

# NSG™ 9000-40G HectoQAM®

SCALABLE UNIVERSAL EDGEQAM



The NSG™ 9000-40G is the latest generation of the Harmonic ultra-dense universal edgeQAM system, capable of reaching up to 648 QAM RF outputs per unit. The device is designed as a highly integrated digital video gateway which multiplexes on-demand content streamed over an IP network. The NSG 9000-40G was engineered for scalability, and is capable of growing in QAM density from 8 to 648 QAMs per unit. In addition to providing unparalleled output density, the NSG 9000-40G is designed to support a variety of applications, including video on demand (VOD), switched digital video (SDV), broadcast, modular cable modem termination systems (M-CMTS) and Direct to Edge (D2E) for cable IPTV.

## Stream Processing

The NSG 9000-40G is housed in a modular, 2-RU chassis, and performs PID filtering, multiplexing, scrambling, QAM modulation, and RF amplification for up to 648 MPEG transport streams simultaneously. The NSG accepts digital MPEG input through its gigabit Ethernet (GbE) ports or 10 GbE SFP+ ports, then directs the video or data to different QAMs to create the outgoing transport streams as QAM-RF output signals. The NSG 9000-40G is also designed to meet the DOCSIS 3.0 M-CMTS requirements for downstream data transmission.

## Modularity

In order to maximize scalability and flexibility, the NSG 9000-40G is designed as a completely modular system. The chassis has nine QAM RF module slots; each module has two RF ports. Each port is capable of supporting up to 36 QAM channels of Annex B and C, or up to 27 QAM channels of Annex A. Unlike traditional RF block upconversion technology, the QAM channels can be flexibly spread across the spectrum, allowing operational benefits in RF combining and spectrum design. The system can host two redundant AC or DC power supplies capable of load sharing — maximizing MTBF and providing the highest reliability.

The main processing module features four 1 GbE SPF cages as well as four SFP+ cages supporting 10 GbE links. The 10G interfaces are also operable in 1 GbE compatibility mode using regular SFPs. This allows a smooth transition between 1G networks and 10G networks, enabling an “upgrade as you grow” model to retain current investment in networking gear.

The processing module includes two 10/100 Base-T ports for management and conditional access networks. In addition, this module supports two DOCSIS Timing Interface (DTI) ports, for synchronizing timing in an M-CMTS application. An on-board ASI monitoring port is used to monitor the transport streams within the system with an MPEG analyzer.

Designed for ease of operation, the NSG 9000-40G QAM RF modules and power supplies are hotswappable, allowing for flexible enhancement of system density without service downtime. The device cooling fans are contained in a detachable front bezel which snaps on the chassis, allowing field replacement.

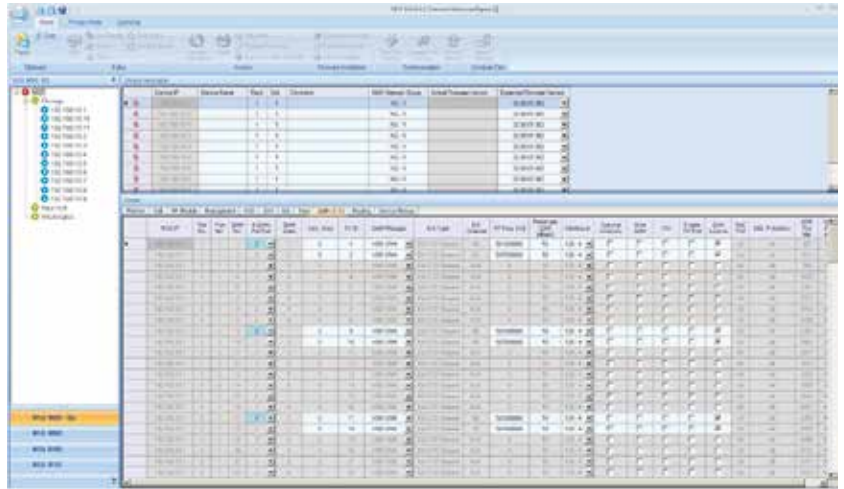
## HIGHLIGHTS

- High-density, modular 2-RU system supporting up to 44 Gbps input and 648 QAMs
- Hot swappable QAM RF modules with 2 RF ports capable of outputting up to 36 QAM channels spread flexibly over the spectrum
- Variable Equalizer™ for advanced RF power control
- Controlled via the Mass Configuration Tool (MCT), an HTTP web GUI or Command Line Interface (CLI)
- Motorola Privacy Mode real-time encryption
- DVB-CSA real-time encryption
- DOCSIS 3.0 ready

## Management

NSG 9000-40G offers several methods of configuration and monitoring. The device uses an LCD and keypad for the initial networking configuration, and includes an intuitive web interface, a command line interface (CLI) and SNMP MIBs for integration to network monitoring systems.

In order to facilitate the simultaneous configuration of a large number of NSG devices, Harmonic offers a spreadsheet-based Mass Configuration Tool (MCT). This tool also allows users to perform firmware upgrades and remote configuration as well as backup and restore for multiple devices.



## Operational Benefits

- **Ultra High Density** — By scaling up to 36 QAMs per port, NSG 9000-40G helps untangle the HFC combining network. Using fewer RF ports to reach a laser transmitter, the NSG helps to realize savings in rack space, cabling, labor, cooling, power consumption and more.
- **Frequency Agility** — Using new Fast DAC technology, NSG not only supports ultra-dense QAM capacity but can also spread the QAMs across the spectrum. This eases HFC plant planning as new projects do not need to factor lengthy and expensive spectrum shifting to accommodate new blocks of QAMs.
- **Software-based RF Leveling** — With the advanced RF power features of Variable Equalizer™ and QAM attenuators, users can tilt the spectral QAM output of a port, or attenuate individual QAMs within a port to achieve what previously required physical attenuators and manual HFC combining labor.
- **EQAM Virtualization** — NSG 9000-40G supports a new software feature that allows partitioning of the physical device to multiple virtual devices. Each virtual device appears as an EQAM to the back office SRM or ERM, allowing quick integration with legacy systems as well as new back office systems.
- **Advanced Troubleshooting** — NSG includes many troubleshooting features that allow traffic analysis in complex environments such as SDV or VOD. With built-in wireshark captures, Syslog server reporting, alarm configuration, ASI output, GbE port forwarding and more, the root cause of a system failure can be traced quickly and efficiently.
- **Modular Design** — The NSG 9000-40G platform features hot-swappable RF-QAM modules and power supplies, a retrievable processing module and detachable front panel. This makes it easier to stock spare parts and apply them quickly in case of a failure, minimizing outage time.
- **Security** — The NSG 9000 is based on Linux kernel and incorporates an integral configurable firewall to protect the device from unauthorized or offensive traffic. Augmented by secure HTTPS and SSH, the NSG provides a secure and flexible means of management while MSOs are transitioning to modern IT environments.

## APPLICATIONS

- Video on Demand (VOD)
- Broadcast
- Cable IPTV Direct to Edge (D2E)
- Switched Digital Video (SDV)
- DOCSIS Modular CMTS (M-CMTS)

## GIGABIT ETHERNET INPUT

Type	Gigabit Ethernet 802.3z and 10 Gbe Ethernet 802.3ae
Ports	8 Independent ports (4*10 Gbe and 4 *1 Gbe)
Connector	4 x SFP cages 4 x SFP+ cages
I/O Speed (1Gbe ports)	960 Mbps per port
I/O Speed (10Gbe ports)	9600 Mbps per port
IP Encapsulation	MPEG TS over UDP/IP/MA 1 to 7 TS/ IP
MPEG Format	188 Bytes per TS packet
I/O Processing	Up to 9600 Mbps per port
Total Processing Capacity	Up to 44 Gbps
Addressing & Protocols	Unicast (UDP, L2TPv3), Multicast (IGMPv1,v2,v3)
Management	ARP, ICMP
Monitoring	GbE port forwarding (port or socket mirroring)
Redundancy	4 x (1 + 1) 2 x (3 + 1) ISA-SDV applications only

## ASI MONITOR PORT

Type	ASI Output
Connector	BNC, 75Ω
Configuration	Configurable mirroring per QAM
MPEG Format	188 Bytes per TS packet

## MANAGEMENT INTERFACES

Ethernet	2 x 10/100/1000 Base-T
Connector	RJ-45 (1 Management, 1 CAS)
Serial Port	RS232

## DTI PORT

DTI	2 * DTI interface for DOCSIS 3.0 support
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## RE-MULTIPLEXING

Program and PID	Re-mapping & remultiplexing
PSI/SI	PAT/PMT extraction and generation
Number of Unicast Services	Up to 4000

## ENCRYPTION

Motorola Privacy Mode	
DVB-CSA	Session-based and tier-based SymulCrypt

## MANAGEMENT

Standalone Control	NSG Web-client Command Line Interface (CLI) through SSH/Serial
Mass Configuration	Mass Configuration Tool (MCT) version 10 and above
NMS	Harmonic NMX Digital Service Manager (monitoring only) version 6.0 and above
SNMP Monitoring	Alarms monitoring via SNMP (traps and polling)
Protocols	TCP/IP, RPC SNMP v1,v2c,v3 HTTP, HTTPS, SCP, RS-232

## REDUNDANCY SCHEMES

Device Redundancy	EdgeCluster
GbE Port Redundancy	4x1:1, 2x3:1, N:1
Socket Redundancy	Inter-port socket redundancy Intra-port socket redundancy

## ENVIRONMENTAL

Operating Temperature Range	32°F to 122°F 0°C to 50°C
Storage Temperature Range	-40°F to 158°F -40°C to 70°C
Relative Humidity	0 to 95% non-condensing
Operating Altitude	Up to 15,000 feet (4,572 meters)

## PHYSICAL

Input Voltage	85-264 VAC, 47-63 Hz 42-60 VDC
Power Consumption	780W @ 220VAC 780W @ 110VAC 780W @ -48VDC
Power Modules	1+1 redundant AC/DC, load sharing power supplies
Rack Space	2-RU
Dimensions (W x H x D)	19 in x 3.47 in x 20.75 in 48.26 cm x 8.81 cm x 52.7 cm
<b>Weight</b>	
Chassis and processing board	34 lb / 15.4 Kg
Power supplies	3.9 lb / 1.8 Kg
RF Module	2.2 lb / 1.0 Kg

## QAM RF

RF Module Type	NSG-36R1G
Connector	F-Type, 75 Ω
Ports	2 RF ports per module
RF Output Power per Channel	

Number of QAM	DRFI	Power per Channel Annex B	Power per Channel Annex A
1-8	49 dBmV	52 dBmV	52 dBmV
9-10	48 dBmV	51 dBmV	51 dBmV
11-12	47 dBmV	50 dBmV	50 dBmV
13-14	46 dBmV	49 dBmV	49 dBmV
15-17	45 dBmV	48 dBmV	48 dBmV
18-21	44 dBmV	47 dBmV	47 dBmV
22-26	43 dBmV	46 dBmV	46 dBmV
27	42 dBmV	45 dBmV	45 dBmV
28-32	42 dBmV	45 dBmV	N/A
33-36	41 dBmV	44 dBmV	N/A

RF Frequency Range	50 MHz to 1002 MHz
RF Frequency Step Size	1 kHz
Carrier's Frequency Offset	± 3 KHz
<b>QAM Constellations</b>	
Annex A,C	16, 32, 64, 128, 256
Annex B	64, 256
<b>Bandwidth</b>	
Standard	6 MHz or 8 MHz
Non-standard	5.65 MHz to 8 MHz
<b>QAM Density per Port</b>	
Annex B, C	Up to 36 QAM channels
Annex A	Up to 26 QAM channels
QAM Agility	Full agility within a 384 MHz frequency span
QAM Encoding	ITU-T J.83 Annex A (DVB), B, C (Japan)
RF Output Power Adjustment Range	8 dB in 0.1 dB steps
Output Return Loss	14 dB within any channel from 50 MHz to 1002 MHz (typical > 16 dB)

Provided by: [Mega Hertz](http://Mega Hertz) | [800-883-8839](tel:800-883-8839) | [info@go2mhz.com](mailto:info@go2mhz.com) | [www.go2mhz.com](http://www.go2mhz.com)