Configuring the Cisco RFGW DS-48 Universal EQAM Line Cards

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The Cisco RF Gateway 10 (RFGW-10) operates as an Universal Edge Quadrature Amplitude Modulation (UEQAM) that supports both Data Over Cable Service Interface Specification (DOCSIS) and Video applications.

The Cisco RFGW-10 DS48 line card is a 12-port, 48-channel Universal EQAM card designed to support Downstream External PHY Interface (DEPI) DOCSIS MPEG Transport (D-MPT), downstream data traffic, and MPEG video traffic for video-on-demand (VoD), switched digital video (SDV), and Broadcast Video applications. The DS48 card is similar to the traditional QAM solutions where the card receives encapsulated data, depacketizes or reformats the packets, maps them to the output QAM channel, and performs QAM modulation and frequency upconversion. From a high level, the DS48 line card receives video and DOCSIS data encapsulated over Ethernet and outputs analog QAM data to the subscriber devices (STB and DOCSIS modems).

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 for Universal EQAM" section on page 30.

Use Cisco Feature Navigator to find information about platform support and Cisco IOS, Catalyst OS, and Cisco IOS XE software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

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Information About Cisco DS48 Line Card

The DS48 line card has 12 physical RF ports, which support up to four QAMs per port. The number of QAM outputs is configurable on a per-port basis (meaning an individual port can support one, two, or four QAMs as well as muting of individual QAMs within a QAM group). In stacked QAM mode, the QAMs are stacked contiguously over a 24 MHz or 32 MHz band. The line card supports a downstream channel frequency range of 88 MHz to 870 MHz.

Table 1 DOCSIS and EuroDOCSIS Downstream Rates

Downstream Channel Width, MHz	Modulation Scheme, bit/symbol	Baud Rate, MSym/sec	Raw Bit Rate, Mb/sec	Throughput (Bit Rate - Overhead), Mb/sec
6	64 QAM (6)	5.056	30.34	27
	256 QAM (8)	5.360	42.88	38
8	64 QAM (6)	6.952	41.71	37
	256 QAM (8)	6.952	55.62	48

The DS48 line card supports redundancy and high availability support. The line card is designed to detect and react to a wide range of faults and failures, and respond with sub-second failover to a dedicated standby card. In the Cisco RFGW-10 platform, DS48 line cards can be configured with 1:N redundancy (up to 1:9), resulting in a fully-protected, high capacity, and highly dense EQAM solution.

The QAM interface supports downstream and upstream signals. The downstream signal is an intermediate-frequency (IF) signal that is suitable for use with an external upconverter. Your cable plant, combined with your planned and installed subscriber base, service offering, and external network connections, determines what combination of Cisco RFGW-10 cable interfaces, network uplink line cards, and other components that you should use.

For information on configuring features on the Cisco RFGW 10 DS48 line card, see:

- How to Configure Universal EQAM, page 11
- Related Documents, page 29

Administratively Shutting Down and Restarting a QAM Interface

You can disable a QAM interface by shutting it down. Shutting down an interface disables all functions on the specified interface and marks the interface as unavailable on the display of all monitoring commands.One reason to shut down an interface is if you want to change the electrical interface type or mode of a port online. This information is communicated to other network servers through all dynamic routing protocols. You replace the serial adapter cable, for example, and use software commands to restart the interface, and if necessary, to reconfigure the port for the new interface. The interface is not featured in any routing updates. On serial interfaces, shutting down an interface causes the dedicated Token Ring (DTR) signal to be dropped. On Token Ring interfaces, shutting down an interface causes the interface to exit from the ring. On Fiber Distributed Data Interfaces (FDDIs), shutting down an interface causes the optical bypass switch, if present, to go into bypass mode.

To shut down an interface and then restart it, use the following commands in interface configuration mode:

- **shutdown**—shuts down an interface
- **no shutdown**—enables an interface that has been disabled

To check whether an interface is disabled, use the **show interfaces** command in Privileged EXEC mode. An interface that is shut down is shown as administratively down in the **show interfaces** command display.

At system startup or restart, the Fast Serial Interface Processor (FSIP) polls the interfaces and determines the electrical interface type of each port (according to the type of port adapter cable attached). However, it does not necessarily poll an interface again when you change the adapter cable online.

To ensure that the system recognizes the new interface type, shut down the interface using the **shutdown** command, and enable the interface after changing the cable. Refer to your hardware documentation for more details.

How to Configure Universal EQAM

This section describes how to configure Universal EQAM in Cisco RFGW-10 UEQAM:

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Activating Downstream QAM

To activate a downstream port on a Cisco RFGW-10 QAM interface card for digital data transmissions over the HFC network, complete the steps in the following table.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot/port.channel*
4. **cable downstream rf-shutdown**
5. **no cable downstream rf-shutdown**
6. **no shutdown**
7. **end**

DETAILED STEPS

	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enters enable (privileged EXEC) mode. Enter the password. You have entered privileged EXEC mode when the prompt displays the pound symbol `(#)`.

Step 2	**configure terminal**
	
	Example:
	`Router# configure terminal`
	`Router(config)#`
		Enters global configuration mode.

Step 3	**interface qam** *slot/port.channel*
	
	Example:
	`Router(config)# interface qam 3/12.4`
	`Router(config-if)#`
		Enters QAM interface configuration mode.
		• *slot*—RF line card slot, from 3 to 12
		• *port*—Downstream QAM port on the RF line card, from 1 to 12
		• *channel*—Downstream QAM channel within the QAM port, from 1 to 4.
		Note If the line card is part of the line card redundancy (LCRED) configuration, use **qam-red** instead of **qam** for both the interfaces and ports.

Step 4	**cable downstream rf-shutdown**
	
	Example:
	
	`Router(config-if)# cable downstream rf-shutdown`
	`Router(config-if)# no cable downstream rf-shutdown`
		Disables the RF output from an integrated upconverter on a Cisco RFGW-10.

	Command	Purpose
Step 5	**no cable downstream rf-shutdown** **Example:** `Router(config-subif)# no cable downstream rf-shutdown`	Enables the RF output on the integrated upconverter.
Step 6	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Places the downstream port in the "admin up" state.
Step 7	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Verifying the Downstream QAM

To verify and determine if the downstream carrier is active (up), enter the **show controllers qam** command for the downstream port that you just configured. The following example is a sample output of a downstream QAM interface:

```
Router# show controllers qam 3/1 downstream

Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Perform these steps if you experience difficulty with verification:

Step 1 Ensure that the cable connections are not loose or disconnected.

Step 2 Ensure that the QAM interface line card is firmly inserted in its chassis slot.

Step 3 Ensure that the captive installation screws are tight.

Step 4 Verify that you have entered the correct slot and port numbers.

Setting the Stacking Level to Enable QAM Channels

This section describes how to configure frequency stacking. Configuring the stacking level affects all channels within an RF port. The default stacking level value is 1:4.

SUMMARY STEPS

1. **enable**

2. **configure terminal**
3. **interface qam** *slot/port*
4. **cable downstream stacking** *stacking*

DETAILED STEPS

	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	**interface qam** *slot/port* **Example:** `Router(config)# interface qam 3/1`	Enters the RF port mode. • *slot*—RF line card slot, from 3 to 12 • *port*—Downstream QAM port on the RF line card, from 1 to 12.
Step 4	**cable downstream stacking** *stacking* **Example:** `Router(config)# cable downstream stacking 4`	Configures the stacking level. Stacking level can be 1, 2, or, 4. • QAM channel 1 is enabled on the specified rf-port for stacking level 1. • QAM channels 1, and 2 are enabled on the specified rf-port for stacking level 2. • QAM channels 1, 2, 3, and 4 are enabled on the specified rf-port for stacking level 4.

Example

The following example shows how to configure the downstream channel on the cable interface for frequency stacking of 4.

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1
Router(config-if)# cable downstream stacking 4
```

Verifying the Downstream Stacking

To verify the downstream stacking level set on the QAM, enter the **show controllers qam** command for the downstream port you just configured. See the following example:

```
Router# show controllers qam 3/1.1 downstream

Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
```

```
Frequency: 297000000 Hz, Power: 45.0 dBmV
Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
Bandwidth Reserved for Video:   0        bps
Bandwidth Used:                 1614968  bps
Bandwidth Total:                38810000 bps
Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
Interleave Level: 2, FEC I: 32 FEC J: 4
```

Enabling the RF Output on the Integrated Upconverter

This section describes how to enable RF output on an integrated upconverter.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*[**.***channel*]
4. **no cable downstream rf-shutdown**

DETAILED STEPS

	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	**interface qam** *slot*/*port*[**.***channel*] **Example:** `Router(config)# interface qam 3/1`	Enters the port or the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**no cable downstream rf-shutdown** **Example:** `Router(config-if)# no cable downstream rf-shutdown`	Enables the integrated upconverter.

Note If the command is executed on the RF port, such as interface qam3/1, it is equivalent to executing the command on all the QAM channels (1/2/4 depending on the stacking level set) on that port.

Example

The following example shows how the integrated upconverter on the Cisco RFGW-10 UEQAM is enabled:

```
Router(config)# configure terminal
Router(config-if)# interface qam 3/1.1
Router(config-subif)# no cable downstream rf-shutdown
```

Setting the Downstream Annex Type

This section describes how to set the Moving Picture Experts Group (MPEG) framing format for a downstream port on a cable interface line card to either Annex A (Europe) Euro-DOCSIS J.112, Annex B (North America) ITU J.83, or Annex C (Japan).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot/port*
4. **cable downstream Annex** {**A** | **B** | **C**}

DETAILED STEPS

	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	**interface qam** *slot/port* **Example:** `Router(config)# interface qam 3/1`	Enters the port mode. *slot* is the RF line card slot, from 3 to 12 and *Port* is a downstream QAM port on the RF line card, from 1 to 12.
Step 4	**cable downstream Annex** {**A** | **B** | **C**} **Example:** `Router(config-if)# cable downstream Annex A`	Configures the MPEG framing format for a downstream port. Annex A is Euro-DOCSIS J.112 (Europe), Annex B is ITU J.83 (North America), and Annex C is for Japan. The default is Annex B for all Cisco cable interface line cards.

Note The Annex mode is a port level configuration and changing it on any QAM channel on the port affects all the other QAM channels on that port.

Note For Annex A, a maximum of 36 QAMs can be used on a Cisco RFGW-10 DS-48 Line Card running on Cisco RFGW-10 Supervisor Engine V-10GE.

Note DS-48 line card have 12 ports. For Annex A mode, user can use only 18 QAMs in the first six ports, and use remaining 18 QAMs in the other six ports. If user configures more than 18 QAMs in the first/second 6 ports, below warning message will be shown: **WARNING: Total Annex A limit [18 QAMs] on internal gig - 1 [port 1 to 6 - 1st Gig; port 7 to 12 - 2nd Gig] is exceeded on slot 4. This may cause oversubscription.**

Example

The following example shows how to set the MPEG framing format to Annex B on the Cisco RFGW-10 UEQAM:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1
Router(config-if)# cable downstream Annex B
```

Verifying the Downstream Annex Type

To verify the downstream MPEG framing format setting, enter the **show controllers qam** command for the downstream port you have just configured. See the following example:

```
Router#show controllers qam 3/1.1 downstream
Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Assigning a TSID to the QAM Channel

This section describes how to configure the Transport Stream Identifier (TSID) for the QAM subinterface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream tsid** *id*

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream tsid** *id* **Example:** `Router(config-if)# cable downstream tsid 44`	Configures the TSID for the QAM subinterface. This unique ID identifies a QAM channel in the cable headend. The valid ID range is 0 to 65535. **Note** Duplicate TSID are not accepted.

Example

The following example shows how to configure the downstream channel on the cable interface with a TSID of 44:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream tsid 44
```

Verifying the Downstream TSID

To verify the downstream TSID value on the QAM, enter the **show controllers qam** command for the downstream port you just configured. See the following example:

```
Router#show controllers qam 3/1.1 downstream
Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Setting the Downstream Frequency on the QAM Channel

This section describes how to set the downstream center frequency for the cable interface line card to reflect the digital carrier frequency of the downstream radio frequency carrier (the channel) in the downstream QAM channel.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream frequency** *frequency*

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream frequency** *frequency* **Example:** `Router(config-if)# cable downstream frequency 520000000`	Configures the downstream center frequency for the cable interface line card. The *frequency* is QAM channel frequency in Hz. On cable interfaces with an integrated upconverter, to reset the downstream frequency and disable the RF output from the integrated upconverter, use the **no** form of this command.

Example

The following example shows how to set the downstream center frequency display value on the Cisco RFGW-10 UEQAM:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream frequency 520000000
```

Verifying the Downstream Frequency

To verify the downstream frequency on the QAM, enter the **show controllers qam** command for the downstream port you just configured. See the following example:

```
Router#show controllers qam 3/1 downstream
Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 520000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Generating a Standard Test Signal on the QAM Subinterface

This section describes how to activate a downstream port on a cable interface, and generate either a standard modulated signal or a test signal.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream if-output continuous-wave**

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream if-output continuous-wave** **Example:** `Router(config-if)# cable downstream if-output continuous-wave`	Activates a downstream port on a cable interface. When using the **continuous-wave** keyword, output is an unmodulated continuous sine wave on the downstream, shutting down normal data network operations. To disable all signal output on the intermediate frequency (IF) carrier, and shut down the interface, use the **no** form of this command.

Example

The following example shows how to enable downstream on QAM interface 3 on the Cisco RFGW-10 UEQAM:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream if-output continuous-wave
```

Setting the FEC Interleaver Level and Depth Values

This section describes how to modify the Interleaver depth and level on the downstream radio frequency carrier (the channel) for the downstream QAM channel.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream interleaver-level** {**1** | **2**}
5. **cable downstream interleaver-depth** *depth*

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream interleaver-level** {**1** | **2**} **Example:** `Router(config-subif)# cable downstream interleaver-level 1`	Configures the interleaver-level. The default interleaver level is 2. **Note** This command is for Annex B only.
Step 5	**cable downstream interleaver-depth** *depth* **Example:** `Router(config-subif)# cable downstream interleaver-depth 4`	Configures the interleaver-depth. **Note** This command is for Annex B only. As you can configure various combinations of the I/J values for Annex B, the input for this command is the fee-code that is derived from the I/J values. The default I/J values are 32/4.

Example

The following example shows how to configure the downstream interleaver level to 2 on the Cisco RFGW-10 UEQAM:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-if)# cable downstream interleaver-level 2
```

The following example shows how to configure the downstream FEC I/J values to 32/4:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream interleaver-depth 8
```

Verifying the Downstream Interleaver-level

To verify the downstream interleaver-level on the QAM, enter the **show controllers qam** command for the downstream port you just configured. See the following example:

```
Router# show controllers qam 3/1 downstream

Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Verifying the Downstream Interleaver Depth

To verify the downstream interleave depth setting, enter the **show controllers qam** command for the downstream port you have just configured:

```
Router# show controllers qam 3/1 downstream

Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Setting the Modulation Format on the QAM Subinterface

This section describes how to set the modulation format for a downstream port on a cable interface line card.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream modulation** {**64qam** | **256qam**}

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream modulation** {**64qam** | **256qam**} **Example:** `Router(config-subif)# cable downstream modulation 256qam`	Configures the modulation format for a downstream port on a cable interface line card. If you change the modulation format, the interface is shut down and all the cable modems are disconnected. The default modulation is set to 64 QAM on all the cable interface cards.

Example

The following example shows how to set the downstream modulation to 256 QAM, implying the downstream data speed. In 256 QAM, the modulation rate is 8 bits per downstream symbol.

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream modulation 64qam
```

Verifying the Downstream Modulation Format

To verify the downstream modulation rate setting, enter the **show controllers qam** command for the downstream port you just configured. See the following example:

```
Router# show controllers qam 3/1.1 downstream

Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Setting the Power Level on the QAM Subinterface

This section describes how to set the RF power output level on an integrated upconverter on the Cisco RFGW-10 UEQAM line card.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream rf-power** *power*

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream rf-power** *power* **Example:** `Router(config-subif)# cable downstream rf-power 50`	Configures the RF power output level on an integrated upconverter. The *power* variable is the RF power value in tenth of a dBmV. To reset the RF output power level to its default value, use the **no** form of this command.

Example

The following example shows the integrated upconverter on the Cisco RFGW-10 line card being configured for an RF output power level of 50 dBmV:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream rf-power 50
```

Verifying the Downstream RF power

To verify the downstream RF power on the QAM, enter the **show controllers qam** command for the downstream port you just configured. See the following example:

```
Router#show controllers qam 3/1.1 downstream
Load for five secs: 12%/0%; one minute: 14%; five minutes: 15%
Time source is NTP, 01:08:51.635 PST Wed Nov 5 2008

Qam3/1.1 Downstream is up
        Annex B, Stacking set to 4
        Frequency: 297000000 Hz, Power: 45.0 dBmV
        Modulation: 256QAM, TSID: 0, QAM IDB_State: UP
        Bandwidth Reserved for Video:   0        bps
        Bandwidth Used:                 1614968  bps
        Bandwidth Total:                38810000 bps
        Transport Mode: QAM_MODE_MPT Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Locking the QAM Subinterface

This section describes how to lock a downstream port on a cable interface line card.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam** *slot*/*port*.*channel*
4. **cable downstream lock**

DETAILED STEPS

	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	**interface qam** *slot*/*port*.*channel* **Example:** `Router(config)# interface qam 3/1.1`	Enters the subinterface mode. *slot* is the RF line card slot, from 3 to 12, *Port* is a downstream QAM port on the RF line card, from 1 to 12 and *Channel* is a downstream QAM channel within the QAM port, from 1 to 4.
Step 4	**cable downstream lock** **Example:** `Router(config-subif)# cable downstream lock`	Locks a downstream port on a cable interface line card. Set this lock to prohibit users from modifying any RF parameters on that QAM channel. If the lock is set at the port level, then all the QAM channels on that port are locked.

Example

The following example shows how to set the downstream lock on QAM interface 3 on the Cisco RFGW-10 UEQAM:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream lock
```

Displaying RF Parameters Set on Line Cards

To display RF information set using the **cable downstream** configuration commands on the cable interface, use the following command in privileged EXEC mode:

```
Router# show controllers qam slot/port.channel [downstream]
```

The following is sample output of downstream configuration on a redundancy line card:

```
Router# show controllers qam 3/1.2 downstream
Qam3/1.2 Downstream is down
        Annex B, Stacking set to 4
        Frequency: 507000000 Hz, Power: 44 dBmV
        Modulation: 64QAM, TSID: 0, State: LCC_QAM_STATE_DOWN
        Bandwidth Reserved:   0        bps
        Bandwidth Unreserved: 26970000 bps
        Bandwidth Total:      26970000 bps
        Transport Mode: QAM_MODE_OFF Qam Owner: LOCAL
        Interleave Level: 2, FEC I: 32 FEC J: 4
```

Additional References

The following sections provide references related to configuring the Cisco RFGW DS48 UEQAM line card with other supported software features:

Related Documents

Related Topic	Document Title
Bundle Image Upgrade—allows efficient upgrade of multiple devices simultaneously by programming them with a new image.	http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw10_bundledimg_upg.html
Alarm and Event Management—provides information about previous and current events in the system.	http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw10_alrm_evt_mgmt.html
DOCSIS Timing Interface (DTI) Offset—enables DOCSIS timing offset adjustment.	http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw10_dtioffset.html
M-CMTS D-MPT Manual Mode—processes D-MPT traffic from the M-CMTS core.	http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw10_dmpt.html
M-CMTS DEPI—	http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw10_m-cmts_depi_control_plane.html
Line Card Redundancy—supports two types of line card redundancy, 1:1 and 1:N	http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw10_1plsnlc.html
Configuring the Cisco RFGW-10 DS-384 Line Card	http://www.cisco.com/en/US/docs/cable/rf_gateway/linecard/ds384/configuration/guide/b_ds384_scg.html
Cisco RFGW-10 commands	Cisco RF Gateway 10 Command Reference http://www.cisco.com/en/US/docs/cable/rf_gateway/command/reference/RFGW-10_Book.html
New Software Features in Cisco IOS Release 12.2SQ	Cisco RF Gateway 10 Software Feature and Configuration Guide http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/guide/rfgw_scg.html

Standards

Standard	Title
ITU-T J.83-B	Annex B to ITU-T Rec. J.83 (4/97), Digital multi-programme systems for television sound and data services for cable distribution.
ISO-169-24	ISO-169-24 F connector, female, indoor
DOCSIS2	Data-Over-Cable Service Interface Specifications, Radio Frequency Interface Specification v2.0, SP-RFIv2.0-I11-060602, June 2, 2006, Cable Television Laboratories, Inc.

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

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/cisco/web/support/index.html

Feature Information for Universal EQAM

Table 2 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

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

Note Table 2 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 2 Feature Information for DTI Client

Feature Name	Releases	Feature Information
Universal Edge Quadrature Amplitude Modulation	12.2(44)SQ	This feature was introduced in the Cisco IOS Release 12.2(44)SQ to support the Cisco RF Gateway 10. The following commands were introduced or modified: • **interface qam** *slot*/*port*[**.***channel*] • **cable downstream stacking** *stacking* • **no cable downstream rf-shutdown** • **cable downstream Annex** {**A** | **B** | **C**} • **cable downstream tsid** *id* • **cable downstream frequency** *frequency* • **cable downstream if-output continuous-wave** • **cable downstream interleaver-level** {**1** | **2**} • **cable downstream interleaver-depth** *depth* • **cable downstream modulation** {**64qam** | **256qam**} • **cable downstream rf-power** *power* • **cable downstream lock** • **show controllers qam** *slot*/*port***.***channel* [**downstream**]

Glossary

dB—Decibels. Ratio of two power levels expressed mathematically as dB = 10log10(POUT/PIN)

dBmV—Decibel-Millivolt. Unit of RF power expressed in decibels relative to 1 millivolt over 75 ohms, where dBmV = 20log10(value in mV/1 mV)

FEC—Forward Error Correction. A class of methods for controlling errors in a communication system. FEC sends parity information with the data which can be used by the receiver to check and correct the data.

GHz—Gigahertz. A unit of frequency; 1,000,000,000 or 109 Hz.

Hz—Hertz. A unit of frequency; formerly cycles per second.

QAM—Quadrature Amplitude Modulation. A modulation technique in which an analog signal's amplitude and phase vary to convey information, such as digital data.

RF—Radio Frequency. A portion of the electromagnetic spectrum from a few kilohertz to just below the frequency of infrared light.

UEQAM—Universal Edge Quadrature Amplitude Modulation. A network element, which receives MPEG-TS frames over a network interface such as Ethernet, and modulates them onto QAM carriers for use on an HFC plant.

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