



Configuring the Cisco RFGW-10 DS-384 Line Card

Effective with Cisco IOS-XE Release 3.2.0SQ, the Cisco RF Gateway 10 (Cisco RFGW-10) chassis supports the Cisco RF Gateway 10 Universal Edge Quadrature Amplitude Modulation (UEQAM) Downstream 384 line card (hereafter called the Cisco RFGW-10 DS-384 line card). This card supports up to 8 RF ports and up to 384 QAM carriers on each line card.

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Prerequisites for Configuring QAM Features for the Cisco RFGW-10 DS-384 Line Card

The Cisco RFGW-10 DS-384 line card requires that the Cisco RF Gateway 10 and Cisco RF Gateway 10 Supervisor Engine 7-E are running the Cisco IOS-XE Release 3.2.0SQ.

The Cisco RF Gateway 10 Supervisor Engine 7-E supports superior capabilities like greater switching capacity (848 Gbps) and throughput (250 Mbps), external Secure Data (SD) and USB card for flexible storage options

and four non-blocking 10 Gigabit Ethernet uplinks. For detailed information on the Cisco RF Gateway 10 Supervisor Engine 7-E, see the [Cisco RF Gateway 10 Hardware Installation Guide](#).

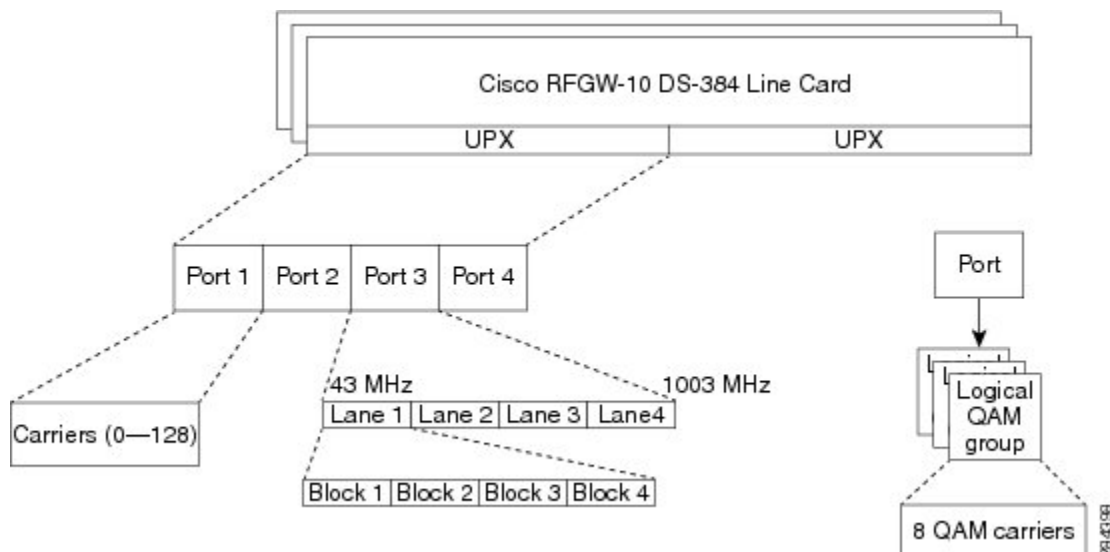
Restrictions for Configuring QAM Features for Cisco RFGW-10 DS-384 Line Card

- Cisco RFGW-10 DS-384 line card does not support mixed-mode annex on a single 48 MHz block.
- Due to the limitation of the upconverter module, only 96 channels per port for Annex A are supported for the Cisco RFGW-10 DS-384 line card.
- Because the number of ports supported in the Cisco RFGW-10 DS-48 line card are different from the Cisco RFGW-10 DS-384 line card, the configuration for one type of line card cannot be applied to a different type of line card. When the Supervisor card detects that a different type of line card has replaced an existing line card, the existing configuration is erased. The default setting of the new line card must be reconfigured.
- LQAM-group configuration restrictions
 - An lqam-group can have a maximum number of eight QAM channels
 - It can be spanned across two QAM ports with maximum of four QAM channels per port
 - It should be associated in an ascending order of QAM interfaces or ports

Information About Configuring QAM Features for the Cisco RFGW-10 DS-384 Line Card

The Cisco RFGW-10 DS-384 line card (see the figure below for software key components of the line card) is a high-density card and has the following features:

Figure 1: Physical QAM Layout and Logical QAM Grouping on the Cisco RFGW-10 DS-384 Line Card



- Maximum of eight RF ports on every line card are supported.
- QAM carriers can be grouped on any port as long as the total number of QAM carriers is less than 384. Maximum of 128 carriers per port are supported on a QAM port or physical RF port.
- The frequency range per port can be configured into maximum of four lanes, with four blocks on every lane. Each block can have 8 carriers, that is, 32 carriers on every lane. The frequency assigned to a carrier can begin on any lane and must be within the frequency range of 216 MHz.



Note The frequency assignments and the block and lane association must be relayed to the line card.

- Carrier spacing of +/- 6 MHz is supported for Annex B and C, and +/- 8MHz for only Annex A.
- A logical QAM (LQAM) channel is a single RF carrier.
- An LQAM group is a group of eight LQAM channels that share the same RF parameters—Annex, modulation format, symbol rate, and ITU interleaver values— in the RF profile. There can be up to 48 LQAM groups in Cisco RFGW-10 DS-384 line card.

For information on configuring features on the Cisco RFGW-10 DS-384 line card, see:

- [How to Configure the QAM Features for the Cisco RFGW-10 DS-384 Line Card](#)

- [Related Documents](#)

QAM Replication

QAM Replication feature allows users to replicate a single QAM output from one port to another port on a Cisco RFGW-10 DS-384 line card from the Supervisor card. It supports replication only within a given line card. Replicated QAM output uses the downstream span licensing policy that allows additional downstream outputs using RF Spanning. The RF spanning feature allows replication of existing downstream output to other ports on the same line card.

A QAM Replication Group (QRG) contains information about a single source QAM and its corresponding replicated copy or copies. A QRG contains only one pilot and a minimum of one and maximum of seven replicate QAMs. Each group is numbered with an identifier and contains the *slot*, *port* and *channel number* for both the source QAM (pilot-qam) and the destination QAM or QAMs (replicate-qam).

An interface, by default, does not belong to any replication group. After it is added to a replication group as a pilot QAM, any change made to it impacts the replicates associated with it. Hence, the pilot QAM must be removed from the replication group before applying any configuration change to it. The only configuration allowed on the pilot QAM in a replication group is RF shutdown. Shut and unshut of the pilot QAM is allowed and the same is reflected on all the replicates associated with that pilot QAM.

Each replicate QAM inherits all the attributes of its pilot QAM, except the *port number*, *carrier-id*, and *channel number*. If *RF power level* is not configured on the replicate QAM, and the pilot QAM *RF power level* is in the acceptable range for the replicate QAM, the pilot QAM *RF power level* value is inherited by the replicate. The *max-carriers* value must be specified for the replicate QAM. Replicate QAMs are configured at the qam-replication-group level and not at the interface level. No interface level changes are accepted for a replicate.



Note

- An entire port can not be replicated except by replicating each QAM individually.
- Effective from Cisco IOS-XE Release 3.4.0SQ, a replicate QAM with DEPI remote learn should be removed from the QRG before changing the QAM to the default state, if not it may lead to QRG corruption.

Port Density

Port density is the maximum number of carriers assigned to a port.

When the Cisco RFGW-10 DS-384 line card is inserted in the chassis, information about all physical port interfaces on that line card is automatically created in the configuration file. However, all port interfaces are in shutdown mode and by default, there are no carriers under a port interface.

Spectral Inversion

The upconverter (UPX) on the RFGW-10 DS-384 line card converts digital signals to analog signals. The analog signals are the output signals sent to the Set Top Boxes (STBs) and modems. The output signals are, by default, inverted signals. Some STBs and modems do not have the capability to process inverted signals.

Therefore, the inverted signal must be converted to non-inverted signals so that these STBs and modems can tune in to the signals.

Cisco DS-384 line card does not support non-inverted signals. This feature enables support for non-inverted signals on the Cisco DS-384 line card. The change from inverted signal to non-inverted signal can be configured with the **no cable downstream spectral-inversion** command. This command can be executed without muting the channel that requires this setting.

Restrictions

- This feature cannot be configured on a channel with QAM Replicate Groups (QRGs) configured. The QRGs must be removed. The feature must, then, be set or unset. The QRGs may be added back after the feature is set or unset.
- Spectral inversion can be set or unset only on Pilot QAMs. Replicate QAMs inherit the setting of the Pilot QAM.

How to Configure the QAM Features for the Cisco RFGW-10 DS-384 Line Card

This section describes the various steps to configure the QAM features on the Cisco RFGW-10 DS-384 Line Card.

Enabling Cisco RFGW-10 DS-384 Line Card Reset

Bass SEU interrupts are single event upset (SEU) interrupts received from Bass field-programmable gate array (FPGA). You can enable Cisco RFGW-10 DS-384 line card reset when a Bass SEU interrupt is received.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	service bass-seu-interrupt Example: Router(config)# service bass-seu-interrupt	Resets the Cisco RFGW-10 DS-384 line card.

Configuring RF Profiles

The Cisco RFGW-10 DS-384 line card supports RF profiles. RF profiles are global templates that define a combination of RF attributes to be used across all line cards in the chassis. A default RF profile is generated by the system with the default RF attributes.

An RF profile consists of:

- Annex mode
- Single symbol rate (applicable for Annex A only. Symbol rates are internally applied for Annex B and Annex C).
- Single modulation index
- Two interleaver depths. Each carrier must use only one defined interleaver depths of the profile it is assigned to.

A group of eight logical QAM channels that share the same modulation format, symbol rate, annex mode, and the two options of interleaver I/J values, form a logical QAM group.

An RF profile has the following characteristics:

- Any number of carriers can be assigned to an RF profile within the RF Gateway 10 chassis.
- 1, 2, 4 or multiples of 4 carriers can be associated with any RF port on that line card (maximum carriers on an RF port is 64).
- Every physical QAM carrier has a one-to-one mapping with a logical QAM channel.



Note Logical QAM channels correspond to physical QAM carriers and are assigned to the carriers when they are enabled.

An RF profile enables several QAM carriers to share the same RF downstream parameters regardless of their RF port or logical QAM group. The Cisco RF Gateway 10 Supervisor Engine 7-E maintains the RF profile and assigns it to the QAM carriers, providing them with a logical QAM ID and a logical QAM group ID. If the RF profile is applied to more than eight QAM carriers, the Supervisor increments the logical QAM group ID.

Restrictions

- The Cisco RF Gateway 10 Supervisor Engine 7-E card must assign carriers to RF profiles in groups of eight. All eight carriers must have the same Annex, symbol rate, QAM modulation, and choice of two interleaver depth values. This grouping makes certain configurations on the Cisco RFGW-10 DS-384 line card, such as 380 carriers with RF profile 1, and 4 carriers with RF profile 2, invalid.
- After it is created, all changes to the RF profile must be made at the RF Gateway 10 chassis level and not at the QAM subinterface level. It is recommended that global RF profiles are modified while they are not in use at the QAM subinterface level.
- A default RF profile (default-rf-profile) is created during system boot up. Any QAM carrier that is enabled without an RF profile and center frequency assigned to it is rejected by the system. In this case, the default-rf-profile is enforced and assigned an RF profile ID of 1.

- For Downstream External PHY Interface (DEPI) configuration, RF parameters can be configured either from the RF Gateway 10 chassis or all RF configurations can be learned from the Cisco CMTS. In DEPI Learn Mode, a new remote RF profile is created by the system, which cannot be modified at the RF Gateway 10 chassis level. In this case, use the **show controller** command to view the downstream parameters applied to the QAM carrier. The **show cable rf-profile** command lists all remote RF profiles that are automatically created on the RF Gateway 10 chassis.
- Annex type is configured as part of the RF profile and different RF profiles for QAMs, can be applied under the same port. So, QAMs under the same port can be configured with different Annex types.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable downstream rf-profile** *rf-profile-id*
4. **cable downstream annex** {A | B | C}
5. **cable downstream modulation** {64 | 256}
6. **cable downstream interleaver-depth** **option1** *depth-value* **option2** *depth-value*
7. **cable downstream symbol-rate** *symbols*
8. **exit**

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	cable downstream rf-profile <i>rf-profile-id</i> Example: Router (config)# cable downstream rf-profile 1	Creates a locally-defined RF profile at the Cisco RFGW-10 chassis level, and applies it across any QAM channel on the Cisco RFGW-10 DS-384 line card. • <i>rf-profile-id</i> —RF profile ID applied to the QAM channel on the line card.
Step 4	cable downstream annex {A B C} Example: Router (config-rf-prof)# cable downstream annex A	Sets 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). • A —Annex A: The downstream uses the EuroDOCSIS J.112 standard. • B —Annex B: The DOCSIS-compliant cable plants that support North American channel uses ITU J.83

	Command or Action	Purpose
		Annex B downstream radio frequency. <ul style="list-style-type: none"> • C—Annex C: A variant of DOCSIS 1.1 designed to operate in Japanese cable systems.
Step 5	cable downstream modulation {64 256} Example: Router(config-rf-prof)# cable downstream modulation 64	Sets the modulation format for a downstream port on a line card. <ul style="list-style-type: none"> • 64—Modulation rate is 6 bits per downstream symbol. • 256—Modulation rate is 8 bits per downstream symbol.
Step 6	cable downstream interleaver-depth option1 depth-value option2 depth-value Example: Router(config-rf-prof)# cable downstream interleaver depth option1 I12-J17 option2 I12-J17	Sets the downstream interleaver depth. <ul style="list-style-type: none"> • <i>option1</i>—Interleaver-depth FEC I/J values at the RF profile. • <i>option2</i>—Interleaver-depth FEC I/J values that are available at the subinterface level when the profile is assigned to the QAM subinterface.
Step 7	cable downstream symbol-rate symbols Example: Router(config-rf-prof)# cable downstream symbol-rate 3500000	Sets the symbol rate on the line card. <ul style="list-style-type: none"> • <i>symbols</i>—Symbol rate of the line card in seconds. The valid range is from 3500000 to 7000000 symbols per second. <p>Note Symbol rate can be specified only for Annex A and Annex C and valid symbol rate values must be in increments of 1000 symbols per second.</p>
Step 8	exit Example: Router(config-rf-prof)# exit	Exits the RF profile configuration mode.

The following example shows how to configure an RF profile on the line card:

```
Router> enable
Router# configure terminal
Router(config)# cable downstream rf-profile 1
Router(config-rf-prof)# cable downstream annex A
Router(config-rf-prof)# cable downstream modulation 64
Router(config-rf-prof)# cable downstream interleaver depth option1 I12-J17 option2 I12-J17
Router(config-rf-prof)# cable downstream symbol-rate 3500000
Router(config-rf-prof)# exit
```

What to Do Next

After the RF profile is created, you can apply this profile to up to eight QAM carriers. You must also apply the interleaver value to the QAM carrier. This value must be one of the two interleaver depth values defined in the RF profile.

The following example shows how to apply the RF profile to a QAM carrier:

```
Router> enable
Router# configure terminal
Router(config)# interface Qam-red 3/1.1
Router(config-subif)# cable downstream rf-profile 1
Router(config-rf-prof)# cable downstream interleaver-depth I12-J17
```

In the DEPI Learn RF mode, use the **show cable rf-profile** command to display the parameters in the RF profile learned from the Cisco CMTS.

```
Router# show cable rf-profile 1

RF Profile ID 1 is configured
  modulation: 256
  interleaver-depth options: I128-J1, I128-J1
  srate: 5056941
  remote: 0
```

Use the **show cable linecard logical-qamid-mapping** command to display the logical QAM group IDs and QAM carriers mapped to the RF profiles on the line card:

```
Router# show cable linecard logical-qamid-mapping 3

Slot: 3, Logical QAM Group ID 1:
  RF Profile ID : Remote-RF-Profile-14
  First Port    : Qam-red3/1
  Associated Qam Carrier ids:
    offset 0 - carrier-id 1 - Qam-red3/1.1
    offset 1 - carrier-id 2 - Qam-red3/1.2
    offset 2 - carrier-id 3 - Qam-red3/1.3
    offset 3 - carrier-id 4 - Qam-red3/1.4
  Second Port   : Qam-red3/2
    offset 4 - carrier-id 5 - Qam-red3/2.1
    offset 5 - carrier-id 6 - Qam-red3/2.2
    offset 6 - carrier-id 18 - Qam-red3/2.14
    offset 7 - carrier-id 19 - Qam-red3/2.15
Slot: 3, Logical QAM Group ID 2:
  First Port    : Qam-red3/2
  Associated Qam Carrier ids:
    offset 0 - carrier-id 22 - Qam-red3/2.18
    offset 1 - carrier-id 23 - Qam-red3/2.19
    offset 2 - carrier-id 24 - Qam-red3/2.20
    offset 3 - carrier-id 25 - Qam-red3/2.21
  Second Port   : Qam-red3/2
    offset 4 - carrier-id 26 - Qam-red3/2.22
    offset 5 - carrier-id 27 - Qam-red3/2.23
    offset 6 - carrier-id 28 - Qam-red3/2.24
    offset 7 - carrier-id 9 - Qam-red3/2.5
Slot: 3, Logical QAM Group ID 3:
  First Port    : Qam-red3/3
  Associated Qam Carrier ids:
    offset 0 - carrier-id 29 - Qam-red3/3.1
    offset 1 - carrier-id 30 - Qam-red3/3.2
    offset 2 - carrier-id 31 - Qam-red3/3.3
    offset 3 - carrier-id 32 - Qam-red3/3.4
  Second Port   : None
```

Configure QAM Constellation Spectrum Inversion

The QAM constellation spectrum is inverted, by default. It is required to be changed to non-inverted mode on specific channels that have STBs that do not support inverted spectrum processing.

SUMMARY STEPS

1. enable
2. configure terminal
3. interface qam-red *slot/port.channel*
4. no cable downstream spectrum inversion

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted. Router#
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode. Router(config)#
Step 3	interface qam-red <i>slot/port.channel</i> Example: Router(config)# interface qam-red 3/1.1	Configures the interface QAM on the line card. <ul style="list-style-type: none"> • slot-Slot of the line card in the QAM interface. The valid range is from 3 to 12. • port-Port on the specified slot. The valid range is from 1 to 8. • channel-(Optional) Channel on the specified port. The valid range is from 1 to 128. Enters the QAM subinterface configuration mode when executed. Router (config-subif)#
Step 4	no cable downstream spectrum inversion Example: Router(config)# interface qam-red 3/1.1	Removes spectrum inversion of the QAM constellation output.

What to Do Next

For details of the **cable downstream spectral-inversion** command, see the [Cisco CMTS Cable Command Reference](#).

Configuring Logical QAM Group Assignment

An RF profile assigned to a logical QAM (LQAM) group applies the same RF parameters, (Annex, modulation format, symbol rate, and the ITU interleaver pair value) to all LQAM channels in that group.



Note When using remote DEPI, use only one interleaver value—`fec_i`. For manual DEPI, use the interleaver pair values—`fec_i` and `fec_j` for RF profiles.

On the Cisco RFGW-10 DS-384 line card, you can configure LQAM group for each QAM channel.

When there is a mismatch between the RF parameters of one QAM channel with the other QAM channels within the same LQAM group:

- The mismatched channel goes into Idle state; the other channels remain operational.
- If the mismatch is intentional, it is recommended to move the mismatched QAM channel to another LQAM group.

Restrictions

- No more than eight QAM channels can belong to an LQAM group.
- No more than two QAM ports can belong to an LQAM group.

If an LQAM group is not assigned:

- DEPI session cannot be configured.
- The `depi-tunnel` and `cable downstream rf-profile` commands cannot be executed.

Effective from Cisco IOS-XE Release 3.4.0SQ, if Annex A is configured, then the Logical QAM groups must be configured contiguously, for example, `lqam-group1`, `lqam-group2`, `lqam-group3`, and so on.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface qam slot/port.[channel]`
4. `cable downstream lqam-group group_ID`
5. `exit`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code> Example: <code>Router> enable</code>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<code>configure terminal</code> Example: <code>Router# configure terminal</code>	Enters global configuration mode.
Step 3	<code>interface qam slot/port.[channel]</code>	Configures the interface QAM on the line card.

	Command or Action	Purpose
	<p>Example: Router(config)# interface qam 3/1.1</p>	<ul style="list-style-type: none"> • <i>slot</i>—Slot of the line card in the QAM interface. The valid range is from 3 to 12. • <i>port</i>—Port on the specified slot. The valid range is from 1 to 8. • <i>channel</i>—(Optional) Channel on the specified port. The valid range is from 1 to 128. <p>Enters the QAM subinterface configuration mode when executed.</p>
Step 4	<p>cable downstream lqam-group <i>group_ID</i></p> <p>Example: Router(config-subif)# cable downstream lqam 1</p>	<p>Configures an LQAM group.</p> <ul style="list-style-type: none"> • <i>group_ID</i>—LQAM group ID on QAM interface on the line card. The valid values range is from 1 to 48.
Step 5	<p>exit</p> <p>Example: Router(config-subif)# exit</p>	<p>Exits the QAM subinterface configuration mode.</p>

Use the **show running-config | include cable downstream lqam-group** command to view the LQAM channels that belong to the same LQAM group.

Router# **show running-config | include cable downstream lqam-group**

```

Interface qam4/2.1
  cable downstream carrier-id 1
  cable downstream lqam-group 40
  cable mode depi remote learn
  cable downstream tsid 42001
  cable depi depi-tunnel tunnel-1
Interface qam4/2.2
  cable downstream carrier-id 2
  cable downstream lqam-group 25
  cable mode depi remote learn
  cable downstream tsid 42002
  cable depi depi-tunnel tunnel-1
Interface qam4/2.3
  cable downstream carrier-id 3
  cable downstream lqam-group 40
  cable mode depi remote learn
  cable downstream tsid 42003
  cable depi depi-tunnel tunnel-1
Interface qam4/5.4
  cable downstream carrier-id 13
  cable downstream lqam-group 40
  cable mode depi remote learn
  cable downstream tsid 42004
  cable depi depi-tunnel tunnel-1

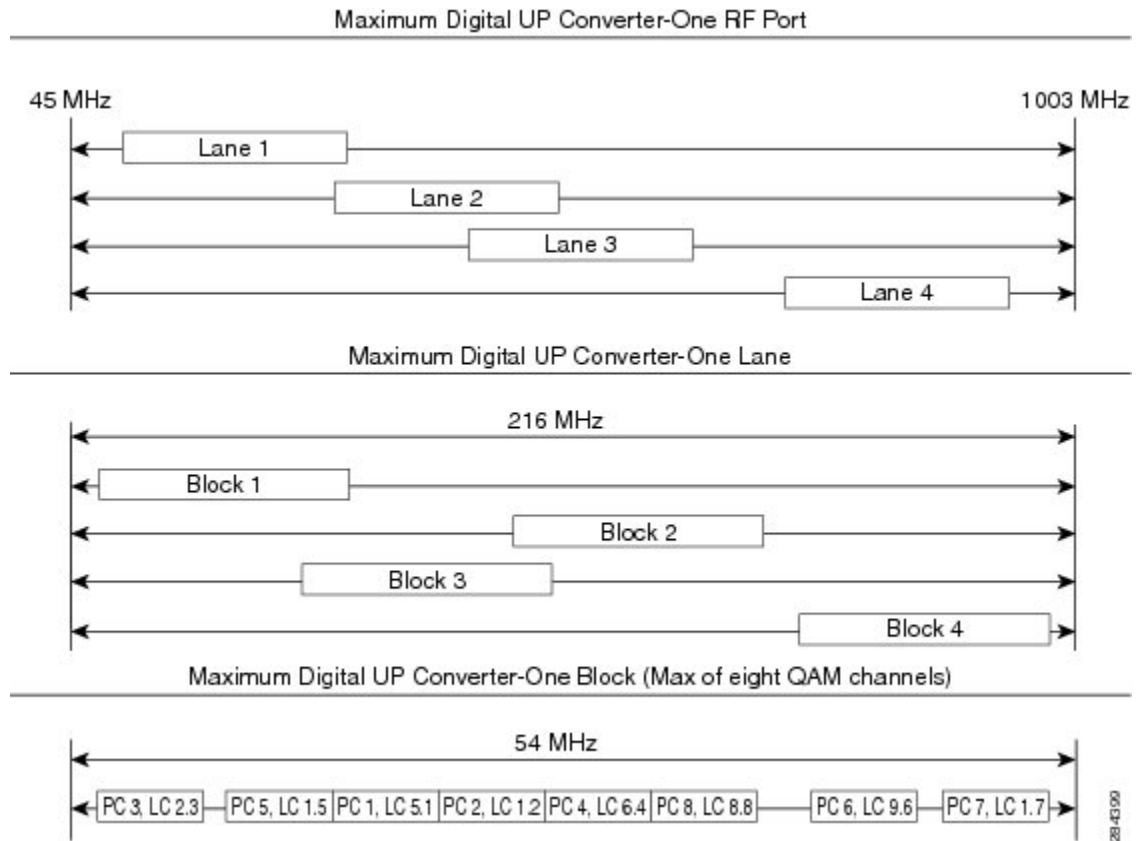
```

The above output indicates the LQAM channel 4/2.2 belongs to a different LQAM group.

Configuring Frequency Profiles and QAM Carrier Frequency

On the RFGW-10 DS-384 line card, frequency stacking can be achieved by grouping QAM carriers on a port. On an RFGW-10 DS-384 line card, each port provides a frequency range of 45 MHz to 1003 MHz. Carriers on a port are not forced to be stacked contiguously and any given carrier can occupy any part of the frequency spectrum on that port.

Figure 2: Frequency Profiles - Lane and Block Concept



The upconverter (UPX) on the RFGW-10 DS-384 line card provides greater frequency band range and more flexible carrier stacking schemes on each RF port. The frequency range is configured into maximum four lanes, with four blocks on every lane.

Each block can have eight carriers of type Annex B or Annex C, that is, 32 carriers on every lane. For Annex A each block can have six carriers, or 24 carriers on every lane. The frequency assigned to a carrier can begin on any lane, but must be within the frequency band of 216 MHz.

The Cisco RF Gateway 10 Supervisor Engine 7-E supports two frequency schemes—Static Frequency scheme and the User-defined Frequency scheme to configure the frequency profile at the port level.

A starting frequency can be configured at the port level (static frequency scheme) or a frequency profile ID can be configured at the port level (user-defined frequency scheme). The valid values for starting frequency is from 45 MHz to 995 MHz.

The Static frequency scheme hides the *lane* and *block* implementation of the UPX and the Cisco IOS image calculates the start frequencies of the lanes and blocks based on the start frequency specified at the port.

The user-defined frequency scheme provides more flexibility to the user to define each lane and block start frequencies through global frequency profiles. These frequency profiles can then be applied to the port in this scheme.



Note Frequency stacking cannot be configured on the RFGW-10 DS-48 line card; it is statically defined—four QAMs on every port.

Restrictions

- Number of QAM carriers configured on a port depends on the Annex value—128 QAM carriers for Annex B and 96 QAM carriers in Annex A.
- Each block is 54 MHz wide and supports only up to a maximum of eight carriers of type Annex B or Annex C. For Annex A, the block supports a maximum of six carriers.
- Each lane is 216 MHz wide. Block and lane overlaps are allowed in order to stack QAM carriers continuously. However, frequencies on each QAM carrier must not overlap on two different blocks.



Note A group of eight logical QAM channels with the same Annex type, modulation format, and symbol rate is called a logical QAM group. Logical and physical channel have a one-to-one mapping, and hence, a QAM carrier is represented as both, physical and logical channel.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam slot/port.[channel]**
4. **cable downstream frequency qam-center-frequency**
5. **exit**

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]	Configures the interface QAM on the line card.

	Command or Action	Purpose
	<p>Example: Router(config)# interface qam 3/1.1</p>	<ul style="list-style-type: none"> • <i>slot</i>—Slot of the line card in the QAM interface. The valid range is from 3 to 12. • <i>port</i>—Port on the specified slot. The valid range is from 1 to 8. • <i>channel</i>—(Optional) Channel on the specified port. The valid range is from 1 to 128. <p>Enters the QAM subinterface configuration mode when executed.</p>
Step 4	<p>cable downstream frequency <i>qam-center-frequency</i></p> <p>Example: Router(config-subif)# cable downstream frequency 714000000</p>	<p>Sets the downstream center frequency on the QAM channel.</p> <ul style="list-style-type: none"> • <i>qam-center-frequency</i>—Center frequency on the QAM subinterface of the Cisco RFGW10-DS-384 line card. The valid range is from 48 MHz to 999 MHz.
Step 5	<p>exit</p> <p>Example: Router(config-subif)# exit</p>	<p>Exits the QAM subinterface configuration mode.</p>

EXAMPLE

The following examples shows how to configure the frequency profile and the center frequency on the QAM interface:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream frequency 714000000
```

Configuring Static Frequency Scheme

The static frequency scheme preallocates lanes based on the starting frequency (*fstart*) of the port. The Supervisor card internally sets up *fstart* for all four lanes and blocks contiguously with the maximum frequency of up to 1003 MHz. The carrier frequency for each carrier can be placed anywhere starting with *fstart*.

After a frequency for a carrier is accepted, the segment of that frequency range is marked "in-use" for that carrier.

By default, *fstart* values range from 45 MHz to 995 MHz.

Table 1: Lane and Block Frequencies for Annex B and Annex C

Lane	Center Frequency	Block 1 Center Frequency	Block 2 Center Frequency	Block 3 Center Frequency	Block 4 Center Frequency
1	<i>fstart</i> + 108	<i>fstart</i> + 27	<i>fstart</i> + 75	<i>fstart</i> + 123	<i>fstart</i> + 171
2	<i>fstart</i> + 300	<i>fstart</i> + 219	<i>fstart</i> + 267	<i>fstart</i> + 315	<i>fstart</i> + 363

Lane	Center Frequency	Block 1 Center Frequency	Block 2 Center Frequency	Block 3 Center Frequency	Block 4 Center Frequency
3	$f_{start} + 492$	$f_{start} + 411$	$f_{start} + 459$	$f_{start} + 507$	$f_{start} + 555$
4	$f_{start} + 684$	$f_{start} + 603$	$f_{start} + 651$	$f_{start} + 699$	$f_{start} + 747$

Table 2: Lane and Block Frequencies for Annex A

Lane	Center Frequency	Block 1 Center Frequency	Block 2 Center Frequency	Block 3 Center Frequency	Block 4 Center Frequency
1	$f_{start} + 108$	$f_{start} + 27$	$f_{start} + 73$	$f_{start} + 119$	$f_{start} + 165$
2	$f_{start} + 292$	$f_{start} + 211$	$f_{start} + 257$	$f_{start} + 303$	$f_{start} + 349$
3	$f_{start} + 476$	$f_{start} + 395$	$f_{start} + 441$	$f_{start} + 487$	$f_{start} + 533$
4	$f_{start} + 660$	$f_{start} + 579$	$f_{start} + 625$	$f_{start} + 671$	$f_{start} + 717$

**Note**

By default all QAM ports are set with the static frequency scheme, and the default f_{start} value of 143 MHz. The value of f_{start} can be changed after system boot up. f_{start} range should be within 45 MHz to 949 MHz for blocks and 45 MHz to 787 MHz for lanes.

Restrictions

- If the new frequency of the carrier overlaps with another carrier frequency, the request is rejected.
- If the carrier frequency is not within the predefined spectrum, the request is rejected.
- If all configured frequencies within a block exceed eight carriers, the request is rejected.

Example

The following example shows how to configure a full-frequency spectrum:

```
Router(config)# interface qam 7/1
Router(config-subif)# cable downstream start-freq 50000000
```

Port 7/1 frequency band edges are set to 50000000 Hz to 824000000 Hz.
All the lane and blocks are set with valid frequency range.

```
Lane 1 start frequency: 50000000 Hz
  Block 1 start frequency: 50000000 Hz
  Block 2 start frequency: 98000000 Hz
  Block 3 start frequency: 146000000 Hz
  Block 4 start frequency: 194000000 Hz
Lane 2 start frequency: 242000000 Hz
  Block 1 start frequency: 242000000 Hz
  Block 2 start frequency: 290000000 Hz
  Block 3 start frequency: 338000000 Hz
  Block 4 start frequency: 386000000 Hz
Lane 3 start frequency: 434000000 Hz
  Block 1 start frequency: 434000000 Hz
  Block 2 start frequency: 482000000 Hz
  Block 3 start frequency: 530000000 Hz
  Block 4 start frequency: 578000000 Hz
```



```

Lane 4 start frequency: 626000000 Hz
  Block 1 start frequency: 626000000 Hz
  Block 2 start frequency: 674000000 Hz
  Block 3 start frequency: 722000000 Hz
  Block 4 start frequency: 770000000 Hz
Record Downloaded to slot(s):
Frequencies in use:

```

The following is a sample output for an incomplete frequency spectrum:

```

Router(config)# interface qam 7/1
Router(config-subif)# cable downstream start-freq 995000000

Port 7/1 frequency band edges are set to 995000000 Hz to 1003000000 Hz
From lane 1 to block 1 of lane 1 has occupied the port frequency range from 995000000 Hz
to 1003000000 Hz

Lane 1 start frequency: 995000000 Hz
  Block 1 start frequency: 995000000 Hz
  Block 2 start frequency: 0 Hz
  Block 3 start frequency: 0 Hz
  Block 4 start frequency: 0 Hz
Lane 2 start frequency: 0 Hz
  Block 1 start frequency: 0 Hz
  Block 2 start frequency: 0 Hz
  Block 3 start frequency: 0 Hz
  Block 4 start frequency: 0 Hz
Lane 3 start frequency: 0 Hz
  Block 1 start frequency: 0 Hz
  Block 2 start frequency: 0 Hz
  Block 3 start frequency: 0 Hz
  Block 4 start frequency: 0 Hz
Lane 4 start frequency: 0 Hz
  Block 1 start frequency: 0 Hz
  Block 2 start frequency: 0 Hz
  Block 3 start frequency: 0 Hz
  Block 4 start frequency: 0 Hz
Record Downloaded to slot(s):
Frequencies in use:

```

The following is a sample output of the **show controller qam slot/port.channel downstream** command that displays information about frequency, lane, and block assignments on a QAM:

```

Router# show controllers qam 3/1.1 downstream

Qam 3/1.1 Downstream is up
  RF Profile Name: Remote-RF-Profile-13
  Annex B, Power: 44.0 dBmV
  Frequency: 555000000 Hz, lane: 3, block: 1
  Modulation: 256QAM, TSID: 311, QAM IDB_State: UP
  Bandwidth Reserved for Video: 0 bps
  Bandwidth Used: 1739488 bps
  Bandwidth Total: 38810000 bps
  Transport Mode: QAM_MODE_MPT Qam Owner: REMOTE
  Interleave Level: 2, FEC_I: 32 FEC_J: 4
  SNMP LINK TRAP: Disabled

```

The following is a sample output of the **show controller qam slot/port downstream** command that displays information about the freq-profile on the port:

```

Router# show controllers qam 4/2 downstream

RF Port4/2 is disabled
Max carrier density on this port set to 8

Valid rf-power range: 39.0 dBmV to 51.0 dBmV
Default RF Power value: 45.0 dBmV

RF Power configured on the Qam channels:

Qam interface current-rf-power

```

```

x-----x-----
Qam-red4/2.1 41.0 dBmV
Qam-red4/2.2 41.0 dBmV
Qam-red4/2.3 41.0 dBmV
Qam-red4/2.4 41.0 dBmV
Qam-red4/2.5 41.0 dBmV
Qam-red4/2.6 41.0 dBmV
Qam-red4/2.7 41.0 dBmV
Qam-red4/2.8 41.0 dBmV
Frequency Profile ID: annex-b-low

Frequency in use carrier_id lane_id block_id
x-----x-----
675000000hz 141 4 1 Qam-red4/2.1
681000000hz 142 4 1 Qam-red4/2.2
687000000hz 143 4 1 Qam-red4/2.3
693000000hz 144 4 1 Qam-red4/2.4
699000000hz 145 4 1 Qam-red4/2.5
705000000hz 146 4 1 Qam-red4/2.6
711000000hz 147 4 1 Qam-red4/2.7
717000000hz 148 4 2 Qam-red4/2.8

```

User Scenario

Consider the following scenario:

- A DS-96 user licence on the Cisco RFGW-10 DS-384, that is, 96 downstream channels on QAM port 3/1
- 32 carriers
- Annex-B
- $f_{start} = 234$ MHz

Requirement:

To configure two non-contiguous and six contiguous channels with frequencies—714, 720, 726, 732, 738, 744, 320, and 475. The following table describes the lane and block frequencies on the corresponding interface.

Table 3: Lane and Block Frequencies Configured as a Mix of Contiguous and Non-Contiguous Frequencies

Interface	Frequency	Lane	Block
3/1.1	714	3	3
3/1.2	720	3	3
3/1.3	726	3	3
3/1.4	732	3	3
3/1.5	738	3	3
3/1.6	744	3	3
3/1.7	320	1	2
3/1.8	475	2	2

As a result, the lane frequencies are assigned as follows:

- Lane 1: 234 MHz - 426 MHz

- Lane 2: 426 MHz - 618 MHz
- Lane 3: 618 MHz - 810 MHz
- Lane 4: 810 MHz - 1002MHz

Twelve (12) additional contiguous channels are configured as shown in the following table:

Table 4: Lane and Block Frequencies Configured as Contiguous Frequencies

Interface	Frequency	Lane	Block
3/1.9	517	2	2
3/1.10	523	2	3
3/1.11	529	2	3
3/1.12	535	2	3
3/1.13	541	2	3
3/1.14	547	2	3
3/1.15	553	2	3
3/1.16	559	2	3
3/1.17	565	2	3
3/1.18	571	2	4
3/1.19	577	2	4
3/1.20	583	2	4



Note

Whenever there is a change in the fstart of the port, all frequencies of QAM channel on the port are revalidated against the new lane and block. If any frequency is invalid, that frequency is set as an invalid frequency or 0 Hz and an error notification is displayed on the console.

Configuring the 8MHz Overlap Starting Frequency

By default, QAM ports are configured with the 6MHz overlap scheme between adjacent blocks. Now the QAM ports can be configured with the 8 MHz overlap fixed scheme between blocks for Annex A.

Effective from Cisco IOS-XE Release 3.4.1SQ, the start frequency profile for the 8 MHz overlap fixed scheme can be set using the **cable downstream 8Mhz-overlap-start-freq** command.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. • Enter password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface qam <i>slot/subslot</i> Example: Router(config)# interface qam3/1	Configures the interface QAM on the line card.
Step 4	cable downstream 8MHz-overlap-start-freq <i>frequency</i> Example: Router(config-if)# cable downstream 8MHz-overlap-start-freq 45000000	Configures the starting frequency for the 8MHz overlap for Annex A on the QAM. • Valid range for 8MHz per Annex A is 45000000-995000000.
Step 5	end Example: Router(config-if)# end	Exits to the privileged EXEC mode.

Configuring User-Defined Frequency Scheme

**Note**

Cisco IOS-XE Release 3.2.0SQ does not support the user-defined frequency scheme.

Configuring the user-defined frequency scheme provides complete control to the user to configure lane, block, and channel frequencies anywhere in the spectrum through global frequency profiles. In this scheme all lane and block start frequencies (*fstart*) can be non-contiguous. These frequency profiles can then be applied to the port.

In the global frequency profile, any set of 216 MHz, or less than 216 MHz (in the range of 45 MHz to 1003 MHz) can be assigned to any lane.

The Cisco RF Gateway 10 Supervisor Engine 7-E displays the lane frequency range after configuring the lane *fstart*.

Restrictions

- Frequency, lane, and block assigned to the QAM subinterface must be within the frequency range for the configured lane and block.
- Configured frequencies within a block must not exceed 54 MHz and 8 carriers.
- Sum total of the configured frequencies must not exceed 216 MHz on the lane and 32 channels of Annex B or 24 channels of Annex A per lane.
- Default frequency profile is 54 MHz wide block width and 216 MHz wide lane width; however, block and lane overlaps starts at 48 MHz and 192 MHz respectively.
- Frequencies on each channel must not overlap.
- Annex type must be configured before configuring the frequency profile on any RF Port. If the Annex type is not specified, Annex B is assumed.



Note In Cisco IOS-XE Release 3.2.0SQ, the Annex type is defined in the RF profile by default.

- Each block *fstart* on a corresponding lane should be equal to, or greater than the lane *fstart*.
- The Supervisor default frequency profile cannot be modified.
- Up to 10 frequency profiles on an RF Gateway 10 chassis can be created.
- Each block frequency range should be within the 216 MHz from the lane start frequency, provided the lane frequency range has not exceeded 1003 MHz.
- If the *fstart* of the lane is not capable of occupying 216 MHz within the frequency range limit of 1003 MHz, the last block with *fstart* below 1003 MHz is configured. Blocks exceeding 1003 MHz are configured as invalid frequency or 0 Hz internally.
- Blocks can overlap within the same lane.
- Duplicate frequency profiles are not allowed.
- If global frequency profiles are applied on any of the port at chassis level, they can no longer be deleted.
- While removing the frequency profile from the port, the Supervisor card enables the static frequency scheme on the port with the *fstart* value of 143 MHz.
- Modifications to the global frequency profile revalidates the center frequencies of all QAM channels of the port where this freq-profile is applied. If a frequency is found to be invalid, then it is set to 0 Hz (invalid frequency) and an error notification is displayed.
- Frequency profile names are case sensitive.

Specifying Frequency Profile

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface qam *slot/port*.**
4. **cable downstream freq-profile *freq-profile-name***
5. **exit**

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 <i>slot/port</i>. Example: Router (config)# interface qam 3/1	Configures the interface QAM on the line card. <ul style="list-style-type: none"> • <i>slot</i>—Slot of the line card in the QAM interface. The valid range is from 3 to 12. • <i>port</i>—Port on the specified slot. The valid range is from 1 to 8. • <i>channel</i>—(Optional) Channel on the specified port. The valid range is from 1 to 128. Enters the QAM subinterface configuration mode when executed.
Step 4	cable downstream freq-profile <i>freq-profile-name</i> Example: Router (config-if)# cable downstream freq-profile <i>freq-profile-1</i>	Creates the frequency profile at the Cisco RFGW-10 chassis level and applies it to any RF port on the Cisco RFGW-10 DS-384 line card. <ul style="list-style-type: none"> • <i>freq-profile-id</i>—Profile ID applied to the RF port. The default value is 1.
Step 5	exit Example: Router (config-freq-prof-lane)# exit	Exits the frequency profile mode.

The following example shows how to configure a user-defined frequency scheme:

```
Router> enable
Router# configure terminal
Router(config)# interface qam 3/1
```

```
Router(config-if)# cable downstream freq-profile freq-profile-1
```

The following is a sample output from the **show running-config** command that displays contiguous frequencies on QAM carriers with Annex B and port density of eight carriers per port:

```
Router# cable downstream freq-profile 1

cable downstream freq-profile 1
  lane 1 start-freq 300000000
    block 1 start-freq 381000000
    block 2 start-freq 327000000
    block 3 start-freq 435000000
    block 4 start-freq 489000000
  lane 2 start-freq 625000000
    block 1 start-freq 652000000
    block 2 start-freq 544000000
    block 4 start-freq 701000000
  lane 3 start-freq 840000000
    block 1 start-freq 759000000
    block 2 start-freq 813000000
!
Interface Qam-red3/1
  cable downstream freq-profile 1
!
interface Qam-red3/1.1
  cable downstream frequency 714000000 lane 2 block 4
!
interface Qam-red3/1.2
  cable downstream frequency 720000000 lane 2 block 4
!
interface Qam-red3/1.3
  cable downstream frequency 726000000 lane 2 block 4
!
interface Qam-red3/1.4
  cable downstream frequency 732000000 lane 3 block 1
!
Interface Qam-red3/1.5
  cable downstream frequency 738000000 lane 3 block 1
!
interface Qam-red3/1.6
  cable downstream frequency 744000000 lane 3 block 1
!
interface Qam-red3/1.7
  cable downstream frequency 320000000 lane 1 block 2
!
Interface Qam-red3/1.8
  cable downstream frequency 580000000 lane 2 block 2
```

To run the command at the QAM interface level, the lane and block number must be assigned to the frequency allocated for the QAM subinterface. The following example shows how to configure the user-defined frequency set at the QAM subinterface level:

```
Router> enable
Router# configure terminal
Router(config)# interface qam-red 3/1
Router(config-if)# cable downstream freq-profile 1
Router(config-if)# interface qam-red 3/1.1
Router(config-subif)# cable downstream frequency 300000000
```

Configuring the QAM Replication Group

Before You Begin

- Check the license on the line card.



Note

The downstream spanning license allows additional replicated output to be added until the total downstream output including replicates is 384.

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	cable qam-replication-group { <i>group-id</i> new } Example: Router(config)# cable qam-replication-group new	Creates a QAM replication group. <ul style="list-style-type: none"> • <i>group-id</i>—QAM replication group ID. The valid range is from 1 to 3840. • new—Creates a new group and assigns a group number automatically.
Step 4	pilot-qam { qam qam-red } { <i>qam-interface-number</i> } Example: Router(config-qrg)# pilot-qam qam-red3/1.1	configures the pilot (source) QAM.
Step 5	replicate-qam { qam qam-red } { <i>qam-interface-number</i> } Example: Router(config-qrg)# replicate-qam qam-red3/5.1	configures the replicate (destination) QAM. Note Effective from Cisco IOS-XE Release 3.4.0SQ, the keywords qam , Qam , qam-red , or Qam-red must be explicitly typed. Typing q or Q and pressing the Tab will not autocomplete the command.
Step 6	end Example: Router# end	Returns to privileged EXEC mode.

Replicating a single QAM from slot 3 port 2 channel 30 to slot 3 port 4 channel 58:

```
Router(config)# cable qam-replication-group 1
Router(config-qrg)# pilot-qam Qam3/2.30
Router(config-qrg)# replicate-qam Qam3/4.58
```

Replicating a single QAM from slot 7 port 5 channel 123 to slot 7 port 4 channel 95 and to slot 7 port 1 channel 11:

```
Router(config)# cable qam-replication-group 6
Router(config-qrg)# pilot-qam Qam7/5.123
Router(config-qrg)# replicate-qam Qam7/4.95
Router(config-qrg)# replicate-qam Qam7/1.11
```

Following is an example of the **show running-config** command when the QAM channel 5/1.1 is replicated to 5/2.1:

```
Router# show running-config interface Qam5/1.1
Building configuration...
Current configuration : 398 bytes
!
interface Qam5/1.1
 cable carrier-id 1
 cable mode video remote encrypt
 cable downstream lqam-group 1
 cable downstream tsid 53001
 cable downstream rf-profile rfprofile_video
 cable downstream rf-power 37.0
 cable downstream frequency 285000000
 no cable downstream rf-shutdown
 cable downstream interleaver-depth I128-J1
 cable qam-replication-group 2 pilot
 cable partition 1 external-channel 1
end
Router# show running-config interface Qam5/2.1
Building configuration...
Current configuration : 88 bytes
!
interface Qam5/2.1
 cable carrier-id 21
 cable qam-replication-group 2 replicate
end
```



Note

In the above example, the replicate interface does not show the “cable downstream rf-shutdown” entry, which otherwise is displayed. This is because, both the pilot and replicate channels are part of qam-replication-group 2.

For the pilot QAM:

```
Router# show controllers Qam 5/1.1 downstream
Qam 5/1.1 Downstream is up
RF Profile Name           : rfprofile_video
LQAM Group: 1 Id          : 0
Annex B, Power            : 37.0 dBmV
Frequency                 : 285000000 Hz, lane: 2, block: 1
Modulation                : 256QAM, TSID: 53001, QAM IDB_State: UP
Bandwidth Reserved for Video : 0 bps
Bandwidth Used            : 15040 bps
Bandwidth Total           : 38810700 bps
Transport Mode            : QAM_MODE_VIDEO Qam Owner: REMOTE
Qam License               : Exists
Interleave Level          : 2, FEC I: 128 FEC J: 1
SNMP LINK TRAP           : Disabled
Bandwidth Reserved for Video Shell Sessions: 0 bps
Bandwidth Used by Video Shell Sessions : 0 bps
```

For the replicate QAM:

```
Router# show controllers Qam 5/3.1 downstream
Qam 5/3.1 Downstream is up
```

```

Replicate of Pilot Qam 5/1.1
RF Profile Name           : rfprofile_video
LQAM Group                : 1 Id: 0
Annex B, Power            : 37.0 dBmV
Frequency: 285000000 Hz, lane : 2, block: 1
Modulation: 256QAM, TSID  : 53001, QAM IDB_State: UP
Bandwidth Reserved for Video : 0 bps
Bandwidth Used            : 15040 bps
Bandwidth Total          : 38810700 bps
Transport Mode           : QAM_MODE_VIDEO Qam Owner: REMOTE
Qam License              : Exists
Interleave Level         : 2, FEC I: 128 FEC J: 1
SNMP LINK TRAP          : Disabled
Bandwidth Reserved for Video Shell Sessions: 0 bps
Bandwidth Used by Video Shell Sessions : 0 bps

```

Following is an example of the **show cable video sessions** for a replicate QAM:

```

Router# show cable video session Qam5/3.1
Interface is a replicate. To view session information, use the same command on the pilot
interface Qam5/1.1

```

Following is a sample output of the **show cable qam-replication-group all** command:

```

Router# show cable qam-replication-group all

QRG   Pilot Qam   Replicate Qams
----   -
1     3/1.1        3/6.1, 3/7.1, 3/8.1
10    3/1.2        3/6.2, 3/8.2, 3/7.2
11    3/1.3        3/6.3, 3/7.3, 3/8.3

```

Following is a sample output of the **show cable qam-replication-group** command for a single group:

```

Router# show cable qam-replication-group 10

QRG   Pilot Qam   Replicate Qams
----   -
10    3/1.2        3/6.2, 3/8.2, 3/7.2

```

What to Do Next

Repeat this configuration for every group. Port-level replication is not supported.

Enabling Cisco RFGW-10 DS-384 Line Card Reset

Bass SEU interrupts are single event upset (SEU) interrupts received from Bass field-programmable gate array (FPGA). You can enable Cisco RFGW-10 DS-384 line card reset when a Bass SEU interrupt is received.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	service bass-seu-interrupt Example: Router (config)# service bass-seu-interrupt	Resets the Cisco RFGW-10 DS-384 line card.

How to Configure DEPI on a QAM Interface

All QAM carriers on an RF port can be used on the DEPI as long as the QAM subinterface is configured for DEPI mode.

Restrictions

To use DEPI, run the **cable mode depi** command to reserve bandwidth for the mid-plane.

The **cable mode depi local lbg** command is used to specify the load balancing group (LBG) that can be used to forward traffic to the line card. However, for remote DEPI, the system reserves the bandwidth of the LBG that is least loaded.

For more information on Configuring Manual DEPI Sessions, see [M-CMTS DEPI](#).

How to Configure a Line Card Switchover

During a line card switchover to a redundant or standby line card, the QAM configuration, logical profile ID, QAM ID mapping, and frequency ID assignments of the primary line card remain unchanged and are reapplied on the standby line card.

Enabling Kernel Dumper for RFGW-10 DS-384 Line Card

When the execution of the kernel is disrupted, a kernel dumper program is invoked. The following events can cause a kernel disruption:

- Kernel Panic
- Non Maskable Interrupts
- Machine Check Exceptions
- Hardware Failure
- Manual Intervention

When there is a kernel crash, the kernel sends one of the above exception signals to the kernel dumper program. The kernel dumper program collects the following information:

- Kernel memory
- Current process information during kernel crash
- Kernel registers
- CPU and memory usage of the monitoring function
- All active process TLB's
- Reboot reason

Once the kernel collects the dumps, the dump logs are compressed and written to the line card flash and a normal reboot is invoked.

By default, the kernel dumper feature is enabled for the line cards in the Line Card Redundancy (LCRED) group and disabled for standalone cards. You can enable or disable this feature for a line card using the **cable slot slot number kdumper enable** command.

To enable kernel dumper for a RFGW-10 DS-384 line card:

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	cable slot slot number kdumper enable Example: Router(config)# cable slot 3 kdumper enable	Enables the kernel dumper feature for the specified line card. <ul style="list-style-type: none"> <i>slot number</i>—Slot number of the line card. The valid range is from 3 to 12. <p>Note This CLI command is supported for RFGW-10 DS-384 line card and not for DS-48/TCC card. Use the no form of the command to disable this feature.</p>

Configuration Examples of the QAM Features for the Cisco RFGW-10 DS-384 Line Card

This section describes a sample user scenario with the following configuration:

- User licence on the Cisco RFGW-10 DS-384 line card: DS-96 (96 downstream channels)
- Four service groups connected to four RF ports on the line card
- Eight contiguous carriers on every port: 32 carriers
- Center frequencies on the RF port: 717 MHz, 723 MHz, 729 MHz, 735 MHz, 741 MHz, 747 MHz, 753 MHz, and 759 MHz

User Requirements

To use QAM 64 in the highest two carriers in the channel lineup.

Recommendation

Configure two RF profiles that can be used for four logical groups in the upconverter as follows:

RF Profile 1

- Logical Group 1 – QAM 64, Annex B

RF Profile 2

- Logical Group 2 – QAM 256, Annex B
- Logical Group 3 – QAM 256, Annex B
- Logical Group 4 – QAM 256, Annex B

The carriers in the logical group can be assigned as:

- Logical Group 1: 3/1.7, 3/1.8, 3/2.7, 3/2.8, 3/3.7, 3/3.8, 3/4.7, 3/4.8
- Logical Group 2: 3/1.1, 3/1.2, 3/1.3, 3/1.4, 3/1.5, 3/1.6, 3/2.1, 3/2.2
- Logical Group 3: 3/2.3, 3/2.4, 3/2.5, 3/2.6, 3/3.1, 3/3.2, 3/3.3, 3/3.4
- Logical Group 4: 3/3.5, 3/3.6, 3/4.1, 3/4.2, 3/4.3, 3/4.4, 3/4.5, 3/4.6

With a default starting frequency of 234 MHz, the lane and block frequencies can be configured as described in the table below:

Table 5: Suggested Lane and Block Frequencies

Lane	Starting Frequency	Block 1 Start	Block 2 Start	Block 3 Start	Block 4 Start
1	234	234	282	330	378
2	426	426	474	522	570
3	618	618	666	714	762
4	810	810	858	906	954

Configuring a QAM Subinterface

The following example shows how a QAM subinterface is configured:



Note

QAM subinterfaces are not visible in the configuration until the density at the port is configured:

```
Router# configure terminal
Router(config)# interface qam 3/1
Router(config-subif)# cable downstream max-carriers 8
```

The following output displays the QAM subinterfaces:

```
Interface Qam3/1
  No ip address
  cable downstream rf-shutdown
  cable downstream max-carriers 8
!
interface Qam3/1.1
  cable downstream rf-power 57
```

```

    cable downstream rf-shutdown
!
interface Qam3/1.2
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/1.3
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/1.4
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/1.5
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/1.6
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/1.7
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/1.8
    cable downstream rf-power 57
    cable downstream rf-shutdown
!
interface Qam3/2
    no ip address
    cable downstream rf-shutdown
!
Interface Qam3/3
    no ip address
    cable downstream rf-shutdown
!
Interface Qam3/4
    no ip address
    cable downstream rf-shutdown
!
Interface Qam3/5
    no ip address
    cable downstream rf-shutdown
!
Interface Qam3/6
    no ip address
    cable downstream rf-shutdown
!
Interface Qam3/7
    no ip address
    cable downstream rf-shutdown
!
Interface Qam3/8
    no ip address
    cable downstream rf-shutdown
!

```

Configuring Downstream RF Parameters

Before configuring carrier center frequencies, the following should be configured:

- A unique Annex mode for the QAM via the rf-profile assignment
- A freq-profile or the start-freq at the port level

To configure and manage the QAM RF profile:

- 1 Create an RF profile, if an RF profile does not exist. See "Creating an RF Profile" section below.

- 2 Assign the profile ID to a given QAM interface. See "Assigning an RF Profile to a QAM Subinterface" section below.

Creating an RF Profile

The following example shows how to create an RF profile:



Note Interleaver depth provides protection from bursts of noise on the hybrid fiber coaxial (HFC) network. For more information on the commands to configure the interleaver depth, see the [Cisco RF Gateway 10 Command Reference](#).

```
Router# configure terminal
Router(config)# cable downstream rf-profile 1
Router(config-rfprof)# cable downstream modulation 64
Router(config-rfprof)# cable downstream annex A
Router(config-rfprof)# cable downstream interleaver-depth option1 I128-J1 option2 I32-J4
```



Note If the Annex mode is set to Annex A, configure the symbol rate using the cable downstream symbol rate command.

Assigning an RF Profile to a QAM Subinterface

After configuring the profile, the RF profile must be assigned to a QAM subinterface in the chassis.



Note An Annex type must be configured on a port before the RF profile is assigned on any one of its QAM subinterfaces; otherwise Annex B is taken as the default Annex type on all ports.



Note An rf-profile with Annex B can be configured and then applied either at the QAM subinterface level or at the port level. If the rf-profile is applied at the port level, all QAMs on that port are configured with this rf-profile.

The following example shows how to assign an RF profile to a QAM subinterface:

```
Router(config)# interface qam 3/1
Router(config-subif)# cable downstream annex A
Router(config-subif)# exit
Router(config)# interface qam 3/1.7
Router(config-subif)# cable downstream rf-profile 1
Router(config-subif)# cable downstream interleaver-depth I32-J4
Router(config-subif)# exit
Router(config)# interface qam 3/1.8
Router(config-subif)# cable downstream rf-profile 1
Router(config-subif)# cable downstream interleaver-depth I128-J1
Router(config-subif)# end
```

Configuring the LQAM Group ID

The following examples show how to configure the LQAM Group ID.

Manual DEPI configuration

```
interface Qam-red4/2.1
cable carrier-id 141
cable mode depi local lbg 1
cable downstream lqam-group 13
cable downstream tsid 501
cable downstream rf-profile local_64_16
cable downstream rf-power 41.0
cable downstream frequency 675000000
cable downstream rf-shutdown
cable downstream interleaver-depth I16-J8
cable depi dest-ip 192.168.5.10
```

Remote DEPI configuration

```
interface Qam-red4/1.1
cable carrier-id 1
cable mode depi remote learn
cable downstream lqam-group 1
cable downstream tsid 101
depi depi-tunnel s_6/1/0
```

Configuring RF Power

When a QAM subinterface is created, the Cisco RF Gateway 10, by default, assigns RF power to the QAM based on the number of combined carriers on the port. However, RF power output can be changed by using the cable downstream rf-power command.

The following example shows how to change the RF output power on a carrier to 50.5 dBmV:

```
Router# configure terminal
Router(config)# interface qam 3/1.7
Router(config-subif)# cable downstream rf-power 50.5
Router(config-subif)# end
```

Configuring Downstream Frequency

To configure downstream frequency two methods can be used:

- Use the **cable downstream frequency** command at the port level to identify the lower edge starting frequency. This command creates a single lane using two blocks on each RF port.

```
Router(config)# interface qam 3/1
Router(config-subif)# cable downstream frequency 627000000
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream frequency 714000000
Router(config)# interface qam 3/1.2
Router(config-subif)# cable downstream frequency 720000000
Router(config)# interface qam 3/1.3
Router(config-subif)# cable downstream frequency 726000000
Router(config)# interface qam 3/1.4
Router(config-subif)# cable downstream frequency 732000000
Router(config)# interface qam 3/1.5
Router(config-subif)# cable downstream frequency 738000000
Router(config)# interface qam 3/1.6
Router(config-subif)# cable downstream frequency 744000000
Router(config)# interface qam 3/1.7
Router(config-subif)# cable downstream frequency 750000000
Router(config)# interface qam 3/1.8
Router(config-subif)# cable downstream frequency 756000000
```


- Specify a frequency plan by configuring the lane and block frequencies, and assigning them to each carrier.



Note Assigning a freq-profile ID on an RF port overwrites the start-frequency that is preassigned at the RF port. Use the show cable freq-profile command to display the frequency profile on the RF port.

```
Router(config)# cable downstream freq-profile 1
Router(config-frq)# lane 1 start-freq 627000000
Router(config-frq-ln)# block 1 start-freq 714000000
Router(config-frq-ln)# end
Router(config)# interface qam 3/1
Router(config-subif)# cable downstream freq-profile 1
Router(config)# interface qam 3/1.1
Router(config-subif)# cable downstream frequency 714000000
Router(config)# interface qam 3/1.2
Router(config-subif)# cable downstream frequency 720000000
Router(config)# interface qam 3/1.3
Router(config-subif)# cable downstream frequency 726000000
Router(config)# interface qam 3/1.4
Router(config-subif)# cable downstream frequency 732000000
Router(config)# interface qam 3/1.5
Router(config-subif)# cable downstream frequency 738000000
Router(config)# interface qam 3/1.6
Router(config-subif)# cable downstream frequency 744000000
Router(config)# interface qam 3/1.7
Router(config-subif)# cable downstream frequency 750000000
Router(config)# interface qam 3/1.8
Router(config-subif)# cable downstream frequency 756000000
```

The following is a sample output that displays a portion of the **show running-configuration** command:

```
Interface Qam3/1
  cable downstream freq-profile 1
  cable downstream rf-shutdown
  cable downstream max-carriers 8
!
.....
interface Qam3/1.7
  cable downstream rf-profile 1
  cable downstream rf-power 57
  cable downstream frequency 750000000 lane 1 block 1
  cable downstream rf-shutdown
!
interface Qam3/1.8
  cable downstream rf-profile 1
  cable downstream rf-power 57
  cable downstream frequency 756000000 lane 1 block 1
  cable downstream rf-shutdown
!
interface Qam3/2
  no ip address
  cable downstream rf-shutdown
!
Interface Qam3/3
  cable downstream rf-shutdown
```

Troubleshooting QAM Features

Use the following commands to troubleshoot and debug the QAM features on the Cisco RFGW-10 DS-384 line card:

- **show cable rf-profile**
- **show cable freq-profile**
- **show cable linecard version**
- **show cable linecard carrier-id-mapping**
- **show cable linecard logical-qamid-grp**
- **debug cable qam events**
- **debug cable qam messages**
- **debug cable qam trace**
- **debug cable qam lcred**
- **debug cable qam errors**
- **debug cable qam config**

Additional References

Related Documents

Related Topic	Document Title
Bundle Image Upgrade—allows efficient upgrade of multiple devices simultaneously by programming them with a new image.	Bundled Image Upgrade
Alarm and Event Management—provides information about previous and current events in the system.	Alarm and Event Management
DOCSIS Timing Interface (DTI) Offset—enables DOCSIS timing offset adjustment.	DTI Offset
M-CMTS D-MPT Manual Mode—processes D-MPT traffic from the M-CMTS core.	D-MPT
M-CMTS DEPI	M-CMTS DEPI
Line Card Redundancy—supports two types of line card redundancy, 1:1 and 1:N	1:1 and 1:N Line Card Redundancy
Cisco RFGW-10 commands	Cisco RF Gateway 10 Command Reference
Release Notes for Cisco RF Gateway 10	Release Notes

Standards and RFCs

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

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

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring QAM Features for the DS-384 Line Card

The table below lists the release history for this feature.

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://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

**Note**

The following 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 6: Feature Information for Configuring QAM Features for the DS-384 Line Card on the Cisco RF Gateway 10

Feature Name	Release	Feature Information
Configuring QAM Features for the DS-384 Line Card on the Cisco RF Gateway 10	IOS-XE Release 3.2.0SQ	This feature was introduced. The following commands were introduced or modified: <ul style="list-style-type: none"> • cable start-freq • cable freq-profile • cable frequency (channel) • show cable linecard carrier-id-mapping
QAM Replication	Cisco IOS-XE Release 3.3.0SQ	This feature allows users to replicate a single QAM output from one port to another port on the same Cisco DS-384 line card from the Supervisor card. The following commands were introduced or modified: <ul style="list-style-type: none"> • cable qam-replication group • pilot-qam • replicate-qam • show cable qam-replication-group

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see [What's New in Cisco Product Documentation](#).

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the [What's New in Cisco Product Documentation RSS feed](#). RSS feeds are a free service.