



Configuring QAM Interface Features for the Cisco RFGW-10

The QAM interface in the Cisco RFGW-10 serves as the cable TV RF interface, supporting downstream and upstream signals. The downstream is output as an intermediate-frequency (IF) signal 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. The QAM interface comprises of the following:

- Up to ten Cisco QAM line cards can be housed in a chassis.
- QAM interface line cards support downstream ports.

The Cisco IOS software command-line interface (CLI) can be used to configure the Cisco cable interface line card for correct operation on the hybrid fiber-coaxial (HFC) cable network. This section describes the following tasks to configure the Cisco cable interfaces:

Section	Purpose
“Administratively Shutting Down and Restarting an Interface” section on page 37	Provides instructions for interface shutdown and restart.
“Configuring the Downstream Cable Interface” section on page 38	Provides instructions for performing required upstream configuration tasks.

The *Cisco RF Gateway 10 New Features List* at http://www.cisco.com/en/US/docs/cable/rf_gateway/feature/list/rfgw10_featlist.html contains several additional interface and router configurations applicable to the Cisco RFGW-10.

Administratively Shutting Down and Restarting an Interface

You can disable an 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:

Command	Purpose
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.

Examples

The following example turns off the Ethernet interface in slot 1 at port 3:

```
interface GigabitEthernet 1/3
shutdown
```

The following example restarts the interface:

```
interface GigabitEthernet 1/3
no shutdown
```

Configuring the Downstream Cable Interface

The first step in configuring the Cisco cable interface is to configure the downstream cable interface. Configuring the downstream cable interface consists of the following procedures:

Task	Description
“Activating Downstream QAM” section on page 39	Provides instructions to activate and verify a downstream port on a QAM interface card for digital data transmissions over the HFC network.
“Setting the Downstream Frequency” section on page 41	Provides instructions to activate and verify the frequency for the downstream port on the Cisco QAM interface line card.
“Setting the Downstream Interleave Depth” section on page 41	Provides instructions to activate the downstream interleave depth on the QAM interface.

Task	Description
“Setting the Downstream Interleaver-level” section on page 42	Provides instructions to activate the downstream interleaver level on the QAM interface.
“Setting the Downstream Modulation Rate” section on page 43	Provides instructions to set and verify the downstream modulation, define the speed in symbols per second at which data travels downstream to the subscriber’s CM
“Setting the Downstream MPEG Framing Format” section on page 43	Provides instructions to set and verify the downstream MPEG framing format, which must be compatible with DOCSIS specifications and your local cable plant operations.
“Setting the Downstream RF Power Output Level” section on page 44	Provides instructions to activate and verify the downstream rf power level set on the QAM interface.
“Setting the Downstream RF Shutdown” section on page 45	Provides instructions to activate downstream RF shutdown on the QAM interface.
“Setting the Downstream Stacking” section on page 45	Provides instructions to activate and verify the downstream stacking level set on the QAM interface.
“Setting the Downstream TSID” section on page 46	Provides instructions to activate and verify the downstream TSID value set on the QAM interface.



Note

In most applications, default values for the commands used in these configuration steps are adequate to configure the Cisco RFGW-10. You do not need to specify individual parameters unless you want to deviate from system defaults.

For information on other configuration options, refer to the *Cisco RF Gateway 10 Command Reference Guide* at

http://www.cisco.com/en/US/docs/cable/rf_gateway/command/reference/RFGW-10_Book.html

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.

	Command	Purpose
Step 1	Router> enable Password: <i>password</i> Router#	Enters enable (privileged EXEC) mode. Enter the password. You have entered privileged EXEC mode when the prompt displays the pound symbol (#).
Step 2	Router# configure terminal Enter configuration commands, one per line. End with CNTL/Z. Router(config)#	Enters global configuration mode. You have entered global configuration mode when the (config)# prompt appears. This command can be abbreviated to config t or conf t .

	Command	Purpose
Step 3	Router(config)# interface qam 3/1 Router(config-if)#	Enters QAM interface configuration mode. In this example, the interface is downstream port 0 on the QAM interface card installed in slot 3 of the Cisco RFGW-10.
Step 4	Router(config-if)# cable downstream rf-shutdown Router(config-if)# no cable downstream rfshutdown	Default. Disables the RF output from an integrated upconverter on a Cisco RFGW-10. To enable the RF output from an integrated upconverter on a Cisco RFGW-10, use the no cable downstream rf-shutdown command.
Step 5	Router(config-subif)# no cable downstream rf-shutdown	Enables the RF output on the integrated upconverter.
Step 6	Router(config-if)# no shutdown	Places the downstream port in the “admin up” state.
Step 7	Router(config-if)# end Router# %SYS-5-CONFIG_I: Configured from console by console	Returns to privileged EXEC mode. This message is normal and does not indicate an error.

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

Qam3/1.1.1 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.

Step 5 Verify that the downstream carrier is active, using the **cable downstream rf-shutdown** command.

Setting the Downstream Frequency

To set the downstream center frequency in the cable interface line card to reflect the digital carrier frequency of the downstream radio frequency carrier (the channel) for that downstream port, use the **cable downstream frequency** command.

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

```
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
```

Setting the Downstream Interleave Depth

Set the interleave depth for the downstream port on the Cisco QAM interface line card. A higher interleave depth provides more protection from bursts of noise on the HFC network; however, it increases downstream latency.

**Note**

The valid values are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, and 14.

To set the downstream interleave depth in milliseconds, use the following command in cable interface configuration mode:

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

Executing this command at the QAM channel level (sub interface) changes the interleave level of that subinterface. However, executing the command at the QAM port level (interface), changes the interleaver levels of all QAM channels on that QAM port.

Verifying the Downstream Interleave 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 Downstream Interleaver-level

To set the downstream interleaver level, use the **cable downstream interleaver-level** command in QAM subinterface configuration mode.

Interleaver level indicates modifiable Fast EtherChannel (FEC) I/J values. Level 1 indicates non-modifiable FEC I/J values. The I/J values are set to 128/1. For level 2, there are different FEC I/J values that can be configured.

The following example shows the interleaver level value set to 2 on QAM subinterface 3:

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

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
```

Setting the Downstream Modulation Rate

To set the downstream modulation rate, define the speed in symbols per second at which data travels downstream to the subscriber's CM. A symbol is the basic unit of modulation. Quadrature Phase Shift Key (QPSK) encodes 2 bits per symbol, QAM-16 encodes 4 bits per symbol, QAM-64 encodes 6 bits per symbol, and QAM-256 encodes 8 bits per symbol.



Note

Setting a downstream modulation rate of QAM-256 requires approximately a 6 dB higher signal-to-noise ratio (SNR) than QAM-64 at the subscriber's QAM interface. If your network is marginal or unreliable at QAM-256, use the QAM-64 format instead. Also, consider the significance of your data.



Note

Executing port level commands such as **cable downstream annex**, **cable downstream modulation**, **cable downstream stacking**, **cable downstream frequency**, and **cable downstream rf-power** at the QAM channel level modifies all the QAM channels on that port.

To set the downstream modulation rate, use the following command in cable interface configuration mode. The standard DOCSIS modulation rate (and the Cisco default) is QAM-64.

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

Verifying the Downstream Modulation Rate

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 Downstream MPEG Framing Format

To set the Moving Picture Experts Group (MPEG) framing format for a downstream port on a cable interface line card to Annex A (Europe), Annex B (North America), or Annex C (Japan), use the **cable downstream annex** command in QAM interface and subinterface configuration mode.

The MPEG framing format must be compatible with DOCSIS specifications (viewable at <http://www.cablelabs.com/cablemodem/specifications/>) and your local cable plant operations.

The Cisco RFGW-10 supports Annex A, Annex B, and Annex C operation.

Annex B framing format is automatically set when configuring Cisco cable interface line cards. The cable interface line card's downstream ports and the connected CMs on the network must be set to the same MPEG framing format and must support DOCSIS operations as appropriate.

The following command sets the QAM type to Annex B operation. This command sets the downstream MPEG framing format.

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

Verifying the Downstream MPEG Framing Format

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
```

Setting the Downstream RF Power Output Level

To set the RF power output level on the Cisco RFGW-10, use the **cable downstream rf-power** command in QAM interface.

The stacking level on Cisco RFGW-10 are as follows:

1:1 stacking—30 dBmV ~ 61 dBmV, default is 44 dBmV

2:1 stacking—30 dBmV ~ 57 dBmV, default is 47 dBmV

4:1 stacking—30 dBmV ~ 53 dBmV, default is 40 dBmV

The official range for acceptable power levels in the DOCSIS standard depends on the stacking level. The DOCSIS levels are as follows:

1:1 stacking—52 dBmV ~ 60 dBmV

2:1 stacking—48 dBmV ~ 56 dBmV

4:1 stacking—44 dBmV ~ 52 dBmV

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

```
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
```

Setting the Downstream RF Shutdown

To disable the RF output from an integrated upconverter on a Cisco RFGW-10, use the **cable downstream rf-shutdown** command in QAM interface and subinterface configuration mode. To enable the RF output on the integrated upconverter, use the **no** form of this command.

The following example enables the integrated upconverter on the Cisco RFGW-10:

```
Router(config)#configure terminal
Router(config-if)#interface qam 3/1.1
Router(config-subif)#cable downstream rf-shutdown
```

Setting the Downstream Stacking

To configure frequency stacking, use the **cable downstream stacking** command in QAM interface.

You can configure the stacking level on the RF port and enable the appropriate QAM channels:

- 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, and 4 are enabled on the specified RF port for stacking level 4.

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

```
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

```

Setting the Downstream TSID

To configure the Transport Stream Identifier (TSID) value on the QAM subinterface, use the **cable downstream tsid** command in QAM subinterface configuration mode.

This command ensures that each downstream QAM channel has a unique ID when there are multiple Cisco Cable Modem Termination System (CMTS) routers at a headend facility. This ID uniquely defines the QAM channel in the cable headend.

The TSID value is overwritten with a new value if there are no sessions established on that QAM channel. However, if a session exists with the specified QAM channel, the newly configured TSID value is rejected.



Note

TSID values are unique and duplicate TSID values are not allowed.

The following example illustrates how the downstream channel on the QAM subinterface with a TSID value of 44:

```

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

```