# Downstream Interface Configuration

This document describes how to configure the downstream interfaces on the Cisco cBR Series Converged Broadband Router .

# Finding Feature Information

### Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

# Hardware Compatibility Matrix for Cisco cBR Series Routers

**Note** The hardware components introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.

*Table 1: Hardware Compatibility Matrix for the  Cisco cBR  Series Routers*

| Cisco CMTS Platform | Processor Engine | Interface Cards |
|---|---|---|
| Cisco cBR-8 Converged Broadband Router | **Cisco IOS-XE Release 3.15.0S and Later Releases**<br><br>Cisco cBR-8   Supervisor :<br><br>• PID—CBR-CCAP-SUP-160G<br><br>• PID—CBR-CCAP-SUP-60G[1]<br><br>• PID—CBR-SUP-8X10G-PIC | **Cisco IOS-XE Release 3.15.0S and Later Releases**<br><br>Cisco cBR-8 CCAP Line Cards:<br><br>• PID—CBR-LC-8D30-16U30<br><br>• PID—CBR-LC-8D31-16U30<br><br>• PID—CBR-RF-PIC<br><br>• PID—CBR-RF-PROT-PIC<br><br>Cisco cBR-8 Downstream PHY Modules:<br><br>• PID—CBR-D30-DS-MOD<br><br>• PID—CBR-D31-DS-MOD<br><br>Cisco cBR-8 Upstream PHY Modules:<br><br>• PID—CBR-D30-US-MOD |

[1] Effective with Cisco IOS-XE Release 3.17.0S, CBR-CCAP-SUP-60G supports 8 cable line cards. The total traffic rate is limited to 60Gbps, the total number of downstream service flow is limited to 72268, and downstream unicast low-latency flow does not count against the limits.

# Information About Downstream Interface Configuration

### Overview

• Each downstream port requires port level configuration and channel level configuration. Port level configuration is optimized with a frequency profile that defines ranges of frequencies available on the port. Channel level configuration is optimized with a QAM profile and channel range configuration block that auto-increments frequency and duplicates annex, modulation, and interleaver.

• Each channel requires a set of parameters: frequency, annex, modulation, interleaver, and DOCSIS channel id.

• Configuration is done in 4 major blocks of configuration:

> • QAM Profile—Example: "cable downstream qam-profile 1"
>
> • Frequency Profile—Example: "cable downstream freq-profile 2"
>
> • Port/Controller—Example: "controller Integrated-Cable 3/0/0"
>
> • RF Channel block—Example: "rf-chan 0 31"

### Downstream RF Port and Channel Management

The downstream RF port and channel management feature is responsible for the configuration and management of the downstream RF ports and channels. Each downstream RF channel can be provisioned either as a DOCSIS or traditional MPEG video QAM channel.

### QAM Profile

A QAM profile describes the common downstream channel modulator settings, referred to as physical layer parameters. This includes QAM constellation, symbol rate, interleaver-depth, spectrum-inversion, and annex. The QAM profile is described by *CCAP DownPhyParams* object. Default QAM profiles are supported and customized for DOCSIS or MPEG Video, which are described as *DocsisPhyDefault* and *VideoPhyDefault* objects, respectively.

A maximum of 32 QAM profiles can be defined. There are four system-defined QAM profiles (0 to 3), which cannot be deleted or modified. You can define profiles 4 to 31.

The system defined profiles are:

- Profile 0 - default-annex-b-64-qam

    - interleaver-depth: I32-J4

    - symbol rate: 5057 kilo-symbol/second

    - spectrum-inversion: off

- Profile 1 - default-annex-b-256-qam

    - interleaver-depth: I32-J4

    - symbol rate: 5361 kilo-symbol/second

    - spectrum-inversion: off

- Profile 2 - default-annex-a-64-qam

    - interleaver-depth: I12-J17

    - symbol rate: 6952 kilo-symbol/second

    - spectrum-inversion: off

- Profile 3 - default-annex-a-256-qam

    - interleaver-depth: I12-J17

    - symbol rate: 6952 kilo-symbol/second

    - spectrum-inversion: off

### Frequency Profile

A frequency profile defines the ranges of frequencies available on a port. A maximum of 16 frequency profiles can be defined. There are four system-defined frequency profiles (0 to 3), which cannot be deleted or modified. You can define profiles 4 to 15.

The system defined profiles are:

- Profile 0 - annex-b-low, Frequency range (Hz): 90000000 - 863999999

- Profile 1 - annex-b-high, Frequency range (Hz): 234000000 - 1002999999

- Profile 2 - annex-a-low, Frequency range (Hz): 94000000 - 867999999

- Profile 3 - annex-a-high, Frequency range (Hz): 267000000 - 1002999999

The frequency ranges are defined using lanes and blocks:

- Four lanes per port, each lane can support 216 MHz range.

- Four blocks per lane, each block can support 54 MHz range.

- Lanes and blocks may have overlapping frequency ranges.

# How to Configure Downstream Interfaces

This section contains the following:

## Configuring the Cisco CMTS Manually Using Configuration Mode

Connect a console terminal to the console port on the I/O controller. When asked if you want to enter the initial dialog, answer **no** to go into the normal operating mode of the router. After a few seconds the user EXEC prompt (**Router>**) appears.

## Configuring the QAM Profile on the Downstream Channels

**Procedure**

|  | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>`Router> enable` | Enables privileged EXEC mode.<br><br>Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **cable downstream qam-profile** *Qam_Profile_ID*<br><br>**Example:**<br><br>`Router(config)# cable downstream qam-profile 3` | Defines or modifies a QAM profile. |
| **Step 4** | **annex {A | B | C}**<br><br>**Example:** | Defines the profile MPEG framing format. The default is Annex B. |

|        | Command or Action | Purpose |
|--------|-------------------|---------|
|        | Router(config-qam-prof)#  **annex A** | |
| **Step 5** | **description** *LINE*<br><br>**Example:**<br><br>Router(config-qam-prof)#  **description qam1** | Name or description for this profile. |
| **Step 6** | **interleaver-depth** {**I12-J17** \| **I128-J1** \| **I128-J2** \| **I128-J3** \| **I128-J4** \| **I128-J5** \| **I128-J6** \| **I128-J7** \| **I128-J8** \| **I16-J8** \| **I32-J4** \| **I64-J2** \| **I8-J16**}<br><br>**Example:**<br><br>Router(config-qam-prof)# **interleaver-depth I64-J2** | Defines the interleaver depth. The default is I32 J4 for DOCSIS. |
| **Step 7** | **modulation** {**256** \| **64**}<br><br>**Example:**<br><br>Router(config-qam-prof)#  **modulation 64** | Defines the modulation. The default is 256QAM. |
| **Step 8** | **spectrum-inversion** {**off** \| **on**}<br><br>**Example:**<br><br>Router(config-qam-prof)# **spectrum-inversion on** | Enables or disables spectrum inversion. Default is off. |
| **Step 9** | **symbol-rate** *value*<br><br>**Example:**<br><br>Router(config-qam-prof)#  **symbol-rate 5057** | Defines the symbol rate. Value is in kilo-symbol/sec. |
| **Step 10** | **exit**<br><br>**Example:**<br><br>Router(config-qam-prof)# **exit** | Exits from the QAM profile configuration mode. |

# Configuring the Frequency Profile on the Downstream Channels

**Procedure**

|        | Command or Action | Purpose |
|--------|-------------------|---------|
| **Step 1** | **enable**<br><br>**Example:**<br><br>Router> **enable** | Enables privileged EXEC mode.<br><br>Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>Router# **configure terminal** | Enters global configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 3** | **cable downstream freq-profile** *DS_frequency_profile_ID* <br><br>**Example:**<br><br>`Router(config)# cable downstream freq-profile 4` | Defines or modifies a frequency profile. |
| **Step 4** | **lane** *lane_id* **start-freq** *start_freq_value* <br><br>**Example:**<br><br>`Router(config-freq-prof)# lane 1 start-freq 90000000` | Defines the frequency lanes. |
| **Step 5** | **block** *block_id* **start-freq** *bl_start_freq_value* <br><br>**Example:**<br><br>`Router(config-freq-prof-lane)#block 1 start-freq 90000000`<br>`Router(config-freq-prof-lane)#` | Configures the lane frequency blocks. |
| **Step 6** | **exit** <br><br>**Example:**<br><br>`Router(config-freq-prof-lane)# exit` | Exits from the frequency lane configuration mode. |

# Configuring the Controller on the Downstream Channels

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable** <br><br>**Example:**<br><br>`Router> enable` | Enables privileged EXEC mode.<br><br>Enter your password if prompted. |
| **Step 2** | **configure terminal** <br><br>**Example:**<br><br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **controller integrated-cable** *slot*/*subslot*/*port* <br><br>**Example:**<br><br>`Router(config)#controller Integrated-Cable 3/0/0` | Enters the controller sub-mode. |
| **Step 4** | **base-channel-power** *value* <br><br>**Example:**<br><br>`Router(config-controller)#base-channel-power 26` | Sets the base channel power level. If not specified, the default value is calculated based on the number of carriers. Maximum limit is 34 dBmV DRFI. If you configure a value greater |

| | Command or Action | Purpose |
|---|---|---|
| | | than the maximum specified by DRFI, the following message is displayed: |
| | | Caution: RF Power above DRFI specification. May result in minor fidelity degradation. |
| **Step 5** | **freq-profile** *number* **Example:** Router(config-controller)#**freq-profile 0** | Specifies the frequency profile for the port. |
| **Step 6** | **max-carrier** *value* **Example:** Router(config-controller)#**max-carrier 1** | Specifies the maximum number of carriers. |
| **Step 7** | **mute** **Example:** Router(config-controller)#**mute** | Mutes the port. Use the **no** prefix to unmute the port. Default is "no mute". |
| **Step 8** | **rf-chan** *starting_Qam_ID ending_Qam_ID* **Example:** Router(config-controller)#**rf-chan 0 1** | Enters RF channel configuration sub-mode to configure an individual channel or a block of channels. |
| **Step 9** | **shutdown** **Example:** Router(config-controller)#**shutdown** | Changes the port administration state to down. Use the **no** prefix to change the port administration state to up. |

# Configuring the RF Channel on a Controller

The RF channel submode is entered from the channel controller configuration submode using the **rf-chan** command as described in the previous section. If an individual channel was specified in the **rf-chan** command, only that channel configuration is changed. If a block of channels was specified in the **rf-chan** command, the configuration change is applied to all channels in the block.

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **docsis-channel-id** *dcid* **Example:** Router(config-rf-chan)#**docsis-channel-id 1** | Changes the channel DOCSIS channel identifier. In block mode, the value is assigned to the first channel and incremented for successive channels. |
| **Step 2** | **frequency** *value* **Example:** Router(config-rf-chan)#**frequency 93000000** | Configures the channel's center frequency in Hz. The available frequency range is determined from the port's frequency profile, if configured. If not configured, the available range will be |

| | Command or Action | Purpose |
|---|---|---|
| | | the full port spectrum. In block mode, the frequency will be assigned to the first channel. Successive channels will get the next center frequency for the annex specified in the QAM profile (+6 Hz for Annex B, +8 Hz for Annex A). |
| Step 3 | **mute**<br><br>**Example:**<br><br>`Router(config-rf-chan)#`**`mute`** | Mutes the RF channel. Enter the **no** prefix to unmute the channel. Default is "no mute". |
| Step 4 | **power-adjust** *pwr_adj_range*<br><br>**Example:**<br><br>`Router(config-rf-chan)#`**`power-adjust 8.0`**<br>**`- 0.0 dBmV`** | Adjusts the RF channel's power. |
| Step 5 | **qam-profile** *qam_profile_number*<br><br>**Example:**<br><br>`Router(config-rf-chan)#`**`qam-profile 0`** | Specifies the QAM profile for this channel. |
| Step 6 | **rf-output** *value*<br><br>**Example:**<br><br>`Router(config-rf-chan)#`**`rf-output normal`** | Changes the RF output mode to test the channel. |
| Step 7 | **shutdown**<br><br>**Example:**<br><br>`Router(config-rf-chan)#`**`shutdown`** | Changes the channel administration state to down. Use the **no** prefix to change the channel administration state to up. The default is "no shut". |
| Step 8 | **type** *value*<br><br>**Example:**<br><br>`Router(config-rf-chan)#`**`type video`** | Configures the channel QAM type. The default is DOCSIS. |

# Configuration Examples

### Downstream Interface Configuration Example

The example below shows the configuration of:

- QAM Profile—The system defined QAM profile for Annex B and 256 QAM.

- Frequency Profile—The system defined frequency profile annex-b-low.

- Controller and RF channel—Port 0 on slot 3/0 with frequency profile 0; 96 channels with QAM profile 1 and center frequencies starting at 93 MHz.

```
cable downstream qam-profile 1
  annex B
  modulation 256
  interleaver-depth I32-J4
  symbol-rate 5361
  spectrum-inversion off
  description default-annex-b-256-qam
cable downstream freq-profile 0
  lane 1 start-freq 90000000
    block 1 start-freq 90000000
    block 2 start-freq 138000000
    block 3 start-freq 186000000
    block 4 start-freq 234000000
  lane 2 start-freq 282000000
    block 1 start-freq 282000000
    block 2 start-freq 330000000
    block 3 start-freq 378000000
    block 4 start-freq 426000000
  lane 3 start-freq 474000000
    block 1 start-freq 474000000
    block 2 start-freq 522000000
    block 3 start-freq 570000000
    block 4 start-freq 618000000
  lane 4 start-freq 666000000
    block 1 start-freq 666000000
    block 2 start-freq 714000000
    block 3 start-freq 762000000
    block 4 start-freq 810000000
controller Integrated-Cable 3/0/0
 max-carrier 128
 base-channel-power 34
 freq-profile 0
 rf-chan 0 95
  type DOCSIS
  frequency 93000000
  rf-output NORMAL
  power-adjust 0
  docsis-channel-id 1
  qam-profile 1
```

### Show Command Examples for Displaying the State

Use the following commands to display the state of any QAM profile, Frequency profile, downstream controller or channel.

### QAM Profile Configuration Example

```
Router#show cable qam-profile 0
QAM Profile ID 0: default-annex-b-64-qam
        annex: B
        modulation: 64
        interleaver-depth: I32-J4
        symbol rate: 5057 kilo-symbol/second
        spectrum-inversion: off
Router#
```

### Frequency Profile Configuration Example

```
Router#show cable freq-profile 0
Frequency Profile ID 0 annex-b-low:
        Lane 1 start-freq 90000000hz
                Block 1 start-freq 90000000hz
                Block 2 start-freq 138000000hz
                Block 3 start-freq 186000000hz
                Block 4 start-freq 234000000hz
        Lane 2 start-freq 282000000hz
                Block 1 start-freq 282000000hz
                Block 2 start-freq 330000000hz
                Block 3 start-freq 378000000hz
                Block 4 start-freq 426000000hz
        Lane 3 start-freq 474000000hz
                Block 1 start-freq 474000000hz
                Block 2 start-freq 522000000hz
                Block 3 start-freq 570000000hz
                Block 4 start-freq 618000000hz
        Lane 4 start-freq 666000000hz
                Block 1 start-freq 666000000hz
                Block 2 start-freq 714000000hz
                Block 3 start-freq 762000000hz
                Block 4 start-freq 810000000hz
Router#
```

### Controller Configuration Example

```
Router#show controller Integrated-Cable 3/0/0 rf-port
  Admin:  UP  MaxCarrier: 128  BasePower: 34 dBmV  Mode: normal
  Rf Module 0: UP
  Frequency profile: 0
  Free freq block list has 1 blocks:
    666000000 - 863999999
  Rf Port Status: UP
Router#
```

### RF Channel Configuration Example

```
Router#show controller integrated-Cable 3/0/0 rf-channel 0-3 95
Chan State Admin Frequency  Type    Annex Mod  srate Interleaver dcid  power  output
 0     UP   UP   93000000   DOCSIS  B    256   5361  I32-J4       1    34     NORMAL
 1     UP   UP   99000000   DOCSIS  B    256   5361  I32-J4       2    34     NORMAL
 2     UP   UP   105000000  DOCSIS  B    256   5361  I32-J4       3    34     NORMAL
 3     UP   UP   111000000  DOCSIS  B    256   5361  I32-J4       4    34     NORMAL
 95    UP   UP   663000000  DOCSIS  B    256   5361  I32-J4       96   34     NORMAL

Router# show controller integrated-Cable 3/0/0 rf-channel 0 verbose
Chan State Admin Frequency  Type    Annex Mod  srate Interleaver dcid  power  output
 0     UP   UP   93000000   DOCSIS  B    256   5361  I32-J4       1    34     NORMAL
 Qam profile: 1
 Spectrum Inversion: Off
 Frequency Lane: 1  Block: 1  index: 1
 Resource status:   OK
 License: granted <02:00:04 EDT Jan 2 2012>
 JIB channel number: 0
Chan EnqQ  Pipe  RAF SyncTmr Vid Mac          Video Primary DqQ  TM Mpts Sniff
  0    0    0    4       0   0 0000.0000.0000   0       0    0  0    0 NO
Grp  Prio P  Prate Phy0-ctl Phy1-ctl Enable Tun-Id  L2TPv3_Ses_id
  0    0  0    1       1        0    TRUE    0       0
Chan  Qos-Hi Qos-Lo  Med-Hi Med-Lo  Low-Hi Low-Lo
  0   32774  16384   32768  16384   65536  32768
```

```
Chan  Med Low TB-neg Qos_Exc  Med_Xof  Low_Xof      Qdrops  Pos Qlen(Hi-Med-lo) Fl
   0   0   0      0       0        0        0            0   Y    0      0      0  0
DSPHY Info:
  DSPHY Register Local Copy: QPRHI = c0000163, QPRLO = e30d0
  DSPHY Register Local Copy Vaddr = 80000290, qam2max_mapping = 80000000
  DSPHY Register Local Copy: SPR ID = 0, SPR Mapping= c200000a
  Last read from HW: Mon Jan  2 02:02:04 2012
   QPRHI = c0000163, QPRLO = e30d0, SPR = c200000a SPRMAPING c0000000 Q2Max 80000000
  Last time read spr rate info from HW: Mon Jan  2 13:21:41 2012
    SPR ID 0, rate value in kbps 0, overflow count 0, underflow count 0


Router#show controllers Integrated-Cable 3/0/0 counter rf-channel

Controller  RF   MPEG      MPEG      MPEG      Sync      MAP/UCD
            Chan Packets   bps       Mbps      Packets   Packets
                 Tx                            Tx        Tx
3/0/0       0    6         0         0.000000  0         6
3/0/0       1    6         0         0.000000  0         6
3/0/0       2    6         0         0.000000  0         6
3/0/0       3    6         0         0.000000  0         6
3/0/0       4    6         0         0.000000  0         6
3/0/0       5    6         0         0.000000  0         6
3/0/0       6    6         0         0.000000  0         6
3/0/0       7    6         0         0.000000  0         6
3/0/0       8    5124124   1381035   1.332459  329444    6531411


Router# show cable licenses ds
--------------------------------------------
Entitlement:  Downstream License
Consumed count: 672
Consumed count reported to SmartAgent: 672
Forced-Shut count: 0
Enforced state: No Enforcement

Router#
```

# Additional References

### Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.<br><br>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.<br><br>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. | http://www.cisco.com/support |

# Feature Information for Downstream Interface Configuration on the Cisco cBR Router

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

**Note** The below table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

*Table 2: Feature Information for Downstream Interface Configuration*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Downstream Interface Configuration | Cisco IOS-XE 3.15.0S | This feature was introduced on the Cisco cBR Series Converged Broadband Router . |