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Optoelectronics

# Model 6940 Four Port Optoelectronic Node 870 MHz with 42/54 MHz Split

## Description

The Model 6940 Node is a high performance, four output optoelectronic node. The Model 6940 Node can be configured with a variety of forward optical receivers and reverse optical transmitters, providing flexibility for use in multiple applications.

Redundant optical receiver and transmitter capability allows optical path redundancy, enabling increased network reliability. Additionally, the Model 6940 Node is capable of reverse port segmentation using the Prisma® bdr ™ system. The bdr system utilizes Scientific-Atlanta's unique baseband digital reverse technology and allows increased performance, reach, and bandwidth efficiency for the critical reverse network.

The Model 6940 Node's housing incorporates many features that enhance ease of use and reliability, such as a separate AC powering port, optional redundant power supply, and extended ports to allow for easy heat shrink weather protection.

The Model 6940 Node can also be configured with a Scientific-Atlanta status monitoring transponder. The transponder, in conjunction with the ROSA® / TNCS or other compatible element management system, enables remote monitoring of critical node related parameters, and remote control of each optional reverse path switch for ingress troubleshooting.

## Features

- 1 GHz RF platform
- 15 amperes continuous power passing
- Four high level forward RF outputs
- Screwless seizures for ease of connector installation
- 40-90 V AC high-efficiency switch mode power supply
- Optional power supply redundancy
- Local test points and LED indicators on optical receivers and transmitters simplify installation and maintenance
- Optional status monitoring and control (status monitoring transponder and TNCS or other compatible element management system required)
- Plug-in pads provide individual level control for each port for forward and reverse paths
- Optional 3-state reverse switch (on/off/-6 dB) allows each reverse input to be isolated for noise and ingress troubleshooting (status monitoring transponder and ROSA / TNCS required)
- Fiber management tray provides convenient fiber and connector storage for up to 6 connector pairs
- 1310 nm analog reverse transmitters with either Fabry-Perot or DFB lasers
- Supports Baseband Digital Reverse technology, allowing reverse path segmentation

ROSA® SUPPORTED

Manage your network with ROSA and TNCS open standards element management. Get faster mean-time-to-repair, increased uptime, and management that evolves as you provision your networks. US toll-free 1-800-722-2009. EMEA +32 56 445 445. www.scientificatlanta.com/ROSA

# Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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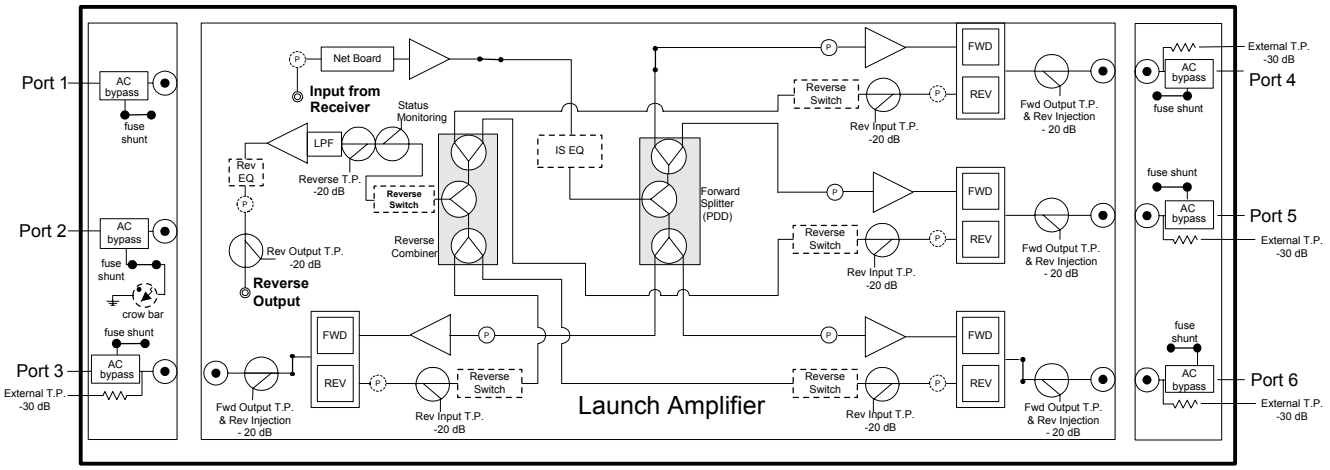
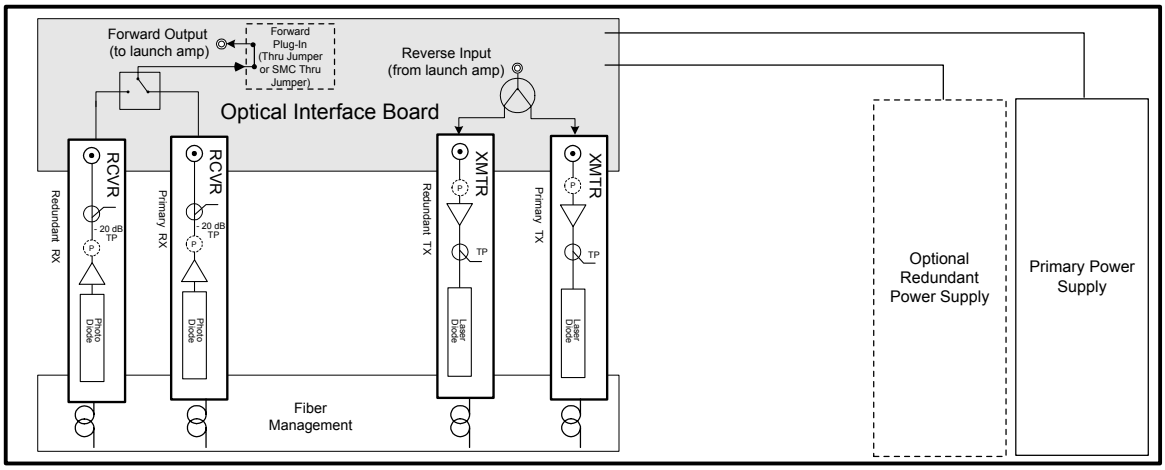
## Block Diagram



# Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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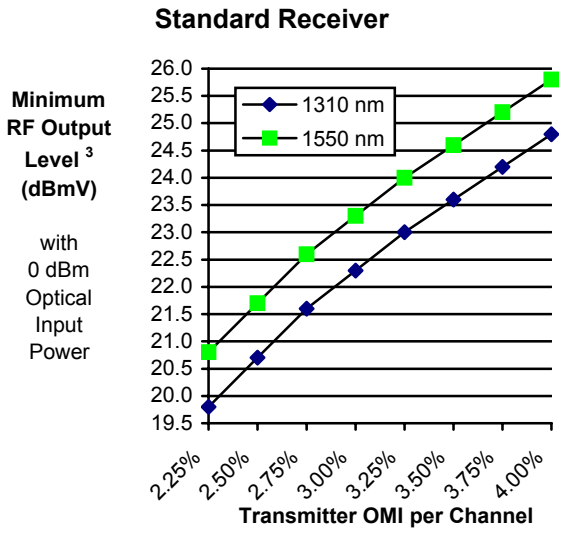
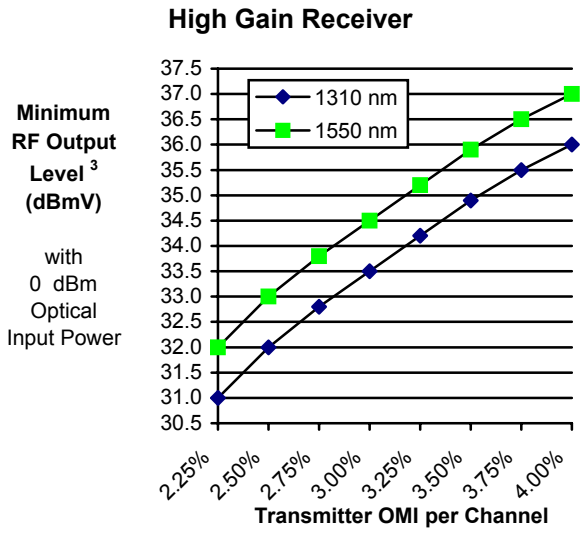
## Optical Section Specifications

| Optical Section - Forward Receiver (RX) Module | Units | Standard RX | High Gain RX | Notes |
|---|---|---|---|---|
| Wavelength | nm | 1310 and 1550 | 1310 and 1550 | |
| Optical Input Range | dBm | -3 to +2.0 | -3.0 to +1.0 | |
| Pass Band | MHz | 52-870 | 52-870 | |
| Frequency Response | dB | ± 0.75 | ± 0.75 | 1 |
| Tilt (±1.5 dB) | dB | 0 | 0 | |
| Optical Input Test Point (± 20 %) | V DC | 1V / mW | 1V / mW | 2 |
| RF Output Test Point (± 1.0 dB) | dB | - 20 | - 20 | |
| RF Output Level | dBmv | See Chart Below | See Chart Below | 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. Referenced to optical input power in milliwatts at 1310 nm.
3. Minimum receiver RF output level for the stated transmitter percent Optical Modulation Index (OMI) 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 for Model 6940/6944 and GainMaker® Optoelectronic Stations" data sheet or the "Model 6940/44 bdr Digital Reverse" data sheet(s).*

Unless otherwise noted, the above specifications reflect typical station performance at stated reference levels in the recommended Operating configuration (s). Unless otherwise noted, specifications are based on measurements made in accordance with NCTA Recommended Practices for Measurements on Cable Television Systems using standard frequency assignments and are referenced to 68°F (20°C).

# Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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## RF Section Specifications

| General Station Performance | Units | Forward | Reverse | Notes |
|---|---|---|---|---|
| Passband | MHz | 54-870 | 5-42 | |
| Amplifier Type | - - | PHD | Push-Pull | |
| Return Loss | dB | 16 | 16 | |
| Hum Modulation @ 12A | dB | 65 | 65 | |
| Hum Modulation @ 15A | dB<br>dB | 65 (54-750 MHz)<br>60 (751-870 MHz) | 65 | |
| Internal RF Test Points (± 1 dB) | dB | -20 | -20 | |
| External RF Test Points (± 1.5 dB) | dB | -30 | -30 | |

| Launch Amplifier Performance - Forward | Units | Forward | Notes |
|---|---|---|---|
| Operational Gain (minimum) | dB | 26 | 4 |
| Frequency Response | dB | ± 0.5 | |
| Internal Tilt (±1.0 dB) | dB | 9.5 | 1,3 |
| Noise Figure @ 870 MHz<br>750 MHz<br>650 MHz<br>550 MHz<br>54 MHz | dB | 11<br>11.5<br>12.5<br>13.5<br>18.5 | 2 |
| Reference Output Levels @… 870 MHz<br>750 MHz<br>650 MHz<br>550 MHz<br>55 MHz | dBmV | 47.5<br>45.7<br>44<br>42.7<br>35 | |
| Reference Output Tilt (55-870 MHz) | dB | 12.5 | 1,5 |
| **78 NTSC Channels (CW) with digital** | | | 12 |
| Composite Triple Beat | dB | 73 | 6 |
| Cross Modulation | dB | 72 | 6 |
| Composite Second Order (high side) | dB | 73 | 6 |
| **94 NTSC Channels (CW) with digital** | | | 13 |
| Composite Triple Beat | dB | 69 | 6 |
| Cross Modulation | dB | 67 | 6 |
| Composite Second Order (high side) | dB | 71 | 6 |
| **110 NTSC Channels (CW) with digital** | | | 14 |
| Composite Triple Beat | dB | 64 | 6 |
| Cross Modulation | dB | 63 | 6 |
| Composite Second Order (high side) | dB | 68 | 6 |

| **Forward Insertion Loss**<br>**Optical Interface Board and Plug-Ins**<br>(Loss from optical receiver RF output to launch amplifier RF input) | Units | With Standard Thru Jumper Board Installed | With Status Monitoring (SMC) Thru Jumper Board Installed | Notes |
|---|---|---|---|---|
| Receiver position 1 and 2 | dB | 1.5 | 2.7 | 15 |

Unless otherwise noted, the above specifications reflect typical station performance at stated reference levels in the recommended Operating configuration (s). Unless otherwise noted, specifications are based on measurements made in accordance with NCTA Recommended Practices for Measurements on Cable Television Systems using standard frequency assignments and are referenced to 68°F (20°C).

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## RF Section Specifications, continued

| Launch Amplifier Performance - Reverse | Units | 6940 Reverse | Notes |
|---|---|---|---|
| Operational Gain (minimum) | dB | 18 | 8,10 |
| Frequency Response | dB | ± 0.5 | 10 |
| Noise Figure | dB | 14 | 9,10 |
| Reference Output Levels @ 5 and 42 MHz | dBmV | 35 | 7,10 |
| **6 NTSC Channels (CW)** | | | |
| Composite Triple Beat | dB | 78 | 10 |
| Cross Modulation | dB | 71 | 10 |
| Composite Second Order | dB | 73 | 10 |

| Station Performance - Reverse (Station port input to optical transmitter input) | Units | | Notes |
|---|---|---|---|
| Amplifier Type | - - | Push Pull | |
| Operational Gain ( minimum) | dB | 14 | 11 |

| Station Delay Characteristics | | | |
|---|---|---|---|
| **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 | 16 | 5.0 - 6.5 | 39 |
| 61.25 - 64.83 | 8 | 6.5 - 8.0 | 17 |
| 67.25 - 70.83 | 5 | 8.0 - 9.5 | 8 |
| | | 37.5 - 39.0 | 15 |
| | | 39.0 - 40.5 | 19 |
| | | 40.5 - 42.0 | 27 |

**Notes for RF Section Specifications:**

1. Reference output tilt and internal tilt are both “Linear” tilt.
2. Launch amplifier forward noise figure with 1 dB input pad and 0 dB interstage equalizer (ISEQ).
3. Forward internal tilt specified with factory installed 0 dB ISEQ.
4. Launch amplifier forward gain from RF input to station output port, with 1 dB input pad and 0 dB ISEQ. The 1 dB input pad simulates the loss of an ISEQ with value greater than 0 dB, which is typically field installed to achieve desired output tilt.
5. The forward reference output tilt specified is achieved via the field installation of appropriate ISEQ, in conjunction with the internal tilt of the launch amplifier and the tilt associated with the optical link (transmitter/receiver combination).
6. 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.
7. Reverse output reference level at reverse output of RF launch amplifier.
8. Launch amplifier reverse gain from station reverse input(s) to launch amplifier RF output, with 0 dB reverse input pad, 0 dB reverse output pad, and 0 dB reverse EQ.
9. Reverse noise figure at station input with 0 dB reverse input pad, 0 dB reverse output pad and 0 dB reverse EQ.
10. All reverse specifications are with reverse switch installed.
11. Station reverse gain from station input(s) to reverse transmitter input. With 0 dB reverse input pad, 0 dB reverse output pad, and 0 dB reverse EQ in launch amplifier. Includes optical interface board losses.
12. “Digital” refers to 550-870 MHz loading with 52 QAM carriers at –6 dB relative to analog video carrier levels.
13. “Digital” refers to 650-870 MHz loading with 35 QAM carriers at –6 dB relative to analog video carrier levels.
14. “Digital” refers to 750-870 MHz loading with 19 QAM carriers at –6 dB relative to analog video carrier levels.
15. Subtract this loss from the launch amplifier forward operational gain to determine forward station gain (gain from optical receiver output to station output).

Unless otherwise noted, the above specifications reflect typical station performance at stated reference levels in the recommended Operating configuration (s). Unless otherwise noted, specifications are based on measurements made in accordance with NCTA Recommended Practices for Measurements on Cable Television Systems using standard frequency assignments and are referenced to 68°F (20°C).

# Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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## Specifications

| Electrical | Units | | | | Notes |
|---|---|---|---|---|---|
| Max. AC Through Current (continuous) | Amps | 15 | | | |
| Max. AC Through Current (surge) | Amps | 25 | | | |
| **Component DC Power Consumption** (typical) | | **@ +24 V DC** | **@ +15 V DC** | **@ -6 V DC** | 1 |
| Launch Amplifier with 5 PHD hybrids | Amps | 2.4 | - | - | |
| Optical Interface Board | Amps | 0.22 | - | - | |
| 6940/44 Status Monitoring Transponder | Amps | 0.15 | - | - | |
| 6940/44 Standard Optical Receiver | Amps | 0.25 | 0.01 | 0.035 | |
| 6940/44 High Gain Optical Receiver | Amps | 0.35 | 0.01 | 0.035 | |
| 6940/44 Optical Transmitter-Standard Gain FP | Amps | 0.14 | - | 0.07 | |
| 6940/44 Optical Transmitter-Standard Gain DFB | Amps | 0.14 | - | 0.09 | |
| 6940/44 Reverse Switch | Amps | 0.02 | - | - | |
| | | | | | |
| Power Supply DC Current Rating | Amps | 4.5 | 0.5 | 1.5 | 1 |
| Power Supply Operating Efficiency | % | 85 | | | |
| AC Input Low Voltage Cutoff | V AC | 33 | | | |
| Minimum Restart Voltage | V AC | 41 | | | |

| Station Powering Data | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6940 Station** | **$I_{DC}$ (Amps at 24 V DC)** | | **AC Voltage** | | | | | | | | | |
| | | | **90** | **85** | **80** | **75** | **70** | **65** | **60** | **55** | **50** | **45** | **41** |
| 1 Std Receiver & 1 DFB or FP Transmitter | 3.16 | AC Current (A) | 1.3 | 1.4 | 1.4 | 1.4 | 1.4 | 1.5 | 1.7 | 1.8 | 1.9 | 2.1 | 2.4 |
| | | Power (W) | 91 | 91 | 90 | 90 | 90 | 90 | 90 | 90 | 91 | 91 | 92 |
| 2 Std Receivers & 2 DFB or FP Transmitters | 3.55 | AC Current (A) | 1.4 | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 | 1.9 | 2.0 | 2.2 | 2.4 | 2.7 |
| | | Power (W) | 103 | 103 | 102 | 102 | 102 | 102 | 102 | 102 | 103 | 103 | 104 |

Data is based on stations configured for 2-way operation with status monitor transponder. AC currents specified are based on measurements made with typical CATV type ferro-resonant AC power supply (quasi-square wave), and standard version DC power supply (pn 590902).

**Note:**
1. 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** |
| 20.2 in. L x 10.8 in. H x 10.8 in. D<br>(51.3 cm L x 27.4 cm H x 27.4 cm D) | Station with 1 RX, 1 TX, 2 power supplies: 37 lbs (16.8 kg) |

# Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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## Ordering Information

The ***Prisma® Node Ordering Matrix*** provides ordering information for configured nodes. This page contains ordering information for required and optional accessories that may not be included as part of a configured node. Please consult with Sales or Access Networks Applications Engineering to determine the best configuration for your particular need.

*The following **Required Accessories** must be ordered separately (not included via Prisma Node Ordering Matrix):*

| Required Accessories for Model 6940 Node | Part Number |
|---|---|
| Plug-in Pads (attenuators)<br>• 1 required per Forward Fiber Optic Receiver Output<br>• 1 required per each Reverse RF Input used<br>• 1 required per Reverse Fiber Optic Transmitter | See Pad (attenuator) part number table |
| Plug-in Forward Equalizer - Available in 1.5 dB steps from 0 to 15 dB at 870 MHz<br>• 1 required | See EQ/Inverse EQ part number table |

*The following **Optional Accessories** may be ordered separately:*

| **Optical Transmitters, Receivers and Related Parts**<br>Note: Transmitters and Receivers include coax cable for connection to launch amplifier | **Part Number** |
|---|---|
| 6940/44 - Standard Optical Receiver with SC/APC connector | 590922 |
| 6940/44 - Standard Optical Receiver with SC/UPC connector | 590923 |
| 6940/44 - High Gain Optical Receiver with SC/APC connector * | 590926 |
| 6940/44 - High Gain Optical Receiver with SC/UPC connector * | 590927 |
| 6940 - 1310 nm FP Optical Transmitter -Standard Gain, with SC/APC connector | 590930 |
| 6940 - 1310 nm FP Optical Transmitter -Standard Gain, with SC/UPC connector | 590931 |
| 6940 - 1310 nm DFB Optical Transmitter -Standard Gain, with SC/APC connector | 590934 |
| 6940 - 1310 nm DFB Optical Transmitter -Standard Gain, with SC/UPC connector | 590935 |
| 6940 - 1550 nm DFB Optical Transmitter -Standard Gain, with SC/APC connector | 4005116 |
| 6940 - 1550 nm DFB Optical Transmitter -Standard Gain, with SC/UPC connector | 4005118 |
| SC/APC (green) Bulkhead Mating Adaptor (mounts in fiber handling tray), (qty 10) | 4006328 |
| SC/UPC (blue) Bulkhead Mating Adaptor (mounts in fiber handling tray), (qty 10) | 4006329 |
| **Plug-In Modules for 6940 870 MHz Node Optical Interface Board** | |
| Standard Thru Jumper | 717946 |
| SMC Thru Jumper (same as above but includes coupler for status monitoring RF) | 590955 |
| **Plug-In Modules for Launch Amplifier** | |
| 6940/44 – Reverse Switch (one may be ordered for each reverse input port or common path) | 590956 |
| **Related Equipment** | |
| 6940/44 – Standard DC Power Supply 40 - 90 V AC | 590902 |
| 6940/44 – Crowbar Surge Protector (qty. 10) | 4007717 |
| Redundant Control Module - Required for redundant optical receiver operation when Status Monitoring Transponder is *not* used | 741509 |
| Status Monitoring Transponder | See Transponder Data Sheet |
| 75 Ohm Transmitter Terminator (used when no TX in redundant slot) | 591133 |
| 75 Ohm SMB Terminator (for female SMB connector termination) | 591134 |
| SMB to F Test Cable Assembly | 590961 |
| 6940/44 – RF Test Probe | 562580 |

* Standard gain receiver is recommended.

## Ordering Information, continued

### Equalizers / Inverse Equalizers

| 870 MHz Linear Forward Equalizers | Part Number |
|---|---|
| 0 dB (jumper) | 717929 |
| 1.5 dB | 590986 |
| 3.0 dB | 590987 |
| 4.5 dB | 590988 |
| 6.0 dB | 590989 |
| 7.5 dB | 590990 |
| 9.0 dB | 590991 |
| 10.5 dB | 590992 |
| 12.0 dB | 590993 |
| 13.5 dB | 590994 |
| 15.0 dB | 590995 |

| 870 MHz Inverse Equalizers | Part Number |
|---|---|
| 1.5 dB | 591010 |
| 3.0 dB | 591011 |
| 4.5 dB | 591012 |
| 6.0 dB | 591013 |
| 7.5 dB | 591014 |
| 9.0 dB | 591015 |
| 10.5 dB | 591016 |

| 42 MHz Reverse Equalizers | Part Number |
|---|---|
| 0 dB (jumper) | 591056 |
| 1.5 dB | 591057 |
| 3.0 dB | 591058 |
| 4.5 dB | 591059 |
| 6.0 dB | 591060 |
| 7.5 dB | 591061 |
| 9.0 dB | 591062 |
| 10.5 dB | 591063 |
| 12.0 dB | 591064 |

### Pads (attenuators)

| Pad Value (dB) | Part Number | Pad Value (dB) | Part Number |
|---|---|---|---|
| 0 | 279500 | 0.5 | 565231 |
| 1 | 279501 | 1.5 | 565232 |
| 2 | 279502 | 2.5 | 565233 |
| 3 | 279503 | 3.5 | 565234 |
| 4 | 279504 | 4.5 | 565235 |
| 5 | 279505 | 5.5 | 565236 |
| 6 | 279506 | 6.5 | 565237 |
| 7 | 279507 | 7.5 | 565238 |
| 8 | 279508 | 8.5 | 565239 |
| 9 | 279509 | 9.5 | 565240 |
| 10 | 279510 | 10.5 | 565241 |
| 11 | 279511 | 11.5 | 565242 |
| 12 | 279512 | 12.5 | 565243 |
| 13 | 279513 | 13.5 | 565244 |
| 14 | 504151 | 14.5 | 565245 |
| 15 | 504152 | 15.5 | 565246 |
| 16 | 504153 | 16.5 | 565247 |
| 17 | 504154 | 17.5 | 565248 |
| 18 | 504155 | 18.5 | 565249 |
| 19 | 504156 | 19.5 | 565250 |
| 20 | 504157 | 20.5 | 565251 |
| 75 ohm terminator | 279524 | | |

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