QAM Profile

A QAM profile describes the common downstream channel modulator settings, referred to as physical layer parameters. This includes QAM constellation, symbol rate, interleaver-depth, spectrum-inversion, and annex.

For more information about the downstream interface configuration, see Downstream Interface Configuration.

But be aware that, if you configure annex A 6MHz or 7MHz in a QAM profile, then this QAM profile cannot be applied to a DOCSIS channel.

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- How to Configure the Video QAM Carriers, on page 4
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QAM Profile

A QAM profile describes the common downstream channel modulator settings, referred to as physical layer parameters. This includes QAM constellation, symbol rate, interleaver-depth, spectrum-inversion, and annex.

For more information about the downstream interface configuration, see Downstream Interface Configuration.

But be aware that, if you configure annex A 6MHz or 7MHz in a QAM profile, then this QAM profile cannot be applied to a DOCSIS channel.

How to Configure the Video QAM Carriers

Configuring the Video QAM Profile

To configure the video QAM profile, complete the following procedure:

```
configure terminal
cable downstream qam-profile id
annex {A freq_spacing|B|C}
modulation value
```

```
interleaver-depth value
symbol-rate value
spectrum-inversion {on|off} [interop]
description line
```

The frequency spacing of 6MHz, 7MHz and 8 MHz can be selected or annex A. In this case, the QAM profile can only be applied to a video channel.

Spectrum Inversion

Spectrum inversion happens because of mixing processes in RF or IF electronics. Spectrum inversion allows for the adaptation of older equipment with the new plant. The mixing of I and Q are used to create a quadrant profile. For some set-tops, the inversion of the quadrant profile is needed where the axis are flipped such that I represents the X and Q represents the Y-axis. Most modern equipment can detect and resolve the inversion split.

You can change this spectrum inversion configuration on a user-defined qam-profile. It cannot be changed on a system generated qam-profile from 0 to 5.

Currently, spectrum inversion configuration in QAM profile has different results between Cisco RPD and the RPD from other vendors. Starting from Cisco IOS XE Bengaluru 17.6.1w release, a new option **interop** is added to the **spectrum-inversion** configuration command. If you configure the interop keyword, cBR-8 sends a vendor specific TLV to reverse the spectrum inversion inside the RPD. You can configure a single profile for both Cisco RPD and other vendor's RPD using this configuration. This enables legacy set-up boxes to detect the spectrum inversion automatically.

To configure spectrum inversion on single QAM profile:

```
cable downstream qam-profile id
spectrum-inversion {on|off} interop
```

Configuration Example

```
cable downstream qam-profile 10
spectrum-inversion off interop
```

When using the inversion flag in combination with different **annex** types, the following table shows the spectrum inversion output on a Cisco RPD:

Table 1: Spectrum Inversion Output on a Cisco RPD

spectrum-inversion command option	annex A	annex B	annex B
on	normal	inverted	normal
off	inverted	normal	inverted
on interop	inverted	inverted	inverted
off interop	normal	normal	normal

Configuring the Video QAM Carriers

To configure the Video QAM carriers, complete the following procedure:

```
configure terminal
controller integrated-cable slot/bay/port
rf-channel start-channel - end-channel
type video
start-frequency frequency
rf-output normal
power-adjust number
qam-profile qam-profile number
```

Note For video provisioning, the carriers must be of type “video” in the controller integrated-cable configuration.

Verify the configuration of the RF Channel

To verify the RF channel configuration, use the Show controller integrated-cable rf-chan command as shown in the example below:

```
Router#show controllers integrated-Cable 9/0/7 rf-channel 0-10
Load for five secs: 6%/0%; one minute: 5%; five minutes: 5%
Chan State Admin Frequency  Type   Annex Mod  srate Interleaver  dcid  power  output
0     UP   UP    100000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
1     UP   UP    106000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
2     UP   UP    112000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
3     UP   UP    118000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
4     UP   UP    124000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
5     UP   UP    130000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
6     UP   UP    136000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
7     UP   UP    142000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
8     UP   UP    148000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
9     UP   UP    154000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
10    UP   UP    160000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
```

Configuration Examples

This section provides configuration examples for the QAM video carrier.

Video QAM Carriers

The following is a sample for the Video QAM carrier configuration:

```
Router#enable
Router(config)#cable downstream qam-profile 4
Router(config-qam-prof)#annex A 6MHz
Router(config-qam-prof)#modulation 256
Router(config-qam-prof)#interleaver-depth I32-J4
Router(config-qam-prof)#symbol-rate 5361
Router(config-qam-prof)#spectrum-inversion off
Router(config-qam-prof)#description default-annex-a-256-qam
Router(config-qam-prof)#exit
Router(config)#controller Integrated-Cable 3/0/0
Router(config-controller)#max-carrier 128
Router(config-controller)#base-channel-power 34
Router(config-controller)#freq-profile 0
Router(config-controller)#rf-chan 0 95
```

```
Router(config-rf-chan)#type video
Router(config-rf-chan)#frequency 93000000
Router(config-rf-chan)#rf-output NORMAL
Router(config-rf-chan)#power-adjust 0
Router(config-rf-chan)#docsis-channel-id 1
Router(config-rf-chan)#qam-profile 1
```

Feature Information for QAM Video Carriers

Note The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 2: Feature Information for QAM Video Carriers

Feature Name	Releases	Feature Information
QAM Video Carriers	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
Annex A Variable Channel Witdh	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.

How to Configure the Video QAM Carriers

Configuring the Video QAM Profile

To configure the video QAM profile, complete the following procedure:

```
configure terminal
cable downstream qam-profile id
annex {A freq_spacing|B|C}
modulation value
interleaver-depth value
symbol-rate value
spectrum-inversion {on|off} [interop]
description line
```

The frequency spacing of 6MHz, 7MHz and 8 MHz can be selected or annex A. In this case, the QAM profile can only be applied to a video channel.

Spectrum Inversion

Spectrum inversion happens because of mixing processes in RF or IF electronics. Spectrum inversion allows for the adaptation of older equipment with the new plant. The mixing of I and Q are used to create a quadrant profile. For some set-tops, the inversion of the quadrant profile is needed where the axis are flipped such that

I represents the X and Q represents the Y-axis. Most modern equipment can detect and resolve the inversion split.

You can change this spectrum inversion configuration on a user-defined qam-profile. It cannot be changed on a system generated qam-profile from 0 to 5.

Currently, spectrum inversion configuration in QAM profile has different results between Cisco RPD and the RPD from other vendors. Starting from Cisco IOS XE Bengaluru 17.6.1w release, a new option **interop** is added to the **spectrum-inversion** configuration command. If you configure the interop keyword, cBR-8 sends a vendor specific TLV to reverse the spectrum inversion inside the RPD. You can configure a single profile for both Cisco RPD and other vendor's RPD using this configuration. This enables legacy set-up boxes to detect the spectrum inversion automatically.

To configure spectrum inversion on single QAM profile:

```
cable downstream qam-profile id
spectrum-inversion {on|off} interop
```

Configuration Example

```
cable downstream qam-profile 10
spectrum-inversion off interop
```

When using the inversion flag in combination with different **annex** types, the following table shows the spectrum inversion output on a Cisco RPD:

Table 3: Spectrum Inversion Output on a Cisco RPD

spectrum-inversion command option	annex A	annex B	annex B
on	normal	inverted	normal
off	inverted	normal	inverted
on interop	inverted	inverted	inverted
off interop	normal	normal	normal

Configuring the Video QAM Carriers

To configure the Video QAM carriers, complete the following procedure:

```
configure terminal
controller integrated-cable slot/bay/port
rf-channel start-channel - end-channel
type video
start-frequency frequency
rf-output normal
power-adjust number
qam-profile qam-profile number
```

Note For video provisioning, the carriers must be of type "video" in the controller integrated-cable configuration.

Verify the configuration of the RF Channel

To verify the RF channel configuration, use the Show controller integrated-cable rf-chan command as shown in the example below:

```
Router#show controllers integrated-Cable 9/0/7 rf-channel 0-10
Load for five secs: 6%/0%; one minute: 5%; five minutes: 5%
Chan State Admin Frequency  Type   Annex Mod  srate Interleaver  dcid  power  output
0     UP   UP    100000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
1     UP   UP    106000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
2     UP   UP    112000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
3     UP   UP    118000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
4     UP   UP    124000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
5     UP   UP    130000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
6     UP   UP    136000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
7     UP   UP    142000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
8     UP   UP    148000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
9     UP   UP    154000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
10    UP   UP    160000000  VIDEO   A    256   5361  I12-J17      -    34.0   NORMAL
```

Configuration Examples

This section provides configuration examples for the QAM video carrier.

Video QAM Carriers

The following is a sample for the Video QAM carrier configuration:

```
Router#enable
Router(config)#cable downstream qam-profile 4
Router(config-qam-prof)#annex A 6MHz
Router(config-qam-prof)#modulation 256
Router(config-qam-prof)#interleaver-depth I32-J4
Router(config-qam-prof)#symbol-rate 5361
Router(config-qam-prof)#spectrum-inversion off
Router(config-qam-prof)#description default-annex-a-256-qam
Router(config-qam-prof)#exit
Router(config)#controller Integrated-Cable 3/0/0
Router(config-controller)#max-carrier 128
Router(config-controller)#base-channel-power 34
Router(config-controller)#freq-profile 0
Router(config-controller)#rf-chan 0 95
Router(config-rf-chan)#type video
Router(config-rf-chan)#frequency 93000000
Router(config-rf-chan)#rf-output NORMAL
Router(config-rf-chan)#power-adjust 0
Router(config-rf-chan)#docsis-channel-id 1
Router(config-rf-chan)#qam-profile 1
```

Feature Information for QAM Video Carriers

Note The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 4: Feature Information for QAM Video Carriers

Feature Name	Releases	Feature Information
QAM Video Carriers	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
Annex A Variable Channel Witdh	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.