

## GainMaker High Output High Gain Balanced Triple (HGBT) 1 GHz System Amplifier with 65/86 MHz Split

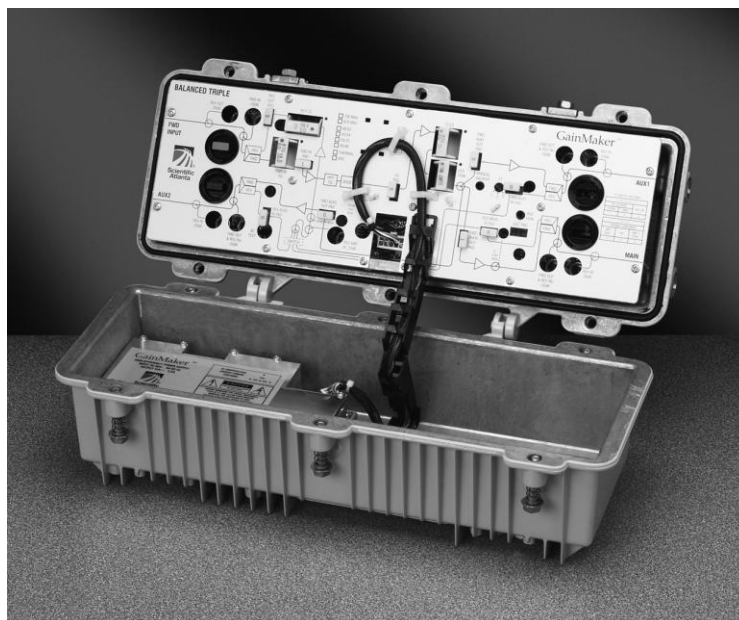
The GainMaker<sup>®</sup> Broadband Amplifier platform includes a variety of RF amplifiers that address the divergent needs of today's broadband networks. All GainMaker amplifiers provide superior 2-way performance and reliability combined with a user-friendly layout. All share common plug-in accessories and perform to 1 GHz in the forward path. The System Amplifiers in this family provide multiple forward RF output ports while the Line Extenders provide a single forward RF output port.

GainMaker System Amplifiers utilize GaAsFET technology in the interstage and output gain stages for improved distortion performance.

The GainMaker High Output System Amplifier modules are capable of higher output levels than standard GainMaker System amplifier modules and are mechanically compatible with previous System Amplifier II, II+, III and GainMaker housing bases. The DC power supply is modular and located in an updated housing lid for easy access. All GainMaker System Amplifier modules are factory configured with reverse amplifier, diplex filters, thermal compensation circuit, forward interstage pads, and equalizer to ensure optimal performance. Optional single-pilot Automatic Gain Control (AGC) configurations are also available.

The GainMaker High Output HGBT System Amplifier has three forward outputs and is ideally suited for providing high (bridger) level RF to the feeder network.

**Figure 1.** GainMaker High Output HGBT System Amplifier

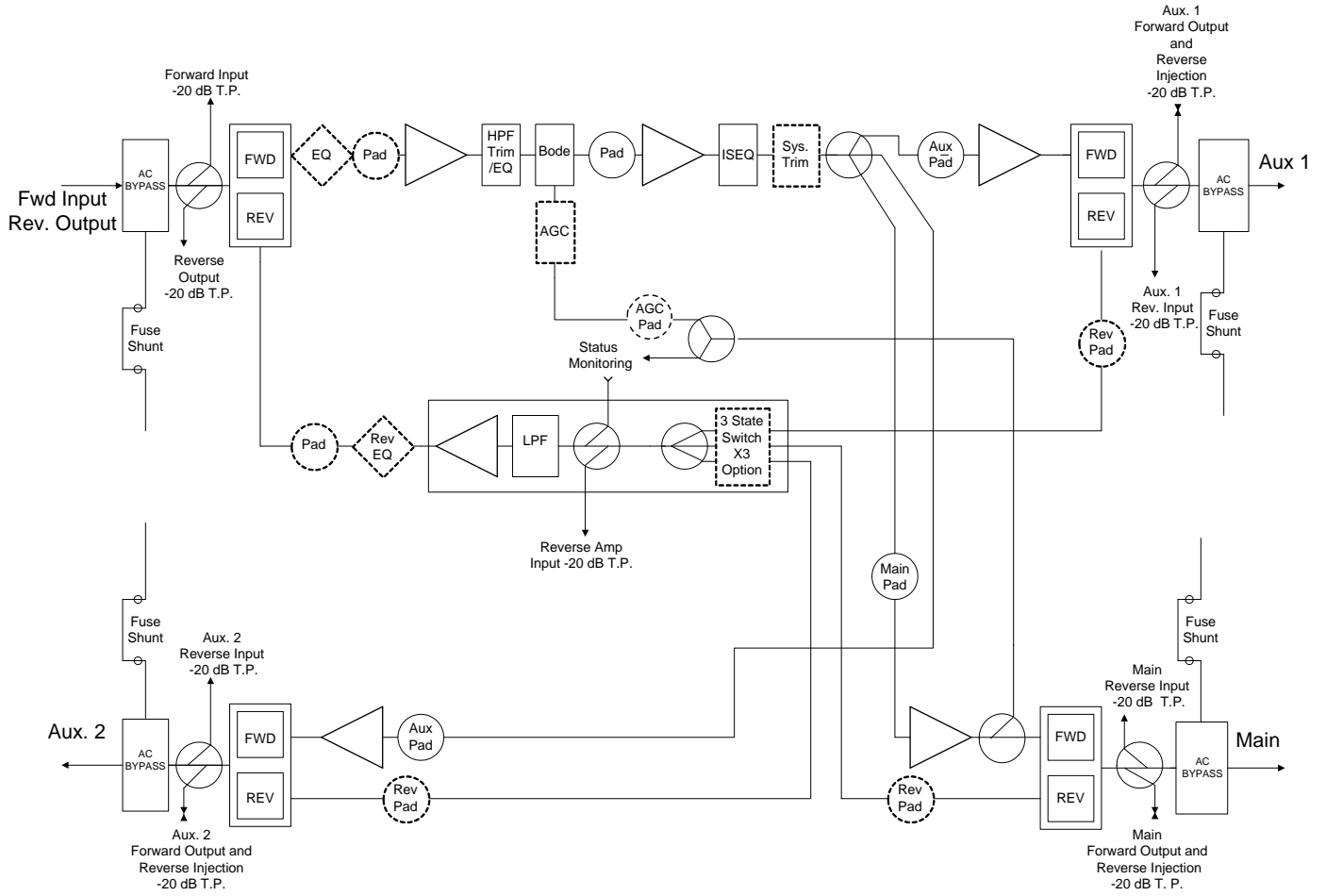


## Features

- Capable of higher output levels than standard GainMaker amplifiers
- Common RF test points for forward output and reverse injection simplify reverse balancing
- Increased forward gain to facilitate drop-in bandwidth extensions without re-spacing
- High-performance GaAsFET gain stage technology
- Fixed value plug-in accessories
- 60 and 90 volt AC powering capability
- 15 A current capacity (steady state) and 25 A surge survivability
- Optional 3-state reverse switch (on/off/-6 dB) allows each reverse input to be isolated for noise and ingress troubleshooting (status monitoring required)
- AGC has Thermal backup, which eliminates disruptive RF output variation in the event of pilot loss
- QAM Pilot AGC now available in addition to existing analog carrier AGCs
- Improved hum modulation
- Plug-in, self-contained duplex filters
- Modular high-efficiency power supply allows simplified maintenance
- Reverse input pad and RF test point for each reverse input port allow optimum reverse path design and alignment
- Directional coupler RF test points provide best accuracy
- Surge Resistant circuitry ensures gain stage protection without fuses or other nuisance failure causing devices

Figure 2. GainMaker High Output HGBT System Amplifier Block Diagram

# GainMaker HGBT



## Product Specifications

**Table 1.** General Station Performance

General Station Performance	Units	Forward	Reverse	No tes
Pass Band	MHz	86-1002	5-65	
Amplifier Type	---	GaAs FET	PP	
Frequency Response	dB	± 0.5	± 0.4	
Auto Slope and Gain Range	dB	± 5.5	N/A	
Return Loss	dB	16	16	7
Max AC Through Current (continuous)	Amps	15	---	
Max AC Through Current (surge)	Amps	25	---	
Hum Modulation @ 12 A (over specified frequency range)	dB	70 (86-870 MHz) 60 (870-1002 MHz)	60 (5-10 MHz) 70 (11-65 MHz)	
Hum Modulation @ 15 A (over specified frequency range)	dB	65 (86-870 MHz) 60 (870-1002 MHz)	60 (5-10 MHz) 65 (11-65 MHz)	
Test Points (± 0.5 dB)	dB	-20	-20	
Reference Output Level @... 1002 MHz 870 MHz 750 MHz 650 MHz 550 MHz 86 MHz	dBmV	56.0 54.0 52.2 50.5 49.0 42.0	35 (@ 65 MHz)     35 (@ 5 MHz)	
Reference Output Tilt (86-1002 MHz)	dB	14.0	-	1

**Table 2.** Forward Station Performance

Forward Station Performance	Units	Auto/Thermal with 10.5 dB I/S EQ	Notes
Operational Gain (minimum)	dB	41	2
Internal Tilt (± 0.5 dB)	dB	14.3	3
Noise Figure @ 86 MHz	dB	8.5	2
Noise Figure @ 1 GHz	dB	8.0	2
<b>64 PAL B/G channels (CW) with digital</b>			<b>4</b>
Composite Triple Beat	dB	66	
Cross Modulation	dB	60	5
Composite Second Order (high side)	dB	64	
<b>64 PAL I channels (CW) with digital</b>			<b>10</b>
Composite Beat	dB	59	8
Cross Modulation	dB	59	5
<b>42 CENELEC channels (CW)</b>			<b>9</b>
Composite Triple Beat	dB	112.5	
Cross Modulation	dB	113	5
Composite Second Order (high side)	dB	115.5	
<b>78 NTSC channels (CW) with digital</b>			<b>11</b>
Composite Triple Beat	dB	65	
Cross Modulation	dB	59	5
Composite Second Order (high side)	dB	64	
Composite Intermodulation Noise (CIN)	dB	57	

## Product Specifications

**Table 3.** Reverse Station Performance

Reverse Station Performance	Units		Notes
Operational Gain (minimum)	dB	19.5	6,7
Internal Tilt ( $\pm 0.5$ dB)	dB	0	3
Noise Figure	dB	12.5	6,7
<b>CENELEC Distortions</b>			<b>9</b>
Discrete Third Order	dBuV	114	
Discrete Second Order	dBuV	120	
<b>6 NTSC Channels (CW)</b>			
Composite Triple Beat	dB	92	
Cross Modulation	dB	80	5
Composite Second Order (high side)	dB	82	

**Note:** Unless otherwise noted, specifications reflect typical station 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.** RF Delay Specifications

Station Delay Characteristics			
Forward (Chrominance to Luminance Delay)		Reverse (Group Delay in 1.5 MHz BW)	
Frequency (MHz)	Delay (nS)	Frequency (MHz)	Delay (nS)
112.25 -116.68	4	5.0 -6.5	60
119.25 -123.68	3	6.5 -8.0	22
126.25 -130.68	3	8.0 -9.5	12
		60.5 -62.0	10
		62.0 -63.5	13
		63.5 -65.0	19

**Table 5.** Station Powering Data

Station Powering Data														
HGBT	I <sub>DC</sub>	AC Voltage												
	(Amps)	90	85	80	75	70	65	60	55	50	45	40	35	
Thermal	2.21	AC Current (A)	0.86	0.88	0.88	0.89	0.93	0.98	1.21	1.25	1.37	1.52	1.72	2.01
		Power (W)	59.6	59.6	59.8	59.1	59.2	59.3	59.0	59.1	59.1	59.5	59.6	60.2
AGC	2.27	AC Current (A)	0.87	0.90	0.90	0.92	0.95	1.01	1.24	1.26	1.39	1.54	1.75	2.05
		Power (W)	60.7	61.2	61.2	60.6	60.4	61.2	60.6	60.6	60.7	60.9	61.5	62.0
AGC with Status Mon. & Reverse Switch	2.41	AC Current (A)	0.91	0.94	0.94	0.97	1.01	1.08	1.34	1.38	1.50	1.64	1.90	2.25
		Power (W)	64.7	65.2	64.9	65.0	64.6	64.2	64.7	65.1	65.0	65.2	65.0	65.9

Data is based on stations configured for 2-way operation. AC currents specified are based on measurements made with typical CATV type ferroresonant AC power supply (quasi-square wave), and GainMaker High Output System Amplifier 24 V power supply, part number 4022846.

DC supply has a user configurable 30 V, 40 V, or 50 VAC under voltage lockout circuit. Default setting is 30 V. 40 V or 50 V AC 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).
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 (-). Up tilt, the effect of equalization is represented by a (+).
4. Loaded with 64 PAL B/G CW carriers from 112 to 600 MHz. "Digital" refers to 600 to 1002 MHz loading with QAM carriers at -6 dB relative to analog CW carrier levels.
5. X-mod (at 15.75 kHz) specified using 100% 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 the reverse switch option. If the reverse switch is installed, reduce gain by 0.5 dB, increase Noise Figure by 0.5 dB, and decrease Return Loss by 1 dB.
8. Measured and specified as Composite Beat.
9. Tested per CENELEC Standard EN50083-3 with reference output tilt. RF output level specified is at 1002 MHz (forward).
10. Loaded with 64 PAL I CW carriers from 88 to 600 MHz. "Digital" refers to 600 to 1002 MHz loading with QAM carriers at -6 dB relative to analog CW carrier levels.
11. Loaded with 78 NTSC CW carriers from 91 to 550 MHz. "Digital" refers to 550 to 1002 MHz loading with QAM carriers at -6 dB relative to analog video carrier levels.
12. CIN is a broadband noise-like distortion product associated with QAM loading.

**Product Specifications**

**Table 6.** Environmental Specifications

Environmental	Units	Value
Operating Temperature Range	°F/°C	-40 to +140°F (-40 to +60°C)
Relative Humidity Range	%	5 to 95%
<b>Mechanical</b>		
Housing Dimensions (L x H x D)	in./mm	17.3 in. L x 7.2 in. H x 7.8 in. D (439.4 mm L x 182.9 mm H x 198.1 mm D)
Weight Housing with power supply Module	lb/kg	12 lbs, 5 oz. (5.6 kg) 5 lbs, 5 oz. (2.4 kg)

## Ordering Information

The GainMaker Ordering Matrix provides ordering information for configured amplifier modules or stations. This page contains ordering information for required and optional accessories that are not included as part of a configured amplifier module or station. Please consult with your Account Representative, Customer Service Representative, or Applications Engineer to determine the best configuration for your particular application.

**Table 7.** Required Accessories - must be ordered separately (not included via GainMaker Ordering Matrix)

Required Accessories	Part Number
Plug-in Pads (attenuators) - Available in 0.5 dB steps from 0 to 20 dB <ul style="list-style-type: none"> <li>• 1 required for forward input</li> <li>• 1 required for AGC, if applicable*</li> <li>• 4 required for reverse (3 input, 1 output)</li> </ul> * To determine AGC pad value, subtract 34 dB from the design value main port RF output level at the AGC pilot frequency (applies to HGD, LGD, HGBT only)	589693 (0 dB) sequentially thru 589734 (20.5 dB)
Plug-in Forward Equalizer - Available in 1.5 dB steps from 0 to 30 dB at 1002 MHz <ul style="list-style-type: none"> <li>• 1 required for forward input</li> </ul>	4007228 (0 dB) sequentially thru 4007248 (30 dB)
Plug-in Reverse Equalizer - Available in 1 dB steps from 0 to 12 dB at 65 MHz <ul style="list-style-type: none"> <li>• 1 required for reverse output – unless design value is 0 dB (0 dB EQ is provided)</li> </ul>	712719 (0 dB) and 589736 (1 dB) sequentially thru 589747 (12 dB)

**Table 8.** Optional Accessories (may be ordered separately)

Optional Accessories	Part Number
24 V Power Supply for GainMaker High Output HGD	4026157
230 V AC 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 1.6 dB "cable equivalent" steps from 1.6 to 16.2 dB.	4007486 (1.6 dB) sequentially thru 4007495 (16.2 dB)
Long Reach Test Point Adapter	562580
Status Monitoring Transponder	*

\*See *Transponder for GainMaker Optoelectronic Node* data sheet, part number 7000087.

**Table 9.** Housing Options – The following Housing Options may be included with the product if ordered using the *GainMaker Ordering Matrix*. They may also be ordered separately.

GainMaker System Amplifier Housing – One required. Housing includes housing base, lid, wiring harness, and 24 V power supply, part number 4022846. All housings have 15 A capacity.	Part Number
Uncoated 4 port housing <i>without</i> external test point access	714027
Chromate Plated 4 port housing <i>without</i> external test point access	714026
Uncoated 4 port housing <i>with</i> external test point access	714025
Chromate Plated 4 port housing <i>without</i> external test point access	714024
GainMaker System Amplifier Housing Upgrade Kit – One required if upgrading an existing SA II, II+, or III housing to allow use of GainMaker System Amplifier modules. Includes a GainMaker System Amplifier housing lid, wiring harness, and 24 V power supply, part number 4022846.	
Uncoated 4 port housing lid <i>without</i> external test point access	714023
Painted 4 port housing lid <i>without</i> external test point access	714022
Uncoated 4 port housing lid <i>with</i> external test point access	714021
Painted 4 port housing lid <i>with</i> external test point access	714020
Seizure Upgrade Kit – 1 required if upgrading an existing SA II or SA II+ housing base to allow use of GainMaker System Amplifier Modules. Includes high current (15 amp) rated seizure screws and anvils.	548775



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