

Cisco 1.2GHz GainMaker Line Extender (GMLE)

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The Cisco® 1.2GHz GainMaker® GaN System Amplifier is the latest-generation broadband amplifier in the Cisco GainMaker platform. Gallium nitride (GaN) technology supports RF output levels up to 57 dBmV. The Cisco GaN amplifier (Figure 1) provides one high-level forward RF output. All Cisco GainMaker products share common plug-in accessories and perform to 1.2 GHz in the forward path.

Cisco 1.2GHz GainMaker system amplifier modules have increased gain to allow drop-in for 750-MHz spacing and are mechanically compatible with previous Cisco GainMaker System Amplifier 1.0GHz GMLE housing bases, often allowing upgrade 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 1.2GHz 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.



Figure 1.
Cisco 1.2GHz GainMaker Line Extender (GMLE)

Features

- High-performance GaN gain stage technology
- Plug-in accessories that are common to all Cisco GainMaker nodes and Cisco GS7000 products (i.e., attenuator pads, equalizers, diplexers, and crowbar)
- Amplifier cover that provides access to RF test points
- 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
- Spring-loaded seizure assemblies allow coaxial connectors to be installed or removed without removing amplifier RF module.

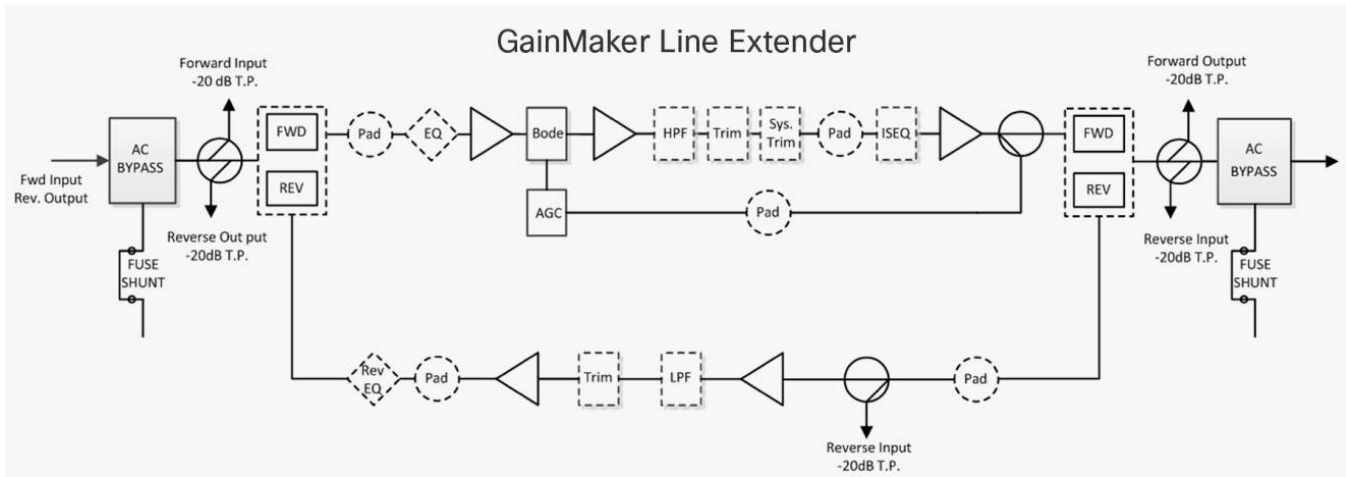


Figure 2.
Block Diagram - Cisco 1.2 GHz GainMaker Line Extender

Table 1. General Station Performance

General Station Performance	Units	Forward	Reverse	Notes
Pass band	MHz	54-1218	5-204	
Amplifier type	-	GaN	GaAs	
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 @ 12A (over specified frequency range)	dB	70 (54-870 MHz) 60 (871-1218 MHz)	60(5-10 MHz) 65 (11-204 MHz)	
Hum modulation @ 15A (over specified frequency range)	dB	65(54-870 MHz) 55 (870-1218 MHz) 50 (1000 – 1218 MHz)	60 (5-10 MHz) 65 (11-204 MHz)	
Test points (± 0.5 dB)	dB	-20	-20	
Reference output level @ 1218MHz 1002 MHz 870 MHz 750 MHz 650 MHz 550 MHz 258 MHz 105 MHz 86 MHz 54 MHz	dBmV	58.0 54.7 52.7 50.8 49.3 47.8 43.3 41.0 40.7 40.2	37 (@204 MHz) 37(@ 5 MHz)	
Reference output tilt (54-1218 MHz) (86-1218 MHz) (105-1218 MHz) (258-1218 MHz)	dB	17.8 17.3 17.0 14.7	-	1

Table 2. Forward Station Performance

Forward Station Performance	Units	Auto/Thermal with 1.5 dB I/S EQ	Notes
Operational gain (minimum)	dB	38	2

Forward Station Performance	Units	Auto/Thermal with 1.5 dB I/S EQ	Notes
Internal tilt (± 0.5 dB) at 54 MHz	dB	+11.7	3
Noise figure @ 54, 86, 105, 258 MHz	dB	7.5	2
Noise figure @ 1218MHz	dB	8.0	2
Composite triple beat	dB	70	4,9
Cross modulation	dB	64	4,5,9
Composite second order (high side)	dB	67	4,9
Composite intermodulation noise (CIN)	dB	52	4,8,9,10

Table 3. Reverse Station Performance

Reverse Station Performance	Units		Notes
Operational gain (minimum)	dB	27	6,7
Internal tilt (± 0.5 dB)	dB	0	3
Noise figure	dB	5	6,7
NPR@50dB CNR at 42 MHz	dB	25	
At 65 MHz		24	
At 85 MHz		23	
At 204 MHz		22	

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 4. Station Delay Characteristics

Station Delay Characteristics(42/54)			
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	37	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	45
Station Delay Characteristics(65/86)			
112.25 to 116.68	10	5.0 to 6.5	60
119.25 to 123.68	8	6.5 to 8.0	22
126.25 to 130.68	6	8.0 to 9.5	12
133.25 to 137.68	6	60.5 to 62.0	10
		62.0 to 63.5	17
		63.5 to 65.0	21
Station Delay Characteristics(85/102)			
109.275 to 112.855	25	5.0 to 6.5	60
115.275 to 118.855	21	6.5 to 8.0	22
121.2625 to 124.8425	17	8.0 to 9.5	12
127.2625 to 130.8425	8	80.5 to 82.0	10
		82.0 to 83.5	17
		83.5 to 85.0	21
Station Delay Characteristics(204/258)			
259.2625 to 262.8425	25	5.0 to 6.5	60
265.2625 to 268.8425	21	6.5 to 8.0	22
271.2625 to 274.8425	17	8.0 to 9.5	12
277.2625 to 280.8425	8	199.5 to 201.0	10
		201.0 to 202.5	17
		202.5 to 204.0	21

Table 5. Station Powering Data

Station Powering Data															
Cisco GainMaker Line Extender System Amplifier	I DC (Amps)			AC Voltage											
	5.5V	24V		90	85	80	75	70	65	60	55	50	45	40	35
Thermal/Manual	0.75	0.72	AC current (A)	0.52	0.56	0.57	0.59	0.60	0.62	0.63	0.64	0.66	0.70	0.76	0.85
			Power (W)	26.1	26.0	26.0	25.9	25.9	25.9	25.9	26.0	26.0	26.1	26.3	26.6
AGC	0.75	0.79	AC current (A)	0.54	0.58	0.60	0.61	0.63	0.65	0.66	0.67	0.69	0.74	0.81	0.91
			Power (W)	27.8	27.7	27.6	27.6	27.6	27.7	27.6	27.6	27.7	27.9	28.2	28.5

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).

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.

Notes:

1. Reference output tilt is specified as "LINEAR" tilt (as opposed to "cable" tilt). These tilts were accomplished using a 1.5 dB EQ in the interstage. The remaining tilt will come from the input EQ and the input signal.
2. Forward gain and noise figure measured with 0 dB input EQ and 1 dB input pad. Thermal and AGC module.
3. Down tilt, the effect of cable, is represented by a (-). Up tilt, the effect of equalization, is represented by a (+).
4. Mixed loading of 79 analog channels (54 – 554MHz) and SC-QAMs (554- 1218MHz) with 6dB back-off.
5. X-mod (@ 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 Systems Engineering for CIN calculation.
10. CIN spec number is the same for both all QAM and mixed analog loading.

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 6. Physical Specifications

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

Mechanical

Housing dimensions (L x H x D)	11.66 in. x 6.77 in. x 9.58 in. (296.1 mm x 172.0 mm x 243.3 mm)
Weight	13 lb, 0 oz (5.9 kg)
<ul style="list-style-type: none"> Housing with power supply 	

Ordering Information

The Cisco GainMaker Line Extender is available in a wide variety of configurations. The PIDs listed in Table 7 include full stations (including RF amplifiers, power supplies, and housings) as well as Launch Amp only PIDs. If you have questions about Line Extender ordering, contact your system or application engineer.

Table 7. Cisco GainMaker Line Extender Configurations

Cisco GainMaker 1.2-GHz HGD Amp Configurations	Part Number for Ordering
42/54 MHz Split	
GMLE 1.2 GHz, 42/54, CB, PS, CTD HSG, TPA, Thermal	GMLES4THXXXXXXXXXX
GMLE 1.2 GHz, 42/54, CB, Launch Amp, Thermal	GMLES4TXXXXXXXXXX
GMLE 1.2 GHz, 42/54, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMLES45HXXXXXXXXXX
GMLE 1.2 GHz, 42/54, CB, Launch Amp, QAM AGC 711 MHz	GMLES45XXXXXXXXXX
65/86 MHz Split	
GMLE 1.2 GHz, 65/86, CB, PS, CTD HSG, TPA, Thermal	GMLES6THXXXXXXXXXX
GMLE 1.2 GHz, 65/86, CB, Launch Amp, Thermal	GMLES6TXXXXXXXXXX
GMLE 1.2 GHz, 65/86, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMLES65HXXXXXXXXXX
GMLE 1.2 GHz, 65/86, CB, Launch Amp, QAM AGC 711 MHz	GMLES65XXXXXXXXXX

Cisco GainMaker 1.2-GHz HGD Amp Configurations	Part Number for Ordering
85/102 MHz Split	
GMLE 1.2 GHz, 85/102, CB, PS, CTD HSG, TPA, Thermal	GMLES8THXXXXXXXXXX
GMLE 1.2 GHz, 85/102, CB, Launch Amp, Thermal	GMLES8TXXXXXXXXXX
GMLE 1.2 GHz, 85/102, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMLES85HXXXXXXXXXX
GMLE 1.2 GHz, 85/102, CB, Launch Amp, QAM AGC 711 MHz	GMLES85XXXXXXXXXX
204/258 MHz Split	
GMLE 1.2 GHz, 204/258, CB, PS, CTD HSG, TPA, Thermal	GMLES2THXXXXXXXXXX
GMLE 1.2 GHz, 204/258, CB, Launch Amp, Thermal	GMLES2TXXXXXXXXXX
GMLE 1.2 GHz, 204/258, CB, PS, CTD HSG, TPA, QAM AGC 711 MHz	GMLES25HXXXXXXXXXX
GMLE 1.2 GHz, 204/258, CB, Launch Amp, QAM AGC 711 MHz	GMLES25XXXXXXXXXX

Table 8. Required Accessories

Required Accessories	Part Number
<p>Plug-in Pads (attenuators): Available in 1 dB steps from 0 to 20 dB</p> <ul style="list-style-type: none"> • 2 required for forward (1 input, 1 output) • 1 required for AGC, if applicable* • 2 required for reverse (1 input, 1 output) <p>*To determine AGC pad value, subtract 34 dB from the design value main port RF output level at the AGC pilot frequency.</p>	<p>GM-PAD-1.2G-00= (0dB) and GM-PAD-1.2G-1.0 (1 dB) sequentially through GM-PAD-1.2G-20.0= (20 dB)</p>
<p>Plug-in Forward Cable Equalizer: Available in 1.5 dB steps from 0 to 30 dB at 1002 MHz</p> <ul style="list-style-type: none"> • 2 required for forward input (1 input, 1 output) 	<p>GM-EQC-1.2G-0= (0 dB) and GM-EQC-1.2G-1.5= (1.5 dB) sequentially through GM-EQC-1.2G-30= (30 dB)</p>
<p>Plug-in Reverse Cable Equalizer: Available in 1 dB steps from 0 to 12 dB at 42 MHz, 65 MHz, 85 MHz, and 204 MHz</p> <ul style="list-style-type: none"> • 1 required for reverse output, unless design value is 0 dB (0 dB EQ is provided) 	<p>712719 (0 dB) and 589628 (1dB) sequentially through 589639 (12 dB) – 40 MHz 589736 (1 dB) sequentially through 589747 (12 dB) – 65 MHz 4036769 (1 dB) sequentially through 4036780 (12 dB) – 85 MHz GM-EQREV-204M-1= (1 dB) sequentially through GM-EQREV-204M-12= (12 dB) – 204 MHz</p>

Table 9. Optional/Spare Accessories

Optional Accessories	Part Number
5.5V and 24V Power Supply for Cisco GainMaker Line Extender	GMLE-PS-1.2G=
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 approximate 1.6 dB "cable equivalent" steps from 1.6 to 16.2 dB	4007486 (1.6 dB) sequentially through 4007495 (16.2 dB)
Long Reach Test Point Adapter	562580
Cisco GainMaker Line Extender Split Kit 85/105 MHz (PKG OF 10)	GMLE-SKT-1.2G-85=
Cisco GainMaker Line Extender Split Kit 204/258 MHz (PKG OF 10)	GMLE-SKT-1.2G-204=
Chromate plated 2-port housing with external test point access	GMLE-HSG-1.2G=

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