NSG™Exo
Indoor Distributed CCAP System

Software Guide
Command Line Interface Release1.2.x

Rev B

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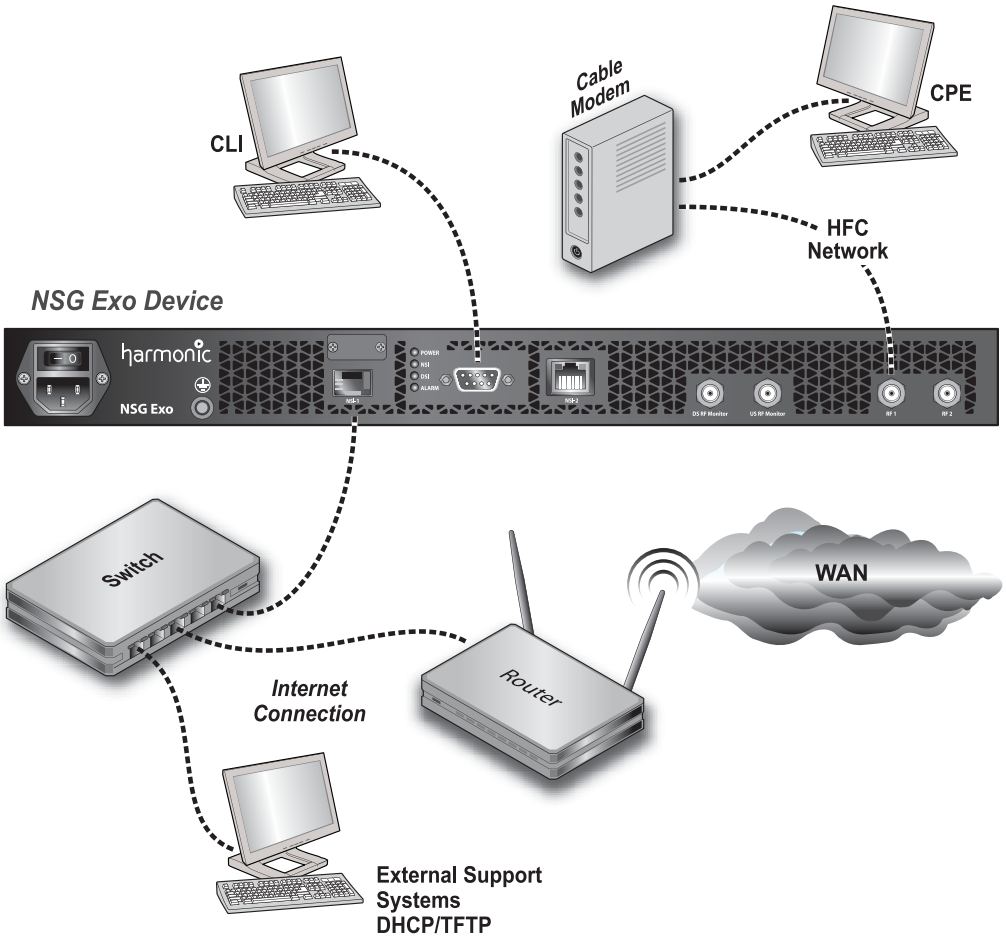
Chapter 1
Command Line Interface Overview

1.1 Introduction

Harmonic's NSG™ Exo distributed CCAP system is a high-performance cable edge device for the delivery of video, data and voice services over coax. Compact and cost-effective, the NSG Exo moves the RF requirements of the service provider out of the headend or hub and places them deep in the fiber network. It simplifies headend design and operation to resolve space and power constraints, lower capital and operational expenses, and provides service flexibility.

The following illustration shows the location of the NSG Exo in the fiber network.



The NSG Exo is managed by Harmonic's Command Line Interface (CLI) software, which supports a wide range of Cable applications and offers great flexibility in operating the NSG Exo.

As described in *1.2 Management Interfaces* on page 8, the NSG Exo supports several optional management interfaces, which allow users to configure, monitor and troubleshoot the device. This guide provides instructions on how to manage the NSG Exo with focus mainly on the Command Line Interface (CLI).

1.2 Management Interfaces

Harmonic offers several methods for configuring the NSG Exo devices and for monitoring their status. All management interfaces listed below connect to the NSG Exo via its NSI port which can be GE, GPON or EPON.

Caution: To ensure maximum network security and minimize the risk of malicious attacks, Harmonic strongly recommends that the NSG Exo management interface will be deployed in a secured network, without any direct internet access.

The table below lists the available management interfaces according to the management purpose for which they are designed:

Table 1–1: Management Interfaces

Interface	Purpose	Explanation
CLI	Configuration and monitoring of a single NSG Exo device	The CLI comprises commands that are organized in a hierarchical structure of submenus. You can use the CLI on any computer that can access the NSG Exo via an IP connection and supports an SSH client. By default, configuration changes that are applied via CLI are stored only in the *running config* database. See *Configuration Files* on page 12.
3rd party SNMP monitoring	Status and Alarm Monitoring of multiple NSG Exo devices	The SNMP interface supports an extended set of SNMP MIBs. In addition, NSG Exo may generate SNMP traps in the following SNMP versions: v1 and v2c. For the supported SNMP MIB objects, see *NSG Exo SNMP Specifications Document*.
Syslog	Monitoring of a single NSG Exo device	This is a standard network protocol for logging device messages. A Syslog server that is registered with the NSG Exo device will receive messages from the device whenever an alarm or warning is asserted or remitted. A Syslog server is not required for the operation of an NSG Exo.

1.3 Document Conventions

This guide uses the following conventions for command documentation:

Table 1–2: Document Conventions

Convention	Explanation
`Boldface screen font`	Commands and keywords
Italic font	Arguments that you need to provide the values
`screen output`	Console output or other text that is displayed to you on a computer screen
[element]	Indicates an optional element
{x | y | z}	Alternative, mutually exclusive, keywords
[x | y | z]	Optional alternative keywords
hyperlinked	Hyperlinked cross-references in online documents
<cr>	Press <Ctr> after typing a command
<Key>	Indicated a keyboard key

NOTE: The Note symbol calls your attention to additional information that you will benefit from heeding. It may be used to call attention to an especially important piece of information you need, or it may provide additional information that applies in only some carefully delineated circumstances.

TIP: The Tip symbol calls your attention to parenthetical information that is not necessary for performing a given procedure, but which, if followed, might make the procedure or its subsequent steps easier, smoother, or more efficient.

Chapter 2
Getting Started

Initial Device Setup

When you connect the NSG Exo to the power source and turn it on via the front-mounted power switch, the boot up procedure starts. Once boot up is complete the power LED shines in steady green.

Network Configuration

To connect the NSG Exo management interface to the network, you must set the following via the serial port:

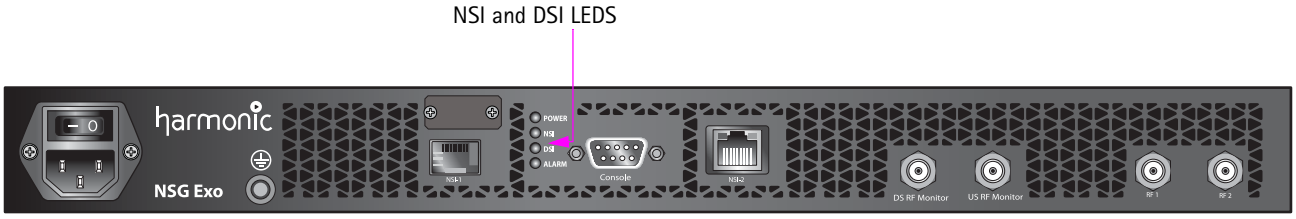
- Management network - Setting the management interface
- DHCP - Configuring operation support system.
- Cable Modem (CM) network - Configuring the RF parameters.
- CPE network

To configure NSG Exo settings, you need the following:

- Any serial application (Putty or Minicom on LINUX) that is installed on your computer and supports an SSH/Telnet connection.
- A cable with a DB-9 male connectors on both sides. In case, your computer does not have a serial port, use a USB to serial cable.

To configure the network:

1. Power-up the NSG Exo, and wait until it completes the boot process. The boot process is complete when the DSI and NSI lamps are lit on the front panel.



2. Connect the serial port cable to the DB-9 female connector on the front panel of the NSG Exo, then connect the cable to the DB-9 connector on the serial port of your computer. A USB-to-serial adapter may also be used at the computer.
3. Using the serial communication utility of your choice, configure the following parameters for the serial connection:
   - **Port Speed** - enter 115,200 bps
   - **Data bits** - enter 8 bits
   - **Stop Bits** - enter 1
   - **Party** - select None
   - **Flow Control** - select None

4. In the console type the following to access the CLI of the NSG Exo:
   - Username: `admin`
   - Password: `nsgadmin`

NOTE: To enhance security, change the default passwords indicated above. See *Changing a Password* on page 11.

5. Configure the physical layer of the management port. See *Configuring Physical Interface Type* on page 68.
6. Configure the management interface and sub-interface, see *Configuring Management Interface* on page 17.
7. Configure the default gateway. See *Configuring Default Gateway* on page 18.
8. Configure network services. See *Configuring Network Services* on page 19
9. Configuring the DHCP relay mode. See *Configuring Network DHCP Relay* on page 18.
10. Type `commit` to allow the NSG Exo to run with the new IP address. See *Saving Configuration* on page 12.
11. Exit *config* mode by pressing <Ctrl > D.
12. At the prompt type `copy running-config startup-config`. See *Saving Configuration* on page 12.

Controlling User-Access to CLI

To enhance the security of the NSG Exo, user-access to the device is controlled by a security mechanism. The security mechanism operates in the following modes:

- Local authorization mechanism - User names and passwords reside on the device.
- Remote authorization mechanism - User names and passwords reside on a remote TACACS+ server.

The following table lists the default username and password:

Table 2–1: Default Users

Account (username)	Password	Functions
admin	nsgadmin	Full read-write access, allows to configure the device and to administer users

To enhance security, change the default passwords indicated in the above table.

Changing a Password

1. To change the default password, type the following command: # **`passwd`**
2. Enter the current password.
3. Enter the new password.
4. Retype the new password.
5. Wait for a confirmation message.

Example

Changing password for admin:

```
admin#nsg-exo> passwd
current) UNIX password:
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
```

Accessing the CLI of the NSG Exo Device

To configure and monitor the NSG Exo device via the CLI, access remotely the CLI according to the instructions below:

1. Install any SSH/Telnet client on the computer, for example PuTTy.
2. Run the SSH/Telnet client.
3. Select SSH/Telnet (Secure Shell) protocol and port 22 - SSH and port 23 - Telnet.
4. Enter the IP address of the required NSG Exo device.
5. Start a session.
6. Login by entering a username and password. See *Controlling User-Access to CLI* on page 11.

   Once the prompt appears with the required access level, CLI Shell is running and you can start working.

CLI Prompt

The prompt of the CLI is as follows: <username>#`nsg-exo`

Configuration Files

Saving Configuration

You can save the configuration by executing one of the following commands:

- `commit` - saves any configuration changes stored in the pending-configuration to the running-configuration. It saves the configuration to the RAM. Validation is performed and CLI informs if commit succeeded. See example below.

  To view the pending configuration, type the following command:

  ```
  show pending-config
  ```

- `copy startup-config running-config` - saves start up configuration to the running configuration. It overrides running-configuration with startup-configuration.
- To save the running configuration to the startup configuration, type one of the following commands. It saves the configuration to the non-volatile memory:

  ```
  copy running-config startup-config
  write
  save
  ```

Revert Command

To negate any pending changes made prior to committing them to the running-configuration and to discard pending changes, type the following:

1. Enter config mode by typing at the prompt: `configure`.
2. At the prompt, type `revert`.

   The pending configuration is deleted.

Exporting/Importing Configuration Files

NSG Exo supports Session Control Protocol (SCP) for importing and exporting configuration files from a remote host.

To export the currently running configuration, type:

```
nsg-exo # export-running-config <scp-url>
```

Table 2–2: Export Configuration Parameters

Parameter	Explanation
scp-url	user@ip-address:path/filename

To import to the pending configuration, type:

```
(config)# import-pending-config <scp-url>
(config)# commit
```

Table 2–3: Import Configuration Parameters

Parameter	Explanation
scp-url	user@ip-address:path/filename

Validation Mechanism

The CLI supports the following types of validations:

- Syntax - checks while typing the command that the command is correct.

```
(config)# cable ds-rf-port
Syntax error: The command is not completed
```

  It checks that the parameter is entered according to its specific type and name and that the valid elements are indicated. In case you entered an invalid parameter the following message appears: `Illegal parameter`

CLI Commands

The CLI commands are grouped according to their functionality as the following table lists:

Table 2–4: CLI Hierarchy

Group	Explanation
General Commands	Execute general commands
Network	Configure/monitor network parameters.
Cable	Configure/monitor upstream and downstream traffic
Network Services	Configure network services such as: ■ access-list - configures the access list of the device ■ dhcp-relay - configures the DHCP Relay management ■ dns-server - allows to select the required dns server ■ ntp-server - configures the NTP server ■ snmp - configures SNMP parameters ■ syslog-server - configures the required Syslog server ■ tacacs-server - configures the TACACS server parameters
Show Cable Modem	■ View a single and multiple Cable Modems (CM)s
Show	■ View default configuration ■ Monitor performance
Troubleshooting	■ Monitor and upgrade the device

Tips for Working with the CLI

- Auto completion - If you type a partial word and press <Tab>, the CLI automatically completes it to the nearest command, or presents a list of possible completion options.
- Characters Case Sensitivity - CLI commands, keywords, and reserved words are case-sensitive.
- On-line Command Assistance - Once you type at the prompt a command followed by a question mark, you will receive a list of possible completion options. For example:
```
nsg-exo# cable ?
ds-rf-port Mute/unmute DS RF port
us-rf-port Mute/unmute DS RF port
```
- To terminate a session, type **`exit`**.

The following table lists the keys supported by CLI and describes their function:

Table 2–5: Keyboard Keys

Key Function	Explanation
Backspace	Deletes characters backwards
?	Displays the following: a list of options to choose from with a short explanation.

Table 2–5: Keyboard Keys

Key Function	Explanation
<Ctrl> A	Moves to the beginning of the line
<Ctrl> E	Moves to the end of the line
Up arrow	Moves to the previous logged command line
Down arrow	Moves to the next logged command line
Left	Moves the insertion point one character to the left
Right	Moves the insertion point one character to the right
<Ctrl> C	Aborts the current line
<Ctrl> K	Deletes the selected character
<Ctrl> U	Deletes the character to the left of the insertion point
Tab	auto completion
Exit	Ends the current command and ends a session

Understanding Command Modes

You can work in either of the following modes:

- Operational - This is the initial mode after successful login to the CLI. It is primarily used for viewing the status of the device, and for monitoring and troubleshooting the device operation. See *Monitoring* on page 37.
  - Action - See *General Commands* on page 68.
- Configuration - This mode allows you to configure the device. You can initiate this mode by entering the `configure` command in operational mode. The changes take effect once a successful commit command is entered.
  To exit the configuration mode, type **`exit`**.

  ```
  # configure
  ```

  Example:

  ```
  nsg-exo # configure
  ```

  See *Configuring Chassis Parameters* on page 16

Do

The `do` command executes a command while in config mode as if in operational mode.

While in config mode, type: do <show command>

Example – `do`

```
(config) # network dhcp-relay
(dhcp-relay) # mode 13
(dhcp-relay) # do show alarm
```

Chapter 3
Configuring Chassis Parameters

Chassis Configuration Overview

To configure the chassis, switch to configure mode. (See *Do* on page 15). The following chapter guides you on how to configure the system:

Configuring Remote Security Mechanism

The following section describes the available commands and parameters for TACACS+ configuration.

To enable the TACACS+ AAA security mechanism, apply the following:

NOTE: In TACACS+ we support Authentication only. There is not support for authorization or accounting.

- NSG Exo should have a connection to the remote TACACS+ server
- Login to the NSG Exo device as *admin* user and configure the server parameters as explained below:
  - tacacs server ip
  - tacacs-server key

To configure the TACACS+ server ip and encryption key, type:

`(config) # network tacacs-server` *`ip-address key`*

Table 3–1: TACACS+ Server Parameters

Parameter	Explanation
ip address	The IP address of the remote TACACS+ server String in a format of an IP address: A.B.C.D
key	The encryption key of the server String, <word>

To remove TACAS+ Server

To remove the TACACS+ server configuration, type:

```
(config) # no network tacacs-server
```

Configuring Management Interface

NSG Exo is furnished with two physical NSI ports:

- RJ-45 - Copper Gigabit interface
- SFP - Fiber Gigabit interface

NOTE: Korean version only. NSI port with LC/SC interface - supports the GPON protocol

At any time, only one NSI port is active and it is defined as port 0. You must select the required NSI port. Once you configure the admin-state of one of the ports to up, the other ports are automatically set to down. Since the port is also a management port, you can never select down.

To configure the physical interface type, see *Configuring Physical Interface Type* on page 68.

```
interface gigabit port
admin-state {up| down}
sub-interface {mng | cm | cpe |emta}
```

Table 3–2: Configuring Interface

Attribute/Value	Explanation
port	Integer Currently only 0
admin-state	Port is always up and cannot be down. up | down
sub-interface	Allows to configure VLAN interfaces.
sub-interface	Select one of the following: mng | cm | cpe| emta
ip-address/netmaks	IP address and subnet of the sub-interface.
ip-address/subnet	String in the following format: xxx.xxx.xxx.xxx/xx
encapsulation	Select the VLAN encapsulation.
encapsulation-dot1q	Integer between 1 to 4095

Example

```
(config) # interface gigabit 0
(if-gigabit 0) # admin-state up
(if-gigabit 0) # sub-interface mng
(sub-interface msg) # ip-address 40.41.42.2/24
(sub-interface msg) # encapsulation-dot1q 555
(if-gigabit 0) # sub-interface cm
```

```
(sub-interface cm) # ip-address 30.31.32.2/24
(sub-interface cm) # encapsulation-dot1q 333
(if-gigabit 0) # sub-interface cpe
(sub-interface cpe) # ip-address 40.41.42.2/24
(sub-interface cpe) # encapsulation-dot1q 444
(if-gigabit 0) # sub-interface emta
(sub-interface emta) # ip-address 50.51.52.2/24
(sub-interface emta) # encapsulation-dot1q 555
(sub-interface emta) # commit
```

Initial Configuration of Management Port

To configure the management port IP, while in configuration mode, type the following command:

`(config)# ip-address` *`ip-address`*

Table 3–3: Configuring Management Port Parameters

Attribute/Value	Explanation
ip-address/netmaks	String in the following format: A.B.C.D/mask

Configuring Default Gateway

To configure the default gateway, type:

NOTE: This command is run while not in config mode!

`# default-gateway` *`ip-address`*

Table 3–4: Configuring Gateway Parameters

Attribute/Value	Explanation
default-gateway	Configure the IP the default gateway for management interface
ip-address	String in the following format: A.B.C.D

Example

```
# default-gateway 172.17.1.100
```

Configuring Network DHCP Relay

You can configure the NSG Exo DHCP Relay to work as l2 or l3. For layer-3, NSG Exo adds DHCP relay-agent option 82.1 *remote id* to upstream DHCPv4-DISCOVER and DHCPv4-REQUEST messages that contain the 6-byte MAC address of the host-type.

To configure, type the following command:

```
# network dhcp-relay
(dhcp-relay) # mode mode
(dhcp-relay) # option82 circuit-id circuit-id
(dhcp-relay) # host-type [{cm|cpe|emta}
(dhcp-relay host-type) dhcp-server ip-address
```

Table 3–5: Configuring DHCP Relay

Attribute/Value	Explanation
network dhcp-relay	Enter this command
mode	DHCP relay mode of work. Set active or passive DHCP relay behavior.
mode	l2 (layer 2) | l3 (layer 3) Default: l3
option82 circuit-id	Set the name of option82 circuit-id
option82 circuit-id	String: user definable, no spaces or special characters are allowed. Default: circuit-id
host-type	Sets the type of the host
host-type	{cm|cpe|emta}
dhcp-relay	Sub-menu to configure CM or CPE
dhcp-server	Parameter of host-type. The IP address of the server for sending unicast packets.
ip-address	String in the format of IPv4 IP address: A.B.C.D

Example

```
(config) # network dhcp-relay
(dhcp-relay) # mode l3
(dhcp-relay) # option82 circuit-id test
(dhcp-relay) # host-type cpe
(dhcp-relay host-type cpe) dhcp-server 24.24.24.24
(dhcp-relay host-type cpe) commit
```

To ping the IP, see *Ping IP* on page 69.

To view the interfaces, see *Show Interfaces* on page 58.

Configuring Network Services

Configuring Access List (ACL)

The access list allows configuration of packets inbound from the Cable Modem (CM)\CPE\EMTA and out-bound to the CM\CPE\EMTA. By default no access list is configured. Once you configure an access list, only the rules of the configured access list apply.

NOTE: If you configured an ACL rule, and it does not match any rule, packets are dropped.

See also *Enable/disable Access List* on page 75.

To configure access lists for traffic, type the following command:

```
(config) # access-list {cm | cpe |emta} rule index action protocol src-ip
dest-ip operator tos tos
```

Table 3–6: Configuring Parameters of Access List Traffic

Attribute/Value	Explanation
access-list	Select the type of packets to be included in the traffic.
host-type	cm | cpe | emta
rule-index	Integer between 0 to 59
action	permit | deny
protocol	any | tcp | udp | igmp | custom protocol number: Integer
src-ip	Source IP any, or IP address in either format: xxx.xxx.xxx.xxx, or xxx.xxx.xxx.xxx/xx
operator [port]	operator: eq [ftp | ssh | snmp | syslog | dns | ntp | custom port: integer]
tos	Type of Service
tos	Integer between 0 to 7

Example

```
access-list cpe 0 permit tcp 32.1.1.1/24 32.1.1.2/24 eq 22 tos 1
```

Configuring Access List for Management

To configure access lists for management traffic, type the following command:

```
(config) # access-list-mng rule index action [protocol] src-ip/[net-
mask] [eq port] [tos tos]
```

For explanation, see *Configuring Access List (ACL)* on page 19.

Examples

```
# access-list-mng 0 permit tcp 26.1.1.100/24 eq ssh tos 1
# access-list-mng 1 permit icmp any
```

Configuring Access List for Multicast Traffic

To configure access lists for multicast traffic, type the following command:

```
(config) # access-list multicast rule index rule index action ip-
address-mask ip-address-mask
```

Table 3–7: Access List Multicast Traffic Parameters

Attribute/Value	Explanation
rule-index	Integer between 0 to 59

Table 3–7: Access List Multicast Traffic Parameters

Attribute/Value	Explanation
action	permit | deny
ip-address-mask	IP address and mask of the multicast group that is either permitted or denied in the following format: xxx.xxx.xxx.xxx/xx

Example

```
(config)# access-list-mng 0 permit 10.40.23.2/24
```

See also *Show Access List* on page 63.

Configuring SNMP Parameters

The NSG Exo is capable of reporting its status via SNMP (Simple Network Management Protocol) to a third-party SNMP-based network management systems.

The NSG Exo status is reported to the SNMP Trap Receiver in the following ways:

- SNMP Traps - notifications that the NSG Exo initiates and sends to the SNMP Trap Receiver to indicate the assertion or remittance of an alarm or warning. SNMP Traps are sent only to SNMP Trap Receivers that are registered with the NSG Exo.
- Alarms status queries - the SNMP Trap Receiver may query the NSG Exo for its current alarms status. The NSG reports this information using standard and custom SNMP MIBs.
- Configuration and Traffic queries - the SNMP Trap Receiver may query the NSG Exo for various configuration parameters, as well as various traffic counters that indicate the rate of traffic that is flowing through the interfaces of the NSG Exo.

Configuring an SNMP Trap Receiver

You can configure a list of up to two SNMP Trap Receivers.

`(config) # network snmp notification-receiver` *receiver-id* [**`server-ip`** *receiver-ip* **`type`** *trap-type*]

Attribute/Value	Explanation
notification-receiver	Destination and type of trap.
receiver-id	Integer between 0 to 1.
ip	The IP Address of the computer to which you wish to forward all SNMP traps from the NSG Exo.
receiver-ip	String in the format of an IP address (xxx.xxx.xxx.xxx)
type	Optional. The SNMP version as follows: ■ snmpv1-trap ■ snmpv2c-inform
type	v1 |v2c | v2inform

Example

```
(config) # network snmp notification-receiver receiver-id 0
(snmp-notif-receiver receiver-id)#
Configure an individual receiver:
(config) # network snmp notification-receiver receiver-id
(snmp-notif-receiver receiver-id)# server-ip receiver-ip
(snmp-notif-receiver receiver-id)# type trap-type
```

Disabling SNMP Trap Notifications

`(config) #` **`no network snmp notification-receiver`** *receiver-id*

Configuring SNMP Community String

To configure the SNMP Community String, type the following command:

`network snmp community` *community-string*

Table 3–8: Configuring SNMP Community String

Attribute/Value	Explanation
community	Optional. Enter the required value for the SNMP Community String. It is the name of the community having Read access to the SNMP MIB Objects of the NSG Exo.
community-string	String 1 to 32 chars. Default: *public*.

Configuring Remote Syslog Services

NSG Exo supports remote Syslog, a standard-based method for centralized logging of device messages. A Syslog server that is registered with the NSG Exo device will receive messages from the device whenever an alarm or warning is asserted or remitted.

You can configure up to two Syslog servers.

`(config) #` **`network syslog-server`** *server-id*

`(syslog-server` *`server-id`*`) #` **`server-ip`** *server-ip*

Table 3–9: Configuring Syslog

Attribute/Value	Explanation
server-id	The ID of the Syslog server. You can configure up to ten Syslog servers.
server-id	0/1/2/3/4/5/6/7/8/9
server-ip	IP address of the Syslog server that logs the NSG events.
server-id	String in the format of an IP address: xxx.xxx.xxx.xxx

Example - Configuring Syslog

```
(config)# network syslog-server 0
(syslog-server 0)# server-ip 10.40.22.67
(syslog-server 0)# commit
Commit complete
```

Remove Remote Syslog Server from Running Config

`(config) # no network syslog-server` *server-id*

For *server-id* see, *Table 3–9* on page 22.

Configuring NTP Server

To maintain proper time, connect to an NTP server. NSG Exo is not furnished with a hardware clock.

`(config) # network ntp-server` *ip-address*

Table 3–10: Configuring NTP Server

Attribute/Value	Explanation
ip-address	String in a format of an IP address: xxx.xxx.xxx.xxx

Configuring DNS Server

You can configure up to two DNS servers. The search is according to the server ID, from 0, the lowest to 1, highest.

```
(config) # network dns-server server-id
(dns-server server-id) # server-ip server-id
```

Remove DNS Server Configuration

To remove DNS server configuration from running config, type:

`(config) # no network dns-server` *server-id*

Table 3–11: Configuring DNS Server

Attribute/Value	Explanation
server-id	Integer 0 |1
server-ip	String in the format of an IP address: xxx.xxx.xxx.xxx

Configuring the RF Ports

The RF ports of the NSG Exo support Downstream (DS) and Upstream (US) channels in the following configuration per platform:

- Two independent RF ports, one DS, one US. (PN: NSGEXO-CH-SRF)

- Combined DS/US ports. (PN: NSGEXO-CH-CRF)

The following commands allow the configuration of the DS and US channels.

`cable ds-rf-port` includes a sub-mode: **`down-channel.`** This sub-mode configures the required down channel. See *Configuring a Downstream RF Port* on page 24.

`cable us-rf-port` includes a sub-mode: **`upstream-channel.`** This sub-mode configures the required upstream channel. See, *Configuring the Upstream RF Port* on page 28.

Configuring a Downstream RF Port

To configure a downstream RF port, type:

```
(config) # cable ds-rf-port port
(ds-rf-port 0) # admin-state admin-state
(ds-rf-port 0) # annex annex
(ds-rf-port 0) # auto-assign-freqs freqs
(ds-rf-port 0) # start-frequency-mhz - start-frequency-mhz
(ds-rf-port 0) # end-frequency-mhz - end-frequency-mhz
(ds-rf-port 0) # interleaver interleaver
(ds-rf-port 0) # modulation modulation
(ds-rf-port 0) # tilt-type tilt-type
(ds-rf-port 0) # base-power-dbmv base-power-dbmv
(ds-rf-port 0) # tilt-attenuation-db tilt-attenuation-db
(ds-rf-port 0) # max-carriers max-carriers
(ds-rf-port 0) # down-channel down-channel
(down-channel-index index)# admin-state admin-state
(down-channel-index index)# attenuation attenuation
(down-channel-index index)# frequency-mhz frequency-mhz]
```

Table 3–12: DS RF Port Configuration

Attribute/Value	Explanation
port	Integer 0
admin-state	Disable/enable the port. Applies to both downstream and upstream.
admin-state	String up | down.
annex	Enter the required ITU-T Annex.
annex	a | b ITU-T Annex A - Utilizes bandwidth of 8 MHz per QAM-RF channel. ITU-T Annex B - Utilizes bandwidth of 6 MHz per QAM-RF channel. Default: Annex A

Table 3–12: DS RF Port Configuration

Attribute/Value	Explanation
auto-assign-freq	Automatically assigns frequencies in MHz for downstream channels. Configure the center frequency of the first (lowest) carrier value channel. The frequency of the adjacent channels is increased from the first channel according to the Annex: Annex A - steps of 8 MHz Annex B - steps of 6 MHz
freq	Integer between: Annex A/B: 85 to 1006, step size 1 MHz Default for Annex A: 530 MHz for channel 0 Default for Annex B: 123 MHz for channel 0 Note: The indicated range is for center frequency
start-frequency-mhz	Lower bound for downstream channel frequency. Use this parameter during tilt equalizing calculations.
start-frequency-mhz	Integer between: Annex A/B: 85 to 1006 MHz with steps of 1 MHz Default: 85 MHz Note: The indicated range is for center frequency
end-frequency-mhz	Upper bound for downstream channel frequency. Use this parameter during tilt equalizing calculations.
end-frequency-mhz	Integer between: Annex A/B: 85 to 1006 MHz with steps of 1 MHz Default: 1006 MHz Note: The indicated range is for center frequency
modulation	The type of Quadrature Amplitude Modulation (QAM) used. QAM constellation affects Data Rate and Symbol Rate, and must be set according to HFC network properties.
modulation	qam64 | qam256 Default: qam256
interleaver	An advanced QAM modulation parameter. Not configurable.
interleaver	The values are according to the following: For Annex-A/C, use i12j17. For Annex-B, use: i8j16/i16j8/i32j4/i64j2/i128j1/i128j2/i128j3/i128j4/i128j5/i128j6/i128j7/i128j8. Default: i32j4

Table 3–12: DS RF Port Configuration

Attribute/Value	Explanation
tilt-type	This parameter affects the configuration of the power level of down-channels. We assume the following: Fs: start frequency Fe: end frequency Fc: down-channel configured frequency. Am: tilt-attenuation Ach: Not normalized attenuation per channel in dB Normalized Ach: The output. Attenuation per down-channel (power-level) They are two formulas to set the power: ■ Linear: Ach = (Fs - Fc) * (Am / (Fe - Fs)) + Am ■ Cable, curve formula: Ach = Am – [Am / (1 – SQRT(Fs/Fe)] * [SQRT(Fc/Fe) - SQRT(Fs/Fe))] The final attenuation per channel value is calculated after bias (normalization) of set of Ach′ by attenuation of highest frequency channel Ach = [A1′, A2′, ..An′] – An′ Then An will be always equal to 0
tilt-type	String: linear | cable
base-power-dbmv	Operational transmit power for all down channel. Base power depends on type of Board whether CFR - Combined RF or SRF - Separate RF
base-power-db	■ CRF Integer between 47 dBmv to 55 dBmv in steps of 0.1 db ■ SRF Integer between 50 dBmv to 58 dBmv in steps of 0.1 db Default: 55 dBmv
tilt-attenuation-db	Configure the maximum tilt attenuation.
tilt-attenuation-db	Integer between 0.0 dBmv to 14 dBmv in steps of 0.1 db Default: 0.0 dBmv

Table 3–12: DS RF Port Configuration

Attribute/Value	Explanation
max-carriers	The number of downstream channels that can be active at the same time. This parameter affects the actual power per channel according to the following formula: $P_{ch} = BasePower - 10log_{10}(max\_carriers) - A_c$, Where Ac is attenuation per channel in accordance to equalizer formula. Example of power per channel calculation: If base-power = 50 dBmV, max-carriers = 8, tilt-attenuation = 0 dB. Since tilt-attenuation = 0dB, Ac = 0 for all channels. (flat mode) Pch = 50 - 10lg(8) - 0 = 50 - 9.03… ~ 41.0 dBmV - to be configured to controller. If tilt-attenuation is not 0, the Ach is calculated for each channel according to the formulas from tilt-type section, and the resulting power varies across channels.
max-carriers	Integer between 1 to 16
cw-freq-mhz	Configures frequency for CW mode
down-channel	Access the down-channel sub-menu
	To configure use the following command parameters: channel-index | admin-state | frequency-mhz
channel-index	Integer between 0 to 15 | all | <channel-index-start-0>[-<channel-index-end-0>][,<channel-index-start-i>[-<channel-index-end-i>]] Downstream channels are numbered from 0 to 15 all – configuring all channels; <channel-index-start-i>-<channel-index-end-i> syntax allows configuring multiple channels at once. Example: `# down-channel 0-2,4,8-10.`

Example

```
(config)# cable ds-rf-port 0
(ds-rf-port 0)# attenuation 0.1
(ds-rf-port 0)# down-channel 1
(down-channel 1)# admin-state up
(down-channel 1)# frequnce-mhz 210
```

Restoring Configuration of DS RF Port and Channel

To restore DS RF port configuration, to factory default configuration, type:

`(config) # no` **`cable ds-rf-port`** *`port`*

To restore DS RF down channel configuration, to factory default configuration, type:

```
(config) # no down-channel channel-index
```

Configuring the Upstream RF Port

To configure the upstream RF port, type:

```
(config) # cable us-rf-port port
(us-rf-port 0) # admin-state admin-state
(us-rf-port 0) # us-phy-channel channel-index
(us-phy-channel channel-index) # frequency-mhz frequency-mhz
(us-phy-channel channel-index) modulation-profile
(us-phy-channel channel-index)width-mhz width-mhz
(us-phy-channel channel-index)power-level-dbmv pwoer-level-dbmv
```

Table 3–13: US RF Port Configuration

Attribute/Value	Explanation
port	Integer: 0
admin-state	Disable/enable the port.
admin-state	String up | down.
auto-assing-freqs	Assign frequencies to all upstream channels. The first channel has center frequency equal to *start-freq* each next channel has frequency of previous channel + *channel-width*.
auto-assign-freqs	*start-freq* width *channel-width* where, *start-freq* - center frequency for the first upstream channel (us-phy-channel 0): Annex A/B: 5 to 65 MHz *channel-width* - width per channel - 1.6 | 3.2 | 6.4 MHz
us-phy-channel	Access the upstream physical-channel sub-menu. The sub-menu includes the following parameters: frequency-mhz, modulation-profile-id and width-mhz
channel-index	<integer: 0..3>| all | <channel-index-start-0>[-<channel-index-end-0>][,<channel-index-start-i>[-<channel-index-end-i>]] Upstream physical channels are numbered from 0 to 3 all – configuring all channels; <channel-index-start-i>-<channel-index-end-i> syntax allows configuring multiple channels at once. Example: # us-phy-channel 0-1,3
frequency-mhz	Sub-menu of us-phy-channel. Configure the center frequency of the up channels.
admin-state	Sub-menu of us-phy-channel. Configure whether channel is enabled or disabled.

Table 3–13: US RF Port Configuration

Attribute/Value	Explanation
frequency-mhz	An integer between: Annex A: 5 to 65 mhz in steps of 0.1 MHz Annex B: 5 to 42 MHz in stpes of 0.1 MHz Default: 20 mhz
modulation-profile	Sub-menu of us-phy-channel. Select the required profile. The profile includes the following parameters: ■ modulation ■ type ■ group
modulation-profile	*modulation* qpsk | qam16 | qam32 | qam64 | qam256 *type* atdma *group* high-noise | medium-noise | low-noise | low latency See *Modulation Profiles for Annex A* on page 85.
width-mhz	Sub-menu of us-phy-channel. The width of the channel.
width-mhz	Select one of the following: 1.6 | 3.2 | 6.4 mhz
power-level-dbmv	Power level in dBmv
power-level-dbmv	Ranges between 13.0 to 23.0 in steps of 0.1 db Default: 0.0 dBmv

```
(config) # cable us-rf-port 0
(us-rf-port 0)# us-phy-channel 0
(us-phy-channel 0)# modulation-profile qpsk atdma high-noise
(us-phy-channel 0)# power-level-dbmv 0.1
```

Restoring Configuration of US RF Port and Channel

To restore US RF port configuration to the factory default configuration, type:

```
(config) # no cable us-rf-port port
```

To restore US RF down cannel configuration to the factory default configuration, type:

```
(config) # no up-channel channel-index
```

Shutting Down DS/US RF Port

To mute the DS/US RF port, type:

```
# cable ds-rf-port port mute
```

```
# cable ds-rf-port port unmute
```

Table 3–14: Mute DS/US RF Port

Attribute	Explanation
port	Integer 0

Cable Modulation Profile

The modulation profile allows to configure modulation intervals. Each configured set of intervals is identified by a unique ID, code IUC. Each set includes a set of burst parameters. Each upstream physical channel is associated with a profile. See *Configuring the Upstream RF Port* on page 28.

The following table lists the IUCs that should be defined for each type of upstream channel:

Table 3–15: IUCs and Upstream Channel

US Channel Type	Required IUCs
tdma	request(1), initial(3), station(4), short(5), long(6)
atdma	request(1), initial(3), station(4), a-short(9), a-long(10), a-ugs(11)
tdma-atdma	request(1), initial(3), station(4), short(5), long(6), a-short(9), a-long(10), a-ugs(11)

NOTE: NSG-Exo release 1.0.x supports atdma modulation-profile only. It is not configurable.

Configuring DS Bonding Group (DBG)

Once you create bonding groups, NSG Exo associates the CMs to the bonding groups and applies load-balancing across the groups.

The following command allows the following:

- To create DS bonding groups
- To modify the configuration of existing DBGs

```
(config) # cable ds-bonding-group dbg-id
(cable ds-bonding-group dbg-id) down-channel-set ds-channel
(cable ds-bonding-group dbg-id) description description
```

Table 3–16: DS Bonding Group Configuration

Attribute	Explanation
`cable ds-bonding-group`	Create a bonding group or define the required existing bonding group
`dbg-id`	The ID of the downstream bonding group. Integer between 0 to 31

Table 3–16: DS Bonding Group Configuration

Attribute	Explanation
down-channel-set	Sub-menu. Defines the down-channels of the bonding group
ds-channel	Down channel set <ds-channel-id-l-start>[-<ds-channel-id-l-end>][,<ds-channel-id-k-start>[-<ds-channel-id-k-end>]
description	Short description to easily identify the group
description	String

Example

```
(config)# cable ds-bonding-group 10
(cable ds-bonding-group 10)# down-channel-set 1-3,7
(cable ds-bonding-group 10)# description "Custom 4 channel DBG"
(cable ds-bonding-group 10)# commit
```

Deleting DS Bonding Group

To delete a DS bonding group, type:

```
(config) # no cable ds-bonding-group dbg-id
```

Configuring Auto DS Bonding Group

You can enable or disable the automatic association with a DS bonding group:

- Automatic mode is disabled - the CM registers to one of the pre-configured DBG, within the LBG (Load Balancing Group).
- Automatic mode is enabled - the CM registers to on-the-fly created DBG, within the LBG (Load Balancing Group). The registration is accoding to the following QAM policy to allow load-balancing across all channels:
  - Assign to CM a set of QAMs with smallest sum (CM count)
  - Prefer lower QAM indexes when count is equal
  - Assign consecutive QAMs
  - Primary QAM for CM is the left most QAM

To enable/disable an auto DS bonding group, type the following command:

```
(config) # cable auto-ds-bonding-group enable|disable
```

Table 3–17: Automatic Bonding Group

Attribute	Explanation
cable auto-ds-bonding-group	When enabled, automatically creates bonding groups to provide CMs with RCS. Manually configured bonding groups are not used. When disabled, only manually configured DS Bonding Groups (DBGs) are used
enable | *disable*	enable | disable Default: enable

Manual Bonding Group Configuration

The simplest method for configuring both upstream and downstream channel bonding groups is for the NSG Exo to automatically perform this action by creating and assigning Cable Modems to specific bonding groups. However, there may be specific use cases where manually defining each bonding group is required. The NSG Exo fully supports this function through the use of Restricted Load Balancing Groups (RLBG).

By default, all Exo downstream and upstream channels belong to the general load balancing group. Once you configure a RLBG, restricted channels are removed from the general load balancing group. Typically CMs with service type TLV 43.11 are restricted from the general group and belong to a RLBG. You can configure up to four RLBGs.

New CMs with service type string, extracted from TLV 43.11, are steered to the matching RLBG. If no RLBG matches the service-ID string, or if the CMs are without service-ID string, the CM is steered to the default load balancing group: the general load balancing group.

This configuration is applied only upon registration. Once CM has passed the registration stage, it can be steered only by using DCC commands and not by changing dynamically the RLBGs. See *Test Cable DCC* on page 73 and *Test Cable DBC* on page 74.

NOTE: DS and US channels of one RLBG should not overlap with other RLBGs.

To configure load-balancing restricted group according to service type TLV 43.11, type the following command:

```
(config) # cable load-balancing restricted lb-group-id
         # down-channel-list down-channel-list
         # up-phy-channel-list up-phy-channel-list
         # service-type service-type
         # description description
```

Table 3–18: RLBG Configuration

Attribute	Explanation
ib-group-id	Define the ID of the RLBG
lb-group-id	The ID of the restricted group. Integer between 0 to 3

Table 3–18: RLBG Configuration

Attribute	Explanation
down-channel-list	Mandatory parameter. Down channel list String
up-phy-channel-list	Mandatory parameter. Up steam cannel list
service-type	Mandatory parameter. Service type ID String
description	Optional. A short description to easily identify the group
description	String

Example

In this example all CMs that have voice configured as TLV 43.11 service type ID in their config file, are steered to DS 0-3 US 0-1. ALL other CMs are on Ds 4-15, Us 2-3.

```
(config) # cable load-balancing restricted 0
(load-balancing 0) # down-channel-list 0-3
(load-balancing 0) # up-phy-channel-list 0-1
(load-balancing 0) # service-type voice
```

Deleting RLBG

To delete RLBG, type the following command:

```
(config) # no cable load-balancing restricted lb-group-id
```

For parameter, see *Table 3–18* on page 32.

Cable Modem Remote Query

This command allows to remotely retrieve CM information.

To poll CM information, type the following command:

```
(config) # cable modem remote-query [polling-interval community-
string] [src-ip ip-address]
```

Table 3–19: Cable Modem Remote Query

Attribute	Explanation
polling-interval	Defines the delay between a query If CM remote query is enabled, but polling interval is not configured, the default value is 30s. Note: The default should be optimized for cases were we have 200 CMs registered. integer between 1 to 86,400

Table 3–19: Cable Modem Remote Query

Attribute	Explanation
community-string	SNMP community string. Note: When resetting SNMP community string, it is advised to disable CM remote query, and then reconfigure it. String
src-ip	TBD
src-ip	

Deleting Remote Query

To delete the remote CM query, type:

```
(config) # no cable modem remote-query
```

Logging

You can access the logging, a sub-menu of config. This sub-menu allows to do the following:

Configure the default destination for logging events

Configure events priority for defining which events to be logged

To enter the logging sub-menu, type **logging** while in configure mode.

```
admin#nsg-exo> configure
Entering configuration mode terminal
(config)#
(config)# logging
(logging)#
```

default

To configure the default logging destination:

```
(logging)# default destination dest-set | disable
```

Table 3–20: Logging default Destination

Attribute	Explanation
dest-set	A substring of ltsc for local (file), traps (snmp), syslog, and console destinations
disable	Disable event logging

NOTE: Destination traps require configuration of network snmp. See *page 21*.

log-level

To configure a default minimum log-level, events with priority lower than the minimum, are not logged, by default, type:

```
(logging)# log-level priority
```

Table 3–21: log level

Attribute	Explanation
priority	debug | information | notice | warning | error | alarm | critical | emergency

priority

To override logging rule for event with specific priority, type:

```
(logging)# priority priority destination dest-set | disable
(logging)# no priority
```

Table 3–22: Logging Priority

Attribute	Explanation
priority	debug | information | notice | warning | error | alarm | critical | emergency
dest-set	A substring of ltsc for local (file), traps (snmp), syslog, and console destinations
disable	Disable event logging for subset of event with specified priority

event

To override logging rule for specific events, type:

```
(logging)# event range-str destination dest-set | disable
(logging)# no event list-str
```

Table 3–23: Override Logging Rule

Attribute	Explanation
range-str	Range of event IDs. For example 1,2-5,7-9
dest-set	A substring of ltsc for local (file), traps (snmp), syslog, and console destinations
disable	Disable event logging for specific event

Chapter 4
Monitoring

Overview

This chapter includes the show commands to monitor the following:

Show Cable Modem

You can view the following:

A single CM with default information. See *Show CM (Default)* on page 37

A single/multiple CM with specific information. See *Show CM Specific Information* on page 40

Show CM (Default)

To view a single Cable Modem (CM), type:

`show cable modem` Shows information regarding all CMs associated with the device.

`show cable modem` {*`cm-mac-addr`* | *`cm-ip-addr`*} Shows information for a single CM associated with the device.

You can also type: **scm** {*cm-mac-addr* | *cm-ip-addr*}

```
CM MAC          CM IP           NUM CM           DOC. BOND DS CHAN     US CHAN
ADDRESS         ADDRESS         CPE STATE        VER  ACT  LIST        LIST
-------------- --------------- --- ------------ ---- ---- ----------- ---------
0002.00e2.8e88 172.17.10.91      0 b-online     2.0  3x1  Ds0:0-2     Us0/1
================================================================================
Command Total:            1 CM   0 CPE
```

Table 4-1: Show Cable Modem (Default) Output

Parameter	Explanation
CM MAC Address	CM Ethernet MAC address
CM IP Address	CM IpV4 address
Num CPE	Indicates the number of the CPEs that are actively supported by the CM.

Table 4–1: Show Cable Modem (Default) Output

Parameter	Explanation
CM State	Displays the CM state: ■ offline - The NSG-EXO is not receiving any ranging requests from the CM. ■ init(r1) - The NSG-EXO received an initial ranging request from the CM but did not yet send a ranging response ■ init(r2) - The NSG-EXO sent a CONTINUE ranging response to the CM, with or without adjustments. ■ init(rc) - The NSG-EXO sent a SUCCESS ranging response to the CM (ranging complete). ■ init(o) - The NSG-Exo forwarded an upstream TFTP-GET request from the CM (options file started). ■ online - The NSG-EXO completed registration for a CM without BPI enabled in its registration request. ■ online(pt) - The NSG-EXO received a valid BPI TEK request and responded to it. BPI encryption is established and the NSG-Exo is forwarding NSI traffic to and from the CM. ■ f-online - An f- prefix before one of the online CM states indicates that the CM is online but failed bonding initial ranging. The Bond Cap column shows the bonding capability of the CM, but it is online using legacy DOCSIS 2.0 1x1 operation. ■ p-online - A p-prefix before one of the online CM states means that the CM is in partial operation with some impairment to one of the channels indicated by its Bond Act column. Run the `show cable modem partial-mode` command to report the particular impairment. See *page 49*. ■ b-online - A b-prefix before one of the online CM states means that the CM is operating normally in a bonded downstream and/or upstream mode. ■ init(d) – The NSG-Exo has forwarded an upstream IPv4HCP-DISCOVER from the initializing CM (“discover”). ■ init(io) – The NSG-Exo has forwarded a downstream IPv4DHCP-OFFER to an initializing CM. ■ init(a) – The NSG-Exo has forwarded a downstream IPv4 DHCP-ACK to an initializing CM. Error states, for all of which the NSG-Exo blocks forwarding of NSI traffic to or from the CM: ■ reject(c) – The NSG-EXO has rejected the configuration in a registration request. This could be for many reasons, including but not limited to format errors, insufficient reserved bandwidth, insufficient internal resources, timestamp check validation error, etc. ■ reject(na) – The NSG-Exo has rejected a CM initialization because it never received a REG-ACK.
Doc. Ver	DOCSIS version of the CM.
Bond Act	The actual number of channels that are used by the default downstream service flow and the default upstream service flow of the registered CM.

Table 4–1: Show Cable Modem (Default) Output

Parameter	Explanation
DS Chan List	Indicates the active DS channels allocated for the modem. Indication is in either of the following formats: Ds<P/C> or Ds<P:X-y> ■ P/C indicates cable ds-rf-port P down-channel C. ■ P:X-y indicates a downstream bonding CM with its default service flow on cable ds-rf-port P in a port-specific load balancing group with channel set X-y
US Chan List	Indicates an active US channels allocated for the modem in either of the following formats: Us<P/C> or Us<P:X-y> ■ P/C indicates cabled us-rf-port P upstream-physical-channel C. ■ P:X-y indicates a CM with a bonded default service flow on cable us-rf-port P channel set X-y

Show CM Specific Information

For a single CM, type:

show cable modem {*cm-mac-addr* | *cm-ip-addr*} [*option*]

For multiple CMs, type

show cable modem [*option*] **select** {*multiple cm*}

`show cable modem`, see *Table 4–2 on page 40*.

`show cable modem [option]`, see *Table 4–3 on page 40*.

`show cable modem [option]` **`select`** {*multiple cm*}, see *Table 4–4* on page 41.

Table 4–2: Show CM

Parameter	Explanation
cm-mac-addr	String in the format of a MAC address: hhhh.hhhh.hhhh
cm-ip-addr	String in the format of an IP address.
`select`	select a particular subset of CMs
multiple cm	Select a particular subset of CMs.

Table 4–3: Show CM Option

Parameter	Explanation
bonding	Display information relevant to a bonding-capable CMs

Table 4–3: Show CM Option

Parameter	Explanation
counters	Display the counters for traffic received and transmitted to a cable modem
host-type	Display information about CPE and EMTA
cpe	Contents of CM/CPE learning tables
EMTA	Display infirmation about EMTA
phy	Display DOCSIS PHY layer information for one or more CMs
primary-channel	Display information about CM's on Primary DS channels
service-flow	Display information about all service flows associated with a particular CM
verbose	Display a detailed state of cable modems
Summary	Displays summary of CM state
Partial-mode	Information about cable modems that are in upstream and downstream partial service mode
Uptime	Indicates the CM uptime since the last reset.
Bonding Group	Indicates the ID of the DS bonding group the CM is associated with.

Table 4–4: Show CM Multiple CMs

Parameter	Explanation
bonding	Selects CMs registered to receive traffic from a DBG or to send traffic on a UBG.
ds-bonding	Selects registered CMs configured to receive downstream bonded traffic
failed-bonding	Selects registered bonding-capable CMs i.e. that advertised MTC Support (TLV 5.26) or MRC Support (TLV 5.29)) and for which any of the following occurred: ■ The CM initially ranged with the legacy "RNG-REQ" or INIT-RNG-REQ message because it failed to detect a downstream MDD, causing the NSG-Exo to register the CM with a traditional 1x1 channel configuration. ■ The NSG-Exo has DBGs configured on the mac-domain of the CM but the downstream SF assignment algorithm failed to assign any DBG to any SF of the CM ■ The NSG-Exo has UBGs configured on the mac-domain of the CM but the upstream SF assignment algorithm failed to assign any UBG to any SF of the CM.

Table 4–4: Show CM Multiple CMs

Parameter	Explanation
legacy-ranging	Selects CMs that are currently performing or have completed initial ranging with legacy RNG-REQ or INIT-RNG-REQ messages instead of the DOCSIS 3.0 B-INIT-RNG-REQ message.
non-bonding-capable	Selects CMs that registered without advertising the capability of Multiple Transmit Channel Support TLV 5.26 or Multiple Receive Channel Support (TLV 5.29). This is a subset of the CMs selected with legacy-ranging, i.e. those that have completed registration and are known to not support bonding.
offline	Selects offline CMs that are no longer attempting to send ranging requests. The NSG-Exo automatically deletes offline CMs after 24 hours.
registered	Selects CMs that are online, i.e. they have completed registration and, if required, initial BPI keying. They are reported with a CM STATE value of online.
un-registered	Selects CMs that are actively initializing, i.e. with a reported CM STATE other than offline or online…
us-bonding	Selects cable modems that are registered with a service flow assigned to an upstream bonding group.

Bonding Information

A bonding CM is a DOCSIS 3.0 CM registered to receive multiple downstream channels or to transmit over multiple upstream transmit channels on any service flow.

The command presents information for all CMs that indicated in their registration request that they are capable of either downstream or upstream bonding.

To display bonding information regarding a single CM, type:

```
# show cable modem {cm-mac-addr cm-mac-addr} bonding
```

To display bonding information regarding multiple CMs, type

```
# show cable modem bonding
```

```
admin#nsg-exo> scm 0c47.3dc7.8b80 bonding
 CM MAC          CM IP           NUM CM           BOND BOND DS CHAN     US CHAN
 ADDRESS         ADDRESS         CPE STATE        CAP  ACT  LIST        LIST
 --------------- --------------- --- ------------ ---- ---- ----------- --------
-
Md0:
 0c47.3dc7.8b80 28.1.1.118        1 b-online     24x8 16x4 Ds0:0-15    Us0:0-3
```

Table 4-5: CM Bonding Information

Parameter	Explanation
CM MAC Address	The MAC address of the CM
CM IP Address	The IP address of the CM.
Num CM CPE State	The ID of the downstream bonding group
Bond CAP	Bonding Capability advertised by the CM when it was last registered in the DDxU format: DD - Multiple Receive Channels capability U - Multiple Transmit Channels capability
Bond ACT	Actual number of channels used by the default downstream service flow and default upstream service flow of the CM.
DS Chan List	List of the downstream channels of the ds-rf-port in the Receive Channel List of the bonding CM.
US Chan List	List of the upstream physical channels in the Transmit Channel Set of the upstream bonding CM.

Counter Information

You can view counters for traffic received and transmitted.

To view counters a single CM, type:

```
# show cable modem {cm-mac-addr cm-mac-addr} counters
```

To counters of multiple CMs, type

```
# show cable modem counters
```

```
CM              US PACKETS     US BYTES         DS PACKETS     DS BYTES
MAC ADDRESS
--------------- -------------- ---------------- -------------- ----------------
0015.cf38.0e13          40585          1141699             13             2432
0015.cf38.10b9          40582          1141614             13             2544
=============== ============== ================ ============== ================
Command Total           81167          2283313             26             4976
```

CPE/host-type Information

To view summary of CPE/host-type of a specific MAC address known to the NSG Exo, type:

```
# show cable modem {cm-mac-addr cm-mac-addr}cpe
```

```
# show cable modem {cm-mac-addr cm-mac-addr}host-type
```

To view summary of CPE MAC addresses of multiple CMs known to the NSG Exo, type:

```
# show cable modem cpe
```

```
# show cable modem host-type
```

The command displays one line per known combination of CPE MAC address and CPE IP address. In general the NSG Exo supports multiple IP addresses per CPE MAC address. Each line contains the MAC address of the CM through which that CPE MAC address is reached, along with a CPE IP address. In some cases, the NSG -Exo knows a CPE MAC address without an IP address or an IP address without a MAC address.

The NSG Exo displays the CPE MAC addresses grouped by mac-domain and the cable modem ordered by MAC address of the cable modem.

Table 4-6: CM CPE/host-type Information

Parameter	Explanation
CM MAC Address	The MAC address of the CM through which the CPE MAC address is acquired.
Host	The host type of the CPE: ■ emta - Embedded Multimedia Terminal Adaptor. It is detected by snooping the DHCP Vendor Class Identifier option. ■ cpe - all other CPE host types.
CPE MAC Addr	The acquired Ethernet MAC address of the CPE host. It is acquired through the CM identifier on the output line.

Table 4-6: CM CPE/host-type Information

Parameter	Explanation
State	The state of the CPE MAC/IP learning: ■ d4(d) - when the last event for a CPE MAC address with no (mac, ipv4) combinations was an upstream DHCPv4 DISCOVER message. ■ d4(o) - when the last event for (mac,ipv4) combination was a downstream DHCPv4 OFFER message ■ d4(r) - when the last event for a (mac,ipv4) combination was an upstream DHCPv4 REQUEST message ■ d4 - when the last event for a (mac,ipv4) combination was a downstream DHCP-ACK message ■ sav4 - when the last event for a (mac,ipv4) combination was an upstream IPv4 packet with a source IP address that was within an authorized Source Address Validation (SAV) IPv4 subnet ■ sta(i) - when a CM initially registers with a static CPE MAC address from the CM configuration file TLV 14, but no upstream IP packet from that CPE MAC has yet been seen. ■ st4 - for a (mac, ipv4) combination learned when an upstream packet with an IPv4 source IP address is from a statically configured CPE MAC address from CM configuration file TLV 14. ■ sm4 - when the last event for a (mac, ipv4) combination was an upstream IPv4 packet snooped with a source IP address within an IPv4 subnet configured with the CM configuration file encoding Subscriber Management CPE IPv4 List (TLV 36) ■ sm4 - when the last event for a (mac, ipv4) combination was an upstream IPv4 packet snooped with a source IP address within an IPv4 subnet configured with the CM configuration file encoding Subscriber Management CPE IPv4 List (TLV 36)
CPE IP Address	The IPv4 address of the CPE MAC address shown in the line. If the NSG Exo has not yet snooped DHCPv4 or DHCPv6 for a statically configured CPE MAC address, a hyphen appears.

Primary Channel Information

The NSG Exo groups the output lines by mac-domain and displays them in order of the mac domain, md#. If md-or-port is specified for upstream ports, the CMs are ordered by Upstream Channel Set. If not, CMs are ordered by Downstream Channel Set. Within each channel set, CMs are displayed according to their CM MAC Address.

NOTE: NSG Exo currently supports a single MAC Domain.

To view primary channel of a single CM, type:

```
# show cable modem {cm-mac-addr cm-mac-addr} primary-channel
```

For multiple CMs, type:

```
# show cable modem primary-channel
```

Table 4-7: CM Primary Channel Information

Parameter	Explanation
Default Downstream	Indicates the assigned default upstream channel in the following formats: ■ P/C where x- US port y- US channel ■ P:X-Y where P - CM with bonded default service, X-Y channel set
Default Upstream	Indicates the assigned default upstream channel in the following formats: ■ P/C where x- US port y- US channel ■ P:X-Y where P - CM with bonded default service, X-Y channel set
MAC Address	The Ethernet MAC address of the CM.
CM State	The state of CM on it MAC domain. See *Table 4-1*.
Prim SID	The primary SID that identifies the CM.
Num CPE	The number of CPE IPs that are reachable through the CM as acquired by snooping DHCP.
Primary DS Chan	The primary downstream channel of the CM

```
admin#nsg-exo> show cable modem 0015.cf38.0e13 primary-channel

 DEFAULT     DEFAULT     CM MAC          CM            PRIM NUM PRIMARY
 DOWNSTREAM  UPSTREAM    ADDRESS         STATE          SID CPE DS CHAN
 ----------- ----------- --------------- ------------ ---- --- ---------
 Ds0:0-3     Us0:0-3     0015.cf38.0e13 b-online(pt)    1   0 Ds0/0

admin#nsg-exo> show cable modem primary-channel

 DEFAULT     DEFAULT     CM MAC          CM            PRIM NUM PRIMARY
 DOWNSTREAM  UPSTREAM    ADDRESS         STATE          SID CPE DS CHAN
 ----------- ----------- --------------- ------------ ---- --- ---------
 Ds0:0-3     Us0:0-3     0015.cf38.0e13 b-online(pt)    1   0 Ds0/0
 Ds0:4-7     Us0:0-3     0015.cf38.10b9 b-online(pt)    2   0 Ds0/4
 ======================================
 Command Total:                    2 CM
```

Verbose Information

The **`show cable modem verbose`** command displays detailed cable modem information. This command applies to a single CM only.

For a single CM, type:

`# show cable modem {cm-mac-addr} verbose`

```
admin#nsg-exo> scm 0002.00e2.8e88 verbose

Downstream Default SF        : Ds0:0-2
Upstream Default SF          : Us0/1
Mac Address                  : 0002.00e2.8e88
Ip Address                   : 172.17.10.91
Prim Sid                     : 1
MD-DS-SG / MD-US-SG          : 0 / 0
MD-CM-SG                     : 0
Primary Downstream           : Ds0/0
RCP ID                       : 0 10 0 10 3
RCC Channels                 : Ds0:0-2
Upstream  Channels:                1
Upstream Power (dBmV):             0.00
Upstream SNR (dB):                 42.10
Timing Offset:                     0
Phy Operating Mode:                atdma
Good Codewords rx:                 16149
Corrected Codewords rx:            0
Uncorrectable Codewords rx:        0
Codewords rx summary:              16149
Good Codewords rx %:               100.0%
Corrected Codewords rx %:          0%
Uncorrectable Codewords rx %:      0%
MAC Version:                 : 2.0
Qos Provisioned Mode         : docsis1.1
MAC Status                   : b-online
Capabilities                 : {Frag=Y, Concat=Y, PHS=N}
Security Capabilities        : {Priv=BPI+}
L2VPN Capabilities           : (L2VPN=N, eSAFE=N)
Sid/Said Limit               : (Max US Sids=16, Max DS Saids=15)
Optional Filtering Support   : (802.1P=N, 802.1Q=N, DUT=N)
Transmit Equalizer Support   : (Taps/Symbol= 1, Num of Taps= 24)
Number of CPE IPs            : 0
Total US Flows               : 1 (1 active)
Total DS Flows               : 1 (1 active)
Num Multicast DSIDs          : 16
```

CM Summary Information

This command allows to view CMs summary information. This command applies to multiple CMs only.

For multiple CMs, type:

```
# show cable modem summary
```

Table 4-8: CM Summary Information

Parameter	Explanation
Interface	Indicates CM interfaces, upstream ports and channels, downstream ports and channels.
Total Modems	Total number of CMs in the NSG Exo database associated with the interface.
Registered Modems	Number of registered CMs using the interface, i.e. as reported in online CM state. A bonding CM is considered to use all downstream channels in its receive channel set and all upstream channels in its transmit channel set.

Table 4-8: CM Summary Information

Parameter	Explanation
Active Modems	Number of CMs using the interface that are actively attempting to register but not yet online. Total number of CMs reported in the command, i.e. as selected by the cable-interfaces option.
Offline Modems	Number of CMs using the interface that were formerly active or registered but are no longer attempting to register.

```
admin#nsg-exo> scm summary
Total        Registered  Active      Offline
Modems       Modems      Modems      Modems
------       ----------  ------      -------
     4               4       0            0
```

CM Phy Information

This command displays DOCSIS Phy layer information.

For a single CM, type:

```
# show cable modem {cm-mac-addr cm-mac-addr}phy
```

For multiple CMs, type:

```
# show cable modem phy
```

Table 4-9: CM Phy Information

Parameter	Explanation
MAC Address	CM Ethernet MAC address
Channel	Total number of CMs in the NSG Exo database associated with the interface.
SID	The service ID that the CM is using.
USPwr (dBmV)	The CM transmit power level in dBmV as measured by the CMTS.
USSNR (dB)	Upstream signal-to-noise ratio (SNR) or carrier-to-noise ratio (CNR), in dB, as measured by the CMTS.
Timing Offset	Timing offset of the CM, in ticks, as recognized on the CMTS. (A tick, as used here, is 6.25/64 microseconds.) This is the delay between the time a particular cable modem is scheduled to make a transmission and the time the CMTS actually receives it.

Table 4-9: CM Phy Information

Parameter	Explanation
DSPwr (dBmV)	Downstream receive power level in dBmv, as the CM reports.
DSSNR (dB)	Downstream signal-to-noise ratio (SNR), in dB, as the CM reports.
Mode	DOCSIS operating mode for the CM: ■ tdma - DOCSIS 1.X, TDMA-only mode ■ atdma - DOCSIS 2.0 A-TDMA mode ■ Hyphen - indicates the mode is unknown or the CM has not yet registered. Note: For DOCSIS 3.0-certified cable modems with multiple upstream channels, the output may contain multiple results for the same MAC address.

```
admin#nsg-exo> show cable modem phy

MAC Address     Channel SID  USPwr  USSNR  Timing  DSPwr  DSSNR  MODE
                               (dBmV) (dB)   Offset  (dBmV) (dB)
--------------  ------- ---- ------ ------ ------- ------ ------ ------
0015.cf38.0e13  Us0/0   1    35.2   30.6   0       -      -      atdma*
0015.cf38.0e13  Us0/1   1    34.5   30.0   0       -      -      atdma*
0015.cf38.0e13  Us0/2   1    35.0   33.1   0       -      -      atdma*
0015.cf38.0e13  Us0/3   1    34.5   42.1   0       -      -      atdma*
0015.cf38.10b9  Us0/0   2    36.2   30.3   0       -      -      atdma*
0015.cf38.10b9  Us0/1   2    35.7   29.7   0       -      -      atdma*
0015.cf38.10b9  Us0/2   2    36.2   33.2   0       -      -      atdma*
0015.cf38.10b9  Us0/3   2    35.7   42.1   0       -      -      atdma*
```

CM Partial Mode Information

This command displays information about CMs that are in upstream and downstream partial service mode.

For multiple CMs, type:

```
# show cable modem partial-mode
```

Table 4-10: CM Partial Mode Information

Parameter	Explanation
CM MAC Address	CM Ethernet MAC address
CM State	CM state
DS Chan Actual List	The actual DS channels of the CM modem.
DS Chan Impaired List	Impaired DS RF channel
US Chan Actual List	The actual US channels of the CM modem.
US Chan Impaired US	Impaired US RF channel

```
admin#nsg-exo> scm partial-mode

 CM MAC          CM             DS CHAN      DS CHAN      US CHAN      US CHAN
 ADDRESS         STATE          ACTUAL       IMPAIRED     ACTUAL       IMPAIRED
                                LIST         LIST         LIST         LIST
 --------------- -------------- ------------ ------------ ------------ ------------
 001d.d15e.1332 p-online(pt)  Ds0:8-15     -            Us0:0-1      Us0:2-3
 788d.f765.4e50 p-online(pt)  Ds0:0-7      -            Us0:0-2      Us0:3
 788d.f765.6110 p-online(pt)  Ds0:5-12     -            Us0:0-2      Us0:3
 ================================================================================
 Command Total:          3 CM
```

Show CM Uptime

To view the CM uptime since the last reset, type:

 # show cable modem uptime

```
admin#nsg-exo> scm uptime
 CM MAC          CM IP           CM
 ADDRESS         ADDRESS         STATE         UPTIME
 --------------- --------------- ------------ ---------
 0002.00d4.31b4 28.1.1.209      b-online(pt) 0h2m52s
 0013.7185.2ad6 28.1.1.208      online(pt)   0h7m28s
 8494.8c45.0b79 28.1.1.186      b-online(pt) 0h6m38s
 b077.ac29.e3a6 28.1.1.159      b-online(pt) 0h8m5s
 ==================================================
 Command Total:            4 CM
```

Show CM DS Bonding Group

To view the parameters of the downstream bonding group, type:

 # show cable modem ds-bonding-group

```
admin#nsg-exo> scm ds-bonding-group
CM MAC          CM IP           DBG DS CHAN
Address         ADDRESS         ID  LIST
--------------- --------------- --- -----------
0002.00d4.31b4 28.1.1.209      -   Ds0:0-2
0013.7185.2ad6 28.1.1.208      -   Ds0/15
8494.8c45.0b79 28.1.1.186      -   Ds0:2-9
b077.ac29.e3a6 28.1.1.159      -   Ds0:10-13
```

Table 4-11: SCM Bonding Group Outcome

Parameter	Explanation
CM MAC Address	The MAC address of the CM

Table 4-11: SCM Bonding Group Outcome

Parameter	Explanation
CM IP Address	The IP address of the CM.
DBG ID	The ID of the downstream bonding group
DS Chan List	List of the downstream channels of the ds-rf-port in the Receive Channel List of the bonding CM.

CM Service Flow Information

This command displays information about all service flows associated with a particular modem.

For a single CM, type:

`# show cable modem {cm-mac-addr | cm-ip-addr} service-flow`

Example

```
admin#nsg-exo> show cable modem 0015.cf38.0e13 service-flow

 DEFAULT     DEFAULT     CM MAC          CM            PRIM NUM PRIMARY
 DOWNSTREAM  UPSTREAM    ADDRESS         STATE          SID CPE DS CHAN
 ----------- ----------- --------------- ------------ ---- --- ----------
 Ds0:0-3     Us0:0-3     0015.cf38.0e13 b-online(pt)    1   0 Ds0/0

Sfid  Dir Curr  Sid   Sched  Prio MaxSusRate  MaxBrst   MinRsvRate
          State       Type
    1 US  act       1 BE        0           0      3044          0
65537 DS  act   65537 n/a       0           0      3044          0

UPSTREAM SERVICE FLOW DETAIL:
SFID  SID   US PACKETS     US BYTES     DROPPED PACKETS
1     1     39416         1108756      0
DOWNSTREAM SERVICE FLOW DETAIL:
SFID  SID   DS PACKETS     DS BYTES     DROPPED PACKETS
65537 0     13            2432         0
```

Table 4-12: CM Service Flow Information

Parameter	Explanation
Sfid	The Service Flow ID (SFID) of this service flow.
Dir	Indicates whether the service flow is an US or DS.
Curr State	The current state of the service flow. Indicates whether active or inactive.
Sid	The Service ID (SID) associated with this SFID.

Table 4-12: CM Service Flow Information

Parameter	Explanation
Sched Type	The US scheduling type of the service flow: ■ BE - Best-Effort ■ N - RTPS-Non-Real-Time Polling Service ■ N/A - Scheduling type is not applicable to a service flow. ■ RTPS - Real-Time Polling Service ■ RSVD - Reserved but not yet in use ■ UGS_AD - Unsolicited Grant Service with Activity Detection ■ UGS - Unsolicited Grant Service ■ UNDF - Not yet defined
Prior	Traffic priority (0 to 7) given to this service flow.
MaxSusRate	Maximum sustained rate value, in bits per second.
MaxBrst	Maximum burst value, in bytes.
MinRsvRate	Minimum reserved rate, in bits per second.

See also, *CM Clear Database* on page 72.

Show CM Host Type

To view summary of CMs and their host-type, type the following command:

show cable modem host-type

```
admin#nsg-exo> show cable modem host-type

 CM MAC          CM IP           HOST HOST MAC       HOST IP         HOST
 ADDRESS         ADDRESS         TYPE ADDRESS        ADDRESS         STATE
 --------------- --------------- ---- -------------- --------------- -----
 0c47.3df1.aab0 34.1.1.104      cpe  0001.0107.aab0 34.1.1.117      d4
 0c47.3df1.ab80 34.1.1.106      cpe  0002.0107.ab80 34.1.1.126      d4
 ================================================================================
 Command Total:            2 CM    2 CPE    0 EMTA
```

Show CM EMTA

To view a summary of the EMTA devices, type the following command:

show cable modem emta

Show CM Load-balancing Restricted

To view information about a transition in the state of all CMs associated to an RLBG, type the following command:

show cable modem load-balancing-restricted

```
admin#nsg-exo> show cable modem load-balancing-restricted

 CM MAC          CM IP           RLBG SERVICE-TYPE DS CHAN     US CHAN
 ADDRESS         ADDRESS         ID   ID           LIST        LIST
 -------------- --------------- ---- ------------ ----------- ---------
 0002.00e2.8e88 172.17.10.91    -    -            Ds0:5-7     Us0/3
 0015.cf38.1452 172.17.10.69    -    voip         Ds0:4-7     Us0:0-3
 001d.d15e.1332 172.17.10.68    -    voip         Ds0:8-15    Us0:0-1,3
 788d.f765.4e50 172.17.10.72    -    voip         Ds0:0-7     Us0:0-3
 788d.f765.6110 172.17.10.73    -    voip         Ds0:8-15    Us0:0-3
 e448.c71d.a25b 172.17.10.67    -    voip         Ds0:12-15   Us0:0-3
 ============================================================================
 Command Total:         6 CM
```

Show CM Instability

The CMTS considers a CM to "flap" when it goes offline or re-initializes while not offline. The CMTS recognizes three distinct categories of flap events:

- Forced flaps - when the CMTS discontinues station maintenance ranging and immediately marks the CM as offline
- Range flaps - when a non-offline CM fails to send range requests for 16 consecutive schedule station maintenance opportunities
- Init flaps - when a non-offline CM sends an initial ranging request.

The total flap count of a CM is the sum of these three counts.

Currently there are several cases where the CMTS forces a CM to re-initialize with a forced flap:

- eset cable modem
- cable ds-rf-port admin-state down
- cable us-rf-port admin-state down

Some CLI commands may indirectly cause CMs to de-register by changing the physical layer of downstream or upstream transmission. For example, a CLI command that changes the power level of a downstream channel. In these cases, the CMTS detects modems that have de-registered only by failing to receive upstream station maintenance range requests (a range flap) or by receiving an initial ranging request from the CM (an init flap).

To show a summary of cable modem instability, namely, flapping, type the following command:

```
# show cable flap-list [single-cm] [sort-flaps | sort-time] [all]
```

With neither `sort-flaps | sort-time` the CMTS displays the selected CMS sorte in increasing order of CM MAC address.

Table 4-13: SCM Instability

Parameter	Explanation
`single-cm`	Select a single CM by IP or MAC The CM is displayed if the total flap count is nonzero.
`sort-flaps`	Display selected CMs in order of increasing total flap count

Table 4-13: SCM Instability

Parameter	Explanation
`sort-time`	Display in increasing order of the time in the current state of the CM.
`all`	all is omitted - the CMTS displays selected CMs only if their total flap count is nonzero all is present - the CMTS displays all selected CMs vent if their total flap count is zero.

To clear all flap counts for selected CMs, type:

`clear cable flap-list`

It does not affect the CMs current state or reported time in state.

Example

```
admin#nsg-exo> show cable flap-list

 CM MAC          CM            FORCED INIT   RANGE  LAST FLAP
 ADDRESS         STATE         FLAPS  FLAPS  FLAPS  (TIME ELAPSED)
 --------------- ------------- ------ ------ ------ --------------
 0002.00e2.8e88 b-online           0      0     40 RANGE (1d9h)
 0015.cf38.1452 b-online(pt)       0      0      1 RANGE (1d9h)
 788d.f765.4e50 p-online(pt)       4      0      2 FORCE (1d8h)
 e448.c71d.a25b b-online(pt)       0      0      1 RANGE (1d9h)
 ================================================================================
 Command Total:         4 CM
```

Show Running Configuration

To view the running configuration of NSG Exo, use the following command:

`show running-config`

Show Startup Configuration

To view the startup configuration of the NSG Exo, use the following command:

`show startup-config`

Show Pending Configuration

To view the current changes to the configuration that are pending and are not yet commented, use the following command:

`show pending-config`

Show Downstream Configuration

To view the downstream configuration, type the following command:

show cable ds-rf-port *port*

Table 4–14: Show Downstream Configuration Command

Parameter	Explanation
port	Port: Integer 0

Example

```
admin#nsg-exo> show cable downstream 0
             CENTER             SYMBOL                                POWER
QAM ID STATE FREQ.  MODULATION RATE(sym/sec) ANNEX INTERLEAVER LEVEL(dBmv)
------ ----- ------ ---------- ------------- ----- ----------- -----------
Ds0/0  up    530.0  256        6952000       A     128_4       44.0
Ds0/1  up    538.0  256        6952000       A     128_4       44.0
Ds0/2  up    546.0  256        6952000       A     128_4       44.0
Ds0/3  up    554.0  256        6952000       A     128_4       44.0
Ds0/4  up    562.0  256        6952000       A     128_4       44.0
Ds0/5  up    570.0  256        6952000       A     128_4       44.0
Ds0/6  up    578.0  256        6952000       A     128_4       44.0
Ds0/7  up    586.0  256        6952000       A     128_4       44.0
Ds0/8  up    594.0  256        6952000       A     128_4       44.0
Ds0/9  up    602.0  256        6952000       A     128_4       44.0
Ds0/10 up    610.0  256        6952000       A     128_4       44.0
Ds0/11 up    618.0  256        6952000       A     128_4       44.0
Ds0/12 up    626.0  256        6952000       A     128_4       44.0
Ds0/13 up    634.0  256        6952000       A     128_4       44.0
Ds0/14 up    642.0  256        6952000       A     128_4       44.0
Ds0/15 up    650.0  256        6952000       A     128_4       44.0
```

The following table lists the outcome parameters:

Table 4–15: Show Downstream Configuration Outcome

Parameter	Explanation
QAM ID	Indicates the downstream QAM ID in the following format: x/y, where: x - port number y - downstream channel number
State	Indicates whether the downstream channel is up.
Center Freq.	The center frequency of the downstream channel. See *Table 3–12 on page 24*.
Modulation	The configured modulation. See *Table 3–12 on page 24*.
Symbol Rate (sym/sec)	The configured symbol rate. See *Table 3–12 on page 24*.
Annex	The configured ITU-T Annex. See *Table 3–12 on page 24*.
Interleaver	The configured interleaver. See *Table 3–12 on page 24*.

Table 4–15: Show Downstream Configuration Outcome

Parameter	Explanation
Power Level (dBmv)	The configured power level in dBmv. See *Table 3–12 on page 24*.

Show Downstream Counters

To view the downstream counters, type the following command:

`show cable ds-rf-port` *port* **`counters`**

Table 4–16: Show Downstream Configuration Command

Parameter	Explanation
port	Port: Integer 0

Example

```
QAM ID BYTES            PACKETS      UTIL
------ ---------------- ------------ ----
Ds0/0  131455328109     2058513842   1%
Ds0/1  131449486981     2058474129   1%
Ds0/2  131449487799     2058474142   1%
Ds0/3  131449490585     2058474164   1%
Ds0/4  131449489361     2058474166   1%
Ds0/5  131449489613     2058474176   1%
Ds0/6  131449490849     2058474190   1%
Ds0/7  131449491523     2058474201   1%
Ds0/8  131449491997     2058474213   1%
Ds0/9  131449493093     2058474227   1%
Ds0/10 131449493857     2058474239   1%
Ds0/11 131449494663     2058474252   1%
Ds0/12 131449493963     2058474262   1%
Ds0/13 131449496528     2058474284   1%
Ds0/14 131449494072     2058474284   1%
Ds0/15 131449490274     2058474283   1%
```

Table 4–17: Show Downstream Counters Outcome

Parameter	Explanation
QAM ID	*channel-type* - DsP/C (Downstream Port/Channel)
Bytes	The total number of bytes of data packets that have been transmitted on this downstream cable
Packets	The total number of data packets that have been transmitted on this downstream cable
Util	Utilization of bandwidth in percentage. It includes MMMs.

Show Upstream Configuration

To view the upstream configuration, type the following command:

show cable us-rf-port *port*

Table 4–18: Show Upstream Configuration

Parameter	Explanation
port	Port: Integer 0

Example

```
admin#nsg-exo> show cable us-rf-port 0
               CENTER CHANNEL UPSTREAM
QAM ID STATE FREQ.  WIDTH   MODE     DOCSIS3.0
------ ----- ------ ------- -------- ---------
Us0/0  up    9.0    6.4     ATDMA    y
Us0/1  up    15.4   6.4     ATDMA    y
Us0/2  up    21.8   6.4     ATDMA    y
Us0/3  up    28.2   6.4     ATDMA    y
```

The following table lists the outcome parameters:

Table 4–19: Show Upstream Outcome Parameters

Parameter	Explanation
QAM ID	Indicates the upstream QAM ID in the following format: x/y, where: x - port number y - upstream channel number
State	Indicates whether the channel is up
Center Freq.	The center frequency of the upstream channel. *Table 3–13 on page 28*
Channel Width	The configured channel width. *Table 3–13 on page 28*.
Upstream Mode	The configured upstream mode. See *Table 3–13 on page 28*
DOCSIS3.0	Indicates whether DOCSIS3.0 is supported
Bytes	The total number of bytes of data packets that have been received on this upstream cable.
Packets	The total number of data packets that have been received on this upstream cable.

Show Upstream Counters

To view the upstream counters, type the following command:

show cable us-rf-port *port* **counters**

Table 4–20: Show Upstream Counters Command

Parameter	Explanation
port	Port: Integer 0

Example

```
admin#nsg-exo> show cable us-rf-port 0 counters
                        GOOD      CORRECTED UNCORR.
                        CODEWORDS CODEWORDS CODEWORDS
CHAN ID BYTES                     ERORRS    ERORRS
------- --------------- --------- --------- ---------
Us0/0   83795           1958      0         2
Us0/1   82394           1927      0         0
Us0/2   67655           1799      0         0
Us0/3   75639           1904      0         0
```

Table 4–21: Show Upstream Counters Outcome

Parameter	Explanation
Chan ID	*channel-type* - UsP/C (Upstream Port/Channel)
Bytes	The total number of bytes of data packets that have been transmitted on this upstream cable
Good Codewords	Same as docsIfSigQUnerroreds .1.3.6.1.2.1.10.127.1.1.4.1.2 Codewords received on this channel without error. This includes all codewords, whether or not they were part of frames destined for this device.
Correct Codewords Errors	Same as docsIfSigQCorrecteds .1.3.6.1.2.1.10.127.1.1.4.1.3 Codewords received on this channel with correctable errors. This includes all codewords, whether or not they were part of frames destined for this device.
Uncorrect Codewords Errors	Same as docsIfSigQUncorrectables .1.3.6.1.2.1.10.127.1.1.4.1.4 Codewords received on this channel with un-correctable errors. This includes all codewords, whether or not they were part of frames destined for this device.

Show Interfaces

To view the interfaces, type

```
# show interfaces
```

```
admin#nsg-exo> show interfaces
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:376 errors:0 dropped:0 overruns:0 frame:0
          TX packets:376 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:27414 (26.7 KiB)  TX bytes:27414 (26.7 KiB)

tap_cm_giaddr Link encap:Ethernet  HWaddr 30:31:32:33:34:06
          inet addr:30.31.32.2  Bcast:30.31.32.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

tap_cpe_giaddr Link encap:Ethernet  HWaddr 40:41:42:43:44:06
          inet addr:40.41.42.2  Bcast:40.41.42.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

tap_docsis Link encap:Ethernet  HWaddr 02:7f:df:0b:f9:f1
          inet addr:192.168.2.100  Bcast:192.168.2.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7380 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7391 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:571527 (558.1 KiB)  TX bytes:516515 (504.4 KiB)

tap_emta_giaddr Link encap:Ethernet  HWaddr 00:71:72:73:74:75
          inet addr:50.51.52.2  Bcast:50.51.52.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

tap_mirror Link encap:Ethernet  HWaddr 5a:e1:b3:49:e2:84
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

tap_network Link encap:Ethernet  HWaddr 20:21:22:23:24:06
          inet addr:172.17.5.6  Bcast:172.17.5.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1732 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1366 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:193657 (189.1 KiB)  TX bytes:182603 (178.3 KiB)
```

.

Table 4–22: Show Interfaces Outcome Parameters

NSG Exo Interface Names (nif)	Explanation
lo	Loopback
tap_docsis	TCP (encapsulating OAM messages) over VLAN 512 between controller and 3219
tap_network	OSSI management
tap_mirror	Debugging
tap_cm_giaddr	CM network
tap_cpe_giaddr	CPE network
tap_emta_giaddr	EMTA network

Show a Interface Physical Type

To view interface physical type, type

```
# show interface gigabit phy-type
```

Example

```
admin#nsg-exo> show interface gigabit phy-type
Phy-type is rj45
```

Show Alarm Commands

Show Alarm

To view the current alarms, type:

```
# show alarm
```

Example

```
admin#nsg-exo> show alarm
INDEX ASSERT TIME              SEVERITY DESCRIPTION                      INST ID
----- ------------------------ -------- -------------------------------- -------
0     2015-04-06 08:08:50+0000 warning  PIC temperatures (C)                   1
1     2015-04-06 08:08:50+0000 warning  PIC temperatures (C)                   2
2     2015-04-06 08:08:50+0000 warning  PIC temperatures (C)                   3
3     2015-04-06 08:08:50+0000 warning  PIC temperatures (C)                   4
4     2015-04-06 08:10:42+0000 warning  FC voltages (V)                        1
5     2015-04-06 08:10:42+0000 warning  FC voltages (V)                        2
6     2015-04-06 08:10:42+0000 warning  FC voltages (V)                        3
7     2015-04-06 08:10:42+0000 warning  FC voltages (V)                        4
8     2015-04-06 08:10:42+0000 warning  FC voltages (V)                        5
```

Show Alarm List

To view the list of possible NSG Exo alarms, type:

```
# show alarm list
```

Example

```
admin#nsg-exo> show alarm list
```

```
admin#nsg-exo> show alarm list
ID    DESCRIPTION
----- ----------------------------------------
00011 DSI is not up
00012 CPU overload
00014 Syslog server unreachable
00013 RAM overrun
00010 No link to BCM3219
00015 95% of CMs capacity is exceeded
00120 FC temperatures (C)
00130 FC voltages (V)
00125 FC r-diodes
00180 PMIC output currents (A)
00170 PMIC output voltages (V)
00140 PIC temperatures (C)
00110 Fan speeds (RPM)
00160 PMIC input voltages (V)
00150 PMIC temperatures (C)
00190 NSI status
00100 FC interrupts
```

Show Alarm Full

To view detailed information of all currently raised alarms, type:

```
# show alarm full
```

Example

```
admin#nsg-exo> show alarm full
```

```
admin#nsg-exo> show alarm full
INDEX ASSERT TIME              SEVERITY DESCRIPTION                                        SNMP OID
----- ------------------------ -------- ---------------------------------------------------- ------------------------
0     2015-04-06 08:08:50+0000 warning  PIC temperatures (C). Amp U42: 34.0                 1.3.6.1.4.1.1563.1.2.0.6011
1     2015-04-06 08:08:50+0000 warning  PIC temperatures (C). Amp U7: 53.0                  1.3.6.1.4.1.1563.1.2.0.6011
2     2015-04-06 08:08:50+0000 warning  PIC temperatures (C). B3218ext: 42.0               1.3.6.1.4.1.1563.1.2.0.6011
3     2015-04-06 08:08:50+0000 warning  PIC temperatures (C). BCM3218: 45.3                1.3.6.1.4.1.1563.1.2.0.6011
4     2015-04-06 08:10:42+0000 warning  FC voltages (V). 3.3V: 3.29                       1.3.6.1.4.1.1563.1.2.0.6009
5     2015-04-06 08:10:42+0000 warning  FC voltages (V). 3.0V: 3.00                       1.3.6.1.4.1.1563.1.2.0.6009
6     2015-04-06 08:10:42+0000 warning  FC voltages (V). 3.3Vcc: 3.24                     1.3.6.1.4.1.1563.1.2.0.6009
7     2015-04-06 08:10:42+0000 warning  FC voltages (V). 6V: 6.07                        1.3.6.1.4.1.1563.1.2.0.6009
8     2015-04-06 08:10:42+0000 warning  FC voltages (V). 8V: 8.02                        1.3.6.1.4.1.1563.1.2.0.6009
```

Show Alarm History

To view the NSG Exo alarms that were raised, type:

```
# show alarm history
```

Example

```
admin#nsg-exo> show alarm history
ASSERT TIME         STATE SEVERITY DESCRIPTION                                          INST ID
------------------- ----- -------- -------------------------------------------------- -------
2015-04-05 14:54:27 on    warning  NSI status                                               1
2015-04-05 14:54:50 off   warning  NSI status                                               1
2015-04-06 02:44:25 on    warning  NSI status                                               1
2015-04-06 02:44:49 off   warning  NSI status                                               1
2015-04-06 05:54:53 on    warning  NSI status                                               1
2015-04-06 05:55:16 off   warning  NSI status                                               1
2015-04-06 08:07:46 on    warning  FC interrupts                                            1
2015-04-06 08:08:50 on    warning  PIC temperatures (C)                                     1
2015-04-06 08:08:50 on    warning  PIC temperatures (C)                                     2
2015-04-06 08:08:50 on    warning  PIC temperatures (C)                                     3
2015-04-06 08:08:50 on    warning  PIC temperatures (C)                                     4
2015-04-06 08:10:41 off   warning  FC interrupts                                            1
2015-04-06 08:10:42 on    warning  FC voltages (V)                                         1
2015-04-06 08:10:42 on    warning  FC voltages (V)                                         2
2015-04-06 08:10:42 on    warning  FC voltages (V)                                         3
2015-04-06 08:10:42 on    warning  FC voltages (V)                                         4
2015-04-06 08:10:42 on    warning  FC voltages (V)                                         5
```

Show Logging

To view device logs:

`# show logging [n number]`

Table 4–23: Show a Specific Interface

Parameter	Explanation
n	Limit the log to the last number of lines.
number	Integer, default:10

```
admin#nsg-exo> show logging
Jul  3 19:37:03 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:38:33 2014 [try http://www.rsyslog.com/e
/2007 ]
Jul  3 19:40:43 exo-device rsyslogd-2007: action 'action 1' suspended, next retry is Thu Jul  3 19:42:13 2014 [try http://www.rsyslog.com/e/
2007 ]
Jul  3 19:40:43 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:42:13 2014 [try http://www.rsyslog.com/e
/2007 ]
Jul  3 19:42:38 exo-device rsyslogd-2007: action 'action 1' suspended, next retry is Thu Jul  3 19:44:08 2014 [try http://www.rsyslog.com/e/
2007 ]
Jul  3 19:42:38 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:44:08 2014 [try http://www.rsyslog.com/e
/2007 ]
Jul  3 19:45:05 exo-device klish[1527]: (admin) startup : 0
Jul  3 19:46:07 exo-device klish[1527]: (admin) show interface cpe : 1
Jul  3 19:46:43 exo-device rsyslogd-2007: action 'action 1' suspended, next retry is Thu Jul  3 19:48:13 2014 [try http://www.rsyslog.com/e/
2007 ]
Jul  3 19:46:43 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:48:13 2014 [try http://www.rsyslog.com/e
/2007 ]
Jul  3 19:47:26 exo-device klish[1527]: (admin) show alarms : 0
admin#nsg-exo>
admin#nsg-exo> show logging
Jul  3 19:37:03 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:38:33 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:40:43 exo-device rsyslogd-2007: action 'action 1' suspended, next retry is Thu Jul  3 19:42:13 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:40:43 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:42:13 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:42:38 exo-device rsyslogd-2007: action 'action 1' suspended, next retry is Thu Jul  3 19:44:08 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:42:38 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:44:08 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:45:05 exo-device klish[1527]: (admin) startup : 0
Jul  3 19:46:07 exo-device klish[1527]: (admin) show interface cpe : 1
Jul  3 19:46:43 exo-device rsyslogd-2007: action 'action 1' suspended, next retry is Thu Jul  3 19:48:13 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:46:43 exo-device rsyslogd-2007: action 'action 18' suspended, next retry is Thu Jul  3 19:48:13 2014 [try http://www.rsyslog.com/e/2007 ]
Jul  3 19:47:26 exo-device klish[1527]: (admin) show alarms : 0
```

Show Tech Support

To view information for tech support, type:

```
# show tech-support
```

Show Access List

To view the multicast access list rules, type:

```
# show access-list multicast
```

Show access-list multicast outcome

```
admin#nsg-exo> show access-list multicast
ID IP ADDRESS/MASK    ACTION
-- ------------------ -------
 0 0.0.0.0/0          permit
```

Show Disabled Access List

To view the access lists that are disabled by the command `access-list disabled`, type:

```
# show disabled access-list
```

See *Enable/disable Access List* on page 75.

Table 4–24: Show Access-List Outcome Parameters

Parameter	Explanation
ID	A unique sequential number between 0 to 59
IP Address/Mask	IP address and mask of the multicast group that is permitted or denied in the following pattern: xxx.xxx.xxx.xxx/xx
Action	permit | deny

Show Reboot

To view the content of the partition and to identify the currently active partition, type

`show reboot`

Example

```
admin#nsg-exo> show reboot
active   : 1.1.0.3
passive  : 1.0.1-26
recovery : 1.0.0-0
```

Show Reboot Reason

To view the reason for the last reboot, type

`show reboot reason`

Example

```
admin#nsg-exo> show reboot reason
The last reboot reason is power

admin#nsg-exo> show reboot reason
The last reboot reason is cli
```

Show Environment

To view information regarding the operation of the device, type:

`show environment`

```
admin#nsg-exo> show environment
Fan controller:
      Name          Val,V    Min,V    Max,V
------------------ -------- -------- --------
+3.3V                 3.29     3.00     3.31
+3.0V                 3.00     2.90     2.99
+3.3Vcc               3.25     2.99     3.59
+6V                   6.08     5.39     6.59
+8V                   8.02     7.19     8.75
================================================

PMICs output:
      Name          Val,V    Min,V    Max,V
------------------ -------- -------- --------
P3_3.00V              3.00     2.85     3.15
P3_2.50V              2.50     2.38     2.62
P3_1.50V              1.50     1.42     1.58
P3_0.90V              0.88     0.85     0.95
P2_3.30V              3.32     3.13     3.46
P2_2.50V              2.52     2.38     2.62
P2_1.20V              1.22     1.14     1.26
P1_3.30V              3.32     3.13     3.46
P1_2.50V              2.54     2.38     2.62
P1_1.50V              1.52     1.42     1.58
P1_1.10V              1.10     1.04     1.16
================================================

PMICs input:
      Name          Val,V    Min,V    Max,V
------------------ -------- -------- --------
P1_12V2              11.80    N/A      N/A
P1_12V1              11.80    N/A      N/A
P3_12V2              12.00    N/A      N/A
P3_12V1              12.00    N/A      N/A
P2_12V2              11.80    N/A      N/A
P2_12V1              11.80    N/A      N/A
================================================

Fan controller:
      Name          Val,C    Min,C    Max,C
------------------ -------- -------- --------
U22-cntr              34.1    -10.0     60.0
Q18-U28 Ampl          37.2    -10.0     70.0
Q26-DAC PCB           36.6    -10.0     80.0
================================================

PIC sensors:
      Name          Val,C    Min,C    Max,C
------------------ -------- -------- --------
PMIC1                 37.0    -10.0    125.0
PMIC3                 37.0    -10.0    125.0
PMIC2                 47.0    -10.0    125.0
================================================

Fan controller:
   Name     Val,RPM   Min,RPM   Max,RPM
---------- --------- --------- ---------
fan1            7906      3483    N/A
fan2            8095      3483    N/A
fan3            8035      3483    N/A
========================================
```

Show Event

Shows a list of events which happened in the past (events which counters >0) with their IDs, descriptions, counters and configurations:

```
# show event filter [clear | restore]
```

Table 4–25: Show Event Command Parameters

Parameter	Explanation
filter	Filter events according to their IDs. For example: 6010,7001-7010,4008,32008
clear	Shows the current delta count and then takes a new “clear snapshot”, i.e. causing the next “show event” command to show the delta counts since the clear.
restore	Restore to full report of the counts.

Show event outcome

```
admin#nsg-exo> show event
EVENT EVENT                                                    DESTINATION
ID    DESCRIPTION                                     COUNTER  LIST
----- ---------------------------------------------- -------- ----------------------
00000 System is ready to generate events                    81 Syslog
06000 Internal error in alarm manager                      604 Syslog | Trap
06001 cmc-controller lost connection to bcm3219             21 Syslog | Trap
06002 cmc-controller reconnected to bcm3219                  7 Syslog | Trap
06009 Voltage is out of range                              125 Syslog | Trap
06010 Voltage is back in valid range                        87 Syslog | Trap
06013 IP connectivity to BCM3219 is lost                  1421 Syslog | Trap
06014 IP connectivity to BCM3219 is restored              1416 Syslog | Trap
06017 Used RAM is above 90%                                  2 Syslog | Trap
06018 Used RAM is below 90%                                  2 Syslog | Trap
06019 Connectivity to Syslog server is lost                 27 Syslog | Trap
06020 Connectivity to Syslog server is restored              8 Syslog | Trap
06023 PMIC temperature is beyond valid range                 1 Syslog | Trap
06024 PMIC temperature is back within valid range            1 Syslog | Trap
06031 Network connection failure                            86 Syslog | Trap
06032 Network connection is OK                              86 Syslog | Trap
07001 'Controller' process is stopped                       10 Syslog
07002 Learning bridge process is stopped                     4 Syslog
07008 REBOOT_STARTED                                        14 Syslog
07009 Last reboot was done by 'exo-health-wd'               13 Syslog
07010 Last reboot was done by CLI user                      19 Syslog
07011 Last reboot was done by PIC                            4 Syslog
07012 Last reboot was done by power                         45 Syslog
32000 internal error                                         1 Syslog
32002 LBR memory DB cleared                                146 Syslog
32003 Initial FPGA configuration                           146 Syslog
32004 DHCP discover                                     147820 Syslog
32005 DHCP offer                                        141137 Syslog
32006 DHCP request                                      111965 Syslog
32008 DHCP ACK                                            5391 Syslog
32010 DHCP release                                         120 Syslog
32012 TFTP GET request                                     216 Syslog
48000 CM state changed to offline                           81 Syslog
48001 CM sent INIT-RNG-REQ or B-INIT-RNG-REQ               152 Syslog
48002 The NSG-EXO has sent a CONTINUE on INIT-RNG-REQ      151 Syslog
48003 The NSG-EXO has sent a SUCCESS on INIT-RNG-REQ       128 Syslog
48004 The NSG-EXO has sent a ABORT on INIT-RNG-REQ          15 Syslog
48005 CM sent REG-REQ                                       85 Syslog
48006 CM sent REG-ACK                                       80 Syslog
48007 CM sent security authentication request               56 Syslog
```

]

Table 4–26: Show Event Outcome Parameters

Parameter	Explanation
Event ID	A unique identifier of the event
Event Description	Event description

Table 4–26: Show Event Outcome Parameters

Parameter	Explanation
Counter	The number of times the event occurred in the past.
Destination List	List of destinations separate by | (or) ■ syslog - sent to the sysog servers ■ trap - sent as an snmp trap ■ local - captured on a local file ■ console - sent to user console

Show Event Local Log

Shows the content of a local event log file. Destination is set to local in Logging configuration:

```
# show event local-log [n number]
```

Table 4–27: Show Event Command Parameters

Parameter	Explanation
number	Limit the output to the last number of lines in the log. Default: 10

Example of show event local-log output

```
admin#nsg-exo> show event local-log
Apr 06 08:26:10 Event PIC_TEMPERATURE_DROPPED(Temperature back within valid range): [140:3]
Apr 06 08:26:10 Event PIC_TEMPERATURE_DROPPED(Temperature back within valid range): [140:4]
Apr 06 08:26:48 Event DHCP_REQUEST(DHCP request): FROM DSI(4,307): DHCP-REQUEST mac:00:03:01:06:c1:40 vci:0
Apr 06 08:26:48 Event DHCP_ACK(DHCP ACK): FROM NSI(4,357): DHCP-ACK mac:00:03:01:06:c1:40 vci:0
Apr 06 08:26:49 Event DHCP_REQUEST(DHCP request): FROM DSI(2,307): DHCP-REQUEST mac:00:01:01:06:aa:50 vci:0
Apr 06 08:26:49 Event DHCP_ACK(DHCP ACK): FROM NSI(2,357): DHCP-ACK mac:00:01:01:06:aa:50 vci:0
Apr 06 08:26:49 Event DHCP_REQUEST(DHCP request): FROM DSI(3,307): DHCP-REQUEST mac:00:04:01:06:bc:99 vci:0
Apr 06 08:26:49 Event DHCP_ACK(DHCP ACK): FROM NSI(3,357): DHCP-ACK mac:00:04:01:06:bc:99 vci:0
Apr 06 08:26:50 Event DHCP_REQUEST(DHCP request): FROM DSI(1,307): DHCP-REQUEST mac:00:02:01:06:56:70 vci:0
Apr 06 08:26:50 Event DHCP_ACK(DHCP ACK): FROM NSI(1,357): DHCP-ACK mac:00:02:01:06:56:70 vci:0


admin#nsg-exo> show event local-log n 20
Apr 06 08:24:50 Event DHCP_ACK(DHCP ACK): FROM NSI(3,363): DHCP-ACK mac:84:94:8c:fd:bc:99 vci:3
Apr 06 08:24:50 Event DHCP_REQUEST(DHCP request): FROM DSI(1,607): DHCP-REQUEST mac:0c:47:3d:f1:56:70 vci:3
Apr 06 08:24:50 Event DHCP_ACK(DHCP ACK): FROM NSI(1,363): DHCP-ACK mac:0c:47:3d:f1:56:70 vci:3
Apr 06 08:25:07 Event VOLTAGE_DROPPED(Voltage is back in valid range): [130:1]
Apr 06 08:25:07 Event VOLTAGE_DROPPED(Voltage is back in valid range): [130:2]
Apr 06 08:25:07 Event VOLTAGE_DROPPED(Voltage is back in valid range): [130:3]
Apr 06 08:25:07 Event VOLTAGE_DROPPED(Voltage is back in valid range): [130:4]
Apr 06 08:25:07 Event VOLTAGE_DROPPED(Voltage is back in valid range): [130:5]
Apr 06 08:26:10 Event PIC_TEMPERATURE_DROPPED(Temperature back within valid range): [140:1]
Apr 06 08:26:10 Event PIC_TEMPERATURE_DROPPED(Temperature back within valid range): [140:2]
Apr 06 08:26:10 Event PIC_TEMPERATURE_DROPPED(Temperature back within valid range): [140:3]
Apr 06 08:26:10 Event PIC_TEMPERATURE_DROPPED(Temperature back within valid range): [140:4]
Apr 06 08:26:48 Event DHCP_REQUEST(DHCP request): FROM DSI(4,307): DHCP-REQUEST mac:00:03:01:06:c1:40 vci:0
Apr 06 08:26:48 Event DHCP_ACK(DHCP ACK): FROM NSI(4,357): DHCP-ACK mac:00:03:01:06:c1:40 vci:0
Apr 06 08:26:49 Event DHCP_REQUEST(DHCP request): FROM DSI(2,307): DHCP-REQUEST mac:00:01:01:06:aa:50 vci:0
Apr 06 08:26:49 Event DHCP_ACK(DHCP ACK): FROM NSI(2,357): DHCP-ACK mac:00:01:01:06:aa:50 vci:0
Apr 06 08:26:49 Event DHCP_REQUEST(DHCP request): FROM DSI(3,307): DHCP-REQUEST mac:00:04:01:06:bc:99 vci:0
Apr 06 08:26:49 Event DHCP_ACK(DHCP ACK): FROM NSI(3,357): DHCP-ACK mac:00:04:01:06:bc:99 vci:0
Apr 06 08:26:50 Event DHCP_REQUEST(DHCP request): FROM DSI(1,307): DHCP-REQUEST mac:00:02:01:06:56:70 vci:0
Apr 06 08:26:50 Event DHCP_ACK(DHCP ACK): FROM NSI(1,357): DHCP-ACK mac:00:02:01:06:56:70 vci:0
```

Show System Load

Shows usage of memory and CPU on the main system and on the BCM:

```
# show system load
```

```
admin#nsg-exo> show system load
Main system resources:
 CPU usage: 17%
 Memory usage(free/total, KB): 928296/1032764
BCM resources:
 CPU usage: 20%
 Memory usage(free/total, KB): 21816/61176
```

Show CPU Load

Shows usage and load information of the CPU on the main system:

 # show process cpu

```
admin#nsg-exo> show process cpu
top - 11:24:51 up 2 days, 16:40,  1 user,  load average: 0.21, 0.24, 0.25
Tasks:  66 total,   1 running,  64 sleeping,   0 stopped,   1 zombie
%Cpu(s):  3.3 us,  4.1 sy,  0.0 ni, 92.4 id,  0.1 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem:   1032756 total,   190004 used,   842752 free,    38796 buffers
KiB Swap:        0 total,        0 used,        0 free.   107920 cached Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
  714 root      20   0  162940   5368   3136 S  18.7  0.5 799:40.75 lbr
13709 admin     20   0    2964   1028    728 R   6.2  0.1   0:00.02 top
    1 root      20   0    4576   2724   1520 S   0.0  0.3  17:16.49 systemd
    2 root      20   0       0      0      0 S   0.0  0.0   0:00.00 kthreadd
    3 root      20   0       0      0      0 S   0.0  0.0   0:08.25 ksoftirqd/0
    5 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 kworker/0:+
    6 root      20   0       0      0      0 S   0.0  0.0   0:00.08 kworker/u:0
    7 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 kworker/u:+
    8 root      rt   0       0      0      0 S   0.0  0.0   0:03.71 migration/0
    9 root      20   0       0      0      0 S   0.0  0.0   0:00.00 rcu_bh
   10 root      20   0       0      0      0 S   0.0  0.0   0:27.36 rcu_sched
   11 root      rt   0       0      0      0 S   0.0  0.0   0:08.76 migration/1
   12 root      20   0       0      0      0 S   0.0  0.0   0:09.56 ksoftirqd/1
   13 root      20   0       0      0      0 S   0.0  0.0   0:00.00 kworker/1:0
   14 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 kworker/1:+
   15 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 khelper
   16 root      20   0       0      0      0 S   0.0  0.0   0:00.00 kdevtmpfs
```

Chapter 5
General Commands

Overview

This chapter describes commands that execute a process:

ping ip- *Ping IP* on page 69

version - *Viewing Firmware Version* on page 70

time - *View Device Date and Time* on page 71

uptime - *View Device Uptime* on page 71

reboot - *Rebooting the Device* on page 71

restore-factory-setting - see *Restoring Factory Defaults* on page 71

clear cable modem database - *CM Clear Database* on page 72

reset cable modem - *CM Reset* on page 72

Firmware upgrade - see *Firmware Upgrade* on page 72

Firmware downgrade - see *Firmware Downgrade* on page 73

Load balancing - see *Test Cable DCC* on page 73 and *Test Cable DBC* on page 74

Set management - see *Set Management* on page 75

Enable/disable access list - see *Enable/disable Access List* on page 75

Configuring Physical Interface Type

NSG Exo is furnished with two physical NSI ports:

- SFP - Fiber Gigabit interface
- RJ-45 - Copper Gigabit interface
- Fiber - LC/SC interface (Korean version only)

NOTE: Korean version only. NSI port with LC/SC interface - supports the GPON protocol

Currently only one port is active and it is port 0. You must select the required interface:

```
interface gigabit phy-type {sfp |fiber | rj45}
```

Table 5–1: Configuring Physical Interface Type

Attribute/Value	Explanation
phy-type	Select one of the following ports: It is recommended to work with either the SFP port sfp - fiber interface rj45 - copper interface. fiber - LC/SC interface (Korean version only.

Example

```
admin#nsg-exo> interface gigabit phy-type rj45
```

See also *Configuring Management Interface* on page 17.

Ping IP

The ping command allows to ping and check connectivity between the device and another platform.

The command

ping ip *destination* [**source** *source*] [**repeat n** *n*] [**resolve**] [**broadcast** *broadcast*] [**size** *s*] [**interval** *p*] [**flood**]

Table 5–2: Ping IP Parameters

Attribute/Value	Explanation
ping ip	The ping command has two formats: **`ping`** **`ping ip`**
destination	The IP address of the ping target.
source	The IP address of the ping initiator.
source	String in a format of an IP address: A.B.C.D
repeat n	Request to repeat the ping with an indication of the required number of repetitions.
n	Integer Default: 5
resolve	Resolve names
broadcast	Ping broadcast address
broadcast	String in a format of a broadcast IP.
size	Number of data bytes to send
s	Integer
interval	The interval between ping messages

Table 5–2: Ping IP Parameters

Attribute/Value	Explanation
p	Integer Default: 1

Example - **ping**

```
admin#nsg-exo> ping 10.40.22.25
PING 10.40.22.25 (10.40.22.25) 56(84) bytes of data.
64 bytes from 10.40.22.25: icmp_seq=1 ttl=126 time=6.88 ms
64 bytes from 10.40.22.25: icmp_seq=2 ttl=126 time=3.49 ms
64 bytes from 10.40.22.25: icmp_seq=3 ttl=126 time=1.26 ms
64 bytes from 10.40.22.25: icmp_seq=4 ttl=126 time=7.65 ms
64 bytes from 10.40.22.25: icmp_seq=5 ttl=126 time=5.66 ms
--- 10.40.22.25 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4002ms
rtt min/avg/max/mdev = 1.267/4.993/7.659/2.335 ms
```

Example - **ping ip**

admin#nsg-exo> ping ip 10.40.22.25

```
PING 10.40.22.25 (10.40.22.25) 56(84) bytes of data.
64 bytes from 10.40.22.25: icmp_seq=1 ttl=126 time=1.25 ms
64 bytes from 10.40.22.25: icmp_seq=2 ttl=126 time=10.6 ms
64 bytes from 10.40.22.25: icmp_seq=3 ttl=126 time=9.31 ms
64 bytes from 10.40.22.25: icmp_seq=4 ttl=126 time=9.95 ms
64 bytes from 10.40.22.25: icmp_seq=5 ttl=126 time=8.59 ms
--- 10.40.22.25 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4001ms
rtt min/avg/max/mdev = 1.251/7.952/10.641/3.419 ms
```

Viewing Firmware Version

To view the current firmware version, type the following command:

admin#nsg-exo> **version**

Example

```
admin#nsg-exo> version
EXO Released Version: 1.0.1.26
BCM Firmware Version: 4_3_0beta3 hrm3.1.7 BCM3218 2.44, 0.1.13, 0.2.0, 0.2.2
PIC FW version: 1.1.9
FPGA Version: 0x10970097
S/N: 331445267
P/N: 03 NSGEXO-CH-CRF-01
```

View Device Date and Time

Allows to view device time and date. Type the following:

```
admin#nsg-exo> date
```

Example

```
admin#nsg-exo> date
date 22:11:45 12-11-2014
```

View Device Time

Allows to view device time. Type the following:

```
admin#nsg-exo> time
```

Example

```
admin#nsg-exo> time
time 15:43:35 03-30-2015
```

View Device Uptime

Allows to view the device uptime since last reboot. Type the following command:

```
admin#nsg-exo> uptime
```

Example

```
admin#nsg-exo> uptime
 18:53:21 up 7 min,  1 user,  load average: 0.00, 0.04, 0.04
```

Rebooting the Device

To reboot the device, type the following command:

```
admin#nsg-exo> reboot {passive | recovery}
```

Table 5–3: Reboot NSG Exo

Attribute/Value	Explanation
reboot	The device reboots.
passive	During firmware upgrade, the device boots up with the newly installed
recovery	Rebooting from the recovery partition.

Restoring Factory Defaults

To restore to the default configuration, type the following:

```
admin#nsg-exo> restore-factory-settings
```

The configuration of the management port is retained.

CM Clear Database

For a single CM, type:

```
admin#nsg-exo> clear cable modem {cm-mac-addr cm-mac-addr}
```

For multiple CMs, type:

```
admin#nsg-exo> # clear cable modem
```

CM Reset

For a single CM, type:

```
admin#nsg-exo> reset cable modem {cm-mac-addr cm-mac-addr}
```

For multiple CMs, type:

```
admin#nsg-exo> reset cable modem all
```

After executing the command, the CM is initializing on DOCSIS.

Firmware Upgrade

To upgrade NSG Exo, obtain the location of the required firmware file. The upgrade supports both HTTP and FTP protocols.

To upgrade NSG Exo, do the following:

1. Log onto the NSG Exo.
2. Type the following command:

```
admin#nsg-exo> # sw-upgrade install url
```

Table 5–4: NSG Exo Upgrade

Attribute/Value	Explanation
sw-upgrade install	Install the firmware on the NSG Exo device.
url	The location of the firmware directory: ■ HTTP - http://<firmware directory> ■ FTP - ftp://<username>:<password>@ftp.harmonicinc.com/<firmware> ■ TFTP - tftp://<tftp server ip>/<firmware>

3. To reboot the device with the newly installed version, type:

   ```
   admin#nsg-exo> # reboot passive
   ```

   Once the device reboots, it reboots with the new firmware and the passive partition is the active one.

Example – using HTTP

```
admin#nsg-exo> #sw-upgrade install http://harmonicinc.com/exo-releases/
1.0.1.23-1/
```

Example – using FTP

```
admin#nsg-exo> #sw-upgrade install ftp://
hlit4109:pNJHuHhs@ftp.harmonicinc.com/1.0.1.23-1/
```

Example – Rebooting with New Firmware

To finalize the installation, type:

```
admin#nsg-exo> # reboot passive
```

To view the content of each partition, see *Show Reboot* on page 63.

Firmware Downgrade

To install a previous firmware version on the NSG Exo, do the following:

1. Obtain the location of the latest firmware file on the installation server of your organization.
2. In the firmware directory, locate the file: exo-device-upgrade.tar.gz
3. Copy this file to the required older firmware version.
4. To install the required firmware on the NSG Exo, see *Firmware Upgrade* on page 72.

Test Cable DCC

To manually move CMs to a specific downstream or upstream channels, type:

NOTE: These commands override load balancing within a load balancing group.

```
admin#nsg-exo> test cable dcc cm-mac [down-channel ds-channel-id] [us-
phy-channel us-channel-id] [jump-frequency ds-frequency-mhz] [init-tech
init-tech]
```

Table 5–5: Test Cable DCC

Attribute/Value	Explanation
test cable dcc	Test cable dcc.
cm-mac	The MAC address of a registered CM.
ds-channel-id	Optional. The ID of the new downstream channel. Integer between 0 to 15.
us-channel-id	Optional. The ID of the new upstream channel. Integer between 0 to 3.
jump-frequency	Optional. A new DS channel frequency to change to.
ds-frequency-mhz	Syntax 85.0 ... 1006.0

Table 5–5: Test Cable DCC

Attribute/Value	Explanation
init-tech	Optional. DOCSIS channel initialization technique. By default - reinit. Possible values are: ■ reinit - Re-initialize the MAC (value 0) ■ initial - Perform broadcast initial ranging on a new channel before normal operation (value 1) ■ station - Perform unicast ranging on a new channel before normal operation (value 2) ■ ranging - Perform either broadcast or unicast ranging on a new channel before normal operation (value 3) ■ direct - Use the new channel(s) directly without re-initializing or ranging (value 4)

Test Cable DBC

To manually move CMs to a specific downstream or upstream channels, type either of the following commands:

NOTE: These commands override load balancing within a load balancing group.

```
admin#nsg-exo> test cable dbc cm-mac [down-channel-set rcs] [us-phy-channel-set tcs] [init-tech init-tech]
admin#nsg-exo> test cable dbc cm-mac dbg-id
```

Table 5–6: Test Cable DBC

Attribute/Value	Explanation
test cable dcc	Test cable dbc.
cm-mac	The MAC address of a registered CM.
rcs	Optional. Receive Channel Set. Syntax: <ds-channel-id-0-start>[-<ds-channel-id-0-end>][,<ds-channel-id-k-start>[-<ds-channel-id-k-end>], where: <ds-channel-id-i-start> - DS channels range first channel ID (integer: 0..15), <ds-channel-id-i-end> - DS channels range last channel ID (integer: 0..15). Example: 0-2,4,6

Table 5–6: Test Cable DBC

Attribute/Value	Explanation
tsc	Optional. Transmit Channel Set. Syntax: <us-channel-id-0-start>[-<us-channel-id-0-end>][,<us-channel-id-k-start>[-<us-channel-id-k-end>], where: <us-channel-id-i-start> - US channels range first channel ID (integer: 0..3), <us-channel-id-i-end> - US channels range last channel ID (integer: 0..3). Example: 0-2; 0,3; etc.
init-tech	Optional. DOCSIS channel initialization technique. By default - initial. Possible values are: ■ initial - Perform broadcast initial ranging on a new channel before normal operation (value 1) ■ station - Perform unicast ranging on a new channel before normal operation (value 2) ■ ranging - Perform either broadcast or unicast ranging on a new channel before normal operation (value 3) ■ direct - Use the new channel(s) directly without re-initializing or ranging (value 4)
dbg-id	Force CM using DS and US channels assigned to the corresponding RLBG.

Set Management

When installing the NSG Exo device, you need to set the management interface to L3 (ip-address). You can do it from the console port. Type the following command:

```
admin#nsg-exo> set-management phy-type phy-type {dhcp | static [ip-address ip-address default-gateway default-gateway]}
```

phy-type, ip-address and default-gateway are special parameters. They are not affected by the command:

```
# restore-factory-settings
```

To restore management interface to factory settings there is a special command:

```
# restore-factory-management-settings
```

Enable/disable Access List

To enable/disable access lists for a specific host type, type the following:

```
access-list host-type disable |enable
```

Table 5–7: Access List

Attribute/Value	Explanation
host-type	{cm | cpe |emta}

Debug Cable Modem

To turn on debug mode, namely, log messages are asynchronously written to the console, type the following:

debug cable modem [mac \|log]

Table 5–8: Debug

Attribute/Value	Explanation
mac	Mac address of the modem
log	Show only log. Do not enter debug mode

To turn off debug mode, type:

no debug cable modem

The supported debug CM states are: offline, init(r1), init(r2), init(rc), init(io), init(d), init(io), init(a), online, online(pt).

Chapter 6
Troubleshooting Commands

sh

This command allows you to access the Linux operating system.

NOTE: The Linux system runs various NSG Exo applications. While in this mode, there are various commands which can adversely affect the operation of the NSG Exo, including causing the NSG Exo to shut down or reboot. Therefore, it is recommended that only users with Linux knowledge access Linux and exercise caution.

```
admin#nsg-exo>#  sh
```

ping arp

```
admin#nsg-exo>#  ping arp [interface] [ip] [repeat n] [broadcast]
[duplicate-detect]
```

Table 6–1: Ping Arp Parameters

Parameter	Explanation
ip	IP or host name of the ping target
interface	Name of the interface: tap_cm_giadd/ tap_cpe_giaddr/tap_docsis/tap_mirror/ tap_network
repeat	Number of times to send Ping Requests Default: 5
broadcast	Ping broadcast address
duplicate-detect	Duplicate address detection mode

Add/Delete ip route

To add or delete IP route, type:

```
admin#nsg-exo> # add ip route
admin#nsg-exo> # del ip route
```

Example

```
admin#nsg-exo> # add ip route 192.168.1.0/24
```

Show ip route

To access the routing table, type:

```
admin#nsg-exo> # show ip route
```

```
default via 172.17.5.1 dev tap_network
172.17.5.0/24 dev tap_network  proto kernel  scope link  src 172.17.5.9
192.168.2.0/24 dev tap_docsis  proto kernel  scope link  src 192.168.2.100
```

show arp

```
admin#nsg-exo> show arp
```

```
admin#nsg-exo> show arp
? (192.168.2.101) at 00:10:18:de:ad:0a [ether] on tap_docsis
? (172.17.5.1) at 00:0a:cd:17:ad:92 [ether] on tap_network
```

Chapter 7
Alarms

TBD

Table 7–1: Alarms List

Alarm ID	Source Object	Alarm Text	Severity	Description	Recommended Action
010		No Link to BCM3219			
011		DSI in Not Up			
012		CPU Overload		CPU Load is over 90%	
013		RAM Overrun		Memory Usage is above 90%	
014		Syslog Server Unreachable			
015		95% of CMs Capacity is Exceeded			
100		FC Interrupts			
110		Fan Speeds (RPM)			
120	Platform	FC Temperatures (C)	6	The unit is overheating.	Shutdown the unit
125		FC r-Diodes			
130	Platform	FC Voltages (V)	6	Invalid voltage is detected.	Shutdown the unit
140		PIC Temperatures (C)		The temperature from the PIC is outside of the 0-75c range.	
150		PMIC Temperatures (C)			
160		PMIC Input Voltages (V)			
170		PMIC Output Voltages (V)			
180		PMIC Output Currents (A)			
190	Platform	NSI Status		You can use it only when connected through serial. NSI link is down.	

Chapter 8
Recovery Partition Commands

Recovery Overview

These commands are relevant to the recovery partition of EXO device.

The Recovery configuration CLI commands are in a separate sub-section of the configuration:

```
nsg-exo> show running-config
   recovery
     enable  1
     trigger count 10
     recovery time 20
     connection lose timeout 10
```

The recovery commands that are available from the non-recovery mode are as follows:

```
admin#nsg-exo> configure
(config)# recovery
(recovery)# enable  <0|1>
(recovery)# trigger count <number of reboots>
(recovery)# recovery time <minutes> ! default value 20
(recovery)# connection lose timeout <minutes> ! default value 10
```

CLI commands that are available from recovery mode are implemented separately in their own view which is loaded instead of the default enable-view, when booting from the recovery partition. In recovery mode, there is no need to wait for the bcm and cmc-controller to load. The CLI is available straight after booting. As recovery mode is meant only for device recovery, configuration mode is not available.

Table 8–1: Available CLI Commands in Recovery Mode

Command	Reference
exo-recovery> **restore-factory-settings** *partition*	
exo-recovery> **sw-upgrade** *partition* **install** *url*	
exo-recovery> **reboot** *partition*	
exo-recovery> **version**	To view the firmware version installed on the recovery partition
exo-recovery> **show partitions**	To view a list of available partitions and the firmware versions installed on them
exo-recovery> **recovery info**	To view information about this recovery session - recovery reason and last working partition

Table 8–1: Available CLI Commands in Recovery Mode

Command	Reference
`exo-recovery> ip-address ip/mask`	To set the management interface IP address and mask
`exo-recovery> default-gateway ip`	To set the management default gateway IP address
`exo-recovery> ping ip`	*Ping IP* on page 69
`exo-recovery> ping arp ip`	*ping arp* on page 77
`exo-recovery> sh`	*sh* on page 77
`exo-recovery> uptime`	*View Device Uptime* on page 71
`exo-recovery> show interfaces`	*Show Interfaces* on page 58
`exo-recovery> show ip route`	*Show ip route* on page 77
`exo-recovery> show arp`	*show arp* on page 78
`exo-recovery> show logging`	*Show Logging* on page 62

Recovering an NSG Exo Device

1. To apply factory settings to a partition, type the following command:
   `exo-recovery> restore-factory-settings partition`
2. To install the required firmware on the required partition, type:
   `exo-recovery> sw-upgrade partition install url`
3. To reboot the device from the required partition, type:
   `exo-recovery> reboot partition`
4. To view the firmware version installed on the recovery partition, type:
   `exo-recovery> version`
5. To view a list of available partitions and the firmware versions installed on them, type:
   `exo-recovery> show partitions`
6. To view information about this recovery session - recovery reason and last working partition, type:
   `exo-recovery> recovery info`
7. To set the management interface IP address and mask, type:
   `exo-recovery> ip-address ip/mask`

   See, *Initial Configuration of Management Port* on page 18.
8. To set the management default gateway IP address
   `exo-recovery> default-gateway ip`

   See, *Configuring Default Gateway* on page 18
9. Execute the following commands:

Table 8–2: Additional Recovery Commands

Command	Reference
exo-recovery> **ping** *ip*	*Ping IP* on page 69
exo-recovery> **ping arp** *ip*	*ping arp* on page 77
exo-recovery> **sh**	*sh* on page 77
exo-recovery> **uptime**	*View Device Uptime* on page 71
exo-recovery> **show interfaces**	*Show Interfaces* on page 58
exo-recovery> **show ip route**	*Show ip route* on page 77
exo-recovery> **show arp**	*show arp* on page 78
exo-recovery> **show logging**	*Show Logging* on page 62

Appendix 9
Contacting the Technical Assistance Center

Harmonic Global Service and Support has many Technical Assistance Centers (TAC) located globally, but virtually co-located where our customers can obtain technical assistance or request on-site visits from the Regional Field Service Management team. The TAC operates a Follow-The-Sun support model to provide Global Technical Support anytime, anywhere, through a single case management and virtual telephone system. Depending on time of day, anywhere in the world, we will receive and address your calls or emails in one of our global support centers. The Follow-the-Sun model greatly benefits our customers by providing continuous problem resolution and escalation of issues around the clock.

Table I–1: For Distribution and Delivery (D&D, Legacy Harmonic) Products

Region	Telephone Technical Support	E-mail
Americas	888.673.4896 (888.MPEG.TWO) or 408.490.6477	*support@harmonicinc.com*
EME	+44.1252.555.450	*support.emea@harmonicinc.com*
India	+44.1252.555.450	*support.emea@harmonicinc.com*
Russia	+7.495.926.4608	*support.sm@harmonicinc.com*
Africa	+44.1252.555.450	*support.emea@harmonicinc.com*
Mainland China	+86.10.6569.5580	*chinasupport@harmonicinc.com*
Japan	+81.3.5565.6737	*japansupport@harmonicinc.com*
Asia Pacific – Other Territories	+65.6542.0050	*apacsupport@harmonicinc.com*

Table I–2: For Production and Playout (P&P, Legacy Omneon and Rhozet) Products

Region	Telephone Technical Support	E-mail
Americas	888.673.4896 (888.MPEG.TWO) or 408.490.6477	*omneon.support@harmonicinc.com*
EMEA	+44.1252.555.450	*omneonemeasupport@harmonicinc.com*
Mainland China	+86.10.6569.5580	*chinasupport@harmonicinc.com*
Japan	+81.3.5565.6737	*japansupport@harmonicinc.com*
Asia Pacific – Other Territories	+65.6542.0050	*apacsupport@harmonicinc.com*

The Harmonic Inc. support website is:

http://www.harmonicinc.com/content/technical-support

The Harmonic Inc. Distribution and Delivery product software downloads site is:

ftp://ftp.harmonicinc.com

The Harmonic Inc. Playout and Production software downloads site is:

ftp://ftp.Omneon.com//Updates/Omneon/Current/

The Harmonic Inc. corporate address is:

Harmonic Inc.
4300 North First St.
San Jose, CA 95134, U.S.A.
Attn: Customer Support

The corporate telephone numbers for Harmonic Inc. are:

Tel. 1.800.788.1330 (from the U.S. and Canada)
Tel. +1.408.542.2500 (outside the U.S. and Canada)
Fax.+1.408.542.2511

Appendix 10
Modulation Profiles for Annex A

The table below list the mapping between CLI modulation profile configuration to the DOCSIS Upstream Burst Descriptor.

Glossary:

Parameters, that change:	Some value
Harmonic profiles:	

SCDMA High noise QPSK

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	3	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QPSK	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QPSK	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA High noise QAM16

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	3	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM16	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM16	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA High noise QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	3	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	64	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA High noise QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	3	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Med. noise QPSK

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QPSK	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QPSK	64	5	33	7	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QPSK	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QPSK	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Med. Noise QAM16

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM16	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM16	64	5	33	7	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM16	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM16	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Med. Noise QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	64	5	33	5	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Med. Noise QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	5	33	5	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Low Noise QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	3	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	64	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Low Noise QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	3	Off	0x32	8	fixed	1	1536	qpsk0
2 - REQ/DATA												
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Low lat. QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	32	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
2 - REQ/DATA												
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	32	2	75	5	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	32	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	32	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Low lat. QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	32	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
2 - REQ/DATA												
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	2	75	5	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

SCDMA Med. noise QAM32

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM32	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM32	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM32	64	5	33	7	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM32	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM32	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA High noise QPSK

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	4	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QPSK	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QPSK	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA High noise QAM16

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	4	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM16	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM16	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA High noise QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	4	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	64	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA High noise QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	4	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Med. noise QPSK

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
2 - REQ/DATA												
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QPSK	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QPSK	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QPSK	68	8	75	7	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QPSK	76	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QPSK	76	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Med. noise QAM16

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM16	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM16	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM16	68	8	75	7	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM16	76	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM16	76	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Med. noise QAM32

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM32	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM32	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM32	64	5	33	7	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM32	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM32	96	10	156	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Med. noise QAM64

- UCD-29: Burst Desc: Type 5, IUC: 1, 3, 4, 9, 10, 11
- UCD-35: Burst Desc: Type 5, IUC: 1, 3, 4, 5, 6, 9, 10, 11

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	80	16	75	6	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	96	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	96	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Med. noise QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	56	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	16	75	6	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	16	219	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Low noise QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	4	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	64	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	96	4	244	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	96	4	244	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Low noise QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	64	12	16	4	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	16	75	3	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Low Lat. QAM64

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	32	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM64	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM64	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM64	32	2	75	5	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM64	32	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM64	32	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1

ATDMA Low Lat. QAM256

IUC	Modulation	Preamble length	FecT	FecK	Max burst slots	Diff encoding	Scrambler seed	Guard time	last codeword len.	Deinterleaver depth	Deint. Size	Preamble
1 - Request	QPSK	32	0	7	1	Off	0x32	8	fixed	1	1536	qpsk0
3 - Init.Maintaince	QPSK	384	5	34	0 (variable)	off	0x152	48	fixed	1	1536	qpsk0
4 - Station Maint.	QPSK	384	5	34	6	off	0x152	48	fixed	1	1536	qpsk0
5 - Short Data Grant	QAM256	64	16	75	4	off	0x185c	8	shortened	1	1536	qpsk1
6- Long data grant	QAM256	128	16	110	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
9 - Adv. PHY data short grant	QAM256	128	2	75	5	off	0x185c	8	shortened	1	1536	qpsk1
10 - Adv. PHY data long grant	QAM256	128	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1
11 - Adv. PHY unsolicited grant	QAM256	128	2	248	0 (variable)	off	0x18ea	8	shortened	1	1536	qpsk1