



Support for Extended Upstream Frequency Ranges

Cisco IOS Release 12.2(15)BC2 adds support for the extended upstream frequency range that is used in cable networks in Japan and other areas. This feature also clarifies the configuration of DOCSIS and EuroDOCSIS networks, so that the router shows only those upstream and downstream frequencies that are valid for each mode of operation.

Feature History for Extended Upstream Frequency Ranges

Release	Modification
Release 12.2(15)BC2	This feature was introduced.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for Extended Upstream Frequency Ranges

- The Cisco CMTS router must be running Cisco IOS Release 12.2(15)BC2 or later.
- The North American upstream frequency range (DOCSIS, 5 MHz to 42 MHz) is supported on all Cisco CMTS routers and all cable interfaces.
- The European upstream frequency range (EuroDOCSIS, 5 MHz to 65 MHz) is supported on the following platforms and cable interfaces:
 - Cisco uBR7111E and Cisco uBR7114E routers
 - Cisco uBR7246VXR router with the Cisco uBR-MC16E, Cisco uBR-MC16U/X, or Cisco uBR-MC28U/X cable interface line cards.
 - Cisco uBR10012 router with the Cisco uBR-LCP2-MC16E or Cisco uBR-MC5X20U cable interface line cards.
- The Japanese extended upstream frequency range (5 MHz to 55 MHz) is supported on the following platforms and cable interfaces:
 - Cisco uBR7111E and Cisco uBR7114E routers
 - Cisco uBR7246VXR router with the Cisco uBR-MC16E, Cisco uBR-MC16U/X, or Cisco uBR-MC28U/X cable interface line cards.
 - Cisco uBR10012 router with the Cisco uBR-LCP2-MC16E or Cisco uBR-MC5X20U cable interface line cards.
- The cable physical plant must be configured with upconverters, filters, and other equipment that supports the desired frequency range and DOCSIS modes of operation.

Restrictions for Extended Upstream Frequency Ranges

- The RF modulation format should be configured for ITU J.112 Annex A for EuroDOCSIS operations, and for ITU J.83 Annex B for DOCSIS and Japanese operations. While it is possible to configure the modulation format differently, we do not recommend this because it violates the DOCSIS and EuroDOCSIS specifications.
- The ITU J.83 Annex C specification is not supported.
- You cannot configure the router for a particular frequency range if an upstream or spectrum group on the router is currently configured for a frequency that is invalid for the new range. If you try to do so, the command is ignored and a warning message is printed prompting you to reconfigure the upstream or spectrum group before retrying the command.

Information About Extended Upstream Frequency Ranges

The original Data-over-Cable Service Interface Specifications (DOCSIS) specified a range of downstream and upstream frequencies that were compatible only with the North American National Television Systems Committee (NTSC) channel plans. Those specifications have been enhanced to provide support for other cable systems.

Frequency Ranges Currently in Use

Table 1 lists the specifications that are commonly used in cable plants at the current time:

Table 1 Frequency Specifications

Region	Channel Plan	Radio Frequency (RF) ¹ Modulation Format	Downstream Frequency Range	Upstream Frequency Range
North American (DOCSIS)	6 MHz NTSC ²	ITU J.83 Annex B	85 MHz to 860 MHz	5 MHz to 42 MHz
European (EuroDOCSIS)	8 MHz PAL ³ /SECAM ⁴	ITU J.112 Annex A	85 MHz to 860 MHz	5 MHz to 65 MHz
Japan ⁵	6 MHz NTSC	ITU J.83 Annex B	70 MHz to 860 MHz	5 MHz to 55 MHz

1. The RF Modulation Format column shows the configuration that is required for operation in normal DOCSIS and EuroDOCSIS networks. While it is possible to configure the Modulation Format differently than what is shown in this table, we do not recommend doing so.
2. NTSC = North American National Television Systems Committee
3. PAL = Phase Alternating Line
4. SECAM= Systeme Electronique Couleur Avec Memoire
5. CableLabs has not released an official version of the DOCSIS specification to support the extended Japanese upstream and downstream frequency ranges.

Extended Frequency Support for Downstreams

All current Cisco cable interface line cards support downstream frequencies between 54 MHz and 860 MHz, which is a superset of the DOCSIS and EuroDOCSIS downstream frequency range. This allows those cards to automatically support the extended downstream frequency range of Japanese networks, assuming that the appropriate upconverters, filters, and other supporting equipment is also installed in the cable plant.

Extended Frequency Support for Upstreams

To support the different upstream frequency ranges, Cisco IOS Release 12.2(15)BC2 introduces a new command, **cable freq-range**, which configures the Cisco CMTS router for the maximum allowable range of frequencies that can be used on the router. This command makes these frequencies available only for those cable interfaces that support them.



Tip

The **cable freq-range** command is not normally needed except to enable EuroDOCSIS operations on the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cards. However, it can be used in other situations to ensure that the other **cable upstream** commands do not allow frequencies outside of the desired range.

Support for the different frequency ranges depends on the cable interfaces being used:

- Cisco uBR-MC16E cable interface line card and the Cisco uBR7111E/7114E routers—Support the EuroDOCSIS frequency range, which is the default mode of operation.
- Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20U cable interface line cards—Support the Japanese extended frequency range and the EuroDOCSIS frequency range, and the Japanese range is the default mode of operation.
- All other cable interfaces—Support the DOCSIS frequency range, which is the default mode of operation.

If a cable interface card does not support the frequency range that is configured with the **cable freq-range** command, a warning message is displayed. The card interface card, however, can continue to be used with its normal set of frequencies.

For example, consider the case where a Cisco uBR7246VXR router has a Cisco uBR-MC16C card and a Cisco uBR-MC28U card installed. By default, the Cisco uBR-MC16C card supports the DOCSIS frequency range, and the Cisco uBR-MC28U supports the Japanese frequency range. If you configure the router to support the EuroDOCSIS frequency range, only the Cisco uBR-MC28U card supports the extra downstream and upstream frequencies. The Cisco uBR-MC16C card, however, can continue to be used with the regular DOCSIS frequencies.

How to Configure the Upstream Frequency Range

To configure a Cisco CMTS router to use a particular range of upstream frequencies, use the following procedures:

- [Configuring DOCSIS Upstream Frequencies, page 4](#)
- [Configuring Extended DOCSIS Upstream Frequencies for Japan, page 6](#)
- [Configuring EuroDOCSIS Upstream Frequencies, page 8](#)



Note

You do not need any special configuration to be able to use the extended range of downstream frequencies that is used in Japanese networks, because all currently-supported Cisco cable interface line cards support a superset (54 MHz to 860 MHz) of the DOCSIS frequencies that include the Japanese range.

Configuring DOCSIS Upstream Frequencies

To configure one or more upstreams with a frequency in the valid DOCSIS range of 5 MHz to 42 MHz, use the following procedure.



Tip

This procedure typically is not needed, because by default all cable interfaces support the DOCSIS frequency range. However, you might want to use this procedure for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cable interface line cards to specify that these cards use a narrower DOCSIS frequency filter that would filter out any noise in the frequencies above 42 MHz, which might improve RF performance on some cable plants.

Prerequisites

All Cisco CMTS platforms and cable interfaces support the North American range of upstream frequencies.

Restrictions

All cable interfaces in the router must be using the North American upstream frequency range.

Any upstreams that are currently configured for frequencies greater than 42 MHz must be reconfigured to use a lower frequency, using the **cable upstream frequency** interface command, before beginning this procedure.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable freq-range north-american**
4. **interface cable** {*x/y* | *x/y/z*}
5. **cable downstream annex b**
6. **cable upstream** *n* **frequency** *frequency*
7. **exit**
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable Router#	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.
Step 3	cable freq-range north-american Example: Router(config)# cable freq-range north-american Router(config)#	Configures the Cisco CMTS router for the DOCSIS upstream frequency range (5 MHz to 42 MHz). Note This command will fail if any upstreams are currently configured with frequencies greater than 42 MHz. Use the cable upstream frequency command to reconfigure these upstreams for a lower frequency and then re-enter this command.

	Command or Action	Purpose
Step 4	<pre>interface cable {x/y x/y/z}</pre> <p>Example: <pre>Router(config)# interface cable 3/0 Router(config-if)#</pre></p>	Enters interface cable configuration mode for the specified cable interface.
Step 5	<pre>cable downstream annex b</pre> <p>Example: <pre>Router(config-if)# cable downstream annex b Router(config-if)#</pre></p>	Configures the downstream for the Annex B (ITU J.83) RF mode, which is used in DOCSIS networks.
Step 6	<pre>cable upstream n frequency frequency</pre> <p>Example: <pre>Router(config-if)# cable upstream 0 frequency 32000000 Router(config-if)#</pre></p>	<p>Configures the upstream for the desired frequency in Hertz. The valid range for <i>n</i> starts with 0 and depends on the number of upstream ports for this downstream. The valid range for <i>frequency</i> is 5000000 to 42000000.</p> <p>Note Repeat this command for each upstream port for this downstream.</p>
Step 7	<pre>exit</pre> <p>Example: <pre>Router(config-if)# exit Router(config)#</pre></p>	Exits interface configuration mode.
Step 8	<pre>exit</pre> <p>Example: <pre>Router(config)# exit Router#</pre></p>	Exits global configuration mode.

Configuring Extended DOCSIS Upstream Frequencies for Japan

To configure one or more upstreams with a frequency in the extended Japanese frequency range of 5 MHz to 55 MHz, use the following procedure.



Note

This procedure is not typically needed, because all of the cable interfaces listed in the [Prerequisites](#) section support the extended upstream frequency ranges in their default configuration. However, if you have configured a Cisco uBR-MC16U/X or Cisco uBR-MC28U/X card as described in the [“Configuring DOCSIS Upstream Frequencies”](#) section on page 4, you must use this procedure to re-enable the extended frequency range.

Prerequisites

The Japanese upstream frequency range (5 MHz to 55 MHz) is supported on the following platforms and cable interfaces:

- Cisco uBR7111E and Cisco uBR7114E routers
- Cisco uBR7246VXR router with the Cisco uBR-MC16E, Cisco uBR-MC16U/X, or Cisco uBR-MC28U/X cable interface line cards.

- Cisco uBR10012 router with the Cisco uBR-LCP2-MC16E or Cisco uBR-MC5X20U cable interface line cards.

Restrictions

All cable interfaces in the router must be using either the North American or the Japanese upstream frequency range.

Any upstreams that are currently configured for EuroDOCSIS, using frequencies greater than 55 MHz must be reconfigured for a lower frequency, using the **cable upstream frequency** interface command, before beginning this procedure.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable freq-range japanese**
4. **interface cable** {*x/y* | *x/y/z*}
5. **cable downstream annex b**
6. **cable upstream *n* frequency *frequency***
7. **exit**
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable Router#	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.
Step 3	cable freq-range japanese Example: Router(config)# cable freq-range japanese Router(config)#	Configures the Cisco CMTS router for the extended upstream frequency range (5 MHz to 55 MHz) that is used in Japanese cable networks. Note This command will fail if any upstreams are currently configured with frequencies greater than 55 MHz. Use the cable upstream frequency command to reconfigure these upstreams for a lower frequency and then re-enter this command.

	Command or Action	Purpose
Step 4	<pre>interface cable {x/y x/y/z}</pre> <p>Example: Router(config)# interface cable 3/0 Router(config-if)# </p>	Enters interface cable configuration mode for the specified cable interface.
Step 5	<pre>cable downstream annex b</pre> <p>Example: Router(config-if)# cable downstream annex b Router(config-if)# </p>	Configures the downstream for the Annex B (ITU J.83) RF mode, which is used in DOCSIS networks.
Step 6	<pre>cable upstream n frequency frequency</pre> <p>Example: Router(config-if)# cable upstream 0 frequency 32000000 Router(config-if)# </p>	<p>Configures the upstream for the desired frequency in Hertz. The valid range for <i>n</i> starts with 0 and depends on the number of upstream ports for this downstream. The valid range for <i>frequency</i> is 5000000 to 55000000.</p> <p>Note Repeat this command for each upstream port for this downstream.</p>
Step 7	<pre>exit</pre> <p>Example: Router(config-if)# exit Router(config)# </p>	Exits interface configuration mode.
Step 8	<pre>exit</pre> <p>Example: Router(config)# exit Router# </p>	Exits global configuration mode.

Configuring EuroDOCSIS Upstream Frequencies

To configure one or more upstreams with a frequency in the valid EuroDOCSIS range of 5 MHz to 65 MHz, use the following procedure.



Tip

This command is not normally needed with the Cisco UBR-MC5X20U cable interface line card, because by default it supports upstream frequencies up to 65 MHz. However, if you have used one of the previous procedures, [Configuring DOCSIS Upstream Frequencies, page 4](#) or [Configuring Extended DOCSIS Upstream Frequencies for Japan, page 6](#), to limit the frequency range, you must use this procedure to re-enable the EuroDOCSIS frequency range.

Prerequisites

The European upstream frequency range (EuroDOCSIS, 5 MHz to 65 MHz) is supported on the following platforms and cable interfaces:

- Cisco uBR7111E and Cisco uBR7114E routers
- Cisco uBR7246VXR router with the Cisco uBR-MC16E, Cisco uBR-MC16U/X, or Cisco uBR-MC28U/X cable interface line cards.

- Cisco uBR10012 router with the Cisco uBR-LCP2-MC16E or Cisco uBR-MC5X20U cable interface line cards.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable freq-range european**
4. **interface cable** {*x/y* | *x/y/z*}
5. **cable downstream annex a**
6. **cable upstream** *n* **frequency** *frequency*
7. **exit**
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable Router#	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.
Step 3	cable freq-range european Example: Router(config)# cable freq-range european Router(config)#	Configures the Cisco CMTS router for the EuroDOCSIS upstream frequency range (5 MHz to 65 MHz).
Step 4	interface cable { <i>x/y</i> <i>x/y/z</i> }	Enters interface cable configuration mode for the specified cable interface.
Step 5	cable downstream annex a Example: Router(config-if)# cable downstream annex a Router(config-if)#	Configures the downstream for the Annex A (ITU J.112) RF mode, which is used in EuroDOCSIS networks. Note You must configure the downstream for Annex A for EuroDOCSIS operations. You can configure certain cable interface cards (such as the Cisco uBR-MC28U) for both Annex B (DOCSIS) and the EuroDOCSIS frequency range, but this violates the DOCSIS specifications and should not be used on standard DOCSIS networks.

	Command or Action	Purpose
Step 6	Command: <code>cable upstream n frequency frequency</code> Example: <pre>Router(config-if)# cable upstream 0 frequency 32000000 Router(config-if)#</pre>	Configures the upstream for the desired frequency in Hertz. The valid range for <i>n</i> starts with 0 and depends on the number of upstream ports for this downstream. The valid range for <i>frequency</i> is 5000000 to 65000000. Note Repeat this command for each upstream port for this downstream.
Step 7	Command: <code>exit</code> Example: <pre>Router(config-if)# exit Router(config)#</pre>	Exits interface configuration mode.
Step 8	Command: <code>exit</code> Example: <pre>Router(config)# exit Router#</pre>	Exits global configuration mode.

Configuration Examples for Extended Upstream Frequency Ranges

This section provides the following examples of sample configurations for the cable interface:

- [North American \(DOCSIS\) Frequency Range Configuration Example](#)
- [European \(EuroDOCSIS\) Frequency Range Configuration Example](#)
- [Japanese Frequency Range Configuration Example](#)

North American (DOCSIS) Frequency Range Configuration Example

The following excerpt from a configuration file for the Cisco uBR7246VXR router shows a Cisco uBR-MC28U card and a Cisco uBR-MC16U card being configured for the default DOCSIS upstream frequency range of 5 MHz to 42 MHz. This frequency spectrum is allocated across two spectrum groups. Also, each downstream is configured for the DOCSIS Annex B mode.



Note

The `cable freq-range north-american` command is not needed for this configuration, but using the command filters out the upstream frequencies above 42 MHz, which could be useful if noise is occurring in those frequencies.

...

```
cable freq-range north-american
cable spectrum-group 1 shared
cable spectrum-group 1 band 5000000 23500000
cable spectrum-group 2 shared
cable spectrum-group 2 band 23500000 42000000
```

...

```
!  
interface Cable3/0  
  description Cisco uBR-MC28U cable interface DS0  
  ip address 10.2.4.1 255.255.255.0 secondary  
  ip address 10.2.3.1 255.255.255.0  
  cable downstream annex B  
  cable downstream modulation 64qam  
  cable downstream interleave-depth 32  
  cable downstream frequency 195000000  
  cable downstream channel-id 0  
  cable upstream 0 frequency 29008000  
  cable upstream 0 power-level 0  
  cable upstream 0 channel-width 3200000  
  cable upstream 0 minislots-size 2  
  cable upstream 0 modulation-profile 1  
  no cable upstream 0 shutdown  
  cable upstream 1 frequency 25808000  
  cable upstream 1 power-level 0  
  cable upstream 1 channel-width 3200000  
  cable upstream 1 minislots-size 2  
  cable upstream 1 modulation-profile 1  
  no cable upstream 1 shutdown  
  cable upstream 2 frequency 9808000  
  cable upstream 2 power-level 0  
  cable upstream 2 channel-width 3200000  
  cable upstream 2 minislots-size 2  
  cable upstream 2 modulation-profile 1  
  no cable upstream 2 shutdown  
  cable upstream 3 frequency 19408000  
  cable upstream 3 power-level 0  
  cable upstream 3 channel-width 3200000  
  cable upstream 3 minislots-size 2  
  cable upstream 3 modulation-profile 1  
  no cable upstream 3 shutdown  
  cable dhcp-giaddr policy  
  cable helper-address 10.2.0.2  
!  
interface Cable3/1  
  description Cisco uBR-MC28U cable interface DS1  
  ip address 10.2.5.1 255.255.255.0 secondary  
  ip address 10.2.4.1 255.255.255.0  
  cable downstream annex B  
  cable downstream modulation 64qam  
  cable downstream interleave-depth 32  
  cable downstream frequency 789000000  
  cable downstream channel-id 1  
  cable upstream 0 spectrum-group 1  
  cable upstream 0 power-level 0  
  cable upstream 0 channel-width 3200000  
  cable upstream 0 minislots-size 2  
  cable upstream 0 modulation-profile 1  
  no cable upstream 0 shutdown  
  cable upstream 1 spectrum-group 1  
  cable upstream 1 power-level 0  
  cable upstream 1 channel-width 3200000  
  cable upstream 1 minislots-size 2  
  cable upstream 1 modulation-profile 1  
  no cable upstream 1 shutdown  
  cable upstream 2 spectrum-group 2  
  cable upstream 2 power-level 0  
  cable upstream 2 channel-width 3200000  
  cable upstream 2 minislots-size 2  
  cable upstream 2 modulation-profile 1
```

```

no cable upstream 2 shutdown
cable upstream 3 spectrum-group 2
cable upstream 3 power-level 0
cable upstream 3 channel-width 1600000
cable upstream 3 minislots-size 4
cable upstream 3 modulation-profile 1
no cable upstream 3 shutdown
cable dhcp-giaddr policy
cable helper-address 10.2.0.2
!
interface Cable4/0
description Cisco uBR-MC16U cable interface
ip address 10.2.0.1 255.255.255.0 secondary
ip address 10.2.0.1 255.255.255.0
cable bundle 10 master
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 195000000
cable downstream channel-id 2
cable upstream 0 frequency 29008000
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislots-size 2
cable upstream 0 modulation-profile 1
cable upstream 0 shutdown
cable upstream 1 frequency 25808000
cable upstream 1 power-level 0
cable upstream 1 channel-width 3200000
cable upstream 1 minislots-size 2
cable upstream 1 modulation-profile 1
cable upstream 1 shutdown
cable upstream 2 frequency 9808000
cable upstream 2 power-level 0
cable upstream 2 channel-width 3200000
cable upstream 2 minislots-size 2
cable upstream 2 modulation-profile 1
cable upstream 2 shutdown
cable upstream 3 frequency 19408000
cable upstream 3 power-level 0
cable upstream 3 channel-width 3200000
cable upstream 3 minislots-size 2
cable upstream 3 modulation-profile 1
cable upstream 3 shutdown
cable upstream 4 frequency 35408000
cable upstream 4 power-level 0
cable upstream 4 channel-width 3200000
cable upstream 4 minislots-size 2
cable upstream 4 modulation-profile 1
cable upstream 4 shutdown
cable upstream 5 frequency 16208000
cable upstream 5 power-level 0
cable upstream 5 channel-width 3200000
cable upstream 5 minislots-size 2
cable upstream 5 modulation-profile 1
cable upstream 5 shutdown
cable dhcp-giaddr policy
cable helper-address 10.2.0.2
!
...

```

European (EuroDOCSIS) Frequency Range Configuration Example

The following excerpt from a configuration file for the Cisco uBR10012 router shows a Cisco uBRMC5X20U card being configured for the EuroDOCSIS frequency range of 5 MHz to 65 MHz. This frequency spectrum is allocated across a number of spectrum groups. Also, each downstream is configured for the EuroDOCSIS Annex A mode.

```
...
card 5/0 5cable-mc520u-d
...

cable freq-range european
cable spectrum-group 1 shared
cable spectrum-group 1 band 5000000 42000000
cable spectrum-group 2 shared
cable spectrum-group 2 band 5000000 30000000
cable spectrum-group 3 shared
cable spectrum-group 3 band 30000000 42000000
cable spectrum-group 4 band 5000000 10000000
cable spectrum-group 5 band 10000000 15000000
cable spectrum-group 6 band 15000000 20000000
cable spectrum-group 7 band 20000000 25000000
cable spectrum-group 8 band 25000000 30000000
cable spectrum-group 9 band 30000000 35000000
cable spectrum-group 10 band 35000000 42000000
cable spectrum-group 12 band 42000000 50000000
cable spectrum-group 13 band 5000000 55000000
cable spectrum-group 14 band 55000000 65000000

!
interface Cable5/0/0
 no ip address
 cable enable-trap cmonoff-notification
 cable bundle 1 master
 cable downstream annex A
 cable downstream modulation 256qam
 cable downstream interleave-depth 64
 cable downstream frequency 47100000
 cable downstream channel-id 0
 no cable downstream rf-shutdown
 cable upstream 0 spectrum-group 6
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 3200000
 cable upstream 0 minislots-size 2
 cable upstream 0 modulation-profile 21 22
 no cable upstream 0 shutdown
 cable upstream 1 spectrum-group 7
 cable upstream 1 power-level 0
 cable upstream 1 channel-width 1600000
 cable upstream 1 minislots-size 4
 cable upstream 1 modulation-profile 121 122
 no cable upstream 1 shutdown
 cable upstream 2 spectrum-group 8
 cable upstream 2 power-level 0
 cable upstream 2 channel-width 800000
 cable upstream 2 minislots-size 8
 cable upstream 2 modulation-profile 123 124
 no cable upstream 2 shutdown
 cable upstream 3 spectrum-group 14
 cable upstream 3 power-level 0
```

```

cable upstream 3 channel-width 400000
cable upstream 3 minislots-size 16
cable upstream 3 modulation-profile 22 23
no cable upstream 3 shutdown
!
interface Cable5/0/1
no ip address
load-interval 30
cable bundle 1
cable downstream annex A
cable downstream modulation 256qam
cable downstream interleave-depth 32
cable downstream frequency 471000000
cable downstream channel-id 0
no cable downstream rf-shutdown
cable upstream 0 spectrum-group 10
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislots-size 2
cable upstream 0 modulation-profile 122 123
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 2
cable upstream 1 power-level 0
cable upstream 1 channel-width 1600000
cable upstream 1 minislots-size 4
cable upstream 1 modulation-profile 124 125
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 3
cable upstream 2 power-level 0
cable upstream 2 channel-width 400000
cable upstream 2 minislots-size 16
cable upstream 2 modulation-profile 126 127
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 1
cable upstream 3 power-level 0
cable upstream 3 channel-width 200000
cable upstream 3 minislots-size 32
cable upstream 3 modulation-profile 125 128
no cable upstream 3 shutdown
!
interface Cable5/0/2
no ip address
load-interval 30
cable bundle 2
cable downstream annex A
cable downstream modulation 256qam
cable downstream interleave-depth 16
cable downstream frequency 453000000
cable downstream channel-id 0
no cable downstream rf-shutdown
cable upstream 0 spectrum-group 1
cable upstream 0 power-level 0
cable upstream 0 channel-width 1600000
cable upstream 0 minislots-size 4
cable upstream 0 modulation-profile 21 22
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 2
cable upstream 1 power-level 0
cable upstream 1 channel-width 3200000
cable upstream 1 minislots-size 2
cable upstream 1 modulation-profile 122 129
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 3
cable upstream 2 power-level 0

```

```
cable upstream 2 channel-width 800000
cable upstream 2 minislot-size 8
cable upstream 2 modulation-profile 123 126
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 1
cable upstream 3 power-level 0
cable upstream 3 channel-width 3200000
cable upstream 3 minislot-size 2
cable upstream 3 modulation-profile 22 23
no cable upstream 3 shutdown
!
interface Cable5/0/3
no ip address
cable bundle 3
cable downstream annex A
cable downstream modulation 256qam
cable downstream interleave-depth 16
cable downstream frequency 471000000
cable downstream channel-id 0
no cable downstream rf-shutdown
cable upstream 0 spectrum-group 6
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislot-size 2
cable upstream 0 modulation-profile 21 22
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 6
cable upstream 1 power-level 0
cable upstream 1 channel-width 1600000
cable upstream 1 minislot-size 4
cable upstream 1 modulation-profile 121 122
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 7
cable upstream 2 power-level 0
cable upstream 2 channel-width 800000
cable upstream 2 minislot-size 8
cable upstream 2 modulation-profile 123 124
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 7
cable upstream 3 power-level 0
cable upstream 3 channel-width 400000
cable upstream 3 minislot-size 16
cable upstream 3 modulation-profile 22 23
no cable upstream 3 shutdown
!
interface Cable5/0/4
no ip address
cable bundle 4
cable downstream annex A
cable downstream modulation 256qam
cable downstream interleave-depth 32
cable downstream frequency 471000000
cable downstream channel-id 0
no cable downstream rf-shutdown
cable upstream 0 spectrum-group 10
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislot-size 2
cable upstream 0 modulation-profile 22 24
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 10
cable upstream 1 power-level 0
cable upstream 1 channel-width 3200000
cable upstream 1 minislot-size 2
```

```

cable upstream 1 modulation-profile 122 129
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 15
cable upstream 2 power-level 0
cable upstream 2 channel-width 3200000
cable upstream 2 minislot-size 2
cable upstream 2 modulation-profile 125 124
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 15
cable upstream 3 power-level 0
cable upstream 3 channel-width 3200000
cable upstream 3 minislot-size 2
cable upstream 3 modulation-profile 22 23
no cable upstream 3 shutdown
no keepalive
!
```

Japanese Frequency Range Configuration Example

The following excerpt from a configuration file for the Cisco uBR7246VXR router shows a Cisco uBR-MC28U card and two Cisco uBR-MC16U cards being configured for the Japanese extended upstream frequency range of 5 MHz to 55 MHz. This frequency spectrum is allocated across three spectrum groups. Also, each downstream is configured for the DOCSIS Annex B mode.

```

...

cable freq-range japanese
cable spectrum-group 1 shared
cable spectrum-group 1 band 5000000 23500000
cable spectrum-group 2 shared
cable spectrum-group 2 band 23500000 42000000
cable spectrum-group 3 shared
cable spectrum-group 3 band 42000000 55000000

...

!
interface Cable3/0
description Cisco uBR-MC28U cable interface DS0
ip address 10.2.4.1 255.255.255.0 secondary
ip address 10.2.3.1 255.255.255.0
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 195000000
cable downstream channel-id 0
cable upstream 0 frequency 29008000
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislot-size 2
cable upstream 0 modulation-profile 1
no cable upstream 0 shutdown
cable upstream 1 frequency 25808000
cable upstream 1 power-level 0
cable upstream 1 channel-width 3200000
cable upstream 1 minislot-size 2
cable upstream 1 modulation-profile 1
no cable upstream 1 shutdown
cable upstream 2 frequency 44808000
cable upstream 2 power-level 0
cable upstream 2 channel-width 3200000
```

```
cable upstream 2 minislot-size 2
cable upstream 2 modulation-profile 1
no cable upstream 2 shutdown
cable upstream 3 frequency 19408000
cable upstream 3 power-level 0
cable upstream 3 channel-width 3200000
cable upstream 3 minislot-size 2
cable upstream 3 modulation-profile 1
no cable upstream 3 shutdown
cable dhcp-giaddr policy
cable helper-address 10.2.0.2
!
interface Cable3/1
description Cisco uBR-MC28U cable interface DS1
ip address 10.2.5.1 255.255.255.0 secondary
ip address 10.2.4.1 255.255.255.0
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 789000000
cable downstream channel-id 1
cable upstream 0 frequency 45408000
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislot-size 2
cable upstream 0 modulation-profile 1
no cable upstream 0 shutdown
cable upstream 1 frequency 16208000
cable upstream 1 power-level 0
cable upstream 1 channel-width 3200000
cable upstream 1 minislot-size 2
cable upstream 1 modulation-profile 1
no cable upstream 1 shutdown
cable upstream 2 frequency 6608000
cable upstream 2 power-level 0
cable upstream 2 channel-width 3200000
cable upstream 2 minislot-size 2
cable upstream 2 modulation-profile 1
no cable upstream 2 shutdown
cable upstream 3 frequency 41008000
cable upstream 3 power-level 0
cable upstream 3 channel-width 1600000
cable upstream 3 minislot-size 4
cable upstream 3 modulation-profile 1
no cable upstream 3 shutdown
cable dhcp-giaddr policy
cable helper-address 10.2.0.2
!
interface Cable4/0
description Cisco uBR-MC16U cable interface
ip address 10.2.0.1 255.255.255.0 secondary
ip address 10.2.0.1 255.255.255.0
cable bundle 10 master
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 195000000
cable downstream channel-id 2
cable upstream 0 frequency 29008000
cable upstream 0 power-level 0
cable upstream 0 channel-width 3200000
cable upstream 0 minislot-size 2
cable upstream 0 modulation-profile 1
cable upstream 0 shutdown
```

```

cable upstream 1 frequency 25808000
cable upstream 1 power-level 0
cable upstream 1 channel-width 3200000
cable upstream 1 minislots-size 2
cable upstream 1 modulation-profile 1
cable upstream 1 shutdown
cable upstream 2 frequency 9808000
cable upstream 2 power-level 0
cable upstream 2 channel-width 3200000
cable upstream 2 minislots-size 2
cable upstream 2 modulation-profile 1
cable upstream 2 shutdown
cable upstream 3 frequency 19408000
cable upstream 3 power-level 0
cable upstream 3 channel-width 3200000
cable upstream 3 minislots-size 2
cable upstream 3 modulation-profile 1
cable upstream 3 shutdown
cable upstream 4 frequency 35408000
cable upstream 4 power-level 0
cable upstream 4 channel-width 3200000
cable upstream 4 minislots-size 2
cable upstream 4 modulation-profile 1
cable upstream 4 shutdown
cable upstream 5 frequency 16208000
cable upstream 5 power-level 0
cable upstream 5 channel-width 3200000
cable upstream 5 minislots-size 2
cable upstream 5 modulation-profile 1
cable upstream 5 shutdown
cable dhcp-giaddr policy
cable helper-address 10.2.0.2
!
interface Cable5/0
description Cisco uBR-MC16U cable interface
no ip address
load-interval 30
cable bundle 10
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 453000000
cable downstream channel-id 4
no cable downstream rf-shutdown
cable upstream 0 spectrum-group 3
cable upstream 0 ingress-noise-cancellation 200
cable upstream 0 power-level 0
cable upstream 0 channel-width 200000 200000
cable upstream 0 minislots-size 32
cable upstream 0 modulation-profile 41
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 1
cable upstream 1 ingress-noise-cancellation 200
cable upstream 1 power-level 0
cable upstream 1 channel-width 1600000 1600000
cable upstream 1 minislots-size 4
cable upstream 1 modulation-profile 42
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 3
cable upstream 2 ingress-noise-cancellation 200
cable upstream 2 power-level 0
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 minislots-size 4
cable upstream 2 modulation-profile 42

```

```
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 3
cable upstream 3 ingress-noise-cancellation 200
cable upstream 3 power-level 0
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 minislots-size 4
cable upstream 3 modulation-profile 42
no cable upstream 3 shutdown
cable upstream 4 spectrum-group 3
cable upstream 4 ingress-noise-cancellation 200
cable upstream 4 power-level 0
cable upstream 4 channel-width 1600000 1600000
cable upstream 4 minislots-size 4
cable upstream 4 modulation-profile 42
no cable upstream 4 shutdown
cable upstream 5 spectrum-group 3
cable upstream 5 ingress-noise-cancellation 200
cable upstream 5 power-level 0
cable upstream 5 channel-width 1600000 1600000
cable upstream 5 minislots-size 4
cable upstream 5 modulation-profile 42
no cable upstream 5 shutdown
cable dhcp-giaddr policy
cable helper-address 10.2.0.2
!
...
```

Where to Go Next

For additional information on configuring the cable interfaces on the Cisco CMTS router, see the documentation listed in the [“Related Documents” section on page 20](#).

Additional References

The following sections provide references related to the Extended Upstream Frequency Ranges.

Related Documents

Related Topic	Document Title
CMTS Command Reference	<p><i>Cisco Broadband Cable Command Reference Guide</i>, at the following URL:</p> <p>http://www.cisco.com/univercd/cc/td/doc/product/cable/bbcmref/index.htm</p>
Software Configuration Information	<p>Cisco uBR7100 Series Software Configuration Guide, at the following URL:</p> <p>http://www.cisco.com/univercd/cc/td/doc/product/cable/ubr7100/scg7100/index.htm</p> <p><i>Cisco uBR7200 Series Software Configuration Guide</i>, at the following URL:</p> <p>http://www.cisco.com/univercd/cc/td/doc/product/cable/cab_rout/cr72scg/index.htm</p> <p>Cisco uBR10012 Universal Broadband Router Software Configuration Guide, at the following URL:</p> <p>http://www.cisco.com/univercd/cc/td/doc/product/cable/ubr10k/ubr10012/scg/index.htm</p>
Cable Features Configuration Guide	<p><i>Cisco CMTS Feature Guide</i>, at the following URL:</p> <p>http://www.cisco.com/univercd/cc/td/doc/product/cable/cab_rout/cmtsfg/index.htm</p>
Cisco IOS Release 12.2 Command Reference	<p>Cisco IOS Release 12.2 Configuration Guides and Command References, at the following URL:</p> <p>http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/index.htm</p>

Standards

Standards	Title
SP-RFIV1.1-I09-020830	Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 1.1
SP-RFIV2.0-I03-021218	Data-Over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 2.0

MIBs

MIBs	MIBs Link
<ul style="list-style-type: none"> CISCO-CABLE-SPECTRUM-MIB—the ranges CCSFrequency and CCSMeasuredFrequency were expanded to include the extended Japanese frequency range, as well as DOCSIS and EuroDOCSIS. 	<p>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p>http://www.cisco.com/go/mibs</p>

RFCs

No RFCs are supported by this feature.

Technical Assistance

Description	Link
<p>Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.</p>	<p>http://www.cisco.com/public/support/tac/home.shtml</p>

Command Reference

This section documents the following new or modified commands that are needed to configure the Extended Upstream Frequency Ranges.

- [cable freq-range](#)



Note

Other cable-specific commands are documented in the *Cisco Broadband Cable Command Reference Guide*, at the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/cable/bbcmref/index.htm>

All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

cable freq-range

To configure the Cisco CMTS router for the range of frequencies that are acceptable on upstreams, use the **cable freq-range** command in global configuration mode. To restore the default value (which is based on the cable interface and on the Annex A/B configuration), use the **no** form of this command.

cable freq-range [european | japanese | north-american]

no cable freq-range

Syntax Description

european	Configures the Cisco CMTS router to accept upstream frequency ranges that conform with the EuroDOCSIS specifications (5 MHz to 65 MHz).
japanese	Configures the Cisco CMTS router to accept upstream frequency ranges that conform to the extended range used in Japan (5 MHz to 55 MHz).
north-american	Configures the Cisco CMTS router to accept upstream frequency ranges that conform to the DOCSIS specifications (5 MHz to 42 MHz).

Defaults

no cable freq-range, which defaults to a frequency range based on the Annex configuration:

- Annex A = **european** (EuroDOCSIS, 5 MHz to 65 MHz)—Supported only on cable interfaces that support EuroDOCSIS
- Annex B = **north-american** (DOCSIS, 5 MHz to 55 MHz)—All cable interfaces support the 5 MHz to 42 MHz range. The 42 MHz to 55 MHz range is supported only on certain cable interfaces.

Command Modes

Global configuration

Command History

Release	Modification
12.2(15)BC2	This command was introduced for the Cisco uBR7246VXR and Cisco uBR10012 universal broadband routers.

Usage Guidelines

In Cisco IOS Release 12.2(15)BC2 and later, the Cisco CMTS router supports three different modes of operation, depending on the cable interface line cards being used. The range of frequencies that are allowed in each mode are as follows:

- North American DOCSIS (Annex B)—Upstreams use frequencies between 5 MHz and 42 MHz. This range is supported by all cable interface line cards.
- European EuroDOCSIS (Annex A)—Upstreams use frequencies between 5 MHz and 65 MHz.
- Japanese Extended Range (Annex B)—Upstreams use frequencies between 5 MHz and 55 MHz.

To configure the router so that it supports the proper range of upstream frequencies, use the **cable freq-range** command. After you have configured the router with the **cable freq-range** command, the **cable upstream frequency** and **cable spectrum-group** commands then accept only frequencies that are in the configured range.

Typically, the **cable freq-range** command is not needed because the default behavior covers the most common configurations. However, this command can be used in the following situations:

- This command is required to enable EuroDOCSIS operations on the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cards.
- This command is never needed for the Cisco uBR-MC5X20U card nor for EuroDOCSIS cable interfaces (Cisco uBR-MC16E card, and the Cisco uBR7111E and Cisco uBR7114E routers), because these interfaces default to the EuroDOCSIS range of frequencies. However, if you have previously used this command to restrict the allowable range of frequencies, you must use the **european** option to re-enable the EuroDOCSIS range of frequencies.
- The **north-american** option is usually not needed, because this is the default mode of operations for all DOCSIS cable interfaces. However, this option can be useful on the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cards when noise exists on the frequencies above 42 MHz. In this situation, using the **north-american** option filters out the higher frequencies and reduces the impact of that noise.
- Similarly, the **japanese** option is not needed on those cable interface cards that support it, because this is the default configuration on those cards. However, if you have previously used the **north-american** option on an interface, you need to use the **japanese** option to re-enable the extended frequency range.
- Even when the **cable freq-range** command is not needed to enable a frequency range, using it ensures that the **cable upstream frequency** and **cable spectrum-group** commands allow only frequencies that are within the desired range. This can help operators from assigning invalid frequencies to upstreams.

**Tip**

If one or more cable interface line cards that are installed in the chassis do not support the frequency range that you select with this command, the command displays an informational warning message for each of those cable interface cards. Also, you cannot configure the router for a particular frequency range if an upstream or spectrum group on the router is currently configured for a frequency that is invalid for the new range. If you try to do so, the command is ignored and a warning message is printed prompting you to reconfigure the upstream or spectrum group before retrying the command.

**Note**

This command configures only the range of frequencies that can be configured on an upstream. It does not configure the upstreams for the DOCSIS (Annex B) or EuroDOCSIS (Annex A) modes of operation, which is done using the **cable downstream annex** interface command. (Annex C mode is not supported.) You must configure the downstream for Annex A for EuroDOCSIS operations and Annex B for DOCSIS operations. You can configure certain cable interface cards (such as the Cisco uBR-MC28U) for both the DOCSIS Annex B mode and the EuroDOCSIS frequency range, but this violates the DOCSIS specifications and should not be used on standard DOCSIS networks.

The allowable range for the upstream channel frequency depends on the cable interface line card and Cisco IOS software release being used. See [Table 2](#) for the currently supported values.

Table 2 Allowable Frequency Range for Cable Interface Line Cards

Frequency Range	Supported Cable Interfaces	Minimum Cisco IOS Releases
5 to 42 MHz	All cable interfaces	All releases supported for the Cisco CMTS
5 to 55 MHz	Cisco uBR-MC16E, Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, Cisco uBR-MC5X20U	Cisco IOS Release 12.2(15)BC2
5 to 65 MHz	Cisco uBR-MC16E, Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, Cisco uBR-MC5X20U, Cisco uBR7111E and Cisco uBR7114E routers	Cisco IOS Release 12.0(13)SC and 12.1(4)EC for Cisco uBR-MC16E Cisco IOS Release 12.1(5)EC1 for Cisco uBR711E and Cisco uBR7114E Cisco IOS Release 12.2(15)BC2 for Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20U

**Note**

The **cable freq-range** command fails if any upstreams or spectrum groups on the router are currently configured for a frequency that is outside the new range being selected. You must reconfigure those upstreams or spectrum groups, using the **cable upstream frequency** or **cable spectrum-group** commands, for lower frequencies, and then repeat the **cable freq-range** command.

Examples

The following example shows how to configure the Cisco CMTS router to support the EuroDOCSIS upstream frequency range of 5 MHz to 65 MHz. The router then displays a list of the cable interface line cards, if any, that do not support this range. After giving this command, the **cable upstream frequency** command shows the valid range of upstream frequencies as being the EuroDOCSIS range:

```
Router# configure terminal
Router(config)# cable freq-range european

Interface Cable3/0 does not support European frequency range
Interface Cable3/1 does not support European frequency range
Interface Cable5/0 does not support European frequency range
Interface Cable5/1 does not support European frequency range

Router(config)# interface cable 6/0 ! This cable interface supports EuroDOCSIS
Router(config-if)# cable upstream 0 frequency ?

<5000000-65000000> Return Frequency in HZ

Router(config-if)#
```

The following example shows how to configure the Cisco CMTS router to support the extended Japanese upstream frequency range of 5 MHz to 55 MHz. The router then displays a list of the cable interface line cards, if any, that do not support this range. After giving this command, the **cable upstream frequency** command shows the valid range of upstream frequencies as being the extended frequency range for Japanese networks:

```
Router# configure terminal
Router(config)# cable freq-range japanese

Interface Cable3/0 does not support Japanese frequency range
```

```
Interface Cable4/0 does not support Japanese frequency range
Interface Cable5/0 does not support Japanese frequency range
```

```
Router(config)# interface cable 6/0 ! This cable interface supports the Japanese range
Router(config-if)# cable upstream 0 frequency ?
```

```
<5000000-55000000> Return Frequency in HZ
```

```
Router(config-if)#
```

The following example shows how to configure the Cisco CMTS router for its default configuration (DOCSIS upstream frequency range of 5 MHz to 42 MHz). (No warning messages are displayed with this configuration because all cable interface line cards support the basic DOCSIS frequency range.) After giving this command, the **cable upstream frequency** command shows the valid range of upstream frequencies as being the DOCSIS range:

```
Router# configure terminal
Router(config)# cable freq-range north-american
Router(config)# interface cable 3/0
Router(config-if)# cable upstream 0 frequency ?
```

```
<5000000-42000000> Return Frequency in HZ
```

```
Router(config-if)#
```

The following example shows all of the commands that are needed to configure the cable interface and upstream on a Cisco uBR-MC28U/X cable interface line card to support a frequency in the EuroDOCSIS upstream frequency range of 5 MHz to 65 MHz:

```
Router# configure terminal
Router(config)# cable freq-range european
Router(config)# interface 3/0
Router(config-if)# cable downstream annex a
Router(config-if)# cable upstream 0 frequency 62500000
Router(config-if)#
```

The following example shows the **cable freq-range** command failing because an upstream is configured for a frequency that is invalid for the new range. The upstream must be reconfigured before the **cable freq-range** command can be given successfully.

```
Router# configure terminal
Router(config)# cable freq-range japanese

%%Interface Cable 3/0/U0 has invalid frequency (62500000 Hz) for specified range
%%Set upstream frequencies within range prior to changing freq-range

Router(config)# interface 3/0
Router(config-if)# cable upstream 0 frequency 38600000
Router(config-if)# exit
Router(config)# cable freq-range japanese
Router(config)#
```

Related Commands

Command	Description
cable downstream annex	Sets the Motion Picture Experts Group (MPEG) framing format for a downstream port on a cable interface line card.
cable upstream frequency	Configures a fixed frequency of the upstream radio frequency (RF) carrier for an upstream port.

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■ cable freq-range