Data Sheet

Cisco 1218 MHz GainMaker High-Gain Balanced Triple System Amplifier

Contents

Consumer bandwidth demand continues to grow at a rapid rate every year. As a result, cable operators with DOCSIS-based equipment will need to future proof their networks. They want to plan for reduced service-group sizes and ultimately double or quadruple (or more) bandwidth speeds. The Cisco 1218 MHz GainMaker® High Gain Balanced Triple (HGBT) System Amplifier helps to make these demands a reality. The Cisco 1218 MHz HGBT amplifier provides three high-level forward RF outputs (main and two auxiliary).

Cisco 1218 MHz GainMaker system amplifier modules have increased gain to allow drop in for 750, 870, and 1002 MHz spacing, and are mechanically compatible with previous Cisco GainMaker, System Amplifier II, II+, and III housing bases, often allowing upgrades to higher bandwidth with no respacing or resplicing. The DC power supply is modular and located in an updated housing lid for easy access. All Cisco 1.2 GHz GainMaker system amplifier modules are factory configured with reverse amplifier, diplex filters, thermal compensation circuit, forward interstage pads, and equalizer to promote optimal performance. Optional single-pilot Automatic Gain Control (AGC) configurations are also available.

Features

- High-performance Gallium Nitride (GaN) gain stage technology.
- Plug-in accessories that are common to all Cisco 1218 MHz GainMaker amps and Cisco GS7000 products (that is, attenuator pads, diplexers, and crowbar).
- Amplifier housing that provides access to RF test points without opening the housing.
- Spring-loaded seizure assemblies allow coaxial connectors to be installed or removed without removing amplifier RF module.
- Power supply mounted in housing lid for efficient thermal dissipation (60- and 90-VAC powering capability).
- 15A current capacity (steady state) and 25A surge survivability.
- Quadrature Amplitude Modulation (QAM) pilot AGC available (optional).
- AGC with thermal backup, which eliminates disruptive RF output variation in the event of pilot loss.
- Reverse input pad and RF test point for each reverse input port to allow optimum reverse path design and alignment.
- Surge-resistant circuitry that helps ensure gain stage protection without fuses or other failure-causing devices.

Figure 1.
Block Diagram – 1.2 GHz High Gain Balanced Triple Amplifier

Specifications

Table 1. General Station Performance

General Station Performance	Units	Forward	Reverse	Notes
Pass band	MHz	54-1218	5-204	
Amplifier type	-	GaN	GaAs HBT	
Frequency response	dB	± 0.5	± 0.5	
Auto slope and gain range	dB	± 5.8	-	
Return loss	dB	16	16	7
Maximum AC through current (continuous)	Amps	15	-	
Maximum AC through current (surge)	Amps	25	-	
Hum modulation at 12A (over specified frequency range)	dB	70 (54-870 MHz) 60 (870-1218 MHz)	60 (5-25 MHz) 70 (25-42 MHz)	
Hum modulation at 15A (over specified frequency range)	dB	65 (54-870 MHz) 60 (870-1218 MHz)	60 (5-25 MHz) 65 (25-42 MHz)	
Test points (±0.75 dB)	dB	-20	-20	

General Station Performance	Units	Forward	Reverse	Notes
Reference output level at 1218 MHz	dBmV	58.0	35 (at 42 MHz)	
1002 MHz		54.7		
870 MHz		52.7		
750 MHz		50.8		
650 MHz		49.3		
550 MHz		47.8	35 (at 5 MHz)	
258 MHz		43.3		
105 MHz		41.0		
86 MHz		40.7		
54 MHz		40.2		
Reference output tilt (54-1218 MHz)	dB	17.8	-	1
(86-1218 MHz)		17.3		
(105-1218 MHz)		17.0		
(258-1218 MHz)		14.7		

Table 2. Forward Station Performance

Forward Station Performance	Units	Auto/Thermal with 12 dB I/S EQ	Notes
Operational gain (minimum)	dB	46	2
Internal tilt (± 0.5 dB) @ 54 – 1218 MHz	dB	19.0	3
Noise figure at 54, 86, 105, 258 MHz	dB	8.5	2
Noise figure at 1 218MHz	dB	8.0	2
Composite triple beat	dBc	66	4,9
Cross modulation	dBc	63	4,5,9
Composite second order (high side)	dBc	66	4,9
Composite intermodulation noise (CIN)	dBc	50	4,8,9,10

Unless otherwise noted, specifications reflect typical performance and are referenced to 68°F (20°C). Specifications are based upon measurements made in accordance with SCTE/ANSI standards (where applicable), using standard frequency assignments.

Table 3. Reverse Station Performance

Reverse Station Performance	Units		Notes
Operational gain (minimum) @ 42 MHz @ 65 MHz @ 85 MHz @ 204 MHz	dB	21.6 22.7 23.8 27.2	6,7
Internal tilt (± 0.5 dB)	dB	0	3
Noise figure	dB	11.0	6,7
NPR at 50dB CNR at 42 MHz NPR at 50dB CNR at 65 MHz NPR at 50dB CNR at 85 MHz NPR at 50dB CNR at 204 MHz	dB	20 19 15 11.5	

Table 4. Station Delay Characteristics

Station Delay Characteristics (42/54 Split)			
Forward (Chrominance to Luminance Delay)		Reverse (Group Delay in 1.5 MHz bandwidth)	
Frequency (MHz)	Delay (ns)	Frequency (MHz)	Delay (ns)
55.25 to 58.83	39	5.0 to 6.5	60
61.25 to 64.83	25	6.5 to 8.0	22
67.25 to 70.83	17	8.0 to 9.5	12
77.25 to 80.83	10	37.5 to 39.0	20
		39.0 to 40.5	32
		40.5 to 42.0	50

Station Delay Characteristics (65/86 Split)			
Forward (Chrominance to Luminance Delay)		Reverse (Group Delay in 1.5 MHz bandwidth)	
Frequency (MHz)	Delay (ns)	Frequency (MHz)	Delay (ns)
112.25 - 116.68	8	5.0 to 6.5	60
119.25 - 123.68	7	6.5 to 8.0	22
126.25 - 130.68	6	8.0 to 9.5	12
133.25 - 137.68	6	60.5 – 62.0	10
		62.0 – 63.5	17
		63.5 – 65.0	21

Station Delay Characteristics (85/102 Split)			
Forward (Chrominance to Luminance Delay)		Reverse (Group Delay in 1.5 MHz bandwidth)	
Frequency (MHz)	Delay (ns)	Frequency (MHz)	Delay (ns)
109.275 - 112.855	25	5.0 to 6.5	60
115.275 - 118.855	15	6.5 to 8.0	22
121.2625 - 124.8425	10	8.0 to 9.5	12
127.2625 - 130.8425	5	80.5 – 82.0	10
		82.0 – 83.5	17
		83.5 – 85.0	21

Station Delay Characteristics (204/258 Split)			
Forward (Chrominance to Luminance Delay)		Reverse (Group Delay in 1.5 MHz bandwidth)	
Frequency (MHz)	Delay (ns)	Frequency (MHz)	Delay (ns)
259.2625 - 262.8425	10	5.0 to 6.5	60
265.2625 - 268.8425	8	6.5 to 8.0	22
271.2625 - 274.8425	7	8.0 to 9.5	12
277.2625 - 280.8425	5	199.5 -201.0	6
		201.0-202.5	5
		202.5-204.0	8

Table 5. Station Powering Data

Station Powering Data													
Cisco GainMaker HGBT System Amplifier	I DC (Amps)		AC Voltage										
			90	85	80	75	70	65	60	55	50	45	40	35
Thermal	1.85	AC current	0.66	0.68	0.72	0.73	0.76	0.81	0.87	0.94	1.04	1.18	1.35	1.61
		Power (W)	49.0	48.7	48.2	48.1	47.8	47.6	47.6	47.5	47.5	47.6	47.5	47.9
AGC	1.90	AC current	0.67	0.69	0.73	0.74	0.77	0.82	0.89	0.97	1.07	1.21	1.38	1.64
		Power (W)	50.1	49.7	49.3	49.2	48.9	48.6	48.6	48.6	48.6	48.6	48.8	49.0

Unless otherwise noted, specifications reflect typical performance and are referenced to 68°F (20°C). Specifications are based upon measurements made in accordance with SCTE/ANSI standards (where applicable), using standard frequency assignments.

Data is based on stations configured for two-way operation. AC currents specified are based on measurements made with typical CATV type ferroresonant AC power supply (quasi-square wave), and Cisco GainMaker High Output System Amplifier power supply (2.5A, 24 VDC, part number 4022846).

DC supply has a user configurable 30V, 40V, or 50 VAC under voltage lockout circuit. Default setting is 30V, 40V, or 50 VAC. Under-voltage lockout may be selected by changing the position of the lockout jumper.

Note:

1. Reference output tilt is specified as "LINEAR" tilt (as opposed to "cable" tilt).
2. Forward gain and noise figure measured with 0 dB input EQ and 1 dB input pad.
3. Down tilt, the effect of cable, is represented by a negative sign (-). Up tilt, the effect of equalization, is represented by a plus sign (+).
4. Mixed loading of 79 analog channels (54–554MHz) and SC-QAM's (554–1218MHz) with 6 dB backoff.
5. X-mod (at 15.75 kHz) specified using 100 percent synchronous modulation and frequency selective measurement device.
6. Reverse gain and noise figure for station with 0 dB reverse input pad, 0 dB reverse output EQ, and 1 dB output pad.
7. Reverse operational gain, noise figure, and return loss are specified without reverse switch option. If switch is installed, reduce gain by 0.5 dB, increase noise figure by 0.5 dB, and decrease return loss by 1 dB.
8. Composite intermodulation noise is a broadband noise-like distortion product associated with QAM loading.
9. Distortion performance at reference output levels and tilt. Contact Cisco Engineering for CIN calculation.
10. CIN spec number is the same for both all QAM and mixed analog loading.

Table 6. Physical Specifications

Environmental	
Operating temperature range	-40 - 140°F (-40 - 60°C)

Mechanical	
Housing dimensions (L x H x D)	17.3 in. x 7.2 in. x7.8 in. (439.4 mm x 182.9 mm x 198.1 mm)
Weight • Housing with power supply • Module	 12 lb, 5 oz (5.6 kg) 5 lb, 5 oz (2.4 kg)

Unless otherwise noted, specifications reflect typical performance and are referenced to 68°F (20°C). Specifications are based on measurements made in accordance with SCTE/ANSI standards (where applicable), using standard frequency assignments.

Ordering Information

The Cisco GainMaker HGBT System Amplifier is available in a wide variety of configurations. Table 7 contains the configured PIDs for the High Gain Balanced Triple Amplifiers. Table 8 and Table 9 contain ordering information for required and optional

accessories. Consult with your Cisco account representative, customer service representative, or system engineer to determine the best configuration for your particular application.

Table 7. Cisco GainMaker High Gain Balanced Triple (HGD) Amp Configurations

Cisco GainMaker 1.2-GHz HGD Amp Configurations	Part Number for Ordering
42/54 MHz Split	
GMSA 1.2 GHz, HGBT,42/54, CB, PS, CTD HSG, TPA, Thermal	GMSATS4THXXXXXXXXX
GMSA 1.2 GHz, HGBT,42/54, CB, Launch Amp, Thermal	GMSATS4TXXXXXXXXXX
GMSA 1.2 GHz, HGBT,42/54, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMSATS45HXXXXXXXXX
GMSA 1.2 GHz, HGBT,42/54, CB, Launch Amp, QAM AGC 711 MHz	GMSATS45XXXXXXXXXX
GMSA 1.2 GHz, HGBT,65/86, CB, PS, CTD HSG, TPA, Thermal	GMSATS6THXXXXXXXXX
GMSA 1.2 GHz, HGBT,65/86, CB, Launch Amp, Thermal	GMSATS6TXXXXXXXXXX
GMSA 1.2 GHz, HGBT,65/86, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMSATS65HXXXXXXXXX
GMSA 1.2 GHz, HGBT,65/86, CB, Launch Amp, QAM AGC 711 MHz	GMSATS65XXXXXXXXXX
GMSA 1.2 GHz, HGBT,85/102, CB, PS, CTD HSG, TPA, Thermal	GMSATS8THXXXXXXXXX
GMSA 1.2 GHz, HGBT,85/102, CB, Launch Amp, Thermal	GMSATS8TXXXXXXXXXX
GMSA 1.2 GHz, HGBT,85/102, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMSATS85HXXXXXXXXX
GMSA 1.2 GHz, HGBT,85/102, CB, Launch Amp, QAM AGC 711 MHz	GMSATS85XXXXXXXXXX
GMSA 1.2 GHz, HGBT,204/258, CB, PS, CTD HSG, TPA, Thermal	GMSATS2THXXXXXXXXX
GMSA 1.2 GHz, HGBT,204/258, CB, Launch Amp, Thermal	GMSATS2TXXXXXXXXXX
GMSA 1.2 GHz, HGBT,204/258, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMSATS25HXXXXXXXXX
GMSA 1.2 GHz, HGBT,204/258, CB, Launch Amp, QAM AGC 711 MHz	GMSATS25XXXXXXXXXX

Table 8. Required Accessories

Required Accessories	Part Number
Plug-in Pads (attenuators): Available in 1.0 dB steps from 0 to 20 dB • 1 required for forward input • 1 required for AGC, if applicable* • 4 required for reverse (3 input, 1 output) ***To determine AGC pad value, subtract 34 dB from the design value main port RF output level at the AGC pilot frequency.**	GM-PAD-1.2G-00= and GM-PAD-1.2G-1.0 sequentially through GM-PAD-1.2G-20.0=
Plug-in Forward Cable Equalizer: Available in 1.5 dB steps from 0 to 30 dB at 1002 MHz • 1 required for forward input	GM-EQC-1.2G-0= and GM-EQC-1.2G-1.5 sequentially through GM-EQC-1.2G-30=
Plug-in Reverse Cable Equalizer: Available in 1 dB steps from 0 to 12 dB at 42 MHz • 1 required for reverse output, unless design value is 0 dB (0 dB EQ is provided)	712719 (0 dB) and 589628 (1dB) sequentially thru 589639 (12 dB) – **40 MHz** 589736 (1 dB) sequentially thru 589747 (12 dB) – **65 MHz** 4036769 (1 dB) sequentially thru 4036780 (12 dB) – **85 MHz** GM-EQREV-204M-1= (1 dB) sequentially thru GM-EQREV-204M-12= (12 dB) – **204 MHz**

The optional accessories listed in Table 9 can be ordered separately.

Table 9. Optional Accessories

Optional Accessories	Part Number
24V Power Supply for Cisco GainMaker HGD	4026157
230 VAC Crowbar Surge Protector (plug-in, one per station)	715973
Plug-in Inverse Equalizer: Simulates cable equivalent tilts (creates tilt opposite that of equalizers). Use in place of forward input EQ as needed to maintain proper output tilt in short spaced locations. Available in 1.5dB cable-equivalent steps from 1.5 to 21.0dB	GM-EQIN-1.2G-1.5= sequentially thru GM-EQIN-1.2G-21=
Long Reach Test Point Adapter	562580
Cisco GainMaker SA HGBT Split Kit 85/102 MHz (PKG OF 10)	GMSA-SKT-1.2G-85=
Cisco GainMaker SA HGBT Split Kit 204/258 MHz (PKG OF 10)	GMSA-SKT-1.2G-204=
Cisco GainMaker 1.2 GHz Amplifier Housing	GMSA-HSG-1.2G=

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