

NSG™ 8R1G

48 MHZ QAM RF MODULE

The 8R1G is a high-density QAM-RF module used in Harmonic's NSG™ 9000 universal EdgeQAM platform. The module has two RF ports, each capable of outputting up to 8 QAMs (ITU-T J.83 Annex B/C) or up to 6 QAMs (ITU-T J.83 Annex A). The configuration of the RF output ports is highly flexible, allowing the number of QAMs and the QAMs frequency location for each port to be set within a 48 MHz block.

The 8R1G can be used for multiple applications, including video on demand (VOD), switched digital video (SDV), broadcast and DOCSIS-compliant modular CMTS (M-CMTS). As part of the NSG 9000 platform, the 8R1G QAM-RF module can be easily and effectively managed and configured using a standalone web GUI, the Mass Configuration Tool (MCT), Harmonic's NMXTM Digital Service Manager or any other SNMP compliant management platform.



The number of output QAM channels can be set independently for each RF port, ranging from Single mode with 1 QAM per port up to Octal mode with 8 QAMs per port (Annex B/C). The location of the QAM channels can be easily set to the required frequencies within a 48 MHz frequency window (See figure 1). The operator can adjust the RF output spectrum according to the HFC system spectrum constraints and the specific solution topology.

The QAM-RF module receives video and data streams from the NSG 9000 main board, scrambles the streams when encryption is enabled, applies FEC and interleaving according to the configured standard, and then modulates them into QAM signals. The digital baseband signals are then upconverted to the desired RF frequency. The output RF signals are fed out, after being amplified to the required level, using ANSI/SCTE 02 2006 Type-F RF connectors.

The signal processing and RF path used in the 8R1G are based on the fourth generation of Harmonic's proven high-performance edgeQAM technology. Designed with advanced digital processing techniques and high-quality custom-made RF components, the 8R1G module achieves very high RF performance, which in most cases exceeds the challenging specifications of the supported standards.

The output power per QAM channel exceeds DOCSIS specification by 2 to 4 dBs depending on the RF port configuration. The output return loss is > 14 dB within any channel from 50 MHz to 1002 MHz. The phase-noise, ACP and (un-)equalized MER exceed DOCSIS specifications, translating directly into a higher-quality transmitted signal. These high quality characteristics ensure better field performance and robustness in challenging RF environments, as well as reduced maintenance and operational costs.

Harmonic's approach to digital signal processing within the 8R1G enables easy and flexible field upgrades and adaptations to the customer's specific and/or emerging requirements. This ensures long-lasting operation and investment protection for the operator.

The 8R1G module is hot-swappable, minimizing operational downtime by enabling easy field maintenance and upgrades.

Notes:

1. As part of Harmonic's edgeQAM product line, the 8R1G is fully backward compatible with the 3Gbps NSG 9000 platform. When plugged into the 3Gbps platform, the module can output up to 4 QAMs per RF port in both Annex A and Annex B. Note that the aggregated output capacity is limited by the platform's 3Gbps maximum input capacity figure.

HIGHLIGHTS

- QAM-RF module for the NSG 9000 platform
- Two RF ports support up to 8 QAMs (Annex B/C) or 6 QAMs (Annex A) each
- Compliant with ITU-T J.83 Annex A, B & C
- DOCSIS 3.0 DRFI compliant
- Superior RF performance
- Flexible configuration of output RF-QAM channels and spectrum
- Flexible design using FPGA allows future upgrades and adaptations
- Extended output frequency range: 50 MHz to 1002 MHz

RF PERFORMANCE

RF Frequency Range	50 MHz to 1002 MHz		
RF Frequency Step Size	62.5 kHz		
Carrier's Frequency Offset	± 3 KHz		
QAM Constellations over temp and time			
Annex A,C	16, 32, 64, 128, 256		
Annex B	64, 256		

Symblol Rate (nominal)

	QAM	Symblol Rate (nominal)	Stability
Annex A	6QAM, 32QAM, 64QAM, 128QAM, 256QAM	5 to 6.952 Msymbl/sec	± 5ppm/ 10years
Annex B	64QAM / 256QAM	5.056941 / 5.360537 Msymbl/sec	± 5ppm/ 10years
Annex C	16QAM, 32QAM, 64 QAM, 128QAM, 256QAM	5 to 5.313 Msymbl/sec	± 5ppm/ 10years

Channel Bandwidth	Standard: 6 MHz, 8MHz Non-standard: 5.65 MHz to 8 MHz	
QAM Density	Annex B/C Annex A	
	1-8 flexibly located QAM channels per RF port 1-6 flexibly located QAM channels per RF port	
RF Output Power per Channel	Annex A	Annex B
N=1	62 dBmV	62 dBmV
N=2	59 dBmV	59 dBmV
N=3	57.2 dBmV	57.2 dBmV
N=4	56 dBmV	56 dBmV
N=5	53 dBmV	54.2 dBmV
N=6	N.A.	52 dBmV

RF OUTPUT

Power Adjustment	8-dB in 0.1-dB steps
Range Amplitude Response	< 0.25 dB (per QAM)
Unequalized MER	
Annex B	> 37 dB (typical > 41 dB)
Annex A	> 35 dB (typical > 37dB)
Equalized MER	
Annex B	> 45 dB (typical > 47dB)
Annex A	> 43 dB (typical > 45 dB)
Phase Noise (double sided)	
1KHz - 10KHz	< -35 dBc (typical <- 40 dBc)
10KHz - 50KHz	< -54 dBc (typical <- 57 dBc)
50KHz - 3MHz	< -57 dBc (typical <- 60 dBc)
Output Return Loss	14-dB within any channel from 50 MHz to 1002 MHz (typical > 16 dB)
Port to Port Isolation	80 dB (all Annexes)
BER	1 x 10 ⁻¹²
Group Delay	< 10 ns peak to peak

COMPLIANCE (TESTED WITHIN THE NSG 9000 PLATFORM)

Electromagnetic Interference	FCC Part 15 subpart B, Class A EN 55022/CISPR 22 Class A EN 61000-3-2:1995 + A1:1997 + A2:1998 EN 61000-3-3:1995 Immunity: EN50082-1:1997
Safety	Low Voltage directive 73/23/EEC, 50083-1 standard EN/IEC60529 UL 60950-1:2003 CAN.CSA-C22.2 No. 60950-1-03
CE	Compliant with R&TTE 1999/5/EC, 89/336/EEC, Article 7(1), 73/23/EEC, Article 5., FCC 47 CFR part 15, subpart B., ICES-003:1997 Council Directives
ESD	EN 61000-4-2; EN 55024, Section 4.2.1

ENVIRONMENTAL

Storage Temperature Range	-4°F to 176°F (-20°C to +80°C)
Operating Temperature Range	32°F to 122°F (0°C to +50°C)
Relative Humidity	0 to 95% non-condensing

PHYSICAL

Dimensions (WxHxD)	4.52" x 0.74" x 18.7" 11.5cm x 1.88cm x 47.5cm
Weight	2.31 lbs 1.050 kg
Typical Power Consumption	40 Watt
Output Connectors	2 x ANSI/SCTE 02 2006 Type-F RF connectors, 75Ω output impedance

ORDERING INFORMATION

8R1G RF module part number	NSG-8R1G-01
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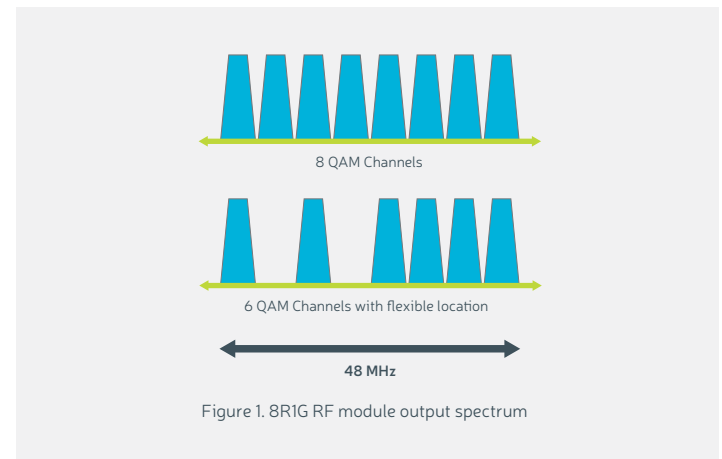


Figure 1. 8R1G RF module output spectrum