



NSG9000-40G[™] DEPI Control

Application Note



Disclaimer

Harmonic reserves the right to alter the equipment specifications and descriptions in this publication without prior notice. No part of this publication shall be deemed to be part of any contract or warranty unless specifically incorporated by reference into such contract or warranty. The information contained herein is merely descriptive in nature, and does not constitute a binding offer for sale of the product described herein. Harmonic assumes no responsibility or liability arising from the use of the products described herein, except as expressly agreed to in writing by Harmonic. The use and purchase of this product do not convey a license under any patent rights, copyrights, trademark rights, or any intellectual property rights of Harmonic. Nothing hereunder constitutes a representation or warranty that using any products in the manner described herein will not infringe any patents of third parties.

Trademark Acknowledgments

Harmonic and all Harmonic product names are trademarks of Harmonic Inc. All other trademarks are the property of their respective owners.

Documentation Conventions

This manual uses some special symbols and fonts to call your attention to important information. The following symbols appear throughout this manual:



DANGER: The Danger symbol calls your attention to information that, if ignored, can cause physical harm to you.



CAUTION: The Caution symbol calls your attention to information that, if ignored, can adversely affect the performance of your Harmonic product, or that can make a procedure needlessly difficult.



LASER DANGER: The Laser symbol and the Danger alert call your attention to information about the lasers in this product that, if ignored, can cause physical harm to you.



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.

In addition to these symbols, this manual uses the following text conventions:

- Data Entry: indicates text you enter at the keyboard.
- User Interface: indicates a button to click, a menu item to select, or a key or key sequence to press.
- Screen Output: shows console output or other text that is displayed to you on a computer screen.
- Bold: indicates the definition of a new term.
- Italics: used for emphasis, cross-references, and hyperlinked cross-references in online documents.

1.1 DEPI Control Overview

The ever-increasing demand for high speed data-over-cable service (DOCSIS) is driving more and more cable operators to adopt the modular CMTS (M-CMTS) architecture. Equipment vendors have responded to this need by introducing high-capacity modules such as:

- Cisco's 3G60 line card, which plugs into the uBR10K CMTS platform. Each 3G60 card can drive up to 3Gbps worth of data
- Various dense EQAM (edgeQAM) products, including Harmonic's NSG9000-40G.
 The NSG9000-40G HectoQAMTM is capable of streaming up to 25 Gbps downstream data, with up to 36 QAM channels per service group

Along with the introduction of these new high-capacity products, cable operators are looking for ways to simplify and stream-line the operation of their rapidly growing M-CMTS deployments. To assist with this effort operators are adopting the DEPI-control protocol, which is specified by the DEPI standard.

This protocol allows the CMTS core (Cisco's uBR10K in this case) to control the EQAM downstream. Using the DEPI control protocol, technicians can easily control and configure much of the EQAM functionality directly from the command console of the CMTS core, without having to directly configure the EQAM. In addition, the DEPI control protocol allows operators to realize N+1 redundancy scheme of their 3G60 line-cards, while ensuring seamless inter-operability with the EQAM.

To support this need, Harmonic has implemented the DEPI-Control capability on its NSG9000-40G. NSG9000-40G also supports DEPI Path Redundancy (DPR). DPR allows the CMTS core to establish backup DEPI sessions on a secondary connection. If the primary connection fails, either because of a line card failure or a network problem, CMTS traffic starts flowing through the secondary connection.

This document provides instructions for setting up and configuring the NSG9000-40G to operate in an M-CMTS environment with DEPI-Control.

1.2 About this Document

This document describes the DEPI control feature in a system with the following:

- CMTS Core Cisco's uBR
- EQAM NSG 9000-40G

The uBR is the management client and it controls the EQAM device. All resources managed by the uBR should not be configured by the web GUI of the NSG.

1.3 Related Documentation

- DEPI Control specification by Cable Labs at: http://www.cablelabs.com/specifications/CM-SP-DEPI-I08-100611.pdf
- L2TP RFC 3931 at: http://www.ietf.org/rfc/rfc3931.txt

 Cisco guide for configuring DEPI control at: http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/mcmts_depi_control_plane.pdf

1.4 System Specifications

- Cisco UBR with 3G60 line card that supports DEPI Control, and IOS version SCF3 or higher.
- NSG-9000-40G with SW version 3.3.x.x and up

2.1 Configuring the NSG

To configure the NSG9000-40G to operate in an M-CMTS environment with DEPI-Control, perform the following in the described order:

- Check network connectivity see 2.1.2 Network Connectivity on page 6.
- Configure QAM-RF parameters see 2.1.3 QAM-RF Configuration on page 7.
- Enable DEPI control see 2.1.4 Enabling DEPI Control on page 9.
- Configure the EQAM via the CMTS Core see 2.2 Configuring the NSG Via the CMTS Core (uBR) on page 12.

NOTE: To change the configuration of the above parameters, disable DEPI Control as explained in *2.1.5 Disabling DEPI Control* on page 12.

2.1.1 Network Connectivity

Verify network connectivity between the designated uBR GbE port and the NSG GbE port.

If the uBR and the NSG are directly connected, add a routing path as explained below.

 \equiv

NOTE: Typically, in case of direct connection use the 1GbE port.

- ➡ To ensure Network Connectivity
 - 1. Connect the NSG GbE port to the uBR GbE port.
 - 2. Verify that both the NSG and the uBR are on the same subnet.
 - 3. Create for the NSG a route through a GbE port to the uBR GbE port:
 - a. Open a Web browser.
 - b. Enter the IP address of the device.
 - c. Enter the user name and password. See NSG9000-40G Software Guide.
 - d. Select Platform > General tab.
 - e. In Back Panel View, select the required GbE port.
 - f. Select Routing Table.

10GbE7 Properties	Post Bedundan	eu Vietual IBe		< ▼ ⊻⊕≫
Routing Table	Fort Keudilaan			
Destination	Mask	Gateway	Delete	
Add Route Delete	Selected			

g. Click Add Route to add a blank row to the table.

- h. Enter the required values as explained below:
- Destination Enter the IP address of the destination device or network.
- Mask Specify the subnet mask. The combination of mask and destination IP will determine the exact range of IP destinations that may be accessed through this route.
- Gateway Enter the IP address of the gateway through which the NSG will attempt to make a connection to a destination. For each GbE port the gateway must be in the same NSG subnet.

2.1.2 QAM-RF Configuration

To configure QAM-RFs, define the following parameters. You cannot change the configuration of these parameters once DEPI control is activated.

- Operation Mode configured per QAM-RF module. This configuration defines the required ITU-T Annex, whether Annex A or B. See 2.1.3.1 Configuring Operation Mode on page 7.
- Number of QAMs per port see 2.1.3.2 Configuring Number of QAMs per Port on page 7.
- □ RF port frequency range see 2.1.3.3 Configuring RF Port Frequency Range on page 8.
- TS ID applies to NSG9000-40G version 3.4 and higher. See 2.1.3.4 Configuring TS ID on page 9.

2.1.2.1 Configuring Operation Mode

- 1. Open a Web browser.
- 2. Enter the IP address of the NSG 9000 device.
- 3. In the Back Panel View, select the required module.
- 4. Select the Module tab.

RF Template Operation Mode	Frequency 6B-6B-12B	•12B •		
	Group 1	Group 2	Group 3	Group 4
ITU-T Annex	Annex-B	Annex-B	Annex-B	Annex-B
Constellation	256	256	• 256	
Symbol Rate (Msps)	5.360537	5.360537	5.360537	
Data Rate (bps)	38810700	38810700	38810700	
Interleaver 1	128-4	128-4	128-4	128-4
Interleaver 2	128-1	128-1	- 128-1 -	128-1

- 5. Open the Operation Mode list and select one of the following:
 - □ 6B-6B-12B-12B for Annex B
 - □ 4A-4A-9A-9A for Annex A

2.1.2.2 Configuring Number of QAMs per Port

- 1. Open a Web browser.
- 2. Enter the IP address of the NSG 9000 device.
- 3. In the Back Panel View, select the required module.

4. Select the Port tab.

General Module Ports	Port 1 QAMs	Port 2 QAMs			
					RF PowerBoost
Port 1		3	Port 2		
RF Enable			RF Enable		
Frequency Range (MHz) 600.0	00 - 984.000		Frequency Range (MHz) 228.000	- 612.000	
Optimized ACP	v		Optimized ACP		
# QAMs per Port	36 💌	Ī	# QAMs per Port	36 💌	Ī
Power level per QAM (dBmV)	3 44	Allowed: 36-44 dBmV	Power level per QAM (dBmV) 🕜	44	Allowed: 36-44 dBm
Power level per QAM (dBuV)	104		Power level per QAM (dBuV)	104]
Total Power Level (dBmV)	59.6]	Total Power Level (dBmV)	59.6]
Total Power Level (dBuV)	119.6]	Total Power Level (dBuV)	119.6]
Enable Variable Equalizer			Enable Variable Equalizer		
Cable Slope (dB)	0	1	Cable Slope (dB)	0 💌	Ι

- 5. Open the **# QAMs** per Port list and select the required number of QAMs:
 - For Annex A a number between 1 to 26
 - □ For Annex B a number between 1 to 36

2.1.2.3 Configuring RF Port Frequency Range

Each RF Port spans across 384MHz transmission frequency of the 1GHz spectrum (to be accurate 50MHZ-1GHz).

You can locate along the spectrum, for each RF port, its Span window = 384MHz divided into steps of 6MHz for Annex B, or 8MHz for Annex A. You can set the Span window with accuracy of up to 1Khz along the 1GHz spectrum. For example 228.001 - 612.001.

When Span window moves, all the allocated QAMs move accordingly. So if e.g. the window moves by +1Mhz, all allocated QAMs shift by +1Mhz.

NOTE: In case any of the QAMs is in DEPI control, you cannot change the span window.

- ➡ To configure the RF frequency span
 - 1. Open a Web browser.
 - 2. Enter the IP address of the NSG 9000 device.
 - 3. In the Back Panel View, select the required module.

≣

4. Select the Port tab.

		Enter the Spar value	n Start I	Enter the Span End value
General Module Ports	Port 1 QAMs Port 2 QAMs			
- Port 1		- Port 2		RF PowerBoost
RE Enable		RE Enable	V V	1
Frequency Range (MHz) 600.00	00 - 984.000	Frequency Range (MHz) 228.00	0 - 612.0	00
Optimized ACP	V	Optimized ACP		
# QAMs per Port	36	# QAMs per Port	36	
Power level per QAM (dBmV)	Allowed: 36-44 dBmV	Power level per QAM (dBmV) 🕝	44	Allowed: 36-44 dBmV
Power level per QAM (dBuV)	104	Power level per QAM (dBuV)	104	
Total Power Level (dBmV)	59.6	Total Power Level (dBmV)	59.6	
Total Power Level (dBuV)	119.6	Total Power Level (dBuV)	119.6	
Enable Variable Equalizer		Enable Variable Equalizer		
Cable Slope (dB)	0	Cable Slope (dB)	0	w.

- 5. In Frequency Range (MHz), enter the required value to start and end the range. You can enter either start or end value and the corresponding value is automatically computed by the device.
- 6. Click Apply.

2.1.2.4 Configuring TS ID

NOTE: Applies to NSG9000-40G version 3.4 and higher.

- 1. Open a Web browser.
- 2. Enter the IP address of the NSG9000 device.
- 3. In the Back Panel View, select the required slot/module.
- 4. Select the Port # QAMs tab.

20 238	246 256 26	4 274 28	4 292 302 310 320 330	2 338 348 356 366	376 386 3	96 404 414 422	432 442 450 46	0 468 478 488	496 506 514	524 534 542	552 560 570	580 590	600 608 €
Outp	QAM In	TS ID	Group	QAM Manager	NGOD	Frequency	Power Level (User Atten	Interlea	QAM ON	Spectral I	CW	P
1.1	1	1	1 (A,256,6.954000)	VOD SRM	QG1	232.000	44	0	12-17	~			
.2	2	2	1 (A,256,6.954000)	Broadcast	QG2	240.000	44	0	12-17	~			
.3	3	3	1 (A,256,6.954000)	Broadcast	QG3	248.000	44	0	12-17	1			
		T											

5. Under TS ID, enter the required TS ID for the QAM.

2.1.3 Enabling DEPI Control

- Select and configure QAMs for DEPI control
- Enable the RF port

2.1.3.1 Select QAMs for DEPI Control

- 1. Open a Web browser.
- 2. Enter the IP address of the device.
- 3. Enter the user name and password. See NSG9000-40G Software Guide.
- 4. Select Platform > General tab.

0 ^	oplications	O Monito	ring O Reports										
> Licens	ing ≻NGOD	→ ISA →	Virtual Devices										
& Back	anel View								-				
Eth1 Et	12			DT11 DT12 Gbt	1 GbE2 GbE3 GbE	4 10GbES 10GbEe	10GbE7 10GbE8		Chassis				
Slot 1	Status:MODULE	OK	-	s	ot 2 Status: NOD	ULE OUT			Slot 3 Status:	MODULE OUT			
Slot 4	Status:MODULE	OUT		Sic	ot 5 Status:MODI	ILE OK			Slot 6 Status:	MODULE OUT			
Slot 7	Status:MODULE	CUT		Sic	ot 8 Status: MOD	JLE OK			Slot 9 Status:	MODULE OUT			
PE Output	06 612 616 624 6	30 636 642 648 6 TE 10	54 650 665 672 678 684 680 f	696 302 708 714 720 72	8 732 738 744 750 7 NGOD CH	6 792 798 774 790 Granuaran	286 792 798 804 812 814	5 822 828 834 880 888	852 858 864 870 878 Totaclassurer	812 588 894 900 90	5 912 918 924 930 93 Reported Toylog	6 942 948 944	
RF Output	QAM Index	30 636 642 648 6 TS ID	14 660 666 672 678 684 680 1 Group 1 (8,256,5,360537)	ен 702 706 714 720 72 <i>QAM Manager</i> VQO SRM	8 712 718 744 760 7	6 7/2 7/6 774 780 u Frequency (M	286 702 708 804 810 814 42) Power Level (dB	6 K22 K28 K34 K40 K46 MTV) User Attenuatio	852 858 864 870 876 Interleaver 128+4	882 888 894 900 90 QAM ON	5 912 918 924 930 93 Spectral Inver	6 942 948 954 CW	
RF Output 1.1.1 1.1.7	QAM Index 1 7	00 656 642 648 6 TS ID 1 7	664 866 872 878 888 880 1 Group 1 (8,236,5.360537) 2 (8,236,5.360537)	ен 702 708 714 720 72 QAM Manager VOD SRM VOD SRM IYOD SRM	8 732 738 744 790 7 NGOD Gro QG7	68 762 768 774 780 Frequency (M) 639.000 639.000	786 792 798 804 893 814 42) Power Level (dB	R R22 R28 834 840 848 RMV) User Attenuatio 0	852 858 864 870 878 Interleaver 128-4 128-4	882 888 894 900 80 QAM ON	6 912 918 524 530 53 Spectral Inver	6 942 948 954 CW	
RF Output 1.1.1 1.1.7 1.1.8	06 612 615 624 6 QAM Index 1 7 8	20 636 642 648 6 TS ID 1 7 8	64 60 66 52 67 64 60 6 Group 1 (6,236,5.360537) 2 (6,256,5.360537) 2 (6,256,5.360537)	AM 20 700 714 720 72 QAM Manager VOD SRM VOD SRM ISA SRM NGOD ERM M-CMTE	8 732 738 744 780 7 NGOD Gro QG7 QG8	6. 762 768 774 780 	740 740 748 806 819 814 fz) Power Level (dB	k 422 KOK KSK KAO KAK KMVU 0 0 0	852 858 858 859 829 128-4 128-4 128-4	882 888 884 900 90 QAM ON	s erz ers so so Spectral Inver	6 542 548 554 CW	
RF Output 1.1.1 1.1.7 1.1.8 1.1.9	QAM Index 1. 7 8 9	1 TS ID 1 7 8 9	64 600 660 672 674 664 680	AM AND THE TOP TO QAM Manager VOD SRM VOD SRM NGOD ERM M-CMTS M-CMTS M-CMTS M-CMTS	NGOD Gro QG7 QG8 ic QG9	63 702 766 774 789 	786 792 798 804 898 816 (2) Power Level (df) 44 44 44 44	s aze os as an as an as User Attenuatio	852 858 854 820 826 128-4 128-4 128-4 128-4 128-4	882 888 894 900 90 QAM ON V V V	5 912 918 924 930 93 Spectral Inver	6 542 548 554 CW	
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10	06 612 618 624 6 QAM Index 1 7 8 9 10	2 TS ID 1 7 8 9 10	Group Group 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537)	AN TO THE THE TOP TO QAM Manager VOD SRM VOD SRM NGOD ERM N-CMTS M-CMTS VOD SRM VOD SRM	x 722 728 744 749 7 x 16000 Gree QG27 QG3 QG47 QG4 QG9 QG10	6 102 26 274 200 53.000 639.000 645.000 651.000 657.000	786 792 798 804 898 814 (27) Power Level (df) 44 44 44 44 44	s sz sos ss so ss User Attenuatio	EC EG EG EG EC EX Interleaver 128-4 128-4 128-4 128-4 128-4 128-4	852 888 884 900 90 QAM ON C C C C C C C C C C C C C	s 912 918 524 930 93 Spectral Inver	CW	
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11	00 01 019 62 01 6 QAM index 1 7 8 9 10 11	30 636 642 648 6 TS ID 1 7 8 9 10 11 11	64 80.0 85.7 27.8 84.8 80.0 Croup 1 (6,256,5,360537) 2 (6,256,5,360537)	All TAL TAL TAL TAL AL	 8 70 78 74 76 7 NGOD Gree QG7 QG8 QG9 QG10 QG11 	4 70 74 74 70 53 70 74 70 70 53 000 639.000 645.000 651.000 652.000 663.000	200 792 798 804 819 814 (41) 200 800000 Level (41) 44 44 44 44 44	b K2 Ke ks ka as k kmV) User Attenuatio	BC2 BC3 BC4 BC5 BC6 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4 1285-4	842 844 900 90 Q AM ON V V V V V V V V	s et2 et4 s24 s35 s3 Spectral Inver		
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.11	00 012 013 624 6 QAM index 1 7 8 9 10 11 12	20 636 642 648 0 TS ID 1 7 8 9 10 11 12	64 600 665 727 674 684 600 Group Group 1 (9,,256,5,5,360537) 2 (9,,256,5,360537) 2 (9,,256,5,360537) 2 (9,,256,5,360537) 2 (9,256,5,360537) 2 <td>AN THE THE THE THE THE THE THE THE THE THE</td> <td>X X X X X X X</td> <td>K 742 744 742 740 Frequency (M S3.000 639.000 645.000 657.000 659.000 669.000</td> <td>740 740 744 804 443 444 (2) Power Level (dt) 44 44 44 44 44 44</td> <td> K22 K24 K34 K40 K40</td> <td>402 848 848 820 824 Interfeaver 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4</td> <td></td> <td>#12 918 824 90 91 9</td> <td></td> <td></td>	AN THE	X X X X X X X	K 742 744 742 740 Frequency (M S3.000 639.000 645.000 657.000 659.000 669.000	740 740 744 804 443 444 (2) Power Level (dt) 44 44 44 44 44 44	 K22 K24 K34 K40 K40	402 848 848 820 824 Interfeaver 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4		#12 918 824 90 91 9		
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.12 1.1.13	QAM Index QAM Index 1 7 8 9 10 11 12 12 13	20 636 642 648 0 TS ID 1 7 8 9 10 11 12 13	Ke Mode KD COLV CFCUp 1 (0,236,5.360537) (0,256,5.360537) 2 (0,256,5.360537) (0,256,5.360537) (0,256,5.360537) 2 (0,256,5.360537) (0,256,5.360537) (0,256,5.360537) 2 (0,256,5.360537) (0,256,5.360537) (0,256,5.360537) 3 (0,256,5.360537) (0,256,5.360537) (0,256,5.360537)	wei 3/2 9/8 7/4 29/3 7/4 29/3 7/4 29/3 7/2 2/3<	X X X X X X X	Ka 762 768 776 760 Frequency (M S3.000 639.000 645.000 653.000 653.000 669.000 660.000 603.000	No No<	User Attenuation 0 0 0 0 0 0 0 0 0 0 0 0 0	40 80<				
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.12 1.1.13 1.1.14	QAM Index QAM Index 1 7 8 9 10 11 12 13 14	0 642 642 643 644	AL UD UD<	## 70 7% 7% 7% QAM Manager QAM Manager 7% 7% VOD SRM VOD SRM 1% 7% VDD SRM VOD SRM VOD SRM 1% VDD SRM VDD SRM VD SRM 1% VDD SRM VDD SRM 1% 1% VDD SRM VDD SRM 1% 1%	Y0 Y4 Y6 AGOD Gro QG7 QG8 QG9 QG91 QG91 QG10 QG12 QG13 QG14 QG14 QG14	No. Prequency (M 939,000 639,000 639,000 648,000 651,000 657,000 669,000 669,000 600,000 661,000	No. No. <td>CO CO SI SI AN AN</td> <td>BC BC BC<</td> <td></td> <td></td> <td></td> <td></td>	CO CO SI SI AN	BC BC<				
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.12 1.1.13 1.1.14 1.1.15	2006 012 019 029 02 2004 019 029 0 7 7 8 9 10 11 12 13 14 15	Image: Non-State State St	Group Group 1 (0,256,5.306537) 2 (0,256,5.306537) 2 (0,256,5.306537) 2 (0,256,5.306537) 2 (0,256,5.306537) 2 (0,256,5.306537) 2 (0,256,5.306537) 2 (0,256,5.306537) 3 (0,256,5.306537) 3 (0,256,5.306537) 3 (0,256,5.306537) 3 (0,256,5.306537)	MR 742 744 744 720 72 QAM Manager VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM VOD SRM	8 702 704 704 709 7 ▲ MGOD GOT QG37 QG4 QG49 QG40 QG41 QG41 QG42 QG43 QG44 QG45	Frequency (M 639.000 639.000 639.000 645.000 651.000 652.000 663.000 669.000 681.000 681.000 669.000 681.000	Mail Top Mail Mail <thm< td=""><td></td><td>BO BO BO<</td><td>B12 BA B14 GO2 B CAM ON S S S S S S S S S S S S S</td><td></td><td></td><td></td></thm<>		BO BO<	B12 BA B14 GO2 B CAM ON S S S S S S S S S S S S S			
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.12 1.1.13 1.1.14 1.1.15 1.1.15	QAM Index QAM Index 7 8 9 10 11 12 13 13 14 14 15	0 0.00 0.	Coup Coup Coup 1 (8,236,5.360337) 2 (6,256,5.360337) 2 (6,256,5.360537) 2 (6,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 2 (8,256,5.360537) 3 (8,256,5.360537) 3 (8,256,5.360537) 3 (8,256,5.360537) 3 (8,256,5.360537) 3 (8,256,5.360537) 3 (8,256,5.360537) 3 (8,256,5.360537)	NO NM Tv1 201 70 QAM Manager VOD S8M VOD S8M VOD S8M NOOD EMM MOOD EMM NOOD S8M VOD S8M VOD S8M VOD S8M VOD S8M	8 70 70 70 70 70 70 70 70 70 70 70 70 70	6 702 708 772 700 	No No<	822 Ethe 834 840 <td>B0 B0 B0<</td> <td></td> <td>1 172 914 524 500 100 11 Spectral Inver I I I I I I I I I I <td< td=""><td></td><td></td></td<></td>	B0 B0<		1 172 914 524 500 100 11 Spectral Inver I I I I I I I I I I <td< td=""><td></td><td></td></td<>		
RF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.12 1.1.13 1.1.14 1.1.15 1.1.16 1.1.16 1.1.17	All reference of the second seco	0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	A B00 B00 CPU EV EV <thev< td=""><td>NO NM TVA TVA</td><td>N 702 704 704 704 N 6000 000 000 000 Q 037 Q 038 000 000 Q 047 Q 040 000 000 Q 040 Q 040 000 000 Q 0410 Q 0412 Q 0412 0012 Q 0414 Q 0415 0014 0014 Q 0415 Q 0415 0015 0017</td><td>No. No. Frequency (M 438.000 438.000 638.000 658.000 657.000 657.000 657.000 659.000 651.000 659.000 659.000 659.000</td><td>No. No. No.<td>EVE VE AND AND AND AND AND AND AND AND AND AND</td><td>BO BA BA BA BA 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4</td><td></td><td></td><td></td><td></td></td></thev<>	NO NM TVA	N 702 704 704 704 N 6000 000 000 000 Q 037 Q 038 000 000 Q 047 Q 040 000 000 Q 040 Q 040 000 000 Q 0410 Q 0412 Q 0412 0012 Q 0414 Q 0415 0014 0014 Q 0415 Q 0415 0015 0017	No. No. Frequency (M 438.000 438.000 638.000 658.000 657.000 657.000 657.000 659.000 651.000 659.000 659.000 659.000	No. No. <td>EVE VE AND AND AND AND AND AND AND AND AND AND</td> <td>BO BA BA BA BA 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4</td> <td></td> <td></td> <td></td> <td></td>	EVE VE AND	BO BA BA BA BA 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4 128-4				
AF Output 1.1.1 1.1.7 1.1.8 1.1.9 1.1.10 1.1.11 1.1.13 1.1.14 1.1.15 1.1.16 1.1.17 1.1.18	QAN 100 100 100 100 100 100 100 100 100 10	8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Interface Correct 1 (0,256,5.306337) 2 (0,256,5.306337) 2 (0,256,5.306337) 2 (0,256,5.306337) 2 (0,256,5.306337) 2 (0,256,5.30637) 2 (0,256,5.30637) 2 (0,256,5.30637) 3 (0,256,5.306337) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637) 3 (0,256,5.30637)	Open Part Open Part <t< td=""><td>N 702 70 704 706 70 NICOD COTO Q07 Q07 Q09 Q09 Q09 Q01 Q01 Q01 Q01 Q01 Q01 Q01 Q01</td><td>III No No No No VEX.putches.com -</td><td>No. No. No.<td>NO NO NO<</td><td>BO BA BA<</td><td></td><td></td><td></td><td></td></td></t<>	N 702 70 704 706 70 NICOD COTO Q07 Q07 Q09 Q09 Q09 Q01 Q01 Q01 Q01 Q01 Q01 Q01 Q01	III No No No No VEX.putches.com -	No. No. <td>NO NO NO<</td> <td>BO BA BA<</td> <td></td> <td></td> <td></td> <td></td>	NO NO<	BO BA BA<				

Select the required Port QAMs tab

Select the required QAM and set its QAM manager to MCMTS Dynamic

- 5. In Back Panel View, select the slot.
- 6. Select the required Port 1/2 QAMs tab.
- 7. Select the required QAM to be managed by the uBR.
- Under QAM Manager, open the list and select M-CMTS Dynamic. QAM manager of all QAMs in the group in both RF ports, changes to M-CMTS Dynamic. If the QAM belongs to group 3 or 4, the QAM manager of both groups on both RF ports changes to M-CMTS Dynamic.
- 9. Click Apply. The following takes place:
- All QAMs with QAM manager *M*-*CMTS Dynamic* are muted until the uBR enables them.
- Applies to NSG9000-40G version 3.3.x.x and lower. TS ID is set the QAM index.
- Interleaver 2 assumes the value of interleaver 1
- Constellation, the type of RF modulation, is set to 256, unless it is set to 64. In case it is set to 64, do not change it.
- Symbol rate:
 - □ Annex A is set to 6.9520
 - □ Annex B:

If constellation is set to 256, symbol rate should be 5.360537 If constellation is set to 64, symbol rate should be 5.056941

- RF Port Optimized ACP is disabled, and is read only.
- The following listed parameters are blocked when working in DEPI Control mode:
 - QAM parameters: Frequency, QAM mute, TSID, CW set to Off.
 - Dert: RF Power, Number of QAMs, RF range, ACP enable set to disable.
 - **QAM** Group: Group Mode, Constellation, Symbol rate, Interleaver
 - Global RF scheme

2.1.3.2 Enabling RF Port(s)

1. In the web client of the NSG device, select the Ports tab. To access the Ports tab, follow steps 1 to 5 in 2.1.4.1 Select QAMs for DEPI Control on page 10.

Module 1 Properties					
General Module Ports	Port 1 QAMs	Port 2 QAMs			
					RF PowerBoo
Port 1			Port 2		
RF Enable 🔽 🔽			RF Enable		
Frequency Range (MHz) 600.00	0 - 984.000		Frequency Range (MHz) 228.00	0 - 612.00	0
Optimized ACP	V		Optimized ACP		
# QAMs per Port	36]	# QAMs per Port	36	•
Power level per QAM (dBmV)	44	Allowed: 36-44 dBmV	Power level per QAM (dBmV) 🔮	44	Allowed: 36-44 dBm
Power level per QAM (dBuV)	104		Power level per QAM (dBuV)	104	
Total Power Level (dBmV)	59.6		Total Power Level (dBmV)	59.6	
Total Power Level (dBuV)	119.6		Total Power Level (dBuV)	119.6	
Enable Variable Equalizer	Γ		Enable Variable Equalizer		
Cable Slope (dB)	0]	Cable Slope (dB)	0	*

Enable the QAM-RF port

2. Select RF Enable to enable the RF port.

NOTE: If the RF port is disabled, or if the QAM-RF is missing and the uBR initiates DEPI control sessions for the disabled RF port or the missing QAM-RF module, the NSG rejects the sessions.

3. Click Apply.

2.1.4 Disabling DEPI Control

When you disable DEPI control for QAMs, the QAMs are controlled by the web client of the NSG 9000-40G device.



≣

NOTE: Disabling DEPI control is service affecting for the QAMs that are removed from DEPI control.

- 1. Via the uBR, close all DEPI sessions.
- 2. Access the NSG 9000 Web client.
- 3. In the NSG 9000 Web client, in Back Panel View, select the required module.
- 4. Select the required Port # QAMs tab.
- 5. Select a QAM in the required QAM Group, and set its QAM manager to the desired value, such as VOD or ISA.

The change applies to all QAMs in the QAM Group in both RF ports. For groups 3 or 4, the QAMs of both groups in both ports are changed to the new QAM manager.

6. Click Apply. NSG rejects uBR requests to setup DEPI sessions on these QAMs.

2.2 Configuring the NSG Via the CMTS Core (uBR)

2.2.1 General Guidelines

- When creating the configuration data of the EQAM on the uBR, the configuration data should comply to the EQAM capabilities and configuration logic.
 For example: If you configure the RF power level of QAM 1 to 51dBmV and you set the power level of QAM 2 to 52dBmV, the EQAM sets the power level of the port according to the last entered value.
- If the uBR requests to configure a parameter with an incorrect value, or to configure a value which conflicts with other sessions, the DEPI session is rejected.
- Troubleshooting If DEPI sessions were not set up, you can view DEPI debug messages in a syslog server. Configure the syslog server IP address by selecting Chassis > SNMP & Syslog tab. In Syslog Server IP Address, enter the required IP address.

2.2.2 TS ID

Applies to NSG9000-40G version 3.3.x.x and lower.

The TS ID you configure on the CMTS core, is identical to the QAM index on the EQAM. For example, TS ID 109 is actually QAM index 109 on the EQAM.

2.2.3 RF Frequency Guidelines

Define the frequency range of the RF port via the EQAM Web client prior to creating the DEPI sessions. See 2.1.3.3 Configuring RF Port Frequency Range on page 8.

To configure the QAM-RF frequency, refer to the following guidelines:

Once you defined the Span window, locate the available QAM channels along this span window while each QAM channel utilizes six MHz in Annex B. For example, if the Span Window = 384 MHz and Span Start = 228 MHz, you can configure QAM channels with any frequency between 228Mhz - 612 MHz. However, the frequency of the QAM channels is defined according to the center frequency. In this case, the first QAM channel valid frequency is 231MHz in steps of 6MHz. For example:

231, 237, 243...

You can locate the QAMs any where along the Span window. For example, QAM #4 can be located at 255MHz.

For Annex B, QAM frequency is calculated according to the following formula:

 $f_{QAM} = SpanStart + 3MHz + n*6MHz < SpanEnd$ $n={0.....63}$

For Annex A, QAM frequency is calculated according to the following formula:

 $f_{QAM} = SpanStart + 4MHz + n*8MHz < SpanEnd n={0.....47}$

2.2.4 **RF Power Guidelines**

RF power level is the same for all sessions in a port. If you change the power level of the RF port via the uBR, it affects all the QAMs of the RF port including QAMs with QAM manager other than M-CMTS.

.

Table 2-1: Power Level Per QAM Ranges

Number of QAMs per Port	Min. Power Level per QAM	Max. Power Level per QAM
1	44	52
2	44	52
3	44	52
4	44	52
5	44	52
6	44	52
7	44	52
8	44	52
9	43	51
10	43	51
11	42	50
12	42	50
13	41	49
14	41	49
15	40	48
16	40	48
17	40	48
18	39	47
19	39	47
20	39	47
21	39	47
22	38	46
23	38	46
24	38	46
25	38	46
26	38	46
27	37	45
28	37	45
29	37	45

	Table	2-1:	Power	Level	Per	QAM	Ranges
--	-------	------	-------	-------	-----	-----	--------

Number of QAMs per Port	Min. Power Level per QAM	Max. Power Level per QAM
30	37	45
31	37	45
32	37	45
33	36	44
34	36	44
35	36	44
36	36	44

2.2.5 RF modulation and Symbol Rate Guidelines

- RF modulation is the same for all sessions in an RF group.
- In Annex B, groups 3 and 4 share the same modulation.

2.2.6 Interleaver Depth Guidelines

Interleaver Depth is the same for all sessions in an RF group.

2.2.7 ITU-T Annex Guidelines

You can configure the ITU-T Annex only via the EQAM Web client. The configuration is per RF module. See *2.1.3.1 Configuring Operation Mode* on page 7.

2.3 Viewing DEPI Control Sessions

Once DEPI control is enabled, you can setup on the CMTS core DEPI sessions. You can view a list of the configured DEPI sessions via either of the following:

- CMTS core by using Cisco CLI
- NSG web client select Application > M-CMTS > Session tab. In the Session tab, the Type column the following may appear:
 - □ Static a static M-CMTS session.
 - Dynamic DEPI control M-CMTS session with no DPR support.
 - Dynamic (P) DEPI control M-CMTS session. This session is the Primary DPR session.
 - Dynamic (S) DEPI control M-CMTS session. This session is a Secondary DPR session.

2.4 Configuring Cisco's uBR



NOTE: The following section provides an example of how to configure Cisco's uBR while working with Harmonic's EQAM. For authorized and comprehensive instructions, refer to the uBR documentation provided by Cisco.

2.4.1 Example of a DEPI Tunnel

The following example shows global configuration which applies to several DEPI sessions:

```
l2tp-class LC1
retransmit retries 5
retransmit timeout max 2
!
depi-class DC1
mode mpt
!
depi-tunnel nsg1
dest-ip 10.30.4.103
l2tp-class LC1
depi-class DC1
!
```

2.4.2 Example of a DEPI Session

The following example shows configuration for a single DEPI session. If some parameters are incorrect, or conflict with other sessions, the session is rejected.

```
controller Modular-Cable 6/0/0
rf-channel 0 cable downstream channel-id 1
rf-channel 0 frequency 447000000 annex A modulation 64qam
rf-channel 0 depi-tunnel nsg1 tsid 17
rf-channel 0 rf-power 52.0
no rf-channel 0 rf-shutdown
!
```

2.4.3 Useful UBR Commands

The following commands monitor the DEPI Control support:

uBR commands, such as: "show depi sessions" - especially "show depi session NNN verbose" "show depi sessions configured" "show cable modem" uBR debug messages, such as: "debug depi" - events and errors "debug l2tp" - especially "debug l2tp packets brief" "show logging"



HEADQUARTERS

 Americas Sales

 4300 North First Street

 San Jose, CA 95134 U.S.A.

 T
 1 800 828 5521 inside the U.S.

 +1 408 542 2559 outside the U.S.

 F
 +108 942 06001

ASIA-PACIFIC

 Harmonic (Asia Pacific) Limited

 Suite 2301, L23, Office Tower

 Langham Place, 8 Argyle St

 Mongkok, Kowloon Hong Kong

 T

 7

 +852 3713 9300

 F

 F

 +852 2116 0083

EUROPE AND MIDDLE EAS

 United Kingdom

 250 Fowler Avenue, Ground Floor

 IQ Famborough

 Famborough Hampshire GU14 7JP

 United Kingdom

 T

 +44 (0)1 252 555 400

 F

 +44 (0)1 252 377 171

Africa, India, Russia and CIS Countries 10 Haamel St Park Afek Rosh Ha'ayin, 48092 Israel 1 +972.3.9007777 +972.3.9007800 F +972.3.9007766

C

© 2013 Harmonic Inc. All rights reserved.