



# Configuring the Card Mode

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



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

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## 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 rates in 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 output 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 output 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<br>(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 | 100G|150G | 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 output 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

HundredGigEctrler0/1/0/2   ODU40/1/0/0/1           100           0
HundredGigEctrler0/1/0/3   ODU40/1/0/0/2           100           0
HundredGigEctrler0/1/0/4   ODU40/1/0/0/3           100           0
HundredGigEctrler0/1/0/5   ODU40/1/0/0/4           100           0
HundredGigEctrler0/1/0/6   ODU40/1/0/0/5           100           0
HundredGigEctrler0/1/0/7   ODU40/1/0/0/6           50            50
HundredGigEctrler0/1/0/8   ODU40/1/0/1/1           0            100
HundredGigEctrler0/1/0/9   ODU40/1/0/1/2           0            100
HundredGigEctrler0/1/0/10  ODU40/1/0/1/3           0            100
HundredGigEctrler0/1/0/11  ODU40/1/0/1/4           0            100
HundredGigEctrler0/1/0/12  ODU40/1/0/1/5           0            100
    
```

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

```

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

HundredGigEctrler0/1/0/2   ODU40/1/0/0/1           100
HundredGigEctrler0/1/0/3   ODU40/1/0/0/2           100
HundredGigEctrler0/1/0/4   ODU40/1/0/0/3           100
HundredGigEctrler0/1/0/5   ODU40/1/0/0/4           100
HundredGigEctrler0/1/0/6   ODU40/1/0/0/5           100
    
```

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

```

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

HundredGigEctrler0/1/0/8   ODU40/1/0/1/1           100
HundredGigEctrler0/1/0/9   ODU40/1/0/1/2           100
HundredGigEctrler0/1/0/10  ODU40/1/0/1/3           100
HundredGigEctrler0/1/0/11  ODU40/1/0/1/4           100
    
```

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

```

RP/0/RP0/CPU0:ios#sh hw-module location 0/0/NXR0 muxponder-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 is 100G 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 lists 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-mpx)#trunk-rate 50G
RP/0/RP0/CPU0:(config-hwmod-mpx)#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-mpx)#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.<br><br>For more information about the NCS1K4-QXP-K9 card, see the <a href="#">datasheet</a> . |

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             | <ul style="list-style-type: none"> <li>• QDD-400G-DR4-S</li> <li>• QDD-400G-FR4-S</li> <li>• QDD-400-AOCxM</li> </ul> | 0,2,4,6,8,10,12,14 | 1,3,5,7,9,11,13,15 |
| 4X100GE MXP    | QXP Card     | 4X100G Break out | <ul style="list-style-type: none"> <li>• QDD-400G-DR4-S</li> <li>• QDD-4X100G-LR-S</li> </ul>                         | 0,2,4,6,8,10,12,14 | 1,3,5,7,9,11,13,15 |
| 2X100GE MXP    | QXP Card     | 2X100G Break out | <ul style="list-style-type: none"> <li>• QDD-400G-DR4-S</li> <li>• QDD-4X100G-LR-S</li> </ul>                         | 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

HundredGigEctr0/3/0/3/1  -                               100
HundredGigEctr0/3/0/3/2  -                               100
HundredGigEctr0/3/0/3/3  -                               100
HundredGigEctr0/3/0/3/4  -                               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

HundredGigEctr0/3/0/3/1  -                               100
HundredGigEctr0/3/0/3/2  -                               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
  WV-LOOL = 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.

---

## 2.4T and 2.4TX Card Trunk Pluggables and Datarates

### Coherent Interconnect Module 8

The 2.4T and 2.4TX cards support Coherent Interconnect Module 8 (CIM8) pluggables as trunk pluggables.

The Coherent Interconnect Module 8 (CIM8) is a pluggable, high-capacity multi-haul transceiver. The module can operate at line rates between 400G and 1200G in 100G increments. It utilizes a single optical carrier for both C-band and L-band operations.

#### CIM8-C-K9

CIM8-C-K9 is the C-band Coherent Interconnect module 8.

The frequency range supported on a 50 GHz or 100 MHz flex grid is from 1912500 to 1961000. Any frequency outside this range will trigger a "Port Pluggable Module Mismatched With Pre-Provisioned PPM" alarm, causing the link to go down.

The default frequency is 193.10 THz.

#### CIM8-CE-K9

CIM8-CE-K9 includes a pre-amplifier (EDFA).

The frequency range supported on a 50 GHz or 100 MHz flex grid is from 1912500 to 1961000. Any frequency outside this range will trigger a "Port Pluggable Module Mismatched With Pre-Provisioned PPM" alarm, causing the link to go down.

Due to the inclusion of the pre-amplifier, the optical performance is enhanced compared to the CIM8-C-K9, enabling longer reach.

#### CIM8-LE-K9

This variant of the CIM8 supports the L-band spectrum and includes a pre-amplifier (EDFA).

The frequency range supported on a 100 MHz flex grid is from 1861500 to 1909250. Any frequency outside this range triggers a "Port Pluggable Module Mismatched With Pre-Provisioned PPM" alarm, causing the link to go down.

There is no default frequency for the CIM8-LE-K9. You must configure the frequency for the laser to be activated.

In R24.3.1 and later releases, if a C-band CIM8 is replaced with an LE CIM8 and the frequency is configured within the specified range, the traffic should resume seamlessly.

| PID        | Frequency Range Supported | Default Frequency |
|------------|---------------------------|-------------------|
| CIM8-C-K9  | 1912500 to 1961000        | 193.10 THz        |
| CIM8-CE-K9 | 1912500 to 1961000        | 193.10 THz        |

| PID        | Frequency Range Supported | Default Frequency    |
|------------|---------------------------|----------------------|
| CIM8-LE-K9 | 1861500 to 1909250        | No default frequency |

The following table shows the different pluggables and datarates that each pluggable supports.

| PID        | Cards Supported      | Supported Rates   |
|------------|----------------------|---|
| CIM8-C-K9  | 2.4T and 2.4TX cards | 400G, 500G, 600G, 700G, 800G, 900G, 1000G, 1100G, 1200G |
| CIM8-CE-K9 | 2.4TX card           | 400G, 500G, 600G, 700G, 800G, 900G, 1000G, 1100G, 1200G |
| CIM8-LE-K9 | 2.4TX card           | 400G, 500G, 600G, 700G, 800G, 900G, 1000G               |

## 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*

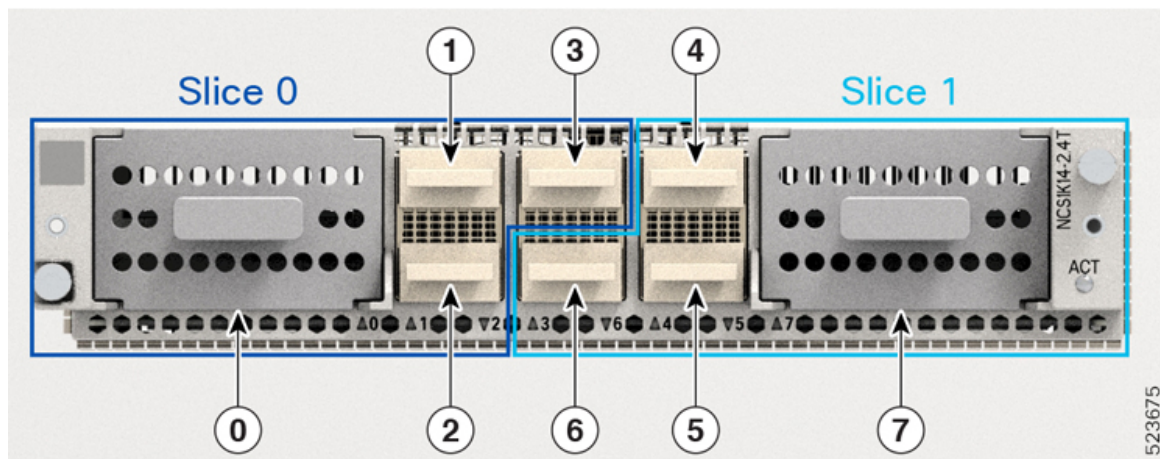




Figure 2: 2.4TX Line Card Slices and Ports

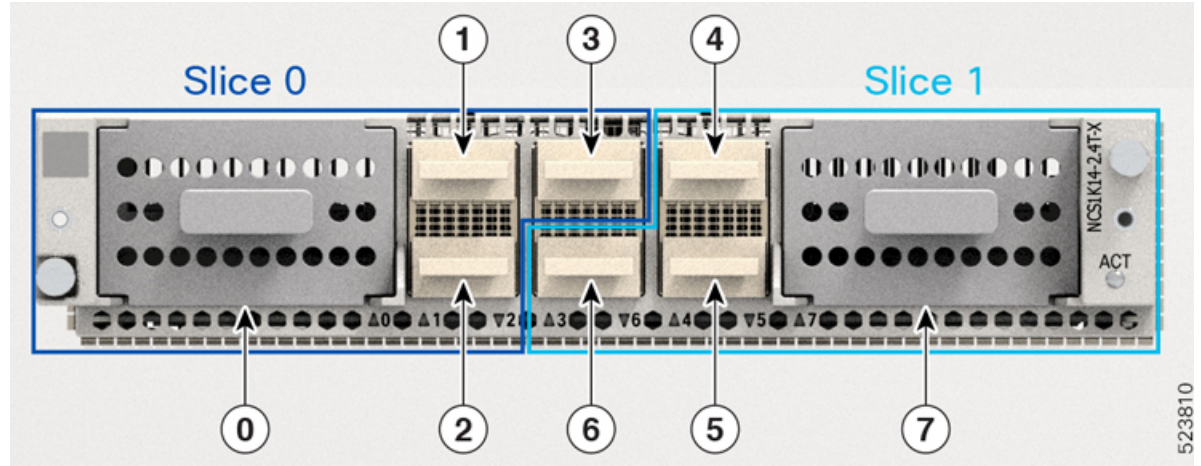


Table 6: Client-to-Trunk Mapping in Slice 0 and Slice 1 Modes

| 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 |
| 700            | -      | 24.2.1 |
| 800            | 7.11.1 | 24.1.1 |
| 900            | -      | 24.2.1 |
| 1000           | 7.11.1 | 24.1.1 |
| 1100           | -      | 24.2.1 |
| 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                |
| 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                          |
| 700                           | 69.45674                | 147.8182                | 138.08166               | 3.2                          | 5                            |
| 800                           | 79.37913                | 148.0555                | 137.978388              | 3.5                          | 5.1                          |

| 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) |
|-------------------------------|-------------------------|-------------------------|-------------------------|------------------------------|------------------------------|
| 900                           | 89.30152                | 147.8709                | 137.89817               | 3.8                          | 5.2                          |
| 1000                          | 99.22392                | 148.0555                | 137.834059              | 4.3                          | 5.3                          |
| 1100                          | 109.1463                | 148.2068                | 137.78165               | 4.7                          | 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.

---

**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               |              |         |
| 700                      | 2.4TX        | 400 GE + 3x 100 GE    | QDD-400G + QDD-4x100G       | 1, 2         | 4, 5    |
|                          |              | 7x 100 GE             | 2x QDD-4x100G               |              |         |
| 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               |              |         |
| 900                      | 2.4TX        | 2x 400 GE + 1x 100 GE | QDD-400G + QDD-4x100G       | 1, 2, 3      | 4, 5, 6 |
|                          |              | 400 GE + 5x 100 GE    | QDD-400G + QDD-4x100G       |              |         |
|                          |              | 9x 100 GE             | 3x 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               |              |         |

| Trunk Rate (G) per Trunk | Card Support       | Client Rate           | Client Pluggable         | Client Ports     |         |
|--------------------------|--------------------|-----------------------|--------------------------|------------------|---------|
|                          |                    |                       |                          | Slice 0          | Slice 1 |
| 1100                     | 2.4TX              | 2x 400 GE + 3x 100 GE | 2x QDD-400G + QDD-4x100G | 1, 2, 3          | 4, 5, 6 |
|                          |                    | 400 GE + 7x 100 GE    | 2x QDD-400G + QDD-4x100G |                  |         |
|                          |                    | 11x 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            |                  |         |
|                          |                    | 6x 2X100 GE           | 6x QDD-2X100-CWDM4-S     | 1, 2, 3, 4, 5, 6 | —       |
|                          | 6x QDD-2X100-LR4-S |                       |                          |                  |         |

<sup>1</sup> QDD-400G refers to QDD-400G-FR4-S, QDD-400G-LR4-S, QDD-400G-AOCxM, and QDD-400G-DR4-S pluggable modules.

<sup>2</sup> QDD-4x100G refers to QDD-4X100G-LR-S, QDD-4X100G-FR-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 slice 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 27.

### Before you begin

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

**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)#muxponder-slice 0
```

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

**Example:**

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

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

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 2 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#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-mlx)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#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 (**FourHundredGigEctr0/1/0/1**) and 2 with breakout lanes 1 and 2 (**HundredGigEctr0/1/0/2/1** and **HundredGigEctr0/1/0/2/2**) 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

FourHundredGigEctr0/1/0/1      ODU-FLEX0/1/0/0/1      100
HundredGigEctr0/1/0/2/1      ODU-FLEX0/1/0/0/2/1    100
HundredGigEctr0/1/0/2/2      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 (**HundredGigEctr0/1/0/1/1** to **HundredGigEctr0/1/0/1/4**) and 1 (**HundredGigEctr0/1/0/2/1**) 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

HundredGigEctr0/1/0/1/1      ODU-FLEX0/1/0/0/1/1    100
HundredGigEctr0/1/0/1/2      ODU-FLEX0/1/0/0/1/2    100
HundredGigEctr0/1/0/1/3      ODU-FLEX0/1/0/0/1/3    100
HundredGigEctr0/1/0/1/4      ODU-FLEX0/1/0/0/1/4    100
HundredGigEctr0/1/0/2/1      ODU-FLEX0/1/0/0/2/1    100
HundredGigEctr0/1/0/2/2      ODU-FLEX0/1/0/0/2/2    100
```

## Set Up 2x100G Clients in 1200G Trunk rate in the Muxponder Slice Mode for 2.4TX Cards

Use this procedure to set up 2x100G client pluggables in 1200G trunk rate in the muxponder slice mode for the 2.4TX card.

For more information on the the data rate on each client port, see [Client Pluggables for Configuring Muxponder Slice Modes](#), on page 27.

**Before you begin**

- Install either of the following pluggables in all 6 client ports.
  - QDD-2X100-CWDM4-S
  - QDD-2X100-LR4-S

**Step 1** Specify the card location.

**Example:**

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

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

For 6x2x100pluggables in 1200G trunk mode all client ports are in slice 0. Enter the `muxponder-slice 0` mode.

**Example:**

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

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

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mp)#trunk-rate 1200G
```

**Step 4** Set up the client rate.

For the 2X100G pluggables, run this command.

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mp)#client-rate 100GE
```

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

**Example:****Command**

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

**Step 6** Verify the 1200-G data rate that you set up.

The following sample shows the 1200-G data rate (**Trunk Bitrate: 1200G**) set up in all 12 client ports.

**Example:**

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

```
Thu Nov 16 15:41:25.720 UTC
Location:                0/2/NXR0
Slice ID:                 0
Client Bit100GE
Trunk Bitrate:       1200G
Status:                  Provisioned
rate:                    LLDP Drop Enabled:  FALSE
ARP Snoop Enabled:      FALSE
Client Port              Mapper/Trunk Port      CoherentDSP0/2/0/0
                        Traffic Split Percentage
```



|                           |                    |     |
|---------------------------|--------------------|-----|
| HundredGigEctr1r0/2/0/1/1 | ODU-FLEX0/2/0/0/1  | 100 |
| HundredGigEctr1r0/2/0/1/5 | ODU-FLEX0/2/0/0/2  | 100 |
| HundredGigEctr1r0/2/0/2/1 | ODU-FLEX0/2/0/0/3  | 100 |
| HundredGigEctr1r0/2/0/2/5 | ODU-FLEX0/2/0/0/4  | 100 |
| HundredGigEctr1r0/2/0/3/1 | ODU-FLEX0/2/0/0/5  | 100 |
| HundredGigEctr1r0/2/0/3/5 | ODU-FLEX0/2/0/0/6  | 100 |
| HundredGigEctr1r0/2/0/4/1 | ODU-FLEX0/2/0/0/7  | 100 |
| HundredGigEctr1r0/2/0/4/5 | ODU-FLEX0/2/0/0/8  | 100 |
| HundredGigEctr1r0/2/0/5/1 | ODU-FLEX0/2/0/0/9  | 100 |
| HundredGigEctr1r0/2/0/5/5 | ODU-FLEX0/2/0/0/10 | 100 |
| HundredGigEctr1r0/2/0/6/1 | ODU-FLEX0/2/0/0/9  | 100 |
| HundredGigEctr1r0/2/0/6/5 | ODU-FLEX0/2/0/0/10 | 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

*Table 11: Feature History*

| Feature Name  | Release Information         | Description   |
|---|-----------------------------|---|
| Additional Muxponder Mode Trunk Rates for the NCS1K14-2.4T-X-K9 Line Card | Cisco IOS XR Release 24.3.1 | The NCS1K14-2.4T-X-K9 line card now supports additional trunk rates of 500G and 900G in muxponder mode, enhancing flexibility and optimizing pluggable count alongside the existing 600G and 1000G rates. |

The 2.4TX card supports different trunk rates.

Table 12: Release-Wise Trunk Rates Supported by the 2.4TX Cards

| Trunk Rate (G) | Release Introduced |
|----------------|--------------------|
| 500            | 24.3.1             |
| 600            | 24.1.1             |
| 900G           | 24.3.1             |
| 1000G          | 24.1.1             |



**Note** For 600G and 1000G trunk rates, in R24.1.1, the shared client port supports only 400GE client and from R24.3.1, the shared client port supports both 400GE and 4x100GE clients.

## Client Pluggables for Configuring 2.4TX Muxponder Mode

Table 13: 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 14: 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               |                    |              |
| 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               |                    |              |

| Trunk Rate (G) per Trunk | Total Configured Trunk Rate (G) | Client Channel Rate  | Client Pluggable            | Shared Client Port | Client Ports |
|--------------------------|---------------------------------|----------------------|-----------------------------|--------------------|--------------|
| 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 15: 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 <sup>3</sup>                      | - | 4x 100                                    | - | - |
|                          | 1x QDD-4x100G               | 4x 100                                    | - | 2x 100 <sup>3</sup>                      | - | 4x 100                                    | - | - |
| 600                      | 3x QDD-400G                 | 400                                       | - | 400                                      | - | 400                                       | - | - |
|                          | 2x QDD-400G + 1x QDD-4x100G | 400                                       | - | 4x 100 <sup>3</sup>                      | - | 400                                       | - | - |
|                          | 1x QDD-400G + 2x QDD-4x100G | 400                                       | - | 4x 100 <sup>3</sup>                      | - | 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 |
| 900                      | 4x QDD-400G + 1x QDD-4x100G | 400                                       | 400    | -  | 2x 100 <sup>3</sup> | 400                                       | 400    | - |
|                          | 3x QDD-400G + 2x QDD-4x100G | 400                                       | 400    | -  | 2x 100 <sup>3</sup> | 400                                       | 4x 100 | - |
|                          | 2x QDD-400G + 3x QDD-4x100G | 400                                       | 400    | -  | 2x 100 <sup>3</sup> | 4x 100                                    | 4x 100 | - |
|                          | 1x QDD-400G + 4x QDD-4x100G | 400                                       | 4x 100 | -  | 2x 100 <sup>3</sup> | 4x 100                                    | 4x 100 | - |
|                          | 5x QDD-4x100G               | 4x 100                                    | 4x 100 | -  | 2x 100 <sup>3</sup> | 4x 100                                    | 4x 100 | - |
| 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 | - |

<sup>3</sup> 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 34.

### Before you begin

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

**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) #muxponder
```

**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 mode
```

**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
```

