Configuring the Card Mode

This chapter lists the supported configurations and the procedures to configure the card mode on the line cards.

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

- 1.2T Line Card, on page 1
- QXP Card, on page 16
- 2.4T and 2.4TX Card Modes Overview, on page 22

1.2T Line Card

The following section describes the supported configurations and procedures to configure the card modes on the line card.

Card Modes

The line cards support module and slice configurations.

The line cards have two trunk ports (0 and 1) and 12 client ports (2 through 13) each. You can configure the line card in two modes:

- Muxponder—In this mode, both trunk ports are configured with the same trunk rate. The client-to-trunk mapping is in a sequence.
- Muxponder slice—In this mode, each trunk port is configured independent of the other with different trunk rates. The client-to-trunk mapping is fixed. For Trunk 0, the client ports are 2 through 7. For Trunk 1, the client ports are 8 through 13.

Sub 50G Configuration

You can configure the sub 50G or coupled mode on the line card only in the muxponder mode. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Card Support	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	1.2T	0, 1	-	2	-
150G	300G	1.2T	0, 1	2	3	4
350G	700G	1.2T	0, 1	2, 3, 4	5	6, 7, 8
450G	900G	1.2T	0, 1	2, 3, 4, 5	6	7, 8, 9, 10
550G	1.1T	1.2T	0, 1	2, 3, 4, 5, 6	7	8, 9, 10, 11, 12

1.2T line card supports an alternate port configuration for Sub 50G (split client port mapping) that you configure using CLI. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Card Support	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	1.2T	0, 1	-	7	-
150G	300G	1.2T	0, 1	2	7	8
250G	500G	1.2T	0, 1	2, 3	7	8, 9
350G	700G	1.2T	0, 1	2, 3, 4	7	8, 9, 10
450G	900G	1.2T	0, 1	2, 3, 4, 5	7	8, 9, 10, 11
550G	1.1T	1.2T	0, 1	2, 3, 4, 5, 6	7	8, 9, 10, 11, 12

Note In all x50G configurations, client traffic on the middle port is affected with ODUK-BDI and LF alarms after the **power cycle or link flap** on the trunk side. This issue is raised when the two network lanes work in coupled mode and move from low to high power. To solve this issue, create a new frame either at the near-end or far-end by performing **shut** or **no shut** of the trunk ports.

Coupled Mode Restrictions

The following restrictions apply to the coupled mode configuration:

- Both trunk ports must be configured with the same bits-per-symbol or baud rate and must be sent over same fiber and direction.
- The chromatic dispersion must be configured to the same value for both trunk ports.
- When trunk internal loopback is configured, it must be done for both trunk ports. Configuring internal loopback on only one trunk results in traffic loss.

- Fault on a trunk port of a coupled pair may cause errors on all clients including those running only on the unaffected trunk port.

Configure Split Client Port Mapping

You can configure the trunk port to client port mapping for sub 50G data ratesin the default mode or in the split client port mapping mode.

To configure the split client port mapping, use the following commands.

configure

hw-module location *location* **mxponder**

split-client-port-mapping

commit

The following is a sample in which split-client-port-mapping is configured with a 450G trunk payload.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#split-client-port-mapping
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

To remove the split client port-mapping configuration and configure default client port mapping, use the following commands.

configure

hw-module location *location* **mxponder**

no split-client-port-mapping

commit

The following is a sample in which split client port-mapping configuration is removed.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#no split-client-port-mapping
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

Verifying the Port Mapping Configuration

The following is a sample ouput of the split client port-mapping.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder

Location:             0/1/NXR0
Client Bitrate:       100GE
Trunk  Bitrate:       450G
Status:               Provisioning In Progress
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/1/0/0
CoherentDSP0/1/0/1
                               Traffic Split Percentage

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

```
       0
HundredGigECtrlr0/1/0/4         ODU40/1/0/0/3                          100
       0
HundredGigECtrlr0/1/0/5         ODU40/1/0/0/4                          100
       0
HundredGigECtrlr0/1/0/7         ODU40/1/0/0/5                           50
      50
HundredGigECtrlr0/1/0/8         ODU40/1/0/1/1                            0
     100
HundredGigECtrlr0/1/0/9         ODU40/1/0/1/2                            0
     100
HundredGigECtrlr0/1/0/10        ODU40/1/0/1/3                            0
     100
HundredGigECtrlr0/1/0/11        ODU40/1/0/1/4                            0
     100
```

The following is a sample ouput of the default client port mapping.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder

Location:             0/1/NXR0
Client Bitrate:       100GE
Trunk  Bitrate:       450G
Status:               Provisioning In Progress
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/0
CoherentDSP0/1/0/1
                                Traffic Split Percentage

HundredGigECtrlr0/1/0/2         ODU40/1/0/0/1                          100
       0
HundredGigECtrlr0/1/0/3         ODU40/1/0/0/2                          100
       0
HundredGigECtrlr0/1/0/4         ODU40/1/0/0/3                          100
       0
HundredGigECtrlr0/1/0/5         ODU40/1/0/0/4                          100
       0
HundredGigECtrlr0/1/0/6         ODU40/1/0/0/5                           50
      50
HundredGigECtrlr0/1/0/7         ODU40/1/0/1/1                            0
     100
HundredGigECtrlr0/1/0/8         ODU40/1/0/1/2                            0
     100
HundredGigECtrlr0/1/0/9         ODU40/1/0/1/3                            0
     100
HundredGigECtrlr0/1/0/10        ODU40/1/0/1/4                            0
     100
```

Supported Data Rates

The following data rates are supported on the line card.

The following table displays the client and trunk ports that are enabled for the muxponder configuration.

Trunk Data Rate	Card Support	Client Data Rate (100GE, OTU4)	Trunk Ports	Client Ports
100	1.2T	100GE, OTU4	0	2
200	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5

Trunk Data Rate	Card Support	Client Data Rate (100GE, OTU4)	Trunk Ports	Client Ports
300	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7
400	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9
500	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11
600	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

The following table displays the client and trunk ports that are enabled for the muxponder slice 0 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	1.2T	100, OTU4	0	2
200	1.2T	100, OTU4	0	2, 3
300	1.2T	100, OTU4	0	2, 3, 4
400	1.2T	100, OTU4	0	2, 3, 4, 5
500	1.2T	100, OTU4	0	2, 3, 4, 5, 6
600	1.2T	100, OTU4	0	2, 3, 4, 5, 6, 7

The following table displays the client and trunk ports that are enabled for the muxponder slice 1 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	1.2T	100, OTU4	1	8
200	1.2T	100, OTU4	1	8, 9
300	1.2T	100, OTU4	1	8, 9, 10
400	1.2T	100, OTU4	1	8, 9, 10, 11
500	1.2T	100, OTU4	1	8, 9, 10, 11, 12
600	1.2T	100, OTU4	1	8, 9, 10, 11, 12, 13

All configurations can be accomplished by using appropriate values for client bitrate and trunk bitrate parameters of the **hw-module** command.

The following table displays the trunk parameter ranges for the 1.2T card.

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
50G	15%	1	1.3125	24.0207911	31.5272884
50G	27%	1	1.4453125	24.0207911	34.7175497

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
100G	15%	1	2.625	24.0207911	63.0545768
100G	27%	1	2.890625	24.0207911	69.4350994
150G	15%	1.3203125	3.9375	24.0207911	71.6359689
150G	27%	1.453125	4.3359375	24.0207911	71.6749413
200G	15%	1.7578125	5.25	24.0207911	71.7420962
200G	27%	2	4.40625	31.51	69.43
250G	15%	2.1953125	6	26.2727403	71.8059237
250G	27%	2.4140625	6	28.9312914	71.9068991
300G	15%	2.6328125	6	31.5272884	71.8485385
300G	27%	2.8984375	6	34.7175497	71.8681352
350G	15%	3.0703125	6	36.7818364	71.8790086
350G	27%	3.3828125	6	40.503808	71.8404724
400G	15%	3.5078125	6	42.0363845	71.9018782
400G	27%	3.8671875	6	46.2900663	71.8197392
450G	15%	3.9453125	6	47.2909326	71.9196757
450G	27%	4.34375	6	52.0763245	71.9327648
500G	15%	4.3828125	6	52.5454806	71.93392
500G	27%	4.8281250	6	57.8625828	71.9068991
550G	15%	4.8203125	6	57.8000287	71.9455787
550G	27%	5.3125	6	63.6488411	71.88575
600G	15%	5.2578125	-	-	71.9552971

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
100G	15%	1	2.625	24.0207911	63.0545768
100G	27%	1	2.890625	24.0207911	69.4350994
150G	15%	1.3203125	3.9375	24.0207911	71.6359689
150G	27%	1.453125	4.3359375	24.0207911	71.6749413
200G	15%	2	4	31.5272884	63.0545768

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
200G	27%	2	4.40625	31.51664088	69.43509943
250G	15%	2.1953125	4.5	35.0303204	71.8059237
250G	27%	2.4140625	4.5	38.5750552	71.9068991
300G	15%	2.6328125	4.5	42.0363845	71.8485385
300G	27%	2.8984375	4.5	46.2900662857142	71.86813526
350G	15%	3.0703125	4.5	49.0424486	71.8790086
350G	27%	3.3828125	4.5	54.0050773	71.8404724
400G	15%	3.5078125	4.5	56.0485127	71.9018782
400G	27%	3.8671875	4.5	61.72008838	71.81973921

Configuring the Card Mode

You can configure the line card in the module (muxponder) or slice configuration (muxponder slice).

To configure the card in the muxponder mode, use the following commands.

configure

hw-module location *location* **mxponder client-rate {100GE** | **OTU4}**

hw-module location *location* **mxponder trunk-rate** {**50G** | **100G150G** | **200G** | **250G** | **300G** | **350G** | **400G** | **450G** | **500G** | **550G** | **600G** }

commit

To configure the card in the muxponder slice mode, use the following commands. **configure hw-module location** *location* **mxponder-slice** *mxponder-slice-number* **client-rate { 100GE|OTU4}**

hw-module location *location* **mxponder-slice trunk-rate** { **100G** | **200G** | **300G** | **400G** | **500G** | **600G** }

commit

Examples

The following is a sample in which the card is configured in the muxponder mode with a 550G trunk payload.

```
RP/0/RP0/CPU0:ios#config
Tue Oct 15 01:24:56.355 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder trunk-rate 550G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder mode with a 500G trunk payload.

```
RP/0/RP0/CPU0:ios#config
Sun Feb 24 14:09:33.989 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2/NXR0 mxponder client-rate OTU4
```

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2/NXR0 mxponder trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 0 mode with a 500G trunk payload.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 0 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 0 trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 1 mode with a 400G trunk payload.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 1 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 1 trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured with mixed client rates in the muxponder slice mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 23 06:10:22.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 0 client-rate OTU4
trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 1 client-rate 100GE
trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

Verifying the Card Configuration

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2/NXR0 mxponder
Fri Mar 15 11:48:48.344 IST

Location:             0/2/NXR0
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port            Mapper/Trunk Port   CoherentDSP0/2/0/0  CoherentDSP0/2/0/1
                     Traffic Split Percentage

HundredGigECtrlr0/2/0/2  ODU40/2/0/0/1               100                   0
HundredGigECtrlr0/2/0/3  ODU40/2/0/0/2               100                   0
HundredGigECtrlr0/2/0/4  ODU40/2/0/0/3               100                   0
HundredGigECtrlr0/2/0/5  ODU40/2/0/0/4               100                   0
HundredGigECtrlr0/2/0/6  ODU40/2/0/0/5               100                   0
HundredGigECtrlr0/2/0/7  ODU40/2/0/1/1                 0                 100
HundredGigECtrlr0/2/0/8  ODU40/2/0/1/2                 0                 100
HundredGigECtrlr0/2/0/9  ODU40/2/0/1/3                 0                 100
HundredGigECtrlr0/2/0/10 ODU40/2/0/1/4                 0                 100
HundredGigECtrlr0/2/0/11 ODU40/2/0/1/5                 0                 100
```

The following is a sample ouput of the coupled mode configuration where the shared client port is highlighted.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder
Tue Oct 15 01:25:57.358 UTC

Location:             0/1/NXR0
Client Bitrate:       100GE
Trunk  Bitrate:       550G
```

```
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port           Mapper/Trunk Port    CoherentDSP0/1/0/0 CoherentDSP0/1/0/1
                  Traffic Split Percentage

HundredGigECtrlr0/1/0/2    ODU40/1/0/0/1             100                  0
HundredGigECtrlr0/1/0/3    ODU40/1/0/0/2             100                  0
HundredGigECtrlr0/1/0/4    ODU40/1/0/0/3             100                  0
HundredGigECtrlr0/1/0/5    ODU40/1/0/0/4             100                  0
HundredGigECtrlr0/1/0/6    ODU40/1/0/0/5             100                  0
HundredGigECtrlr0/1/0/7    ODU40/1/0/0/6              50                 50
HundredGigECtrlr0/1/0/8    ODU40/1/0/1/1               0                100
HundredGigECtrlr0/1/0/9    ODU40/1/0/1/2               0                100
HundredGigECtrlr0/1/0/10   ODU40/1/0/1/3               0                100
HundredGigECtrlr0/1/0/11   ODU40/1/0/1/4               0                100
HundredGigECtrlr0/1/0/12   ODU40/1/0/1/5               0                100
```

The following is a sample ouput of all the muxponder slice 0 configurations.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice  0
Fri Mar 15 06:04:18.348 UTC

Location:             0/1/NXR0
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         ODU40/1/0/0/1                      100
HundredGigECtrlr0/1/0/3         ODU40/1/0/0/2                      100
HundredGigECtrlr0/1/0/4         ODU40/1/0/0/3                      100
HundredGigECtrlr0/1/0/5         ODU40/1/0/0/4                      100
HundredGigECtrlr0/1/0/6         ODU40/1/0/0/5                      100
```

The following is a sample ouput of all the muxponder slice 1 configurations.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 1
Fri Mar 15 06:11:50.020 UTC

Location:             0/1/NXR0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    TRUE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/1
                                Traffic Split Percentage

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

The following is a sample ouput of the muxponder slice 1 configuration with client configured as OTU4.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/0/NXR0 mxponder-slice 1

Wed Mar 11 13:59:11.073 UTC

Location:             0/0/NXR0
Slice ID:             1
```

```
Client Bitrate:       OTU4
Trunk  Bitrate:       200G
Status:               Provisioned
Client Port                    Peer/Trunk Port            CoherentDSP0/0/0/1
                             Traffic Split Percentage
OTU40/0/0/8                    ODU40/0/0/1/1                      100
OTU40/0/0/9                    ODU40/0/0/1/2                      100
```

The following is a sample to verify the mixed client rate configuration in the muxponder slice mode.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder
Mon Mar 23 06:20:22.227 UTC

Location:             0/1/NXR0
Slice ID:             0
Client Bitrate:       OTU4
Trunk  Bitrate:       500G
Status:               Provisioned
Client Port                    Peer/Trunk Port            CoherentDSP0/1/0/0
                               Traffic Split Percentage

OTU40/1/0/2                    ODU40/1/0/0/1                      100
OTU40/1/0/3                    ODU40/1/0/0/2                      100
OTU40/1/0/4                    ODU40/1/0/0/3                      100
OTU40/1/0/5                    ODU40/1/0/0/4                      100
OTU40/1/0/6                    ODU40/1/0/0/5                      100


Location:             0/1/NXR0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/1/0/1
                               Traffic Split Percentage

HundredGigECtrlr0/1/0/8        ODU40/1/0/1/1                        100
HundredGigECtrlr0/1/0/9        ODU40/1/0/1/2                        100
HundredGigECtrlr0/1/0/10       ODU40/1/0/1/3                        100
HundredGigECtrlr0/1/0/11       ODU40/1/0/1/4                        100
HundredGigECtrlr0/1/0/12       ODU40/1/0/1/5                        100
```

Use the following command to clear alarm statistics on the optics or coherent DSP controller.

clear counters controller *controllertype R/S/I/P*

The following is a sample in which the alarm statistics are cleared on the coherent DSP controller.

```
RP/0/RP0/CPU0:ios#show controller coherentDSP 0/1/0/0
Tue Jun 11 05:15:12.540 UTC

Port                                        : CoherentDSP 0/1/0/0
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

Alarm Information:
```

```
LOS = 1 LOF = 1 LOM = 0
OOF = 1 OOM = 1 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 2      BDI = 2 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
PREFEC  BER                                     : 8.8E-03
POSTFEC BER                                     : 0.0E+00

TTI :
        Remote hostname                         : P2B8
        Remote interface                        : CoherentDSP 0/1/0/0
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : Soft-Decision 15

AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds
RP/0/RP0/CPU0:ios#clear counters controller coherentDSP 0/1/0/0
Tue Jun 11 05:17:07.271 UTC
All counters are cleared
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/1
Tue Jun 11 05:20:55.199 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 = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
PREFEC  BER                                     : 1.2E-02
POSTFEC BER                                     : 0.0E+00

TTI :
        Remote hostname                         : P2B8
        Remote interface                        : CoherentDSP 0/1/0/1
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : Soft-Decision 15

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

Regeneration Mode

In an optical transmission system, 3R regeneration helps extend the reach of the optical communication links by reamplifying, reshaping, and retiming the data pulses. Regeneration helps to correct any distortion of optical signals by converting it to an electrical signal, processing that electrical signal, and then retransmitting it again as an optical signal.

In Regeneration (Regen) mode, the OTN signal is received on a trunk port and the regenerated OTN signal is sent on the other trunk port of the line card and the other way round. In this mode, only the trunk optics controller and coherentDSP controllers are created.

Configuring the Card in Regen Mode

The supported trunk rates for 1.2T card is100G to 600G in multiples of 100G.

To configure regen mode on 1.2T, use the following commands:

configure

hw-module location *location*

regen

trunk-rate *trunk-rate*

commit

exit

Example

The following is a sample to configure the regen mode on 1.2T line card with the trunk-rate 300.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXR0
RP/0/RP0/CPU0:ios(config-hwmod)#regen
RP/0/RP0/CPU0:ios(config-regen)#trunk-rate 300
RP/0/RP0/CPU0:ios(config-regen)#commit
RP/0/RP0/CPU0:ios(config-regen)#exit
```

Verifying the Regen Mode

The following is a sample to verify the regen mode.

show hw-module location *location* **regen**

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 regen
Mon Mar 25 09:50:42.936 UTC

Location:             0/0/NXR0
Trunk  Bitrate:       400G
Status:               Provisioned
East Port              West Port
CoherentDSP0/0/0/0      CoherentDSP0/0/0/1
```

The terms, East Port and West Port are used to represent OTN signal regeneration at the same layer.

Configuring the BPS

You can configure the Bits per Symbol (BPS) to 3.4375 to support 300G trunk configurations on 75 GHz networks using the following commands:

configure

controller optics *R/S/I/P* **bits-per-symbol value**

commit

The following is a sample in which the BPS is configured to 3.4375.

```
RP/0/RP0/CPU0:ios#configure
Wed Mar 27 14:12:49.932 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/3/0/0 bits-per-symbol 3.4375
RP/0/RP0/CPU0:ios(config)#commit
```

Supported Baud Rates

Table 1: Supported Baud Rates

Traffic Rate	Minimum Baud Rate	Maximum Baud Rate
400	43.34518	130.4647
600	59.53435	148.0555
800	79.37913	148.0555
1000	99.22392	148.0555

Viewing BPS and Baud Rate Ranges

To view the the BPS for a specific range use the following command:

show controller optics *R/S/I/P* **bps-range** *bps-range* **| include** *data-rate* **| include** *fec-type*

```
RP/0/RP0/CPU0:ios#show controllers optics 0/3/0/0 bps-range 3 3.05 | include 300G | include
 SD27
Thu Mar 28 03:01:39.751 UTC
300G            SD27            3.0000000       69.4350994
300G            SD27            3.0078125       69.2547485
300G            SD27            3.0156250       69.0753320
300G            SD27            3.0234375       68.8968428
300G            SD27            3.0312500       68.7192736
300G            SD27            3.0390625       68.5426174
300G            SD27            3.0468750       68.3668671
```

To view the baud for a specific range use the following command:

show controller optics *R/S/I/P* **baud-rate-range** *baud-range* **| include** *data-rate* **| include** *fec-type*

```
RP/0/RP0/CPU0:ios#show controllers optics 0/3/0/0 baud-rate-range 43 43.4 | include 300G |
 include SD27
Thu Mar 28 03:12:36.521 UTC
300G            SD27            4.8046875       43.3545986
300G            SD27            4.8125000       43.2842178
300G            SD27            4.8203125       43.2140651
300G            SD27            4.8281250       43.1441394
```

```
300G            SD27            4.8359375       43.0744397
300G            SD27            4.8437500       43.0049648
```

Configuring the Trunk Rate for BPSK

You can configure trunk rates of 50G, 100G, and 150G to support Binary Phase-Shift Keying (BPSK) modulation. The BPSK modulation enables information to be carried over radio signals more efficiently.

You can configure trunk rates for BPSK using CLI, NetConf YANG, and OC models.

The following table list the 50G, 100G, and 150G trunk rates with the supported BPSK modulation:

Trunk Rate	BPSK Modulation
50G	1 to 1.4453125
100G	1 to 2.890625
150G	1.453125 to 4.3359375

To configure the trunk rate for BPSK modulation, enter the following commands:

configure

hw-module location *location* **mxponder**

trunk-rate {50G | 100G | 150G}

commit

The following example shows how to configure trunk rate to 50G:

```
RP/0/RP0/CPU0:(config)#hw-module location 0/0/NXR0 mxponder
RP/0/RP0/CPU0:(config-hwmod-mxp)#trunk-rate 50G
RP/0/RP0/CPU0:(config-hwmod-mxp)#commit
```

Viewing the BPSK Trunk Rate Ranges

To view the trunk rate configured for the BPSK modulation, use the following **show** commands:

```
RP/0/RP0/CPU0:ios(hwmod-mxp)#show hw-module location 0/0/NXR0 mxponder

Tue Feb 25 11:13:41.934 UTC


Location:             0/0/NXR0
Client Bitrate:       100GE
Trunk  Bitrate:       50G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/0
CoherentDSP0/0/0/1
                                Traffic Split Percentage


HundredGigECtrlr0/0/0/2         ODU40/0/0/0                              50
      50
```

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/0
Thu Mar  5 07:12:55.681 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Green

 Optics Status

        Optics Type:  DWDM optics
        DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
        Wavelength=1552.524nm

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


        LOS/LOL/Fault Status:

        Alarm Statistics:

        -------------
        HIGH-RX-PWR = 0            LOW-RX-PWR = 2
        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
        Laser Bias Current = 0.0 %
        Actual TX Power = 1.97 dBm
        RX Power = 1.58 dBm
        RX Signal Power = 0.60 dBm
        Frequency Offset = 386 MHz

        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

        Configured Tx Power = 2.00 dBm
        Configured CD High Threshold = 180000 ps/nm
        Configured CD lower Threshold = -180000 ps/nm
        Configured OSNR lower Threshold = 0.00 dB
        Configured DGD Higher Threshold = 180.00 ps
        Baud Rate =  34.7175521851 GBd
        Bits per Symbol = 1.0000000000  bits/symbol
        Modulation Type: BPSK
        Chromatic Dispersion -9 ps/nm
        Configured CD-MIN -180000 ps/nm  CD-MAX 180000 ps/nm
        Polarization Mode Dispersion = 0.0 ps
        Second Order Polarization Mode Dispersion = 125.00 ps^2
```

```
        Optical Signal to Noise Ratio = 34.60 dB
        SNR = 20.30 dB
        Polarization Dependent Loss = 0.20 dB
        Polarization Change Rate = 0.00 rad/s
        Differential Group Delay = 2.00 ps
        Filter Roll Off Factor : 0.100
        Rx VOA Fixed Ratio : 15.00 dB
        Enhanced Colorless Mode : 0
        Enhanced SOP Tolerance Mode : 0
        NLEQ Compensation Mode : 0
        Cross Polarization Gain Mode : 0
        Cross Polarization Weight Mode : 0
        Carrier Phase Recovery Window : 0
        Carrier Phase Recovery Extended Window : 0


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

QXP Card

Table 2: Feature History

Feature Name	Release Information	Description
NCS1K4-QXP-K9 Line Card Support on NCS 1014	Cisco IOS XR Release 24.1.1	NCS1K4-QXP-K9 line card delivers low cost 100G and 400G DWDM transmission with ZR+ optics on a router. This line card can be used in both traditional Optical Networking solution and in Routed Optical Networking solution. This line card has 16 pluggable ports with eight QSFP-DD client ports and eight QSFP-DD trunk ports. For more information about the NCS1K4-QXP-K9 card, see the datasheet.

The NCS1K4-QXP-K9 3.2T QSFP-DD DCO Transponder Line Card has eight client ports (QSFP-DD) and eight trunk ports (QSFP-DD ZR+). Each line card supports up to 3.2 Tbps traffic. The client rates that are supported are 400GE, 4x100GE, and 100GE Ethernet only. The modulation formats supported are 16 QAM for 400GE Txp/4x100GE Mxp.

The QXP line card provides up to 16 QSFP-DD ports (eight QSFP-DD client ports and eight QSFP-DD trunk ports). The supported operating modes are:

- 400GE-TXP
- 4X100GE MXP
- 2x100GE MXP

The QXP card has 8 slices. Each slice consists of one client and one trunk port with a slice capacity of 400G. The total capacity is 3.2T.

Table 3: Slice and Port Mapping on the QXP Card

Slice	Trunk Port	Client Port
0	0	1
1	2	3
2	4	5
3	6	7
4	8	9
5	10	11
6	12	13
7	14	15

Note

- When you use OPENROADM trunk mode by configuring the **trunk-mode OR** command, use only alternate slices on the QXP card. Either use slices 0, 2, 4, 6 or 1, 3, 5, 7.
- QDD-400G-ZR-S pluggable module supports FEC mode CFEC only.
- QDD-400G-ZR-S pluggable module operates only as an Ethernet transponder.

Supported Data Rates for QXP Card

The following table displays the client and trunk ports that are enabled for transponder and muxponder modes.

Operating mode	Card Support	Client Data Rate	Client Optics	Trunk Ports	Client Ports
400GE-TXP	QXP Card	400G	• QDD-400G-DR4-S • QDD-400G-FR4-S • QDD-400-AOCxM	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
4X100GE MXP	QXP Card	4X100G Break out	• QDD-400G-DR4-S • QDD-4X100G-LR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
2X100GE MXP	QXP Card	2X100G Break out	• QDD-400G-DR4-S • QDD-4X100G-LR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15

Configure 400G Transponder Mode

Use the following commands to configure and provision 400G TXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 400G

trunk-mode [ZR | OR]

client-port-rate *port-number***client-type 400GE**

The following is a sample configuration of configuring a 400G TXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 400GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 400G Transponder Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/0 mxponder-slice 0
Sat Jun 25 21:32:58.799 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       400GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/0/0/0
                               Traffic Split Percentage

FourHundredGigECtrlr0/0/0/1                 -                           100
```

Note The **trunk-mode** command allows you to choose between OTN and ethernet traffic on the trunk port.

Configure 400G Muxponder Mode

Use the following commands to configure and provision 400G MXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 400G

client-port-rate *port-number* **lane** *lane-number***client-type 100GE**

The following is a sample configuration of configuring a 400G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
```

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type 100GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 400G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:             0/3
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/3/0/2
                               Traffic Split Percentage

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

Configure 2x100G Muxponder Mode

Use the following commands to configure and provision 2x100G MXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 200G

client-port-rate *port-number* **lane** *lane-number***client-type 100GE**

The following is a sample configuration of configuring a 2x100G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 2x100G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:             0/3
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/3/0/2
                               Traffic Split Percentage

HundredGigECtrlr0/3/0/3/1              -                           100
HundredGigECtrlr0/3/0/3/2              -                           100
```

DAC Supported Modes for NCS1K4-QXP-K9 Card

DAC support is enabled on the NCS1K4-QXP-K9 card for 2x100G, 4x100G, and 400G operating modes. The following table provides the details of the respective DAC rates for the different trunk rates for NCS1K4-QXP-K9 card.

Table 4: DAC Supported Data Rates for NCS1K4-QXP-K9 Card

Trunk Rate	Modulation Format	Default Value	Modified DAC Supported
200G	QPSK	1x1	1x1.50
200G	8QAM	1x1.25	N/A
200G	16-QAM	1x1.25	N/A
400G	16-QAM	1x1	1x1.50

The following example changes the DAC rate to 1x1.5 on an optics controller.

```
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/0
RP/0/RP0/CPU0:ios(config-Optics)#dac-Rate 1x1.50
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

Note

- Changing the DAC turns the laser Off and then back on for the optics. This is a traffic impacting operation.
- The DAC rate configuration must match on both ends of a connection.

Cisco 400G QSFP-DD High-Power (Bright ZR+) Optical Module Support on QXP Card

QXP card supports Cisco 400G QSFP-DD High-Power (Bright) Optical Modules. DP04QSDD-HK9 operates as Ethernet or OTN transponder. DP04QSDD-HE0 operates only as an Ethernet transponder.

Use the following commands to configure OTN data path on the Bright ZR+ pluggable optical modules. The **trunk-mode OR** refers to OpenROADM.

hw-module location *location*

mxponder-slice 1 *slice-number*

trunk-mode OR

trunk-rate *rate*

Use the following commands to configure Ethernet data path on the Bright ZR+ pluggable optical modules.

hw-module location *location*

mxponder-slice 1 *slice-number*

trunk-mode ZR

trunk-rate *rate*

Note DP04QSDD-HK9 operates as Ethernet or OTN transponder. DP04QSDD-HE0 operates only as an Ethernet transponder. DP04QSDD-HE0 supports only trunk-mode ZR. Configuring trunk-mode OR on the DP04QSDD-HE0 pluggable raises the MEA alarm.

The following is a sample configuration of configuring a 4x100G OTN trunk on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder-slice 4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-mode OR
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 4 client-type 100GE
```

The following is a sample configuration of configuring Ethernet trunk on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder-slice 4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-mode ZR
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
```

The following is a sample configuration of setting 0dBm transmit power on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/2
RP/0/RP0/CPU0:ios(config-Optics)#transmit-power 0
Thu Mar  9 13:02:30.662 UTC
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config-Optics)#commit
Thu Mar  9 13:02:31.566 UTC
```

The following is a sample output of the **show controllers optics** command, with the transmit power set to 0 dBm.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/8
Thu Apr 13 13:54:33.163 UTC
 Controller State: Up
 Transport Admin State: In Service
 Laser State: On
 LED State: Green
 Optics Status
         Optics Type:  QSFP-DD DWDM
         DWDM carrier Info: C BAND, MSA ITU Channel=49, Frequency=193.70THz,
         Wavelength=1547.715nm
         Alarm Status:
         -------------
         Detected Alarms: None
         LOS/LOL/Fault Status:
         Alarm Statistics:
         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 4
         HIGH-TX-PWR = 0            LOW-TX-PWR = 1
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 4
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0
```

```
Laser Bias Current = 0.0 %
Actual TX Power = 0.00 dBm
RX Power = -10.50 dBm
RX Signal Power = -10.35 dBm
Frequency Offset = 199 MHz

Performance Monitoring: Enable

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

Parameter                 High Alarm  Low Alarm  High Warning  Low Warning
------------------------  ----------  ---------  ------------  -----------
Rx Power Threshold(dBm)          3.0      -24.5           0.0          0.0
Tx Power Threshold(dBm)          0.0      -16.0           0.0          0.0
LBC Threshold(mA)                N/A        N/A          0.00         0.00

LBC High Threshold = 90 %
Configured Tx Power = 0.00 dBm
Configured CD High Threshold = 52000 ps/nm
Configured CD lower Threshold = -52000 ps/nm
Configured OSNR lower Threshold = 21.10 dB
Configured DGD Higher Threshold = 67.00 ps
```

Table 5: Operating Modes Supported for Bright ZR+ Pluggable Modules on QXP Card

Operating mode	Modulation	FEC
4x100GE MXP	16-QAM	CFEC
4x100GE MXP	16-QAM	OFEC
2x100GE MXP	QPSK	OFEC
400GE TXP	16-QAM	CFEC
400GE TXP	16-QAM	OFEC

2.4T and 2.4TX Card Modes Overview

This section helps you familiarize with the different card modes available in the 2.4T and 2.4TX cards, their corresponding data rates, baud rate of each data rate, and the step-by-step procedure to configure line card in muxponder modes with the QDD-4x100GE and QDD-400GE pluggables.

Available Card Modes

The 2.4T and 2.4TX line cards have two trunk ports (0 and 7) and six client ports (from 1 to 6) each. You can configure the line card in:

- Muxponder slice—You can configure each trunk port independent of the other with different trunk rates. The client-to-trunk mapping is fixed. For Trunk 0, the client ports are 1 to 3. For Trunk 7, the client ports are 4 to 6.
- Muxponder—You can configure both trunk ports with the same trunk rate. The client-to-trunk mapping is fixed.

Note The muxponder mode is supported on the 2.4TX card only.

Muxponder Slice Mode for 2.4T and 2.4TX Cards

The line card is divided into two slices, namely, Slice 0 and Slice 1. Each slice contains a trunk port and three client ports. In this mode, the trunk ports operate independently, carrying different data rates. The slices enable the card to function as two different modules. For example, if you set the trunk as 400 G for Slice 0 and 600 G for Slice 1, then Trunk 0 delivers 400 G and Trunk 7 delivers 600 G.

Figure 1: 2.4T Line Card Slices and Ports

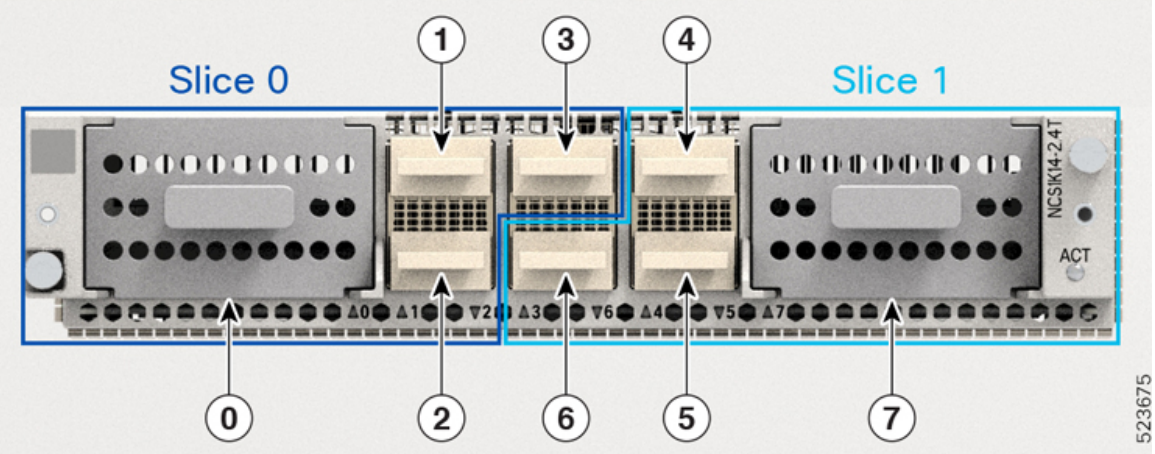

Figure 2: 2.4TX Line Card Slices and Ports

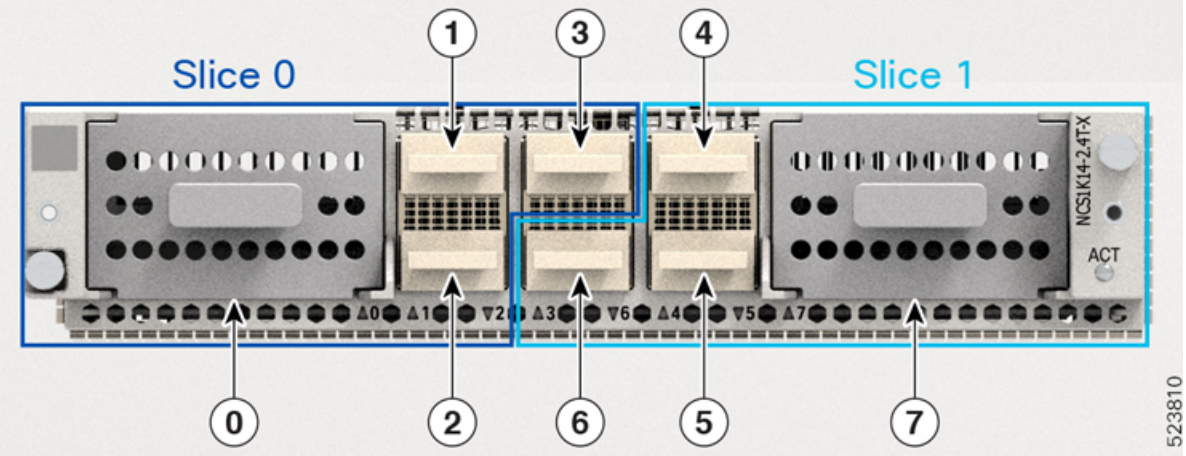

Table 6: Client-to-Trunk Mapping in Slice 0 and Slice 1 Modes

Slice 0		Slice 1	
Trunk Port	**Client Ports**	**Trunk Port**	**Client Ports**
0	1, 2, 3	7	4, 5, 6

Data Rate Capabilities for 2.4T and 2.4TX Line Cards in Muxponder Slice Mode

The 2.4T and 2.4TX line cards support various trunk rates.

The table shows the releases from which the 2.4T and 2.4TX cards started supporting each trunk rate.

Table 7: Release-Wise Trunk Rates Supported by the 2.4T and 2.4TX Cards

Trunk Rate (G)	2.4T	2.4TX
400	7.11.1	24.1.1
500	-	24.1.1
600	7.11.1	24.1.1
800	7.11.1	24.1.1
1000	7.11.1	24.1.1
1200	-	24.1.1

Recommended Trunk Parameters in the 2.4T and 2.4TX Cards

Baud Rate Ranges for Each Trunk Rate in the 2.4T Card

The 2.4T card carries signals at different trunk rates, with each trunk rate operating within a baud rate range.

In the *Baud Rate Ranges for Each Trunk Rate in the 2.4T Card* table, you can find the recommended baud rate ranges to maintain the signal health for each trunk rate in the network.

Table 8: Baud Rate Ranges for Each Trunk Rate in the 2.4T Card

Data Rate per Trunk (G)	Minimum Baud Rate (GBd)	Maximum Baud Rate (GBd)
400	43.34518	130.4647
500	49.61196	147.7235
600	59.53435	148.0555
700	69.45674	147.8182
800	79.37913	148.0555
900	89.30152	147.8709

Data Rate per Trunk (G)	Minimum Baud Rate (GBd)	Maximum Baud Rate (GBd)
1000	99.22392	148.0555
1100	109.1463	148.2068
1200	119.0687	148.0555

Baud Rate and Bit Rate Range for Each Trunk Rate in the 2.4TX Card

The 2.4TX card carries trunk signals at different data rates. Each trunk data rate operates in a default baud rate. However, you can customize the baud rate within the recommended baud rate range based on your deployment scenario. To customize baud rate, see.

In the *Baud Rate and Bit Rate Range for Each Trunk Rate in the 2.4TX Card* table, you can find the recommended baud rate ranges to maintain the signal health for each trunk rate in the network. The table also features the bit per second information for the respective baud rates.

Table 9: Baud Rate and Bit Rate Range for Each Trunk Rate in the 2.4TX Card

Trunk Data Rate per Trunk (G)	Minimum Baud Rate (GBd)	Maximum Baud Rate (GBd)	Default Baud Rate (GBd)	Minimum Bit per Second (bps)	Maximum Bit per Second (bps)
400	43.34518	130.4647	127.931418	2.1	4.1
500	49.61196	147.7235	137.8340588	2.5	5
600	59.53435	148.0555	137.738007	2.8	5.1
800	79.37913	148.0555	137.978388	3.5	5.1
1000	99.22392	148.0555	137.834059	4.3	5.3
1200	119.0687	148.0555	137.738007	5.3	5.7

Customize Baud Rates

The muxponder mode enables the 2.4T and 2.4TX cards to carry signals in default baud rates when you set up the trunk rate. However, you can customize the baud rates for each trunk rate based on the bandwidth in the network.

Use this procedure to customize the baud rates within the recommended range as per your deployment scenario.

Before you begin

- Install the following pluggable modules as required.
  - QDD-4x100G
  - QDD-400G
- Enter the Cisco IOS XR configuration mode.

Procedure

Step 1 Locate the Trunk Optics Controller for the 2.4T or 2.4TX card.

Example:

```
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
```

Step 2 Enter baud rate.

Example:

```
RP/0/RP0/CPU0:ios(config-Optics)#baud-rate 120.0000
```

Step 3 Save the changes.

Example:

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

Client Pluggables for Configuring Muxponder Slice Modes

This section provides details about the client pluggable combinations that you need to set up the client rate for each trunk rate in slice 0 and slice 1.

Pluggable Combinations in Muxponder Slice Modes

The client data rates and ports differ for each trunk rate in the muxponder slice 0 (Trunk 0) and muxponder slice 1 (Trunk 1) configurations. However, the type of client pluggable modules stays the same for both slice modes.

Table 10: Trunk Rate and Client Pluggable Combinations for Slices 0 and Slice 1

Trunk Rate (G) per Trunk	Card Support	Client Rate	Client Pluggable	Client Ports	
				Slice 0	Slice 1
400	2.4T, 2.4TX	400 GE	QDD-400G	1	4
		4x 100 GE	QDD-4x100G		
500	2.4TX	400 GE + 1x 100 GE	QDD-400G + QDD-4x100G	1, 2	4, 5
		5x 100 GE	2x QDD-4x100G		
600	2.4T, 2.4TX	400 GE + 2x 100 GE	QDD-400G + QDD-4x100G	1, 2	4, 5
		6x 100 GE	2x QDD-4x100G		

Trunk Rate (G) per Trunk	Card Support	Client Rate	Client Pluggable	Client Ports	
				Slice 0	Slice 1
800	2.4T, 2.4TX	2x 400 GE	2x QDD-400G	1, 2	4, 5
		400 GE + 4x 100 GE	QDD-400G + QDD-4x100G		
		8x 100 GE	2x QDD-4x100G		
1000	2.4T, 2.4TX	2x 400GE + 2x 100 GE	2x QDD-400G + 2x QDD-4x100G	1, 2, 3	4, 5, 6
		10x 100 GE	3x QDD-4x100G		
1200	2.4TX	3x 400 GE	3x QDD-400G	1, 2, 3	4, 5,6
		2x 400 GE + 4x 100 GE	2x QDD-400G + QDD-4x100G		
		400 GE + 8x 100 GE	QDD-400G + 2x QDD-4x100G		
		12x 100 GE	3x QDD-4x100G		

[1] QDD-400G refers to QDD-400G-FR4-S, QDD-400G-AOCxM, and QDD-400G-DR4-S pluggable modules.
[2] QDD-4x100G refers to QDD-4X100G-LR-S, and QDD-400G-DR4-S pluggable modules.

Make sure you use the appropriate values for client bitrate and trunk bitrate parameters when configuring the Muxponder slide mode using the **hw-module** command.

Set Up the Client and Trunk Rate in the Muxponder Slice Mode for 2.4T and 2.4TX Cards

Use this procedure to set up the client and trunk rate in the muxponder slice mode for the 2.4T and 2.4TX cards.

This procedure considers that you are setting up the 600-G data rate in one of the trunk ports of the 2.4T or 2.4TX card. This scenario requires you to set the client rate for the client ports. Based on the client pluggable that you use, the client rate can change to 400-GE client, 100-GE client, or mixed client.

For more information on the the data rate on each client port, see Client Pluggables for Configuring Muxponder Slice Modes, on page 26.

Before you begin

- Install the following pluggables as required.
  - QDD-400G
  - QDD-4x100G

Procedure

Step 1 Specify the card location.

Example:

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0
```

Step 2 Configure the 2.4T or 2.4TX line cards in the muxponder slice mode.

For Trunk 0 port, enter the `muxponder-slice 0` mode.

Example:

```
RP/0/RP0/CPU0:ios(config)#mxponder-slice 0
```

For Trunk 1 port, enter the `muxponder-slice 1` mode.

Example:

```
RP/0/RP0/CPU0:ios(config)#mxponder-slice 1
```

Note
You can configure both muxponder slice 0 and slice 1 modes when needed.

For more information on how to configure muxponder slice mode with QDD-4x100GE and QDD-4x100GE pluggables, see the hw-module command.

Step 3 Set up the trunk rate for the 2.4T or 2.4TX card.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 600G
```

Step 4 Set up the client rate based on the pluggables that you use.

For the QDD-400G pluggable, run this command.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 400GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 client-type 400GE
```

For the QDD-4x100G pluggable, run this command.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 2 client-type 100GE
```

Note
Use the **lane** keyword to set up the 100-GE client rate in the client ports.

For the mixed client pluggable, use the combination of the QDD-400G and QDD-4x100G commands.

Step 5 Save the configuration and exit the muxponder slice mode.

Example:

Command

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

Step 6 Verify the 600-G data rate that you set up.

The following sample shows the 600-G data rate (**Trunk Bitrate: 600G**) set up in client ports 1 (**FourHundredGigECtrlr0/1/0/1**) and 2 with breakout lanes 1 and 2 (**HundredGigECtrlr0/1/0/2/1** and **HundredGigECtrlr0/1/0/2/2**) using 400-GE and 100-GE client type pluggables (**Client Bitrate: MIXED**) in muxponder slice 0 (**Slice ID: 0**).

Example:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 0

Thu Nov 16 15:41:25.720 UTC
Location:             0/1/NXR0
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       600G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/0
                                Traffic Split Percentage

FourHundredGigECtrlr0/1/0/1     ODU-FLEX0/1/0/0/1                          100
HundredGigECtrlr0/1/0/2/1       ODU-FLEX0/1/0/0/2/1                        100
HundredGigECtrlr0/1/0/2/2       ODU-FLEX0/1/0/0/2/2                        100
```

The following sample shows the 600-G data rate (**Trunk Bitrate: 600G**) set up in client ports 0 with breakout lanes 1 to 4 (**HundredGigECtrlr0/1/0/1/1** to **HundredGigECtrlr0/1/0/1/4**) and 1 (**HundredGigECtrlr0/1/0/2/1**) using 100-GE client type pluggable (**Client Bitrate: 100GE**) in muxponder slice 0 (**Slice ID: 0**).

Example:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 0

Thu Nov 16 16:06:57.575 UTC
Location:             0/1/NXR0
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       600G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/0
                                Traffic Split Percentage

HundredGigECtrlr0/1/0/1/1       ODU-FLEX0/1/0/0/1/1                        100
HundredGigECtrlr0/1/0/1/2       ODU-FLEX0/1/0/0/1/2                        100
HundredGigECtrlr0/1/0/1/3       ODU-FLEX0/1/0/0/1/3                        100
HundredGigECtrlr0/1/0/1/4       ODU-FLEX0/1/0/0/1/4                        100
HundredGigECtrlr0/1/0/2/1       ODU-FLEX0/1/0/0/2/1                        100
HundredGigECtrlr0/1/0/2/2       ODU-FLEX0/1/0/0/2/2                        100
```

Muxponder Mode for 2.4TX Card

The muxponder mode enables the 2.4TX card to split wavelengths in specific client ports between the two trunk ports. In the slice mode, the client ports that support wavelength splitting act the same as other client ports. However, in the muxponder mode, the 2.4TX card activates the split client ports. The shared client ports are client port 2 for 600G and client port 3 for 1000G.

How Muxponder Mode Splits 400GE and 4x100GE Client Traffic

This use case explains the wavelength splitting for 600G trunk rate.

For 600G trunk rate, you must configure client port 1, 2, and 4 as 400GE or 4x100GE. Trunk 0 receives 400GE from port 1. Trunk 7 receives 400GE from port 4. As per split client configuration, port 2 gives 200GE to Trunk 0 and another 200GE to Trunk 7. In this way, both trunk ports deliver 600G trunk rate each.

Recommended Connections for Point-to-Point Topology in Muxponder Mode

- Connect the port 0 and port 7 in the near end node to their respective port 0 and port 7 in the far end node.
- Make sure the optic fibers connected to trunk ports 0 and 7 are the same length. The difference must be less than 500 m; otherwise, you'll lose traffic on the split port.

Data Rate Capabilities for the 2.4TX Card

The 2.4TX card supports different trunk rates.

Table 11: Release-Wise Trunk Rates Supported by the 2.4TX Cards

Trunk Rate (G)	Release Introduced
600	24.1.1
1000G	24.1.1

Client Pluggables for Configuring 2.4TX Muxponder Mode

Table 12: Feature History

Feature Name	Release Information	Description
100GE Channel Support for the 600G and 1000G Trunk Rate in NCS1K14-2.4T-X-K9 Muxponder Mode	Cisco IOS XR Release 24.3.1	The NCS1K14-2.4T-X-K9 line card now allows 100G breakout client support for 600G and 1000G trunk rate in muxponder mode. It features 4x100GE breakout channels in shared client ports, enabling easy integration with existing 100G networks using QDD-4X100G-LR-S, QDD-4X100G-FR-S, and QDD-400G-DR4-S pluggable modules. These channels offer high density and bandwidth efficiency without extra costs.

This section provides details about the client pluggable combinations that you need to set up the client rate for each trunk rate.

Client Pluggable Combinations in Muxponder Mode

The 2.4TX muxponder mode supports various trunk rate per trunk with different client pluggable combinations.

Note From R24.3.1, the 2.4TX card supports 100GE client traffic in the shared client port for both 600G and 1000G trunk rates.

The client channel rate in the table refers to both the total client rate and the client rate per channel in the client ports. For example, **2x 400GE + 2x 100GE** indicates that the client traffic consists of two channels at 400GE each and two channels at 100GE each.

Table 13: 2.4TX Muxponder Mode Port Configurations

Trunk Rate (G) per Trunk	Total Configured Trunk Rate (G)	Client Channel Rate	Client Pluggable	Shared Client Port	Client Ports
500	1000	2x 400GE + 2x 100GE	2x QDD-400G + 1x QDD-4x100G	2	1, 4
		1x 400GE + 6x 100GE	1x QDD-400G + 2x QDD-4x100G		
		10x 100GE	3x QDD-4x100G		

Trunk Rate (G) per Trunk	Total Configured Trunk Rate (G)	Client Channel Rate	Client Pluggable	Shared Client Port	Client Ports
600	1200	3x 400GE	3x QDD-400G	2	1, 4
		2x 400GE + 4x 100GE	2x QDD-400G + 1x QDD-4x100G		
		1x 400GE + 8x 100GE	1x QDD-400G + 2x QDD-4x100G		
900	1800	4x 400GE + 2x 100GE	4x QDD-400G + 1x QDD-4x100G	3	1, 2, 4, 5
		3x 400GE + 6x 100GE	3x QDD-400G + 2x QDD-4x100G		
		2x 400GE + 10x 100GE	2x QDD-400G + 3x QDD-4x100G		
		1x 400GE + 14x 100GE	1x QDD-400G + 4x QDD-4x100G		
		18x 100GE	5x QDD-4x100G		
1000	2000	5x 400GE	5x QDD-400G	3	1, 2, 4, 5
		4x 400GE + 4x 100GE	4x QDD-400G + 1x QDD-4x100G		
		3x 400GE + 8x 100GE	3x QDD-400G + 2x QDD-4x100G		
		2x 400GE + 12x 100GE	2x QDD-400G + 3x QDD-4x100G		
		1x 400GE + 16x 100GE	1x QDD-400G + 4x QDD-4x100G		

Understanding Client Rates per Client Port for Each Trunk Rate

The table shows the sample client rate per client port for each trunk rate. This simplified matrix helps you understand the traffic flow in each client port. It also indicates the number of channels that each client port

uses to deliver the client traffic. The type of pluggable module inserted in the shared client port determines the traffic rate through breakout and non-breakout channels.

You can customize the configuration by mixing and matching the client pluggable modules according to your requirements.

Table 14: Client Rate Traffic per Trunk Rate and Client Pluggable Combinations

Trunk Rate (G) per Trunk	Client Pluggable	Client Rate (GE) per Trunk 0 Client Ports		Client Rate (GE) per Shared Client Ports		Client Rate (GE) per Trunk 1 client ports		
		1	2	2	3	4	5	6
500	2x QDD-400G + 1x QDD-4x100G	400	-	2x 100	-	400	-	-
	1x QDD-400G + 2x QDD-4x100G	400	-	2x 100[3]	-	4x 100	-	-
	1x QDD-4x100G	4x 100	-	2x 100[3]	-	4x 100	-	-
600	3x QDD-400G	400	-	400	-	400	-	-
	2x QDD-400G + 1x QDD-4x100G	400	-	4x 100[3]	-	400	-	-
	1x QDD-400G + 2x QDD-4x100G	400	-	4x 100[3]	-	4x 100	-	-
900	4x QDD-400G + 1x QDD-4x100G	400	400	-	2x 100[3]	400	400	-
	3x QDD-400G + 2x QDD-4x100G	400	400	-	2x 100[3]	400	4x 100	-
	2x QDD-400G + 3x QDD-4x100G	400	400	-	2x 100[3]	4x 100	4x 100	-
	1x QDD-400G + 4x QDD-4x100G	400	4x 100	-	2x 100[3]	4x 100	4x 100	-
	5x QDD-4x100G	4x 100	4x 100	-	2x 100[3]	4x 100	4x 100	-

Trunk Rate (G) per Trunk	Client Pluggable	Client Rate (GE) per Trunk 0 Client Ports		Client Rate (GE) per Shared Client Ports		Client Rate (GE) per Trunk 1 client ports		
		1	2	2	3	4	5	6
1000	5x QDD-400G	400	400	-	400	400	400	-
	4x QDD-400G + 1x QDD-4x100G	400	400	-	4x 100	400	400	-
	3x QDD-400G + 2x QDD-4x100G	400	400	-	4x 100	400	4x 100	-
	2x QDD-400G + 3x QDD-4x100G	400	400	-	4x 100	4x 100	4x 100	-
	1x QDD-400G + 4x QDD-4x100G	400	4x 100	-	4x 100	4x 100	4x 100	-

[3] In this shared port, the pluggable capacity is 400GE or 4x 100GE, but, for this trunk rate, the 2.4TX card consumes only 2x 100GE client data.

Set Up the Client and Trunk Rate in the Muxponder Mode for the 2.4TX Card

Use this procedure to configure a trunk rate in muxponder mode for the 2.4TX card.

Note This procedure considers that you're setting up the 600G trunk rate in the muxponder mode for the 2.4TX card. The commands and output shown are for 600G trunk rate. The commands and output change for other trunk rates.

This procedure uses a mix of client pluggable modules. For this procedure, the card has:

- QDD-4x100G pluggable in shared client port 2, and
- QDD-400G pluggable in client ports 1 and 4

Note For the 600G trunk rate, the split port supports both 400GE and 4x100GE. For more information on required pluggable modules for other trunk rates, see Client Pluggables for Configuring 2.4TX Muxponder Mode, on page 31.

Before you begin

- Install the pluggables as required.
  - QDD-400G
  - QDD-4x100G

Procedure

Step 1 Specify the card location.

Example:

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0
```

Step 2 Enter the muxponder card mode.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder
```

Step 3 Set up the trunk rate.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 600G
```

Step 4 Set up the client rate for the QDD-400G and QDD-4x100G pluggable modules.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 400GE
// QDD-400G pluggable in client port 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 1 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 2 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 client-type 400GE
```

Note
Use the **lane** keyword to set up the 100GE client rate in the client ports.

Step 5 Save the configuration and exit the muxponder mode.

Example:

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#exit
// Exits muxponder mode
RP/0/RP0/CPU0:ios(config)#exit
// Exits configuration moder
```

Step 6 Verify the 600G mixed client rate configured for the 2.4TX muxponder mode.

The sample shows the 600G data rate (**Trunk Bitrate: 600G**) set up in client ports 1 and 4 (**FourHundredGigECtrlr0/2/0/1** and **FourHundredGigECtrlr0/2/0/4**) and split client port 2 with breakout lanes 1 to 4 (**HundredGigECtrlr0/2/0/2/1** to **HundredGigECtrlr0/2/0/2/4**).

Example:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2/NXR0 mxponder

Location:             0/2/NXR0
Client Bitrate:       MIXED
Trunk  Bitrate:       600G
Status:               Provisioned
```

```
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                    Mapper/Trunk Port          CoherentDSP0/2/0/0   CoherentDSP0/2/0/7

                               Traffic Split Percentage

FourHundredGigECtrlr0/2/0/1    ODU-FLEX0/2/0/0/1                          100
      0
HundredGigECtrlr0/2/0/2/1      ODU-FLEX0/2/0/0/2/1                        100
      0
HundredGigECtrlr0/2/0/2/2      ODU-FLEX0/2/0/0/2/2                        100
      0
HundredGigECtrlr0/2/0/2/1      ODU-FLEX0/2/0/7/2/3                          0
    100
HundredGigECtrlr0/2/0/2/2      ODU-FLEX0/2/0/7/2/4                          0
    100
FourHundredGigECtrlr0/2/0/4    ODU-FLEX0/2/0/7/4                            0
    100
```