Downstream Interface Configuration

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

- Finding Feature Information, on page 1
- Hardware Compatibility Matrix for the Cisco cBR Series Routers, on page 1
- Information About Downstream Interface Configuration , on page 2
- How to Configure Downstream Interfaces, on page 4
- Configuration Examples, on page 9
- Additional References, on page 12
- Feature Information for Downstream Interface Configuration on the Cisco cBR Router, on page 12

Finding Feature Information

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

Hardware Compatibility Matrix for the Cisco cBR Series Routers

Note The hardware components that are 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 16.5.1 and Later Releases** Cisco cBR-8 Supervisor: • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G • PID—CBR-CCAP-SUP-60G	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 CCAP Line Cards: • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC • PID—CBR-CCAP-LC-40G • PID—CBR-CCAP-LC-40G-R • PID—CBR-CCAP-LC-G2-R • PID—CBR-SUP-8X10G-PIC • PID—CBR-2X100G-PIC Digital PICs: • PID—CBR-DPIC-8X10G • PID—CBR-DPIC-2X100G Cisco cBR-8 Downstream PHY Module: • PID—CBR-D31-DS-MOD Cisco cBR-8 Upstream PHY Modules: • PID—CBR-D31-US-MOD

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** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**cable downstream qam-profile** *Qam_Profile_ID* **Example:** `Router(config)# cable downstream qam-profile 3`	Defines or modifies a QAM profile.
Step 4	**annex** {**A** | **B** | **C**} **Example:** `Router(config-qam-prof)# annex A`	Defines the profile MPEG framing format. The default is Annex B.
Step 5	**description** *LINE* **Example:** `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**} **Example:** `Router(config-qam-prof)# interleaver-depth I64-J2`	Defines the interleaver depth. The default is I32 J4 for DOCSIS.
Step 7	**modulation** {**256** | **64**} **Example:** `Router(config-qam-prof)# modulation 64`	Defines the modulation. The default is 256QAM.
Step 8	**spectrum-inversion** {**off** | **on**} **Example:** `Router(config-qam-prof)# spectrum-inversion on`	Enables or disables spectrum inversion. Default is off.
Step 9	**symbol-rate** *value* **Example:** `Router(config-qam-prof)# symbol-rate 5057`	Defines the symbol rate. Value is in kilo-symbol/sec.
Step 10	**exit** **Example:** `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** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**cable downstream freq-profile** *DS_frequency_profile_ID* **Example:** `Router(config)# cable downstream freq-profile 4`	Defines or modifies a frequency profile.
Step 4	**exit** **Example:** `Router(config)# exit`	Exits from the frequency lane configuration mode.

Configuring the Controller on the Downstream Channels

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller integrated-cable** *slot/subslot/port* **Example:** `Router(config)#controller Integrated-Cable 3/0/0`	Enters the controller sub-mode.
Step 4	**base-channel-power** *value* **Example:** `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 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:**	Specifies the maximum number of carriers.

	Command or Action	Purpose
	`Router(config-controller)#max-carrier 1`	
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.

Troubleshooting Tips

Shutting and No Shutting Downstream Controller Immediately

Problem Shutting down a downstream controller on a cable line card and bringing the controller back up immediately can cause a Queue ID Pending Drain event on the system. This results in traffic disruption to the modems or modems going offline.

Solution It is recommended that you wait for a few seconds (>30 secs) before issuing the no shut command on a shut downstream controller. The system also restricts the user from issuing the no shut command immediately by printing this message.

```
Config change could not be applied as a cleanup is pending following shut on
controller x/x/x. Please wait for the cleanup to complete before attempting to
no shut controller.
```

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.

Note If the user tries to add a video type RF channel to a cable interface, the following message appears to reject the configuration:

```
X/X/X rf-channel XX is video type channel, it can't be configured as primary DS
```

If a RF channel is configured under cable interface, when the user tries to change the channel type to video, the following message appears to reject the configuration:

```
X/X/X rf channel X can't be set to video type.
It is configured under Cable1/0/1.
Please remove the configuration before change the qam type
```

Procedure

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 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**

Example:

```
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*

Example:

```
Router(config-rf-chan)#power-adjust 8.0 -  0.0  dBmV
```

Adjusts the RF channel's power.

Step 5 **qam-profile** *qam_profile_number*

Example:

```
Router(config-rf-chan)#qam-profile 0
```

Specifies the QAM profile for this channel.

Step 6 **rf-output** *value*

Example:

```
Router(config-rf-chan)#rf-output normal
```

Changes the RF output mode to test the channel.

Step 7 **shutdown**

Example:

```
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*

Example:

```
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# sh controllers Integrated-Cable 7/0/0 counter rf-channel
Controller  RF    MPEG       MPEG        MPEG   Sync       MAP/UCD    User    QAM
            Chan  Packets    bps         Mbps   Packets    Packets    Mbps    Util
                             Tx                            Tx         Tx      Percentage
7/0/0       0     0          0          00.00   0          0          00.00   000.00
7/0/0       1     0          0          00.00   0          0          00.00   000.00
7/0/0       2     8239954    2475952    02.47   0          0          02.39   006.60
7/0/0       3     85927382   25769779   25.76   0          0          24.94   068.71
7/0/0       4     85927608   25769027   25.76   0          0          24.94   068.71
7/0/0       5     8239088    2474599    02.47   0          0          02.39   006.59
7/0/0       6     8210840    2463770    02.46   0          0          02.38   006.57
7/0/0       7     50103      15040      00.01   0          0          00.01   000.04
7/0/0       8     50103      15040      00.01   0          0          00.01   000.04

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. 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. 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

Note The following table lists the software release in which a given feature is introduced. 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 Fuji 16.7.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
Display QAM Utillization Percentage using the **sh controllers Integrated-Cable 7/0/0 counter rf-channel**	Cisco IOS XE Gibraltar 16.10.1f	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.