Determining RF or Configuration Issues on the CMTS

Document ID: 7137

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Introduction

This document describes the troubleshooting steps to determine whether a cable network problem is with a cable router or is a radio frequency (RF) plant issue. The majority of RF plant issues are diagnosed by a low upstream Signal−to−Noise Ratio (SNR) level, so heavy emphasis is placed on examining this value. This document first states some simple rules to follow, along with an explanation of how the upstream SNR level is calculated. It then illustrates the major configuration parameters and commands to issue to verify the downstream and upstream channels. It finishes with an explanation of the **show cable flap−list** command to further diagnose RF issues.

Using a spectrum analyzer for troubleshooting the RF plant is beyond the scope of this document. If the SNR level or other analysis points toward an RF plant issue, and you wish to troubleshoot this area further using a spectrum analyzer, then refer to Connecting the Cisco uBR7200 Series Router to the Cable Headend.

All uBR7100, uBR7200, and uBR10000 models, as well as NPE cards with different Cable Cisco IOS® Software versions, follow the same principle in troubleshooting, whether this is an RF issue or not. The only difference may be some command syntax changes and performance capabilities, and the fact that the uBR7100 has an integrated upconverter.

Prerequisites

Requirements

Readers of this document should be knowledgeable of the following:

- The Data−over−Cable Service Interface Specifications (DOCSIS) protocol
- RF technologies
- Cisco IOS Software command line interface (CLI)

Components Used

The information in this document is based on the software and hardware versions:

- Cisco uBR7246 VXR (NPE300) Processor (Revision C)
- Cisco IOS Software (UBR7200−K1P−M), Version 12.1(9)EC
- CVA122 Cisco IOS Software 12.2(2)XA

Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

RF Plant Troubleshooting Rules

- The RF plant can be thought of as a MAC Layer 2 (L2) equivalent. Usually, if there is a problem with the RF plant, then L2 connectivity is not established. If the **show cable modem** command output indicates that the online state has progressed past **init(rc)** status, this indicates that L2 connectivity has been established and usually does not indicate an RF problem. However, it is possible for the cable modem to go past init(rc) and even as far as init(i), but still have RF issues. In this case, using a narrower upstream channel may prove the problem is RF−related. Refer to the documentation on the **cable upstream 0 channel−width** *xxx* command.
- Before installing a live network, always verify the cable router configurations in a controlled environment, such as a laboratory, where the RF plant characteristics are known. This way, when you install in a live network, the characteristics of the router configurations are known and can be eliminated as a problem source. A good RF design is imperative to make this work. Refer to Connecting the Cisco uBR7200 Series Router to the Cable Headend and RF Specifications before putting the cable network into production use.
- The downstream direction is a broadcast domain. If a problem affects a large number of cable modems (or all cable modems), it is likely to be in the downstream plant.
- The upstream direction is based on individual circuits for each cable modem. Most cable network problems are in the upstream direction. A problem that affects individual or small groups of cable modems may be in the upstream direction. However, loose connections, downstream ingress, and drop problems could affect the downstream signal to an individual cable modem. Likewise, a problem with an individual downstream laser, optical link, node, or coax plant beyond the node could affect only a small number of modems.
- Many upstream cable modem problems are caused by low SNR level. This is a computed value based upon some assumptions within the Broadcom chipset. The chip is a 3037 A3 burst demodulator chip manufactured by Broadcom. Every DOCSIS cable modem termination system (CMTS) on the market uses this chip, and there is no way to change this algorithm or configuration unless you change the hardware.
- The Broadcom 3137 upstream receiver chip that provides the SNR estimate reported by the CMTS is not the same thing as Carrier−to−Noise Ratio (CNR) that one would measure with a spectrum analyzer. In an environment where additive white Gaussian noise (AWGN) is the only impairment such as a lab environment there is a reasonable numerical correlation between CMTS−reported SNR and CNR measured with a spectrum analyzer. According to Broadcom, when the CNR is in the 15 to 25 dB range, the reported SNR is typically within about 2 dB of the measured CNR. If the CNR is very low or very high that is, outside of the 15to 25 dB range the numerical difference between CMTS−reported SNR and measured CNR increases.

  Given these facts, it is important to understand that the Broadcom SNR value is actually more similar to modulation error ratio (MER). Therefore, the reported SNR value is less than the CNR, because it includes the effects of upstream CNR, upstream distortions, in−channel amplitude tilt or ripple (frequency response problems), group delay, microreflections, cable modem upstream transmitter

phase noise, and so on. Many of these impairments are not evident when measuring CNR with a spectrum analyzer, so it is possible to have poor SNR even though the CNR of the cable network is good.

- However, note that the Broadcom chip SNR estimate could indicate apparent normal operation, yet impulse noise (or a similar impairment not indicated by the SNR) may be the real culprit. The **show controller cable−modem** *x/x* and **show cable modem verbose** commands interrogate the Broadcom 3137 chip on the uBR72xx line cards that compute the upstream SNR value. Note that CNR is a more appropriate term, because SNR is actually a post−detection baseband measurement.
- The settings on an external upconverter used when having uBR7200 or uBR10000 need to be properly set. Remember that General Instruments, Inc. (GI) upconverters are configured 1.75 MHz lower than the center frequency, according to the National Television Systems Committee (NTSC) table. For an explanation of why this is so, refer to Cable Radio Frequency (RF) FAQ.
- Different Media Cards (MCs) have different output power on the downstream port. For this reason, it is necessary to add padding (external attenuation) for some cards. Make sure that you follow the specifications on how much padding to add for the specific linecard used. MC11 and MC16B cards give an output power of 32 dBmV, and they do not need padding. However, all the other MCxx cards give an output power of 42 dBmV, and therefore need 10 dB padding.

The SNR estimation process uses only packets that are free from uncorrectable forward error corrections (FEC) errors and is averaged over 10,000 received symbols. If the packet is damaged, it is not counted, so the upstream SNR estimate can read artificially high. The upstream SNR estimate does not take into account the real world of burst noise (impulse or intermittent noise that is common in cable television [CATV] upstream networks). Comparing the Broadcom chip's upstream SNR estimate to what one would measure with a spectrum analyzer often yields quite different results. The Broadcom chip's upstream SNR estimation process is most reliable in the 25 to 32 dB range. If the upstream SNR estimate reaches 35 dB or greater, consider the result to be unreliable and use a spectrum analyzer to get a true upstream CNR measurement.

The optimal period to collect the 10,000 symbols is 10−20 ms of 100% utilization upstream for a 3.2 or 1.6 MHz channel width. It is unusual to have this quantity of traffic being passed and at the same time to experience a low upstream SNR. The lower the upstream SNR, the greater the degradation of traffic passed. This degradation causes the Broadcom chip to take too long to collect the 10,000 symbols, and for the resulting upstream SNR estimate to be inaccurate. If the upstream SNR estimate falls below 25 dB, consider it to be unreliable. At this low upstream SNR level, the system is experiencing many errors and too little traffic. Expect many flap list entries and low Service ID (SID) connectivity numbers. The **show cable hop** command output should indicate many FEC correctable and uncorrectable errors.

After mentioning the above limitations, however, if the upstream SNR level is between 25 and 32 dB (as shown by the **show controller cable−modem** *x/x* command), issue the command multiple times to see if the SNR fluctuates outside the 25 to 32 dB range, to determine whether there is an apparent RF issue.

The SNR estimate should indeed be less than the CNR. This is because the Broadcom SNR estimate includes the contributions of upstream CNR, as well as cable network impairments such as micro−reflections, group delay, amplitude ripple (in−channel frequency response), data collisions, and so on. When all of these impairments are considered, the cumulative effect on the Broadcom SNR estimate means that it is a value lower than the CNR that would be measured with a spectrum analyzer.

Cable show Commands for RF Problems

The following **show** commands are issued on the CMTS to help diagnose RF issues:

- **show controllers cable** *slot/port* **downstream**
- **show controllers cable** *slot/port* **upstream**
- **show cable modem detail**

- **show interface cable** *slot/port* **upstream** *n*
- **show cable hop**
- **ping docsis**
- **show cable flap−list**

The following **show** commands issued on the cable modem to help diagnose RF issues:

- **show controllers cable−modem 0 | include snr**

Refer to Understanding show Command Responses for more information.

The **show controllers cable** *slot/port* **downstream** and **show controllers cable** *slot/port* **upstream** commands can be issued to show the L2 status of the cable card on the CMTS when diagnosing suspected RF problems. Issue these commands to check the frequency settings and the upstream SNR. The **show controllers cable** *slot/port* **upstream** command should be issued several times to see if the SNR fluctuates rapidly. Even with good upstream SNRs, a very rapid fluctuation also means RF problems.

Issue the **show interface cable** *slot/port* **upstream** *n* command to check for noise within the RF plant. If the uncorrectable errors, noise, and microreflection counters are high in number and increasing quickly, this typically indicates that noise is present within the RF plant. You can also issue the **ping docsis** command to verify the L2 connectivity to the cable modem.

Issue the commands described above to check the following:

- The configuration parameters
- The downstream and upstream frequencies used
- The noise measurements in dB. Make certain that they are correct and within the allowed limits. Refer to the table of noise limits below.

DOCSIS Cable Upstream RF Specifications

Note: An ***n** indicates that additional information can be found below the table.

Specifications UPSTREAM	**DOCSIS Specifications**	**Minimum Settings**
System/Channel	***1**	***2**
Frequency range	5 to 42 MHz (North America) 5 to 65 MHz (Europe)	5 to 42 MHz (North America) 5 to 65 MHz (Europe)
Transit delay from the most distant cable modem to the nearest cable modem or CMTS.	< 0.800 microseconds	< 0.800 microseconds
CNR	25 dB	25 dB
Carrier−to−ingress−power ratio	> 25 dB	> 25 dB
Carrier−to−interference ratio	> 25 dB (QPSK) ***3, 4** > 25 dB (16 QAM) ***4, 5**	> 21 dB (QPSK) ***3, 4** > 24 dB (16 QAM) ***4, 5**
Carrier hum modulation	< −23 dBc ***6** (7%)	< −23 dBc (7%)

Burst noise	Not longer than 10 µsec at a 1 kHz average rate for most cases.	Not longer than 10 µsec at a 1 kHz average rate for most cases.
Amplitude ripple	0.5 dB/MHz	0.5 dB/MHz
Group delay ripple	200 ns/MHz	200 Ns/MHz
Micro reflections (single echo)	−10 dBc @ < 0.5 µsec −20 dBc @ < 1.0 µsec 30 dBc @ 1.0 µsec	−10 dBc @ < 0.5 µsec −20 dBc @ < 1.0 µsec 30 dBc @ 1.0 µsec
Seasonal/diurnal signal level variation	Not greater that 8 dB min to max.	Not greater than 8 dB min to max.
Digital Signal Levels		
From cable modem (upstream)	+8 to +58 dBmV (QPSK) +8 to +55 dBmV (16 QAM)	+8 to +58 dBmV (QPSK) +8 to +55 dBmV (16 QAM)
Input amplitude to modem card (upstream)	From −16 to +26 dBmV, depending on symbol rate.	From −16 to +26 dBmV, depending on symbol rate.
Signal as relative to adjacent video signal	−6 to −10 dBc	−6 to −10 dBc

DOCSIS Cable Downstream RF Specifications

Specification DOWNSTREAM	**DOCSIS Specifications**	**Minimum Settings**
System/Channel	***1**	***2**
RF channel spacing (bandwidth)	6 MHz	6 MHz
Transit delay	0.800 microseconds	0.800 microseconds
CNR	35 dB	35 dB
Carrier−to−interference ratio for total power (discrete and broadband ingress signals).	> 35 dB	> 35 dB
Composite triple beat distortion	< −50 dBc ***6**	< −50 dBc
Carrier to second order	< −50 dBc	< −50 dBc
Cross−modulation level	< −40 dBc	< −40 dBc
Amplitude ripple	0.5 dB in 6 MHz	0.5 dB in 6 MHz
Group delay	75 ns in 6 MHz	75 Ns in 6 MHz

Micro reflections bound for dominant echo	−10 dBc @ < 0.5 µsec −15 dBc @ < 1.0 µsec −20 dBc @ < 1.5 µsec −30 dBc @ >1.5 µsec	−10 dBc @ < 0.5 µsec −15 dBc @ < 1.0 µsec −20 dBc @ < 1.5 µsec −30 dBc @ >1.5 µsec
Carrier hum modulation	< −26 dBc (5%)	< −26 dBc (5%)
Burst noise	Not longer than 25 µsec at a 10 kHz average rate.	Not longer than 25 µsec at a 10 kHz average rate.
Seasonal/diurnal signal level variation	8 dB	8 dB
Signal level slope (50 to 750 MHz)	16 dB	16 dB
Maximum analog video carrier level at the cable modem input, inclusive of above signal level variation.	+17 dBmV	+17 dBmV
Minimum analog video carrier level at the cable modem input, inclusive of above signal level variation.	−5 dBmV	−5 dBmV
Digital Signal Levels		
Input to cable modem (level range, one channel)	−15 to +15 dBmV	−15 to +15 dBmV
Signal as relative to adjacent video signal	−6 to −10 dBc	−6 to −10 dBc

Notes for Tables

***1** DOCSIS specifications are baseline settings for a DOCSIS−compliant, two−way data−over−cable system.

***2** Minimum settings are slightly different than the DOCSIS settings to account for cable system variations over time and temperature. Using these settings should increase the reliability of DOCSIS−compliant, two−way data−over−cable systems.

***3** QPSK = Quadrature Phase−Shift Keying: a method of modulating digital signals onto a radio−frequency carrier signal using four phase states to code two digital bits.

***4** These settings are measured relative to the digital carrier. Add 6 or 10 dB, as determined by your company policy and derived from the initial cable network setup, relative to the analog video signal.

***5** QAM = Quadrature Amplitude Modulation: a method of modulating digital signals onto a radio−frequency carrier signal involving both amplitude and phase coding.

***6** dBc = decibels relative to carrier.

Note: For a full set of the specifications for the European Standard, refer to RF Specifications.

Checking the Downstream

When you check the downstream interface, first ensure that the configuration is correct. In most cases when configuring the downstream cable interface on the CMTS, the default values are sufficient. You do not need to specify individual parameters unless you want to deviate from system defaults. Use the output below to match the downstream configuration parameters with the matching values seen in the **show** command output on the CMTS and the cable modem.

```
interface Cable6/1
 ip address 192.168.161.1 255.255.255.0 secondary
 ip address 10.1.61.1 255.255.255.0
 no keepalive
 cable insertion-interval 100
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream frequency 405000000
 cable upstream 0 frequency 20000000
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 3200000
 no cable upstream 0 shutdown
 cable upstream 1 shutdown
 cable upstream 2 shutdown
 cable upstream 3 shutdown


VXR# show controller cable 6/1 downstream
 Cable6/1 Downstream is up
  Frequency 405.0000 MHz, Channel Width 6 MHz, 64-QAM, Symbol Rate 5.056941 Msps
  FEC ITU-T J.83 Annex B, R/S Interleave I=32, J=4
  Downstream channel ID: 3
VXR#
```

Make sure that the physical CMTS cable connections are not loose or disconnected, and that the cable modem card is firmly seated in its chassis slot with the installation screws tight. Also check that you have entered the correct slot and port numbers for the downstream interface that you are checking.

Remember that entering the downstream center frequency on the CMTS is only cosmetic for the uBR7200 and uBR10000. The uBR7100 has an integrated upconverter. To learn how to set it up, refer to Setting the Integrated Upconverter.

Entering a **shut** or **no shut** command on the downstream interface that you are checking may resolve problems where the cable modems find a downstream signal but not an upstream signal.

Important: If you issue a **shut** or **no shut** command on the downstream interface in a production environment with several hundred cable modems, they may take a long time to come back online. In non−production environments such as new cable installations, however, it is safe to issue these commands.

The downstream SNR must be checked at the cable modem where it is received, rather than at the CMTS where it is input into the upconverter that is responsible for the signal sent to the cable modem. This measurement at the cable modem can pose the following problems:

- Most cable installations do not have Cisco cable modems. Even if they do, the console port on the cable modem is locked by default.
- You have to make a Telnet connection to the cable modem to measure the received SNR value. If you do not have IP connectivity to Telnet, you must go manually to the customer site where the Cisco

cable modem is installed. Then you can connect using the console port. Ensure that the cable modem has a configuration that allows access to the console port.

At the cable modem, issue the **show controllers cable−modem 0 | include snr** command to check the downstream SNR value received at the cable modem. Verify that the received SNR level is within the permitted limits of >30 dB for 64 QAM and >35 dB for 256 QAM.

```
Router# show controller cable−modem 0 | include snr
    snr_estimate 336(TenthdB), ber_estimate 0, lock_threshold 23000
Router#
```

Note: This is showing a downstream receive SNR of 33.6 dB at the cable modem. Acceptable levels are >30 dB for 64 QAM and >35 dB for 256 QAM.

Annex B is the DOCSIS MPEG framing format standard for North America. Annex A is the European standard, which is supported only when using the Cisco MC16E cable modem card and Cisco CMTS images that support EuroDOCSIS Annex A operation. Annex A or B framing format is automatically set when configuring Cisco cable modem cards. The downstream ports of the cable modem card and the connected Customer Premises Equipment (CPEs) on the network must be set to the same MPEG framing format and support either DOCSIS or EuroDOCSIS operations, as appropriate.

Setting a downstream modulation format of 256 QAM requires approximately a 6 dB higher CNR than 64 QAM at the subscriber's cable modem. If your network is marginal or unreliable at 256 QAM, use the 64 QAM format instead.

If a cable modem is offline, one of the first thing to investigate is the RF plant. For more information, refer to the *Offline State* and *Ranging Process* troubleshooting sections of Troubleshooting uBR Cable Modems Not Coming Online.

Checking the Upstream

On the upstream side, many RF problems are indicated by a low SNR level. Note that upstream impulse noise is the major source of degraded bit error rate (BER) performance. The Broadcom SNR estimate generally does not show the presence of impulse noise.

Later in this section, you are shown how to check the upstream SNR levels.

First, check the upstream interface, ensuring that the configuration is correct. In most cases when configuring the upstream cable interface on the CMTS, the default values are sufficient. You do not need to specify individual parameters unless you want to deviate from system defaults. Use the diagram below to match the upstream configuration parameters with the matching values seen in the **show** command output at the CMTS.

```
interface Cable6/1
 ip address 192.168.161.1 255.255.255.0 secondary
 ip address 10.1.61.1 255.255.255.0
 no keepalive
 cable insertion−interval 100
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave−depth 32
 cable downstream frequency 405000000
 cable upstream 0 frequency 20000000
 cable upstream 0 power−level 0
 cable upstream 0 channel−width 3200000
 no cable upstream 0 shutdown
 cable upstream 1 shutdown
 cable upstream 2 shutdown
```

```
 cable upstream 3 shutdown

VXR# show controller cable 6/1 upstream 0
 Cable6/1 Upstream 0 is up
  Frequency 19.984 MHz, Channel Width 3.200 MHz, QPSK Symbol Rate 2.560 Msps
  Spectrum Group is overridden
  SNR 35.1180 dB
  Nominal Input Power Level 0 dBmV, Tx Timing Offset 2738
  Ranging Backoff automatic (Start 0, End 3)
  Ranging Insertion Interval 100 ms
  TX Backoff Start 0, TX Backoff End 4
  Modulation Profile Group 1
  Concatenation is enabled
  part_id=0x3137, rev_id=0x03, rev2_id=0xFF
  nb_agc_thr=0x0000, NB_agc_nom=0x0000
  Range Load Reg Size=0x58
  Request Load Reg Size=0x0E
  Minislot Size in number of Timebase Ticks is = 8
  Minislot Size in Symbols = 128
  Bandwidth Requests = 0x335
  Piggyback Requests = 0xA
  Invalid BW Requests= 0x0
  Minislots Requested= 0xA52
  Minislots Granted  = 0xA52
  Minislot Size in Bytes = 32
  Map Advance (Dynamic) : 2447 usecs
  UCD Count = 46476
  DES Ctrl Reg#0 = C000C043, Reg#1 = 0
VXR#
```

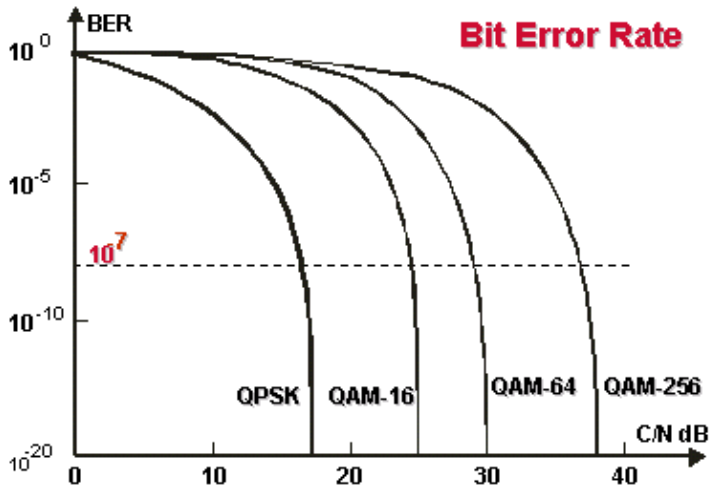
Make sure that the physical CMTS cable connections are not loose or disconnected and that the cable modem card is firmly seated in its chassis slot with the installation screws tight. Verify also that you have entered the correct slot and port numbers for the upstream interface you are checking.

Remember that the upstream channel on the Cisco cable modem is shut down by default, so you must issue the **no shut** command to activate it.

Note: The upstream frequency displayed in the **show controllers cable** command output might not match the frequency that you entered when you set the upstream frequency. The Cisco CMTS might select an upstream frequency close to the frequency you entered that offers better performance. The minimum upstream frequency step size on the MC16C is 32 kHz. The Cisco CMTS selects the closest frequency available. Refer to the explanation of the **cable upstream 0 frequency** command for more information.

Note: Some cable systems cannot reliably transport frequencies near the allowed band edges. The wider the upstream channel (in MHz), the more difficulty you may have. Enter a center frequency between 20 and 38 MHz if you experience problems. The Cisco CMTS then commands the cable modems to use an upstream frequency within this range. Setting the right upstream frequency is the most important task in designing the RF network. The upstream operates on a range from 5 to 42 MHz. Below 20MHz, it is common to find a great deal of interference. Setting up the upstream in a live network represents the biggest RF challenge.

Note: Higher symbol rates are more susceptible to RF noise and interference. If you use a symbol rate or modulation format beyond the capabilities of your hybrid fiber−coaxial (HFC) network, you may experience packet loss or poor cable modem connectivity. This can be seen in the figure below, in which a higher CNR is needed to maintain the same BER with more complex modulation formats.



Waterfall curves. More complex modulation formats require a higher CNR in order to maintain the same BER.

The upstream input power level at the CMTS is normally expected to be 0 dBmV. This power level can be increased to overcome noise in the RF plant. If the upstream input power level is increased, then cable modems on your HFC network increase their upstream transmit power level. This increases the CNR, overcoming the noise on the RF plant. Refer to the explanation of the **cable upstream** *port* **power−level** *dbmv* command for this. You should not adjust your input power level by more than 5 dB in a 30−second interval. If you increase the power level by more than 5 dB within 30 seconds, cable modem service on your network is disrupted. If you decrease the power level by more than 5 dB within 30 seconds, cable modems on your network are forced offline.

Software adjustments of 1 to 3 dB can be used to adjust for minor variations in measurement, or setup and port−to−port calibration differences. These adjustments can significantly improve cable modem performance, especially in marginal situations. Larger adjustments should be made in conjunction with spectrum analyzer support at the headend or distribution hub.

As mentioned previously in this document, many RF problems are indicated by a low upstream SNR level. If your upstream SNR level is low, try to use a narrower channel width (**cable upstream 0 channel−width** *xxx*) for the upstream; for example, instead of 3.2 Mhz, use 200 khz. If the upstream SNR level increases, then you have a noise problem.

Issue the **show controllers cable** *slot/port* **upstream** *channel* command to check the upstream SNR level for a particular cable interface, as shown below.

```
VXR# show controllers cable 6/1 upstream 0
 Cable6/1 Upstream 0 is up
  Frequency 19.984 MHz, Channel Width 3.200 MHz, QPSK Symbol Rate 2.560 Msps
  Spectrum Group is overridden
  SNR 35.1180 dB
!-- Note: Check the upstream SNR level for an interface here.

  Nominal Input Power Level 0 dBmV, TX Timing Offset 2738
  Ranging Backoff automatic (Start 0, End 3)
  Ranging Insertion Interval 100 ms
  TX Backoff Start 0, TX Backoff End 4
  Modulation Profile Group 1
  Concatenation is enabled
  part_id=0x3137, rev_id=0x03, rev2_id=0xFF
  NB_agc_thr=0x0000, NB_agc_nom=0x0000
  Range Load Reg Size=0x58
```

```
  Request Load Reg Size=0x0E
  Minislot Size in number of Timebase Ticks is = 8
  Minislot Size in Symbols = 128
  Bandwidth Requests = 0x335
  Piggyback Requests = 0xA
  Invalid BW Requests= 0x0
  Minislots Requested= 0xA52
  Minislots Granted  = 0xA52
  Minislot Size in Bytes = 32
  Map Advance (Dynamic) : 2447 usecs
  UCD Count = 46476
  DES Ctrl Reg#0 = C000C043, Reg#1 = 0
VXR#
```

Issue the **show cable modem detail** command to view the SNR estimate for individual cable modems. (Refer to the table below for further explanation of SID, MAC address, Max CPE, and so on.)

```
VXR# show cable modem detail
Interface   SID  MAC address    Max CPE  Concatenation  Rx SNR
Cable6/1/U0 1    0001.64ff.e47d 1        yes            33.611

Cable6/1/U0 2    0001.9659.47bf 1        yes            31.21
Cable6/1/U0 3    0004.27ca.0e9b 1        yes            31.14
Cable6/1/U0 4    0020.4086.2704 1        yes            32.88
Cable6/1/U0 5    0002.fdfa.0a63 1        yes            33.61
```

SID	Service ID
MAC address	The MAC address of the cable interface of the cable modems.
Max CPE	The maximum number of hosts that are simultaneously active on the cable modem.
Concatenation	Concatenation combines multiple upstream packets into one packet to reduce packet overhead and overall latency, as well as to increase transmission efficiency. Using concatenation, a DOCSIS compliant cable modem makes only one bandwidth request for multiple packets, as opposed to making a different bandwidth request for each individual packet. Concatenation will work only if a single cable modem has multiple voice calls, each running at the same data rate, without Voice Activity Detection (VAD) packet suppression. **Note:** Concatenation may be a problem if Voice over IP (VoIP) is not configured correctly.
Rx SNR	The received upstream SNR level at the CMTS. If the CMTS is not configured for SNMP reads from the cable modems, then the CMTS returns a zero value. The SNR is the difference in amplitude between a baseband signal and the noise in a portion of the spectrum. In practice, a margin of 6 dB or

	more may be required for reliable operation.

Issue the **show interface cable** *slot/port* **upstream** *n* command as shown below to check for noise within the RF plant. If the uncorrectable errors, noise, and microreflection counter numbers are high and increasing quickly, this typically indicates that noise is present within the RF plant. (Refer to the table below for further information on this output.)

```
VXR# show interface cable 6/1 upstream 0
Cable6/1: Upstream 0 is up
     Received 22 broadcasts, 0 multicasts, 247822 unicasts
     0 discards, 1 errors, 0 unknown protocol
     247844 packets input, 1 uncorrectable
     0 noise, 0 microreflections
     Total Modems On This Upstream Channel : 1 (1 active)
     Default MAC scheduler
     Queue[Rng Polls]  0/64, fifo queueing, 0 drops
     Queue[Cont Mslots]  0/52, FIFO queueing, 0 drops
     Queue[CIR Grants]  0/64, fair queueing, 0 drops
     Queue[BE Grants]  0/64, fair queueing, 0 drops
     Queue[Grant Shpr]   0/64, calendar queueing, 0 drops
     Reserved slot table currently has 0 CBR entries
     Req IEs 360815362, Req/Data IEs 0
     Init Mtn IEs 3060187, Stn Mtn IEs 244636
     Long Grant IEs 7, Short Grant IEs 1609
     Avg upstream channel utilization : 0%
     Avg percent contention slots : 95%
     Avg percent initial ranging slots : 2%
     Avg percent minislots lost on late MAPs : 0%
     Total channel bw reserved 0 bps
     CIR admission control not enforced
     Admission requests rejected 0
     Current minislot count   : 40084    Flag: 0
     Scheduled minislot count : 54974    Flag: 0
VXR#
```

Received broadcasts	Broadcast packets received through this upstream interface.
Multicasts	Multicast packets received through this upstream interface.
Unicasts	Unicast packets received through this interface.
Discards	Packets discarded by this interface.
Errors	Sum of all errors that prevented upstream transmission of packets.
Unknown	Packets received that were generated using a protocol unknown to the Cisco uBR7246.
Packets input	Packets received through the upstream interface that are free from errors.
Corrected	Error packets received through the upstream interface that were corrected.
Uncorrectable	Error packets received through the upstream interface that could not be corrected.

Noise	Upstream packets corrupted by line noise.
Microreflections	Upstream packets corrupted by microreflections.
Total Modems On This Upstream Channel	The number of cable modems currently sharing this upstream channel. This field also shows how many of these modems are active.
Rng Polls	The MAC scheduler queue showing the number of ranging polls.
Cont Mslots	The MAC scheduler queue showing the number of forced contention request slots in MAPS.
CIR Grants	The MAC scheduler queue showing the number of committed information rate (CIR) grants pending.
BE Grants	The MAC scheduler queue showing the number of best effort grants pending.
Grant Shpr	The MAC scheduler queue showing the number of grants buffered for traffic shaping.
Reserved slot table	At the time the command was issued, the MAC scheduler had admitted two CBR slots in the reserved slot table.
Req IEs	Running counter of request information elements (IEs) sent in MAPS.
Req/Data lEs	Counter of request/data IEs sent in MAPS.
Init Mtn IEs	Counter of initial maintenance IEs.
Stn Mtn IES	Number of station maintenance (ranging poll) IEs.
Long Grant lEs	Number of long grant IEs.
ShortGrmg lEs	Number of short grant IEs.
Avg upstream channel utilization	Average percentage of the upstream channel bandwidth being used.
Avg percent contention slots	Average percentage of slots available for modems to request bandwidth through contention mechanisms. Also indicates the amount of unused capacity in the network.
Avg percent initial ranging slots	Average percentage of slots in initial ranging state.
Avg percent minislots lost on late Maps	Average percentage of slots lost because a MAP interrupt was too late.
Total channel bw reserved	Total amount of bandwidth reserved by all modems sharing this upstream channel that

	require bandwidth reservation. The Class of Service (CoS) for these modems specifies some non−zero value for the guaranteed upstream rate. When one of these modems is admitted on the upstream, this field value is incremented by this guaranteed−upstream rate value.

Note: Check the noise and microreflection counters. They should be very low values and, in a normal cable plant, increment slowly. If they are at a high value and increment quickly, this typically indicates a problem with the RF plant.

Note: Check for uncorrectable errors. These typically indicate a problem with noise within the RF plant. Check the received upstream SNR level.

Issue the **show cable hop** command to check the correctable and uncorrectable FEC error counts for a specific interface or upstream port. Consider that uncorrectable FEC errors result in dropped packets. Correctable FEC errors come just before uncorrectable FEC errors, and should be considered a warning sign of uncorrectable errors yet to come. The **show cable hop** command output shows the frequency hop status of an upstream port. (Refer to the table below for further information on this output.)

```
VXR# show cable hop cable 6/1 upstream 0
Upstream    Port       Poll Missed Min    Missed Hop   Hop     Corr    Uncorr
Port        Status     Rate Poll   Poll   Poll   Thres Period  FEC     FEC
                       (ms) Count  Sample Pcnt   Pcnt  (sec)   Errors  Errors
Cable6/1/U0 20.000 MHz 1000 * * * set to fixed frequency * * * 10      1
VXR#
```

Upstream Port	The upstream port for this information line.
Port Status	Lists the status of the port. Valid states are down if frequency is unassigned or administrative down if the port is shut down. If the port is up, this column shows the center frequency of the channel.
Poll Rate	The rate that station maintenance polls are generated (in milliseconds).
Missed Poll Count	The number of missing polls.
Min Poll Sample	The number of polls in the sample.
Missed PollPcnt	The ratio of missing polls to the number of polls, expressed as a percentage.
Hop Thres Pcnt	The level that the missed poll percentage must exceed to trigger a frequency hop, expressed as a percentage.
Hop Period	The maximum rate at which frequency hopping occurs (in seconds).
Corr FEC Errors	The number of correctable FEC errors on this upstream port. FECs measure noise.

Uncorr FEC Errors	The number of uncorrectable FEC errors on this upstream port.

Issue the **show cable hop** command to check for correctable and uncorrectable FEC errors on a particular interface. Counters should have a low value. High or rapidly increasing uncorrectable errors typically indicate a problem with noise within the RF plant. If this is the case, check the received upstream SNR level.

Finally, issue the **ping docsis** command to verify the L2 connectivity to the cable modem, as shown below.

```
VXR#ping docsis ?
  A.B.C.D  Modem IP address
  H.H.H    Modem MAC address
```

Note: Issue this command to ping either the modem IP or MAC address, as shown below.

```
VXR#ping docsis 10.1.61.3
Queueing 5 MAC-layer station maintenance intervals, timeout is 25 msec:
!!!!!
Success rate is 100 percent (5/5)
VXR#
```

Using the Flap List for Diagnosing RF Problems

One of the most powerful tools on the CMTS for diagnosing RF problems on cable networks is the **show cable flap-list** command. To assist in locating cable plant problems, the CMTS maintains a database of flapping cable modems. This document highlights the most important practical information about this feature. For more detailed information about the flap list feature, refer to Flap List Troubleshooting for the Cisco CMTS.

Below is a sample **show cable flap-list** command output. Note that an asterisk appears in the power adjustment field when an unstable return path for a particular modem has been detected and a power adjustment has been made. An exclamation point appears when so many power adjustments have been made that the modem has reached its maximum power transmit level. Both of these symbols indicate a problem in the RF plant.

```
VXR# show cable flap-list
MAC Address     Upstream     Ins   Hit   Miss  CRC   P-Adj Flap  Time
0001.64ff.e47d  Cable6/1/U0  0     20000 1     0    *30504 30504 Oct 25 08:35:32
0001.9659.47bf  Cable6/1/U0  0     30687 3     0    *34350 34350 Oct 25 08:35:34
0004.27ca.0e9b  Cable6/1/U0  0     28659 0     0    !2519  2519  Oct 23 16:21:18
0020.4086.2704  Cable6/1/U0  0     28637 4     0     2468  2468  Oct 23 16:20:47
0002.fdfa.0a63  Cable6/1/U0  0     28648 5     0     2453  2453  Oct 23 16:21:20
```

*	Indicates that a power adjustment has been made.
!	Indicates that a cable modem has increased its power level to the maximum. For Cisco cable modems, that is 61 dBmV.

The flap list is an event detector. There are three situations that cause an event to be counted. Below are descriptions of these three situations.

1. **Reinsertions**

   You may see flaps and insertions if a modem has a registration problem and tries to quickly reregister again and again. The value in the P-Adj column may be low. When the time between two initial maintenance reregistrations by the cable modem is less than 180 seconds, you see flaps and insertions,

and the flap detector counts this as a flap. (The default value of 180 seconds can be changed if desired.) Reinsertions also help to identify potential problems in the downstream because improperly provisioned cable modems tend to try to reestablish a link repeatedly:

```
VXR(config)# cable flap-list insertion-time ?
  <60-86400>  Insertion time interval in seconds
```

2. **Hits/Misses**

   The flap detector counts a flap when a miss is followed by a hit. Event detection is counted in the Flap column only. These polls are hello packets that are sent every 30 seconds. If a miss is followed by a miss, the polls are sent every second for 16 seconds, vigorously attempting to get a response. If a hit comes before the 16 seconds are up, a flap is counted, but if a hit doesn't come for 16 polls, the modem goes offline in order to begin initial maintenance all over again. If the modem finally comes back online, an insertion is counted, because the cable modem inserted itself back into an active state. The flap count is incremented if there are six consecutive misses. This default value can be changed if desired. If there are a number of misses, this typically points to a potential problem in the upstream.

```
VXR(config)# cable flap miss-threshold ?
  <1-12>  missing consecutive polling messages
```

3. **Power Adjustments**

   The flap detector shows a flap in the list when power adjustment activity occurs. Event detection is counted in the P−Adj columns and in the Flap column. The station maintenance poll constantly adjusts the cable modem transmit power, frequency, and timing. Whenever the power adjustment exceeds 2 dB, the Flap and the P−Adj counters are incremented. This event suggests upstream plant problems. The threshold default value of 2 dB can be changed if desired. If constant power adjustments are detected, this usually indicates a problem with an amplifier. By looking at the cable modems in front and behind various amplifiers, you can find the source of failure.

```
VXR(config)#cable flap power-adjust ?
  threshold  Power adjust threshold
```

Related Information

- **Troubleshooting [uBR7200]**
- **Sunrise Telecom Online Learning**
- **Connecting the Cisco uBR7200 Series Router to the Cable Headend**
- **Flap List Troubleshooting for the Cisco CMTS**
- **RF Specifications**
- **Cable Radio Frequency (RF) FAQ**
- **Understanding show Command Responses**
- **Technical Support & Documentation − Cisco Systems**

Updated: Sep 03, 2006 Document ID: 7137