Cisco GainMaker High Output High Gain Balanced Triple 1 GHz Node 85/102 MHz

Looking for the ideal platform for delivering digital and analog video and high-speed data services over advanced hybrid fiber/coax (HFC) networks? Look no further. The GainMaker® High Output Node is designed to serve as an integral part of today’s network architectures. It combines the proven technologies of both the GainMaker RF Amplifier and Prisma® optical components. The GainMaker High Output Node is capable of higher output levels than standard Cisco® GainMaker Nodes. With its modular design of fiber receiver, reverse fiber transmitter, and RF amplifier electronics, the GainMaker High Output Node station can provide a variety of functions required by advanced networks.

Figure 1. GainMaker High Output Node

The GainMaker High Output Node accommodates a second forward receiver with an RF switch to provide forward path optical redundancy. Reverse traffic can be combined and routed to distributed feedback (DFB), coarse wavelength-division multiplexing (CWDM), dense wavelength-division multiplexing (DWDM), or Enhanced Digital Reverse (EDR) transmitters. The High Gain Balanced Triple (HGBT) launch amplifier module provides three high-level outputs. Additionally, the node is available with an optional DOCSIS status monitoring transponder. On-board temperature, automatic gain control (AGC) levels, RF switch position, power supply condition, as well as other features and parameters can be monitored through this transponder.
Features

- Capable of higher output levels than standard GainMaker nodes
- Forward redundancy available through a second 1310/1550 nm optical receiver (optional)
- Uses plug-in accessories common to all GainMaker products
- Cable to linear EQ in amplifiers I/S EQ spot provides 15.5 dB of internal Linear tilt
- Local test points and LED indicators on optical receivers, transmitters, and optical interface board simplify installation and maintenance
- AGC has thermal mode, eliminating disruptive RF output variation in the event of pilot loss
- Optional plug-in for status monitoring
- Optional 3-state reverse switch (on/off/-6 dB) allows each reverse input to be isolated for noise and ingress troubleshooting (status monitoring required)
- Fiber management tray provides easy access to fiber connections and folds back to provide access to optical transmitter and receivers
- Reverse input pad and RF test point for each reverse input port on launch amplifier allow optimum reverse path design and alignment
Block Diagrams

Figure 2. High Gain Balanced Triple (HGBT) Diagram
Optical specifications for the GainMaker High Output Node are shown in Table 1.

### Table 1. Optical Section Specifications

<table>
<thead>
<tr>
<th>Optical Section - Forward Receiver Module</th>
<th>Units</th>
<th>GainMaker Standard RX</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>nm</td>
<td>1310 and 1550</td>
<td></td>
</tr>
<tr>
<td>Optical Input Range</td>
<td>mW</td>
<td>0.5 to 1.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dBm</td>
<td>-3 to + 2</td>
<td></td>
</tr>
<tr>
<td>Pass Band</td>
<td>MHz</td>
<td>105-1002</td>
<td></td>
</tr>
<tr>
<td>Frequency Response</td>
<td>dB</td>
<td>+/- 0.75</td>
<td>1</td>
</tr>
<tr>
<td>Tilt (+/- 1.0 dB)</td>
<td>dB</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Optical Input Test Point (+/- 10%)</td>
<td>V DC</td>
<td>1V/mW</td>
<td></td>
</tr>
<tr>
<td>Redundant Optical Rx switching threshold (± 1.0 dB)</td>
<td>dBm</td>
<td>-6</td>
<td></td>
</tr>
<tr>
<td>RF Output Level @ 0 dBm Optical Input</td>
<td>dBmV</td>
<td>Refer to chart (below)</td>
<td>2</td>
</tr>
<tr>
<td>RF Output Test Point (± 1.0 dB)</td>
<td>dB</td>
<td>-20</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3.** Receiver RF Output Level vs. Transmitter OMI

**Notes for Optical Section Specifications:**

1. For forward receiver module only. Does not include frequency response contributions from forward optical transmitter.

2. Minimum receiver RF output level for the stated transmitter percent OMI/ch. (Optical Modulation Index per channel), with receiver optical input power of 0 dBm. To determine RF output levels at other optical input power, add (or subtract) 2 dB in RF level for each 1 dB increase (or decrease) in receiver optical input power.

For reverse optical transmitter and link performance, see the “Analog Reverse Optical Transmitters with Thermal Compensation” data sheet.

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 2. RF Section Specifications

<table>
<thead>
<tr>
<th>General Station Performance</th>
<th>Units</th>
<th>Forward</th>
<th>Reverse</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass Band</td>
<td>MHz</td>
<td>105-1002</td>
<td>5-85</td>
<td>14</td>
</tr>
<tr>
<td>Return Loss</td>
<td>dB</td>
<td>16</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Hum Modulation @ 12 A</td>
<td>dB</td>
<td>70 (105-870 MHz)</td>
<td>60 (5-10 MHz)</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 (870-1002 MHz)</td>
<td>70 (11-85 MHz)</td>
<td>7</td>
</tr>
<tr>
<td>Hum Modulation @ 15 A</td>
<td>dB</td>
<td>65 (105-870 MHz)</td>
<td>60 (5-10 MHz)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 (870-1002 MHz)</td>
<td>65 (11-85 MHz)</td>
<td>7</td>
</tr>
<tr>
<td>Test Points (±0.5 dB)</td>
<td>dB</td>
<td>-20</td>
<td>-20</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Launch Amplifier Performance - Forward

<table>
<thead>
<tr>
<th>Launch Amplifier Performance - Forward</th>
<th>Units</th>
<th>HGBT</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Gain (minimum)</td>
<td>dB</td>
<td>41</td>
<td>2, 14</td>
</tr>
<tr>
<td>Frequency Response</td>
<td>dB</td>
<td>+/- 0.5</td>
<td></td>
</tr>
<tr>
<td>Internal Tilt (±1 dB)</td>
<td>dB</td>
<td>15.5</td>
<td>1, 3</td>
</tr>
<tr>
<td>Noise Figure @... 105 MHz 1002 MHz</td>
<td>dB</td>
<td>8.5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>Reference Output Levels @... 1002 MHz</td>
<td>dBmV</td>
<td>56.0</td>
<td></td>
</tr>
<tr>
<td>870 MHz</td>
<td></td>
<td>54.0</td>
<td></td>
</tr>
<tr>
<td>750 MHz</td>
<td></td>
<td>52.2</td>
<td></td>
</tr>
<tr>
<td>650 MHz</td>
<td></td>
<td>50.5</td>
<td></td>
</tr>
<tr>
<td>550 MHz</td>
<td></td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>105 MHz</td>
<td></td>
<td>42.3</td>
<td></td>
</tr>
<tr>
<td>Reference Output Tilt (105-1002 MHz)</td>
<td>dB</td>
<td>13.7</td>
<td>1, 4</td>
</tr>
<tr>
<td>73 NTSC channels (CW) with digital</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Composite Triple Beat</td>
<td>dB</td>
<td>65</td>
<td>5</td>
</tr>
<tr>
<td>Cross Modulation</td>
<td>dB</td>
<td>59</td>
<td>5, 13</td>
</tr>
<tr>
<td>Composite Second Order (high side)</td>
<td>dB</td>
<td>64</td>
<td>5</td>
</tr>
<tr>
<td>Composite Intermodulation Distortion (CIN)</td>
<td>dB</td>
<td>57</td>
<td>5, 10</td>
</tr>
</tbody>
</table>

Table 4. Forward Insertion Loss

<table>
<thead>
<tr>
<th>Forward Insertion Loss</th>
<th>Units</th>
<th>With Redundancy Module Installed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical Interface Board and Plug-Ins (Loss from Specified Optical Receiver RF Output to Launch Amplifier RF Input)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiver position 1</td>
<td>dB</td>
<td>1.5</td>
<td>11</td>
</tr>
<tr>
<td>Receiver position 2</td>
<td>dB</td>
<td>1.5</td>
<td>11</td>
</tr>
</tbody>
</table>

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 5. Launch Amplifier Performance - Reverse

<table>
<thead>
<tr>
<th>Launch Amplifier Performance - Reverse</th>
<th>Units</th>
<th>Reverse</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplifier Type</td>
<td>-</td>
<td>Push-Pull</td>
<td></td>
</tr>
<tr>
<td>Operational Gain (minimum)</td>
<td>dBmV</td>
<td>19</td>
<td>7, 12</td>
</tr>
<tr>
<td>Frequency Response</td>
<td>dB</td>
<td>+/- 0.5</td>
<td></td>
</tr>
<tr>
<td>Internal Tilt (+/- 1dB)</td>
<td>dB</td>
<td>-0.5</td>
<td></td>
</tr>
<tr>
<td>Noise Figure</td>
<td>dB</td>
<td>14.5</td>
<td>7, 12</td>
</tr>
<tr>
<td>Reference Output Levels @ 5 and 85 MHz</td>
<td>dBmV</td>
<td>35</td>
<td>6</td>
</tr>
</tbody>
</table>

6 NTSC Channels (CW)

<table>
<thead>
<tr>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB</td>
</tr>
<tr>
<td>92</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>82</td>
</tr>
</tbody>
</table>

Table 6. Station Delay Characteristics and Frequency

<table>
<thead>
<tr>
<th>Station Delay Characteristics 85/105 Split</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward (Chrominance to Luminance Delay)</td>
</tr>
<tr>
<td>Frequency (MHz)</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>109.25 - 112.83</td>
</tr>
<tr>
<td>115.25 - 118.83</td>
</tr>
<tr>
<td>121.25 - 124.83</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Notes for RF Section Specifications:
1. Reference output tilt and internal tilt are both “linear” tilt.
2. Forward gain and noise figure measured with 0 dB input EQ and 1 dB input pad.
3. Forward internal tilt specified is primarily due to an on-board equalizer and a factory configured 10.5 dB cable to linear interstage equalizer (ISEQ).
4. The forward reference output tilt specified is achieved via field installation of appropriate input EQ, in conjunction with the internal tilt of the launch amplifier and the tilt associated with the optical link (transmitter/receiver combination).
5. Station performance can be determined by combining optic performance and launch amplifier performance. Stated distortion performance is for launch amplifier section operated at reference output levels and tilt. Consult Cisco System Engineering for CIN calculations.
6. Reverse output reference level at the RF output of the launch amplifier.
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 by 0.5 dB, and decrease return loss by 1 dB.
8. Station reverse gain from station input(s) to reverse transmitter input. With 0 dB reverse input pad, 1 dB reverse output pad, and 0 dB reverse EQ in launch amplifier. Includes optical interface board losses.
9. “Digital” refers to 550 - 1002 MHz loading with QAM carriers at -6 dB relative to analog video carrier levels.
10. Composite Intermodulation Noise is a broadband noise-like distortion product associated with QAM loading.
11. Insertion loss from optical receiver RF output to launch amplifier RF input, with specified forward plug-in module installed in the optical interface board. Subtract this loss from the launch amplifier operational gain to determine forward station gain from optical receiver output to station output.
12. Reverse Gain and Noise Figure for launch amp with 0 dB reverse input pad, 0 dB reverse output EQ, and 1 dB output pad.
13. X-mod (@ 15.75 kHz) specified using 100% synchronous modulation and frequency selective measurement device.
14. The gain at 102 MHz is < 1.5 dB below the gain at 105 MHz. 102 to 105 MHz is recommended for out of band communication only. No video carriers should be used between 102 and 105 MHz.

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 7. Electrical and Component DC Power Consumption

<table>
<thead>
<tr>
<th>Electrical</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. AC Through Current (continuous)</td>
<td>Amps</td>
<td>15</td>
</tr>
<tr>
<td>Max. AC Through Current (surge)</td>
<td>Amps</td>
<td>25</td>
</tr>
<tr>
<td>Component DC Power Consumption (Typical)</td>
<td>@+24 VDC</td>
<td>@+15 VDC</td>
</tr>
<tr>
<td>Launch Amplifier High Gain Dual (thermal)</td>
<td>Amps</td>
<td>1.7</td>
</tr>
<tr>
<td>Status Monitoring Transponder</td>
<td>Amps</td>
<td>0.15</td>
</tr>
<tr>
<td>Standard Optical Receiver</td>
<td>Amps</td>
<td>0.25</td>
</tr>
<tr>
<td>Reverse Transmitter - Standard FP</td>
<td>Amps</td>
<td>0.14</td>
</tr>
<tr>
<td>Reverse Transmitter - Standard DFB</td>
<td>Amps</td>
<td>0.08</td>
</tr>
<tr>
<td>Power Supply DC Current Rating</td>
<td>Amps</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Table 8. Station Powering Data

<table>
<thead>
<tr>
<th>Station Powering Data</th>
<th>I DC (Amps at 24V DC)</th>
<th>AC Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Output GainMaker HGBT 1 RX, 1 TX, &amp; Stat Mon</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>AC Current (A)</td>
<td>1.04 1.08 1.09 1.14 1.20 1.28 1.56 1.63 1.77 1.97 2.23</td>
<td></td>
</tr>
<tr>
<td>AC Power (W)</td>
<td>78.50 78.10 77.60 77.90 78.00 77.30 77.60 77.70 77.90 78.40 78.80</td>
<td></td>
</tr>
</tbody>
</table>

Data is based on stations configured for 2-way operation with status monitoring transponder. AC currents specified are based on measurements made with typical CATV type ferro-resonant AC power supply (quasi-square wave), and GainMaker High Output Node DC power supply (3.4 amp, 24 V DC, pn 4022705). DC supply has a user configurable 40 V or 50 V AC under-voltage lockout circuit.

**Note:** 1. The total DC Power consumption of installed components should not exceed the power supply DC current rating.

Table 9. Environmental and Mechanical Housing Dimensions

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range</td>
<td>degrees</td>
</tr>
<tr>
<td>Relative Humidity Range</td>
<td>percent</td>
</tr>
<tr>
<td>Mechanical</td>
<td></td>
</tr>
<tr>
<td>Housing Dimensions</td>
<td>Weight</td>
</tr>
<tr>
<td>17.5 in. L x 7.3 in. H x 7.5 in. D (445 mm L x 185 mm H x 191 mm D)</td>
<td>Station with 1 RX, 1 TX, &amp; power supply: 22 lbs (9.9 kg)</td>
</tr>
</tbody>
</table>

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.
Ordering Information

The GainMaker High Gain Balanced Triple Node is available in a wide variety of configurations. The desired configuration is built by accessing the Cisco Commerce Workspace tool at https://cisco-apps.cisco.com/cisco/psn/commerce. The user specifies the new Assemble to Order (ATO) Product ID for the GainMaker High Gain Balanced Triple Node “GMN-HGBTand the tool steps through the available options. Services may also be selected during this process. Once all the desired options are selected, the configuration and price are displayed. When the “Done” radio button is clicked, the configuration can be exported and saved for future use or immediate ordering.

Table 10. Required Accessories for RF Module

<table>
<thead>
<tr>
<th>Required Accessories for RF Module</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug-in Pads (attenuators) - Available in 0.5 dB steps from 0 to 20 dB</td>
<td>589693 (0 dB)</td>
</tr>
<tr>
<td>• 1 required for forward input</td>
<td>sequentially thru</td>
</tr>
<tr>
<td>• 1 required for AGC, if applicable*</td>
<td>589734 (20.5 dB)</td>
</tr>
<tr>
<td>• 4 required for reverse (3 input, 1 output)</td>
<td></td>
</tr>
<tr>
<td>To determine AGC pad value, subtract 34dB from the design value main port RF output level at the AGC pilot frequency.</td>
<td></td>
</tr>
<tr>
<td>Plug-in Forward Linear Equalizer - Available in 1.5 dB steps from 0 to 21 dB</td>
<td>See table below</td>
</tr>
<tr>
<td>• 1 required for forward input</td>
<td></td>
</tr>
<tr>
<td>Plug-in Reverse Equalizer - Available in 1 dB steps from 0 to 12 dB at 40 MHz</td>
<td>712719 (0 dB) and 589628</td>
</tr>
<tr>
<td>• 1 required for reverse output - unless design value is 0 dB (0 dB EQ is provided)</td>
<td>sequentially thru 589639</td>
</tr>
<tr>
<td></td>
<td>(12 dB)</td>
</tr>
</tbody>
</table>

Table 11. Required Accessories for Optical Components

<table>
<thead>
<tr>
<th>Required Accessories for Optical Components</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug-in Pads (attenuators) - Available in 0.5 dB steps from 0 to 20.5 dB</td>
<td>279500 (0 dB) sequentially thru</td>
</tr>
<tr>
<td>• 1 ea required for Transmitter and Receiver(s).</td>
<td>279513 (13 dB) in 1 dB steps</td>
</tr>
<tr>
<td></td>
<td>504151 (14 dB) sequentially thru 504157 (20 dB) in 1 dB steps</td>
</tr>
<tr>
<td></td>
<td>565231 (0.5 dB) sequentially thru 565251 (20.5 dB) in 1 dB steps</td>
</tr>
</tbody>
</table>

Table 12. Forward Linear Equalizers

<table>
<thead>
<tr>
<th>Forward Linear Equalizers</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 dB 1GHz Forward Linear EQ</td>
<td>4007228</td>
</tr>
<tr>
<td>1.5 dB 1GHz Forward Linear EQ</td>
<td>4008778</td>
</tr>
<tr>
<td>3.0 dB 1GHz Forward Linear EQ</td>
<td>4008779</td>
</tr>
<tr>
<td>4.5 dB 1GHz Forward Linear EQ</td>
<td>4008780</td>
</tr>
<tr>
<td>6.0 dB 1GHz Forward Linear EQ</td>
<td>4008781</td>
</tr>
<tr>
<td>7.5 dB 1GHz Forward Linear EQ</td>
<td>4008782</td>
</tr>
<tr>
<td>9.0 dB 1GHz Forward Linear EQ</td>
<td>4008783</td>
</tr>
<tr>
<td>10.5 dB 1GHz Forward Linear EQ</td>
<td>4008784</td>
</tr>
<tr>
<td>12.0 dB 1GHz Forward Linear EQ</td>
<td>4008785</td>
</tr>
<tr>
<td>13.5 dB 1GHz Forward Linear EQ</td>
<td>4008786</td>
</tr>
<tr>
<td>15.0 dB 1GHz Forward Linear EQ</td>
<td>4008787</td>
</tr>
<tr>
<td>16.5 dB 1GHz Forward Linear EQ</td>
<td>4019258</td>
</tr>
</tbody>
</table>
### Forward Linear Equalizers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Gain</th>
<th>GainMaker Node Optical Receiver with SC/APC Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>4019259</td>
<td>18.0 dB 1GHz</td>
<td>4007501</td>
</tr>
<tr>
<td>4019260</td>
<td>19.5 dB 1GHz</td>
<td>4007502</td>
</tr>
<tr>
<td>4019261</td>
<td>21.0 dB 1GHz</td>
<td>4007503</td>
</tr>
</tbody>
</table>

### Optical Receivers

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number on Module</th>
<th>Part Number for Ordering</th>
</tr>
</thead>
<tbody>
<tr>
<td>GainMaker Node Optical Receiver with SC/APC Connector</td>
<td>4007501</td>
<td>4007671</td>
</tr>
<tr>
<td>GainMaker Node Optical Receiver with SC/UPC Connector</td>
<td>4007502</td>
<td>4007672</td>
</tr>
<tr>
<td>GainMaker Node Optical Receiver with FC/APC Connector</td>
<td>4007503</td>
<td>4007673</td>
</tr>
</tbody>
</table>

### Optical Transmitters

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number on Module</th>
<th>Part Number for Ordering</th>
</tr>
</thead>
<tbody>
<tr>
<td>1310 nm DFB Optical Transmitter - Standard Gain, with SC/APC connector</td>
<td>4013903.1310</td>
<td>590934</td>
</tr>
<tr>
<td>1310 nm DFB Optical Transmitter - Standard Gain, with SC/UPC connector</td>
<td>4013904.1310</td>
<td>590935</td>
</tr>
<tr>
<td>1470 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1470</td>
<td>4006971</td>
</tr>
<tr>
<td>1490 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1490</td>
<td>4006972</td>
</tr>
<tr>
<td>1510 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1510</td>
<td>4006973</td>
</tr>
<tr>
<td>1530 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1530</td>
<td>4006974</td>
</tr>
<tr>
<td>1550 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1550</td>
<td>4006975</td>
</tr>
<tr>
<td>1570 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1570</td>
<td>4006976</td>
</tr>
<tr>
<td>1590 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1590</td>
<td>4006977</td>
</tr>
<tr>
<td>1610 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1610</td>
<td>4006978</td>
</tr>
<tr>
<td>1700 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector</td>
<td>4013903.1700</td>
<td>4006979</td>
</tr>
<tr>
<td>1510 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector</td>
<td>4013904.1510</td>
<td>4006981</td>
</tr>
<tr>
<td>1530 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector</td>
<td>4013904.1530</td>
<td>4006982</td>
</tr>
<tr>
<td>1550 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector</td>
<td>4013904.1550</td>
<td>4006983</td>
</tr>
<tr>
<td>1570 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector</td>
<td>4013904.1570</td>
<td>4006984</td>
</tr>
<tr>
<td>1590 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector</td>
<td>4013904.1590</td>
<td>4006985</td>
</tr>
<tr>
<td>1610 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector</td>
<td>4013904.1610</td>
<td>4006986</td>
</tr>
<tr>
<td>1470 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1470</td>
<td>4006987</td>
</tr>
<tr>
<td>1490 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1490</td>
<td>4006988</td>
</tr>
<tr>
<td>1510 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1510</td>
<td>4006989</td>
</tr>
<tr>
<td>1530 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1530</td>
<td>4006990</td>
</tr>
<tr>
<td>1550 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1550</td>
<td>4006991</td>
</tr>
<tr>
<td>1570 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1570</td>
<td>4006992</td>
</tr>
<tr>
<td>1590 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1590</td>
<td>4006993</td>
</tr>
<tr>
<td>1610 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector</td>
<td>4013905.1610</td>
<td>4006994</td>
</tr>
</tbody>
</table>
### Table 15. Cisco GainMaker EDR DWDM Reverse Optical Transmitters

<table>
<thead>
<tr>
<th>GainMaker EDR DWDM Reverse Optical Transmitter and Optical Pluggable Modules (OPMs)</th>
<th>Part Number Module</th>
<th>Part Number for Ordering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digital 1:1 EDR DWDM Transmitter OPMs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDR GM1185 transmitter module</td>
<td>800-4042187-01</td>
<td>4042881</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-17</td>
<td>10-1022090-01</td>
<td>4042869.17</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-18</td>
<td>10-1022091-01</td>
<td>4042869.18</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-19</td>
<td>10-1022092-01</td>
<td>4042869.19</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-20</td>
<td>10-1022093-01</td>
<td>4042869.20</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-21</td>
<td>10-1022094-01</td>
<td>4042869.21</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-22</td>
<td>10-1022095-01</td>
<td>4042869.22</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-23</td>
<td>10-1022096-01</td>
<td>4042869.23</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-24</td>
<td>10-1022097-01</td>
<td>4042869.24</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-25</td>
<td>10-1022098-01</td>
<td>4042869.25</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-26</td>
<td>10-1022099-01</td>
<td>4042869.26</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-27</td>
<td>10-1022100-01</td>
<td>4042869.27</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-28</td>
<td>10-1022101-01</td>
<td>4042869.28</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-29</td>
<td>10-1022102-01</td>
<td>4042869.29</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-30</td>
<td>10-1022103-01</td>
<td>4042869.30</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-31</td>
<td>10-1022104-01</td>
<td>4042869.31</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-32</td>
<td>10-1022105-01</td>
<td>4042869.32</td>
</tr>
<tr>
<td>GainMaker EDR DWDM Reverse Optical Transmitter Optical Pluggable Modules (OPMs)</td>
<td>Part Number on Transmitter Module</td>
<td>Part Number for Ordering</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-33</td>
<td>10-1022106-01</td>
<td>4042869.33</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-34</td>
<td>10-1022107-01</td>
<td>4042869.34</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-35</td>
<td>10-1022108-01</td>
<td>4042869.35</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-36</td>
<td>10-1022109-01</td>
<td>4042869.36</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-37</td>
<td>10-1022110-01</td>
<td>4042869.37</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-38</td>
<td>10-1022111-01</td>
<td>4042869.38</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-39</td>
<td>10-1022112-01</td>
<td>4042869.39</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-40</td>
<td>10-1022113-01</td>
<td>4042869.40</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-41</td>
<td>10-1022114-01</td>
<td>4042869.41</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-42</td>
<td>10-1022115-01</td>
<td>4042869.42</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-43</td>
<td>10-1022116-01</td>
<td>4042869.43</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-44</td>
<td>10-1022117-01</td>
<td>4042869.44</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-45</td>
<td>10-1022118-01</td>
<td>4042869.45</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-46</td>
<td>10-1022119-01</td>
<td>4042869.46</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-47</td>
<td>10-1022120-01</td>
<td>4042869.47</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-48</td>
<td>10-1022121-01</td>
<td>4042869.48</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-49</td>
<td>10-1022122-01</td>
<td>4042869.49</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-50</td>
<td>10-1022123-01</td>
<td>4042869.50</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-51</td>
<td>10-1022124-01</td>
<td>4042869.51</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-52</td>
<td>10-1022125-01</td>
<td>4042869.52</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-53</td>
<td>10-1022126-01</td>
<td>4042869.53</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-54</td>
<td>10-1022127-01</td>
<td>4042869.54</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-55</td>
<td>10-1022128-01</td>
<td>4042869.55</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-56</td>
<td>10-1022129-01</td>
<td>4042869.56</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-57</td>
<td>10-1022130-01</td>
<td>4042869.57</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-58</td>
<td>10-1022131-01</td>
<td>4042869.58</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-59</td>
<td>10-1022132-01</td>
<td>4042869.59</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-60</td>
<td>10-1022133-01</td>
<td>4042869.60</td>
</tr>
<tr>
<td>EDR 1:1 transmitter OPM DWDM-61</td>
<td>10-1022134-01</td>
<td>4042869.61</td>
</tr>
</tbody>
</table>

Table 16. Related Equipment

<table>
<thead>
<tr>
<th>Related Equipment (Available As Part of Configuration or Separately)</th>
<th>Part Number on Module</th>
<th>Part Number for Ordering</th>
</tr>
</thead>
<tbody>
<tr>
<td>GainMaker High Output Node - DC Power Supply 40 - 90 V AC</td>
<td>4022705</td>
<td>4026156</td>
</tr>
<tr>
<td>GainMaker - Crowbar Surge Protector</td>
<td>715973</td>
<td>4007682</td>
</tr>
<tr>
<td>GainMaker Reverse RF Switch</td>
<td>-</td>
<td>GM-3WSW=</td>
</tr>
</tbody>
</table>