

GainMaker[®] High Output High Gain Balanced Triple Node 5-42/54-1002 MHz

Description

The GainMaker[®] High Output Node is designed to serve as an integral part of today's network architectures, and 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 the standard GainMaker Node. Featuring three RF output ports, it is the ideal platform for delivering video (digital and analog) as well as high-speed data services over advanced hybrid fiber/coax (HFC) networks. 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.

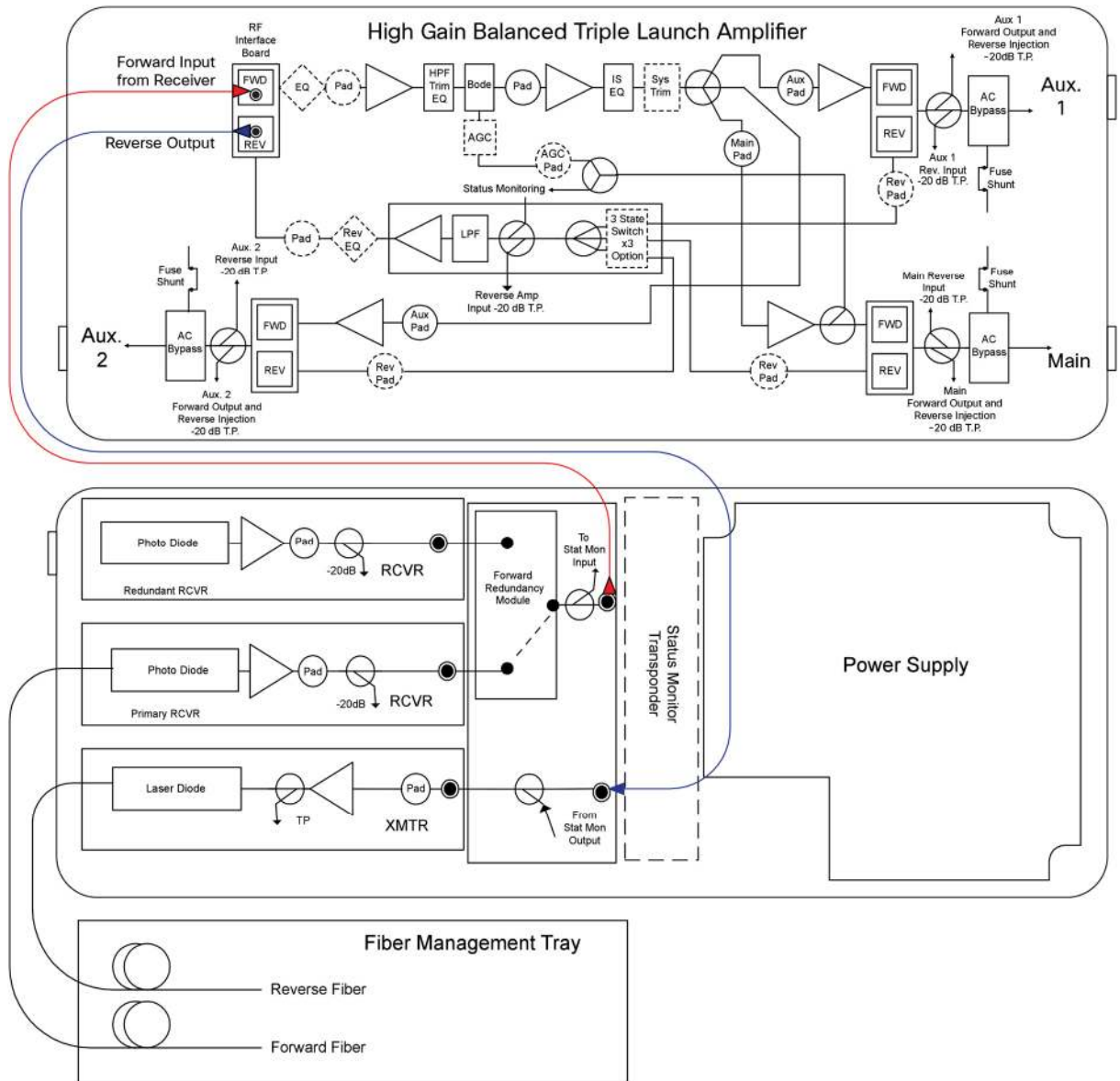


The GainMaker High Output Node accommodates a second forward receiver with an RF switch to accommodate forward path optical redundancy. Reverse traffic can be combined and routed to FP, DFB, or CWDM reverse transmitters. The High Gain Balanced Triple (HGBT) launch amplifier module provides three high-level 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/parameters can be monitored through this transponder.

Features

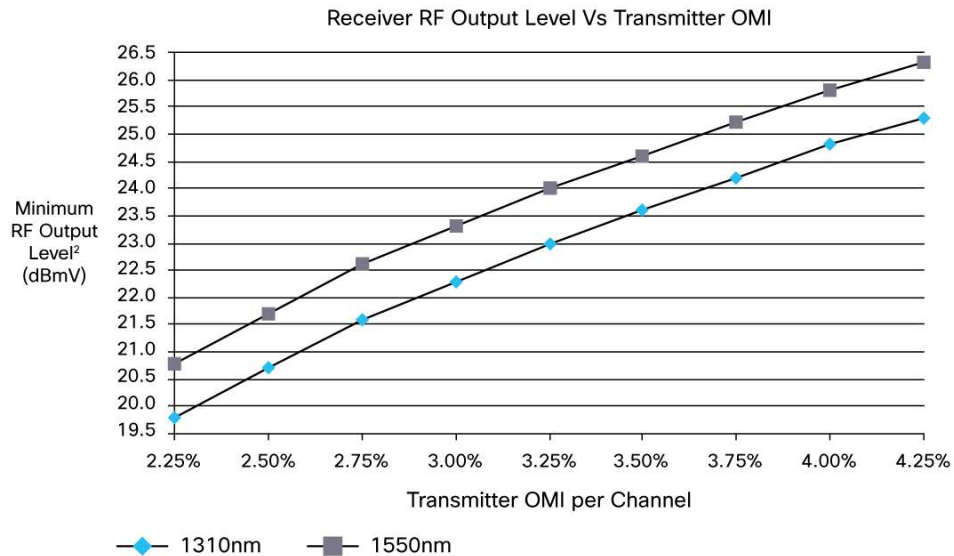
- Capable of higher output levels than standard GainMaker Nodes
- Forward redundancy available via a second 1310/1550 nm optical receiver (optional)
- Uses plug-in accessories common to all GainMaker products
- Cable to Linear EQ in amplifiers I/S EQ spot provides 15.5 dB of internal Linear tilt
- Local 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 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



Optical Section Specifications

| Optical Section - Forward Receiver Module | Units | GainMaker Standard RX | Notes |
|--|-----------|------------------------|-------|
| Wavelength | nm | 1310 and 1550 | |
| Optical Input Range | mW dBm | 0.5 to 1.6 -3 to +2 | |
| Pass Band | MHz | 52-1002 | |
| Frequency Response | dB | +/- 0.75 | 1 |
| Tilt (+/- 1.0 dB) | dB | 0 | |
| Optical Input Test Point (+/- 10%) | V DC | 1V/mW | |
| Redundant Optical Rx switching threshold (± 1.0 dB) | dBm | -6 | |
| RF Output Level @ 0 dBm Optical Input | dBmV | Refer to chart (below) | 2 |
| RF Output Test Point (± 1.0 dB) | dB | -20 | |



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.

RF Section Specifications

| General Station Performance | Units | Forward | Reverse | Notes |
|-----------------------------|-------|--------------------------------------|---------------------------------|-------|
| Pass Band | MHz | 54-1002 | 5-42 | |
| Return Loss | dB | 16 | 16 | 7 |
| Hum Modulation @ 12 A | dB | 70 (54-870 MHz) 60 (870-1002 MHz) | 60 (5-10 MHz) 70 (11-42 MHz) | |
| Hum Modulation @ 15 A | dB | 65 (54-870 MHz) 60 (870-1002 MHz) | 60 (5-10 MHz) 65 (11-42 MHz) | |
| Test Points (± 0.5 dB) | dB | -20 | -20 | |

| Launch Amplifier Performance - Forward | Units | HGBT | Notes |
|--|-------|---------|-------|
| Operational Gain (minimum) | dB | 41 | 2 |
| Frequency Response | dB | +/- 0.5 | |
| Internal Tilt (± 1 dB) | dB | 15.5 | 1, 3 |
| Noise Figure @... 54 MHz | dB | 8.5 | 2 |
| 1002 MHz | | 8.0 | |
| Reference Output Levels @... 1002 MHz | dBmV | 56.0 | |
| 870 MHz | | 54.0 | |
| 750 MHz | | 52.2 | |
| 650 MHz | | 50.5 | |
| 550 MHz | | 49.0 | |
| 55 MHz | | 41.5 | |
| Reference Output Tilt (55-1002 MHz) | dB | | 1,4 |
| 78 NTSC channels (CW) with digital | | | 9 |
| Composite Triple Beat | dB | 65 | 5 |
| Cross Modulation | dB | 59 | 5, 13 |
| Composite Second Order (high side) | dB | 64 | 5 |
| Composite Intermodulation Distortion (CIN) | dB | 57 | 5, 10 |

| Forward Insertion Loss Optical Interface Board and Plug-Ins (Loss from Specified Optical Receiver RF Output to Launch Amplifier RF Input) | Units | With Redundancy Module Installed | Notes |
|---|-------|----------------------------------|-------|
| Receiver position 1 | dB | 1.5 | 11 |
| Receiver position 2 | dB | 1.5 | 11 |

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.

RF Section Specifications, Continued

| Launch Amplifier Performance - Reverse | | Units | Reverse | Notes |
|--|--|--------------|-----------|-------|
| Amplifier Type | | - | Push-Pull | |
| Operational Gain (minimum) | | dBmV | 19.5 | 7, 12 |
| Frequency Response | | dB | +/- 0.5 | |
| Internal Tilt (+/- 1dB) | | dB | -0.5 | |
| Noise Figure | | dB | 14.5 | 7, 12 |
| Reference Output Levels @ 5 and 42 MHz | | dBmV | 35 | 6 |
| 6 NTSC Channels (CW) | | | | |
| Composite Triple Beat | | dB | 92 | |
| Cross Modulation | | dB | 80 | 13 |
| Composite Second Order | | dB | 82 | |
| Station Performance - Reverse (Station port input to optical transmitter input) | | Units | | |
| Operational Gain (minimum) | | dB | 17.5 | 7, 8 |

| Station Delay Characteristics | | 42/54 Split | |
|---|------------|--|------------|
| Forward (Chrominance to Luminance Delay) | | Reverse (Group Delay in 1.5 MHz BW) | |
| Frequency (MHz) | Delay (nS) | Frequency (MHz) | Delay (nS) |
| 55.25 - 58.83 | 22 | 5.0 - 6.5 | 29 |
| 61.25 - 64.83 | 9 | 6.5 - 8.0 | 13 |
| 67.25 - 70.83 | 6 | 8.0 - 9.5 | 8 |
| | | 37.5 - 39.0 | 13 |
| | | 39.0 - 40.5 | 18 |
| | | 40.5 - 42.0 | 28 |

Notes for RF Section Specifications:

- Reference output tilt and internal tilt are both "Linear" tilt.
- Forward Gain and Noise Figure measured with 0 dB input EQ and 1 dB input pad.
- 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).
- 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).
- 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.
- Reverse output reference level at the RF output of the launch amplifier.
- 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.
- 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.
- "Digital" refers to 550 - 1002 MHz loading with QAM carriers at -6 dB relative to analog video carrier levels.
- Composite Intermodulation Noise is a broadband noise-like distortion product associated with QAM loading.
- 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.
- Reverse Gain and Noise Figure for launch amp with 0 dB reverse input pad, 0 dB reverse output EQ, and 1 dB output pad.
- X-mod (@ 15.75 kHz) specified using 100% synchronous modulation and frequency selective measurement device.

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.

Specifications, Continued

| Electrical | Units | | | | Notes |
|---|-------|-----------|-----------|----------|-------|
| Max. AC Through Current (continuous) | Amps | 15 | | | |
| Max. AC Through Current (surge) | Amps | 25 | | | |
| Component DC Power Consumption (Typical) | | @ +24 VDC | @ +15 VDC | @ -6 VDC | 1 |
| Launch Amplifier High Gain Dual (thermal) | Amps | 1.7 | - | - | |
| Status Monitoring Transponder | Amps | 0.15 | - | - | |
| Standard Optical Receiver | Amps | 0.25 | 0.01 | 0.035 | |
| Reverse Transmitter - Standard FP | Amps | 0.14 | - | 0.07 | |
| Reverse Transmitter - Standard DFB | Amps | 0.08 | - | 0.09 | |
| Power Supply DC Current Rating | Amps | 3.4 | 0.05 | 0.3 | 1 |

| Station Powering Data | | | | | | | | | | | | | |
|-----------------------------------|-----------------------|----------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| High Output GainMaker HGBT | I DC (Amps at 24V DC) | | AC Voltage | | | | | | | | | | |
| | | | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 | 50 | 45 | 40 |
| 1 or 2 RX, 1 TX, & Stat Mon | 2.8 | AC Current (A) | 1.04 | 1.08 | 1.09 | 1.14 | 1.20 | 1.28 | 1.56 | 1.63 | 1.77 | 1.97 | 2.23 |
| | | AC Power (W) | 78.50 | 78.10 | 77.60 | 77.90 | 78.00 | 77.30 | 77.60 | 77.70 | 77.90 | 78.40 | 78.80 |

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:

- The total DC Power consumption of installed components should not exceed the power supply DC current rating.

| Environmental | Units | |
|--|---------|--|
| Operating Temperature Range | degrees | -40°F to 140°F (-40°C to 60°C) |
| Relative Humidity Range | percent | 5% to 95% |
| Mechanical | | |
| Housing Dimensions | Weight | |
| 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) | | Station with 1 RX, 1 TX, & power supply: 22 lbs (9.9 kg) |

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 Output Node is available in a wide variety of configurations. The GainMaker Ordering Matrix provides ordering information for configured node stations, existing amp to node upgrade kits, and launch amplifiers. This page contains ordering information for required and optional accessories. Please consult with your Account Representative, Customer Service Representative, or Applications Engineer to determine the best configuration for your particular application.

| Required Accessories for RF Module | Part Number |
|--|---|
| Plug-in Pads (attenuators) - Available in 0.5 dB steps from 0 to 20 dB <ul style="list-style-type: none"> • 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 34dB from the design value main port RF output level at the AGC pilot frequency. | 589693 (0 dB) sequentially thru 589734 (20.5 dB) |
| Plug-in Forward Linear Equalizer - Available in 1.5 dB steps from 0 to 21 dB <ul style="list-style-type: none"> • 1 required for forward input | See table below |
| Plug-in Reverse Equalizer - Available in 1 dB steps from 0 to 12 dB at 40 MHz <ul style="list-style-type: none"> • 1 required for reverse output - unless design value is 0 dB (0 dB EQ is provided) | 712719 (0 dB) and 589628 (1 dB) sequentially thru 589639 (12 dB) |

| Required Accessories for Optical Components | Part Number |
|--|--|
| Plug-in Pads (attenuators) - Available in 0.5 dB steps from 0 to 20.5 dB <ul style="list-style-type: none"> • 1 ea required for Transmitter and Receiver(s). | 279500 (0 dB) sequentially thru 279513 (13 dB) in 1 dB steps 504151 (14 dB) sequentially thru 504157 (20 dB) in 1 dB steps 565231 (0.5 dB) sequentially thru 565251 (20.5 dB) in 1 dB steps |

| Forward Linear Equalizers | Part Number |
|--------------------------------|-------------|
| 0 dB 1GHz Forward Linear EQ | 4007228 |
| 1.5 dB 1GHz Forward Linear EQ | 4008778 |
| 3.0 dB 1GHz Forward Linear EQ | 4008779 |
| 4.5 dB 1GHz Forward Linear EQ | 4008780 |
| 6.0 dB 1GHz Forward Linear EQ | 4008781 |
| 7.5 dB 1GHz Forward Linear EQ | 4008782 |
| 9.0 dB 1GHz Forward Linear EQ | 4008783 |
| 10.5 dB 1GHz Forward Linear EQ | 4008784 |
| 12.0 dB 1GHz Forward Linear EQ | 4008785 |
| 13.5 dB 1GHz Forward Linear EQ | 4008786 |
| 15.0 dB 1GHz Forward Linear EQ | 4008787 |
| 16.5 dB 1GHz Forward Linear EQ | 4019258 |
| 18.0 dB 1GHz Forward Linear EQ | 4019259 |
| 19.5 dB 1GHz Forward Linear EQ | 4019260 |
| 21.0 dB 1GHz Forward Linear EQ | 4019261 |

Ordering Information, Continued

| Optical Receivers (Available As Part of Configuration or Separately) | Part Number on Module | Part Number for Ordering |
|--|-----------------------|--------------------------|
| GainMaker Node Optical Receiver with SC/APC Connector | 4007501 | 4007671 |
| GainMaker Node Optical Receiver with SC/UPC Connector | 4007502 | 4007672 |
| GainMaker Node Optical Receiver with FC/APC Connector | 4007503 | 4007673 |
| Optical Transmitters (Available As Part of Configuration or Separately) | Part Number on Module | Part Number for Ordering |
| All Listed Below Are Thermally Compensated Transmitters | | |
| GainMaker Node FP Optical Transmitter with SC/APC Connector | 717904 | 590930 |
| GainMaker Node FP Optical Transmitter with SC/UPC Connector | 717905 | 590931 |
| GainMaker Node FP Optical Transmitter with FC/APC Connector | 717902 | 590928 |
| 1310 nm DFB Optical Transmitter - Standard Gain, with SC/APC connector | 4013903.1310 | 590934 |
| 1310 nm DFB Optical Transmitter - Standard Gain, with SC/UPC connector | 4013904.1310 | 590935 |
| 1310 nm DFB Optical Transmitter - Standard Gain, with FC/APC connector | 4013905.1310 | 590932 |
| 1470 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1470 | 4006971 |
| 1490 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1490 | 4006972 |
| 1510 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1510 | 4006973 |
| 1530 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1530 | 4006974 |
| 1550 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1550 | 4006975 |
| 1570 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1570 | 4006976 |
| 1590 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1590 | 4006977 |
| 1610 nm CWDM DFB Optical Transmitter - Standard Gain with SC/APC connector | 4013903.1610 | 4006978 |
| 1470 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1470 | 4006979 |
| 1490 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1490 | 4006980 |
| 1510 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1510 | 4006981 |
| 1530 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1530 | 4006982 |
| 1550 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1550 | 4006983 |
| 1570 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1570 | 4006984 |
| 1590 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1590 | 4006985 |
| 1610 nm CWDM DFB Optical Transmitter - Standard Gain with SC/UPC connector | 4013904.1610 | 4006986 |
| 1470 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1470 | 4006987 |
| 1490 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1490 | 4006988 |
| 1510 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1510 | 4006989 |
| 1530 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1530 | 4006990 |
| 1550 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1550 | 4006991 |
| 1570 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1570 | 4006992 |
| 1590 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1590 | 4006993 |
| 1610 nm CWDM DFB Optical Transmitter - Standard Gain with FC/APC connector | 4013905.1610 | 4006994 |

| Related Equipment (Available As Part of Configuration or Separately) | Part Number on Module | Part Number for Ordering |
|---|-----------------------|--------------------------|
| GainMaker High Output Node - DC Power Supply 40 - 90 V AC | 4022705 | 4026156 |
| GainMaker - Crowbar Surge Protector | 715973 | 4007682 |
| GainMaker Reverse RF Switch | - | 589347 |
| GainMaker Node Status Monitoring Transponder (See Transponder Data Sheet) | 744234 | 4018687 |



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

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