-details
Mon Mar 14 21:33:02.293 UTC

 -------------------------PRBS details----------------------------------
PRBS Test                       : Enable
PRBS Mode                       : Source-Sink
PRBS Pattern                    : INVERTED PN31
PRBS Status                     : Locked
PRBS Lock Time(in seconds)      : 1190
PRBS Bit Errors                 : 0
```

```
-------------------------------------------------
```

The following example shows how to configure PRBS mode as source-sink with pattern as invertedpn31 with direction as system:

```
RP/0/RP0/CPU0:ios#configure
Wed Nov 11 00:38:11.789 UTC
RP/0/RP0/CPU0:ios(config)#controller odu4 0/2/0/5
RP/0/RP0/CPU0:ios(config-odu4)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-odu4)#opu prbs mode source-sink pattern invertedpn31 direction
system
RP/0/RP0/CPU0:ios(config-odu4)#commit
Wed Nov 11 00:38:26.391 UTC
```

The following example shows how to configure PRBS mode as source-sink with pattern as invertedpn31 with direction as line:

```
RP/0/RP0/CPU0:ios#configure
Wed Nov 11 00:38:11.789 UTC
RP/0/RP0/CPU0:ios(config)#controller odu4 0/2/0/5
RP/0/RP0/CPU0:ios(config-odu4)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-odu4)#opu prbs mode source-sink pattern invertedpn31 direction
line
RP/0/RP0/CPU0:ios(config-odu4)#commit
Wed Nov 11 00:38:26.391 UTC
```

Verifying PRBS on OTN-XP Card

You can monitor the status of PRBS on the ODU2e controller using the following command:

show controllers odu2e *R/S/I/P/client-port/client-lane* **prbs-details**

The following example displays the output of the PRBS configuration with PRBS mode as sink:

```
RP/0/RP0/CPU0:ios#show controllers odu2e 0/2/0/12/3/2 prbs-details
-------------------------PRBS details-----------------------------------
PRBS Test               : Enable
PRBS Mode               : Sink
PRBS Pattern            : INVERTED PN31
PRBS Status             : Locked
```

The following example displays the output of the PRBS configuration with PRBS mode as source-sink:

```
RP/0/RP0/CPU0:ios#show controllers odu2e 0/2/0/12/3/2 prbs-details
-------------------------PRBS details-----------------------------------
PRBS Test               : Enable
PRBS Mode               : Source-Sink
PRBS Pattern            : INVERTED PN31
PRBS Status             : Locked
```