GainMaker Broadband Amplifier Platform System Amplifier Modules and Housing

Installation and Operation Guide

For Your Safety

Explanation of Warning and Caution Icons

Avoid personal injury and product damage! Do not proceed beyond any symbol until you fully understand the indicated conditions.

The following warning and caution icons alert you to important information about the safe operation of this product:

You may find this symbol in the document that accompanies this product. This symbol indicates important operating or maintenance instructions.

You may find this symbol affixed to the product. This symbol indicates a live terminal where a dangerous voltage may be present; the tip of the flash points to the terminal device.

You may find this symbol affixed to the product. This symbol indicates a protective ground terminal.

You may find this symbol affixed to the product. This symbol indicates a chassis terminal (normally used for equipotential bonding).

You may find this symbol affixed to the product. This symbol warns of a potentially hot surface.

You may find this symbol affixed to the product and in this document. This symbol indicates an infrared laser that transmits intensity-modulated light and emits invisible laser radiation or an LED that transmits intensity-modulated light.

Important

Please read this entire guide. If this guide provides installation or operation instructions, give particular attention to all safety statements included in this guide.

Notices

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Contents

Safety Precautions

Protect Yourself From Electric Shock and Your System From Damage!

This product complies with international safety and design standards.

- Observe all safety procedures that appear throughout this guide, and the safety symbols that are affixed to this product.
- If circumstances impair the safe operation of this product, stop operation and secure this product against further operation.

Safety Symbols

Avoid personal injury and product damage! Do not proceed beyond any symbol until you fully understand the indicated conditions!

You will find this symbol in the literature that accompanies this product. This symbol indicates important operating or maintenance instructions.

You may find this symbol affixed to this product. This symbol indicates a live terminal; the flash points to the terminal device.

You may find this symbol affixed to this product. This symbol indicates a protective ground terminal.

You may find this symbol affixed to this product. This symbol indicates excessive or dangerous heat.

Power

Important! The power shunts must be removed before installing the unit into a powered housing. With the shunts removed, it reduces the power surge to the components and F-connectors.

CAUTION:

RF connectors and housing seizure assemblies can be damaged if shunts are not removed from the amplifier before installing or removing the amplifier module from the housing.

Continued on next page

Enclosure

- Do not allow moisture to enter this product.
- Do not open the enclosure of this product unless otherwise specified.

Cables

- Always pull on the plug or the connector to disconnect a cable. Never pull on the cable itself.

AC Shunt Power Directors

AC shunt power directors are provided with this product.

Service

Refer service only to service personnel who are authorized by Scientific-Atlanta.

Compliance

Electrical Safety

EN 50083-1/A2:1998 and IEC 60065:1998/EN 60065:1998: A notified body has issued a Certificate of Compliance according to the Low Voltage Directive of February 19, 1973. A sample of this equipment has been tested and found to be in conformity with **EN 50083-1/A2:1998 and IEC 60065:1998/EN 60065:1998.**

Important: The installer should review EN 50083-1/A2:1998 and install this product per EN 50083-1/A2:1998.

Electromagnetic Compatibility

EN 50083-2/A1: 1998: According to the provisions of the EMC Directive of May 3, 1989, a sample of this equipment has been tested and found to be in conformity with **EN 50083-2/A1: 1998.**

FCC Part 76 Subpart K: This equipment has been tested and found to comply with the limits for Part 76 of the FCC Rules. These limits provide reasonable protection against harmful interference when operating this equipment in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if the user does not install and use this equipment according to the instruction manual, it may cause harmful interference to radio communications.

> **CAUTION:**
>
> **Any changes or modification to this equipment not expressly approved by Scientific-Atlanta can void the user's authority to operate this equipment.**

Environmental Standard

IEC 529/EN 60529-A1: 1992: A sample of this equipment has been tested according to IEC 529/EN 60529-A1: 1992 and found to provide a degree of protection equal to IP 68.

Preface

About this Guide

Introduction

This guide provides the needed technical information to install and configure the GainMaker® System Amplifier modules and housings.

Who Should Read This Guide

This guide is intended for service personnel who are responsible for installing and maintaining GainMaker products. The personnel should have experience with hardware component installation.

In This Guide

This guide is divided into the following chapters and appendix.

Related Publications

Refer to the following Scientific-Atlanta publications for more information about GainMaker amplifiers.

- *GainMaker Broadband Amplifier Platform Line Extender Modules and Housings Installation and Operation Guide*, part number 593057
- *GainMaker Amplifier AGC Module Replacement Installation Instructions,* part number 748051

Chapter 1
Introducing the GainMaker System Amplifier

Overview

Introduction

The GainMaker® 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.

Chapter Contents

This chapter introduces you to the GainMaker® Broadband Amplifier Platform and contains the following topics.

Description of the GainMaker System Amplifier

Introduction

The GainMaker System Amplifier is available in the following forward bandwidth.

- 870 MHz

The GainMaker System Amplifier is available in the following amplifier types.

- High Gain Dual
- Low Gain Dual
- Unbalanced Triple
- High Gain Balanced Triple

The GainMaker System Amplifier is available in the following reverse path splits.

- 40/52 MHz
- 42/54 MHz
- 55/70 MHz
- 65/86 MHz

GainMaker Amplifier Characteristics

The GainMaker amplifier modules have the following characteristics.

- -20 dB test points, located electrically outside of the diplex filter, provide testing of forward and reverse input and output signals without disrupting normal operation
- Backward compatibility with System Amplifier II and System Amplifier III housing bottoms provides reduced upgrade costs
- Housing lids offered with or without external test point access
- Room for optional status monitoring transponder in housing lid
- Direct module plug-in to the housing provides superior amplifier heat sinking
- Symmetrical housing and modules provide convenient mounting
  - Reversible amplifier module due to diagonally positioned input and main output ports enabling installation of street-side housing lid access
- Improved AC circuitry provides 15 A of steady state current capability that is able to withstand 25 A of peak current (for a maximum of 2 hours)
- Surge Resistant Circuitry provides improved resistance to high voltage transients
- Coated housing protects outdoor equipment in coastal areas and other corrosive environments. Uncoated housing also available
- Input and output reverse pad locations to increase flexibility in reverse path design and alignment

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Power Supply

The DC power supply has the following features.

- Located in housing lid for ease of maintenance
- AC and DC test points provided on both the power supply and the amplifier board
- Selectable AC undervoltage lockout feature
  - The 30 volt lockout is for 60 volt systems (factory default)
  - The 40 volt and 50 volt lockout positions are for 90 volt systems (field configurable by moving a jumper)

Input and Output Ports

Input and output ports for the GainMaker System Amplifier are configured for each amplifier type as follows.

High Gain Dual and Low Gain Dual

These amplifiers have one input port, and two or three output ports. The number of output ports is determined by which one of the following is installed in the plug-in signal director position.

- Jumper
- Two-way splitter
- 8 dB directional coupler
- 12 dB directional coupler

Note: The Aux 1 or Aux 2 output port can be selected as the second output port in the jumper configuration. The splitter or couplers activate both Aux 1 and Aux 2 ports.

High Gain Balanced Triple and Unbalanced Triple

These amplifiers have one input port and three output ports.

Continued on next page

Configuration

All GainMaker System Amplifiers are configured with the following.

- Diplex Filters
- Reverse Amplifier
- Forward Interstage Equalizer
- Forward Interstage and Output Attenuator Pads

Test Points

There are nine RF and four voltage test points on the GainMaker System Amplifier.

AC Shunt Power Directors

The GainMaker System Amplifier has four AC shunt power directors located near the ports of the amplifier which are used to direct AC current to and from the amplifier input and output ports.

GainMaker Amplifier Ordering

For the latest available amplifier ordering information, contact your Scientific-Atlanta customer representative, or visit the Scientific-Atlanta website.

Note: A station consists of a configured amplifier module with a complete housing, power supply, and wiring harness.

Accessories

Introduction

The GainMaker System Amplifiers are equipped to work with the following customer installable and miscellaneous accessories.

Customer Installable Accessories for All Amplifiers

The following table lists the customer installable accessories and their part number.

Note: All GainMaker System Amplifier accessories are unique to the GainMaker Broadband Amplifier Platform product line.

Accessory	Part Number
Attenuator pads	589693 through 589734 0 dB through 20.5 dB in 0.5 dB Increments
75 ohm terminator	589735 In Attenuator Pad Package
Forward Equalizer	
Jumper	589260
870 MHz	589261 through 589278 1.5 dB through 27 dB in 1.5 dB Increments
750 MHz	589306 through 589323 1.5 dB through 27 dB in 1.5 dB Increments
Inverse Equalizer 750 MHz/870 MHz	589325 through 589334 1.5 dB through 15 dB in 1.5 dB Increments
Reverse Equalizer	
Jumper	712719
40 MHz 42 MHz	589628 through 589639 1 dB through 12 dB in 1 dB Increments
55 MHz	712679 - 712690 1 dB through 12 dB in 1 dB Increments
65 MHz	589736 through 589747 1 dB through 12 dB in 1 dB Increments

Continued on next page

Accessory	Part Number
3-State Reverse Switch	589347
Power Supply	734771
Trim Network	714446
System Trim Jumper	589285

Customer Installable Accessories for the High Gain Dual and Low Gain Dual Only

The following table lists additional customer installable accessories that are available for the High Gain Dual and Low Gain Dual only. These accessories plug into the signal director position.

Accessory	Part Number
Jumper	589281
Splitter	589357
DC-8 directional coupler	589363
DC-12 directional coupler	589367

Miscellaneous Accessories

The following table contains the miscellaneous accessories used with all GainMaker System Amplifiers, and their part numbers.

Accessory	Part Number
Surge protector	715973
Status monitoring transponder	715980

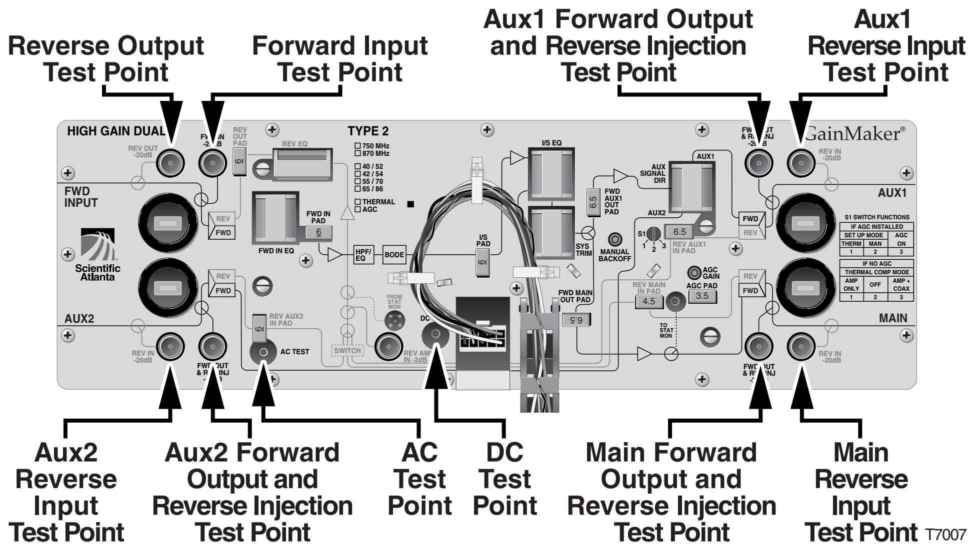
Illustrations

System Amplifier Test Points

The following diagram shows the test points of the High Gain Dual amplifier module.

Notes:

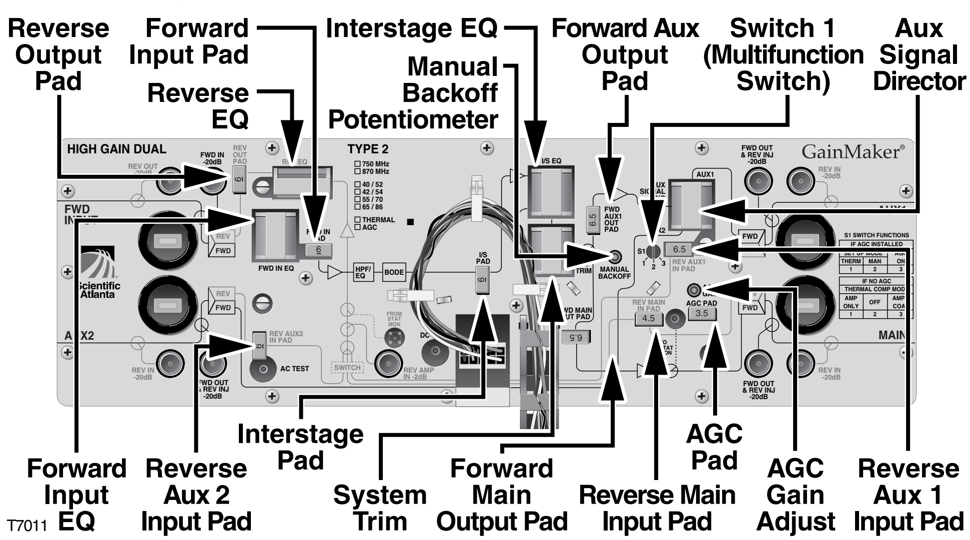
- The test point locations are the same for all GainMaker System Amplifiers.
- Test points shown are -20 dB, except for AC and DC test points.



High Gain Dual and Low Gain Dual Accessories

The following diagram shows the accessory locations of the High Gain Dual amplifier module.

Note: The accessory locations are the same for the High Gain Dual and Low Gain Dual GainMaker System Amplifiers.



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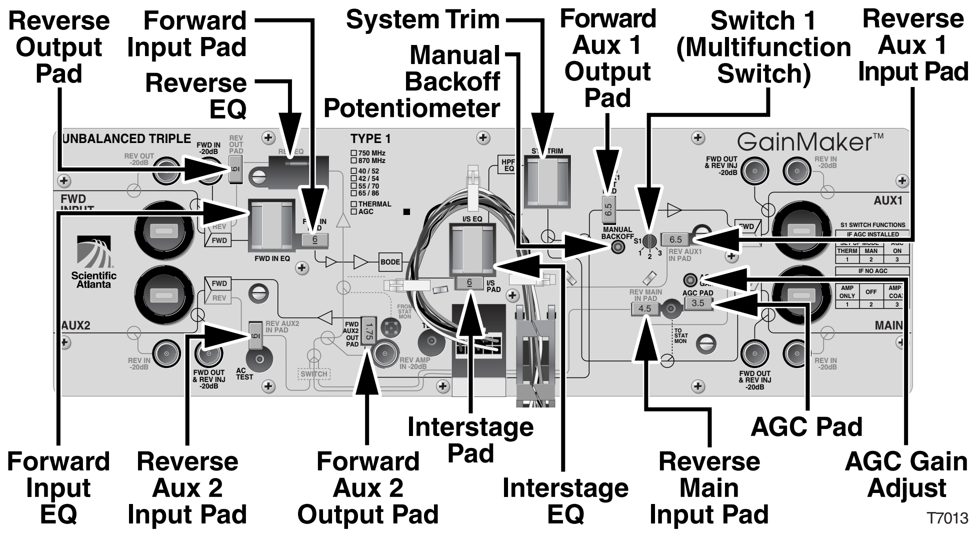
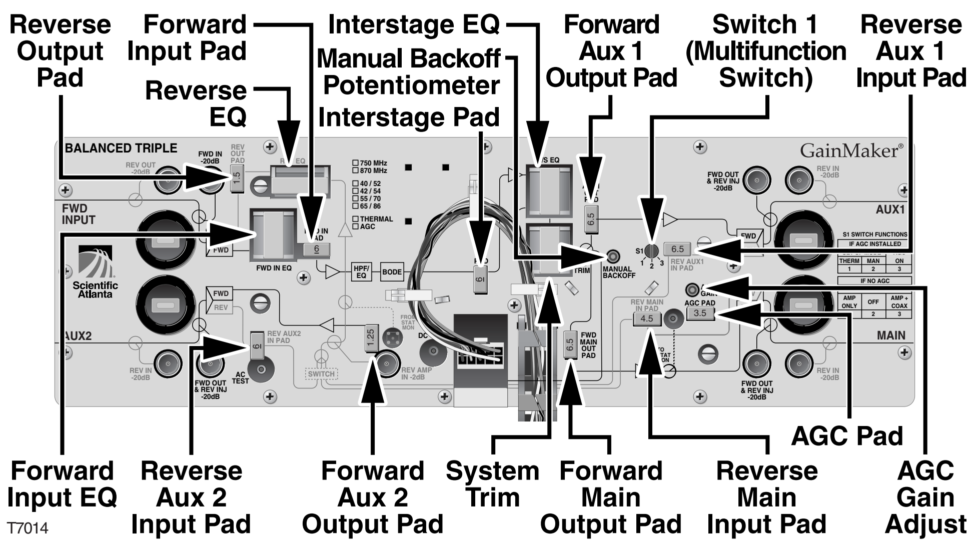
Unbalanced Triple Accessories

The following diagram shows the accessory locations of the Unbalanced Triple amplifier module.



High Gain Balanced Triple Accessories

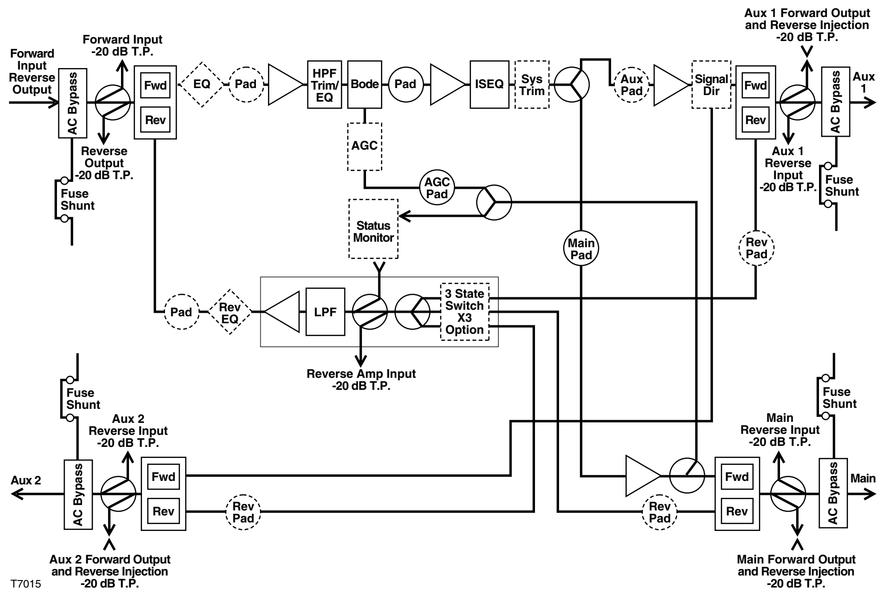
The following diagram shows the accessory locations of the High Gain Balanced Triple amplifier module.



Block Diagrams

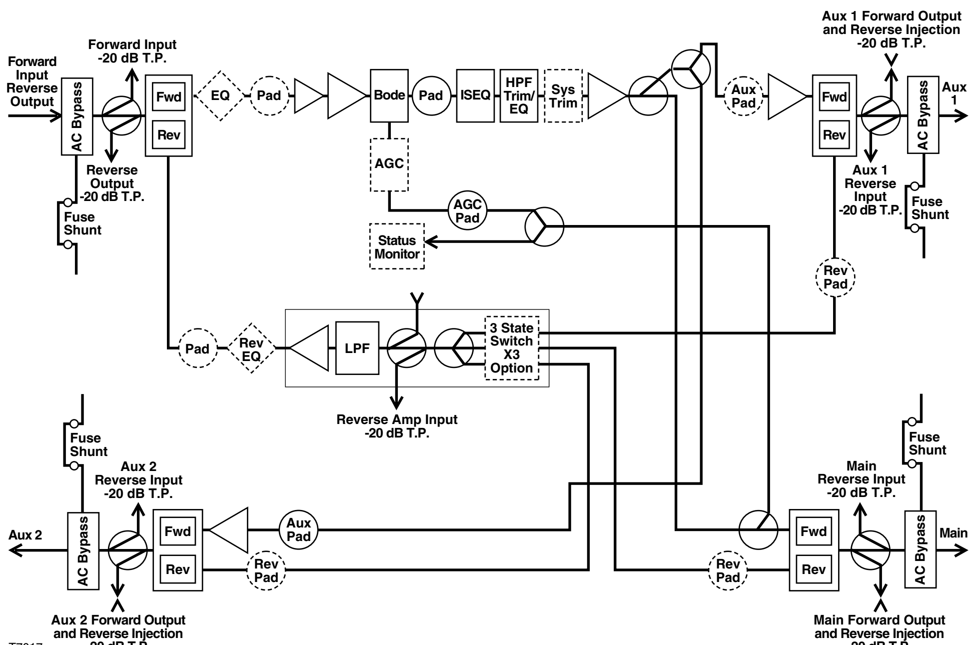
High Gain Dual and Low Gain Dual

The following illustration is a block diagram of the High Gain Dual amplifier module.



Unbalanced Triple

The following illustration is a block diagram of the Unbalanced Triple amplifier module.



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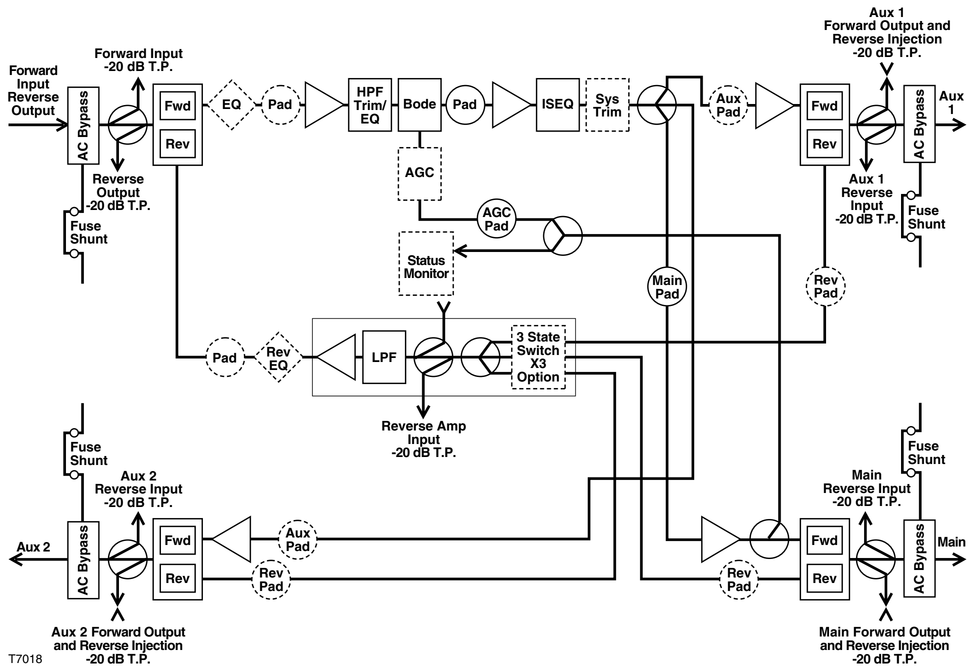
High Gain Balanced Triple

The following illustration is a block diagram of the High Gain Balanced Triple amplifier module.



Chapter 2
Installing and Configuring the GainMaker System Amplifier

Overview

Chapter Contents

This chapter is divided into three sections and provides instructions for installing and configuring the GainMaker System Amplifier in your cable system.

Section A
Installing the Housing

Overview

Section Contents

This section provides requirements and procedures for installing the GainMaker System Amplifier housing in the distribution system and contains the following topics.

Before You Begin

Overview

The procedures in this section assume you have completed the following:

- Prepared the installation site
- Located the coaxial cable, with or without the pin-type coaxial connectors mounted on the cable

Required Tools

Before you start, make sure you have the following tools:

- Torque wrench with a 1/2-in. socket
- Heavy-duty wire cutters or snips

Amplifier Module Cover

GainMaker amplifier modules have an aluminum cover attached to the chassis with 14 self-tapping screws. Normal field maintenance will not require the removal of this cover.

Module and Housing Compatibility

Housing Lid

The GainMaker amplifier module is compatible with the GainMaker housing lid only. The GainMaker amplifier module will not work with System Amplifier III housings lids, and System Amplifier II or II+ housing lids.

Housing Base

The GainMaker system amplifier module is compatible with the GainMaker housing base. The GainMaker system amplifier module will also work with System Amplifier III housing bases, and System Amplifier II or II+ housing bases.

Important: GainMaker system amplifier modules are marked with a blue label to indicate 15 ampere capability. The RF connectors in these modules are also blue. The GainMaker amplifier module must be used in conjunction with a 15 ampere capable housing base which is marked with a blue label.

Note: 15 ampere capable System Amplifier III housings with the blue label and System Amplifier II or II+ housings that have been upgraded to 15 ampere capability with an available seizure upgrade kit are compatible with GainMaker system amplifier modules.

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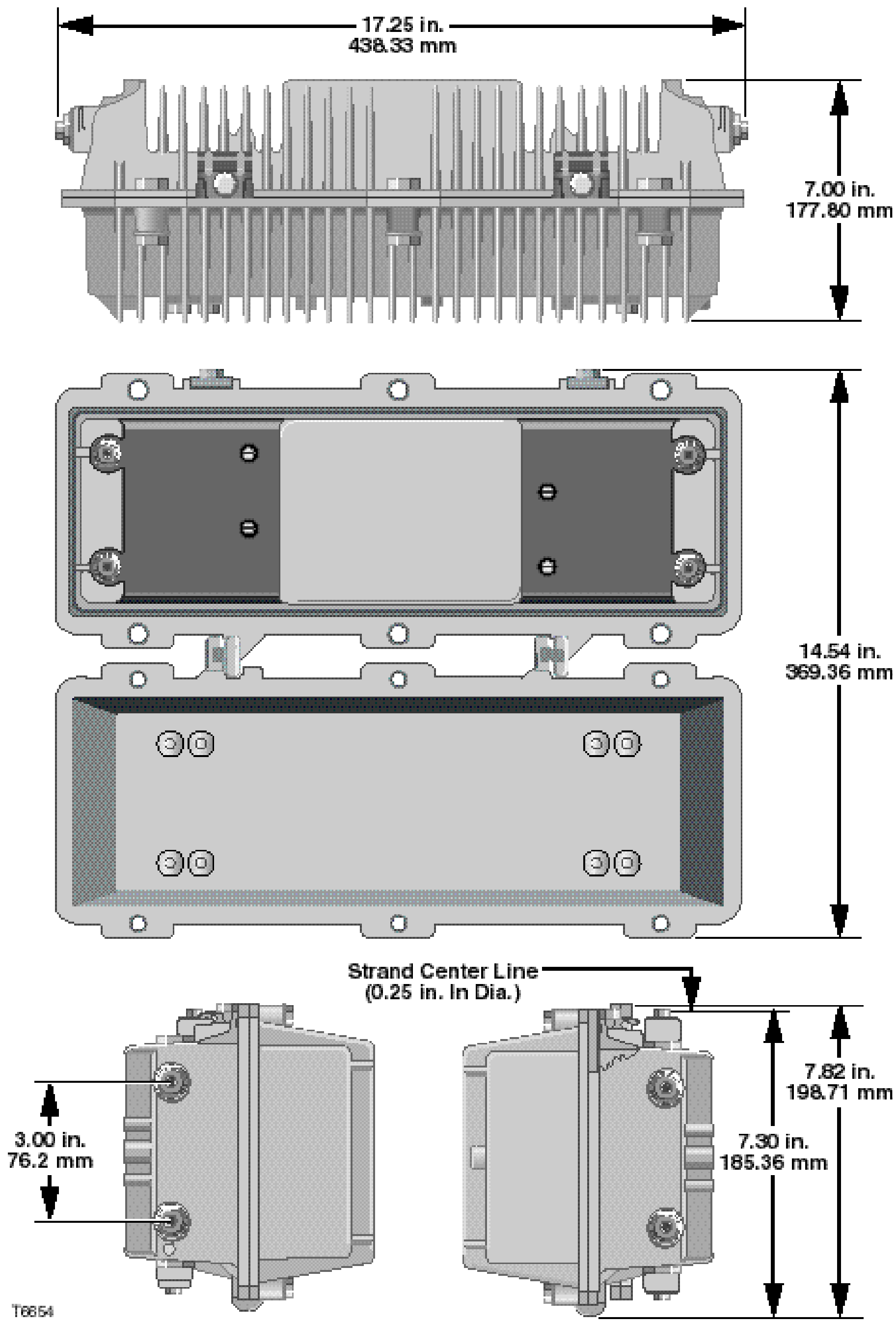
Measurements

The diagram below shows dimensions, in inches and millimeters, of the system amplifier housing with a standard lid. Use these measurements to calculate clearance requirements for your installation.



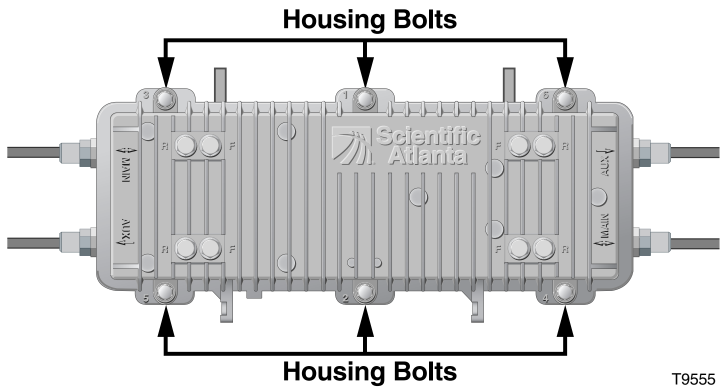
Opening the Housing

Opening the GainMaker Amplifier Housing

Follow these steps to open the GainMaker amplifier housing.

Important: Before unscrewing the housing bolts, make sure the removable locking screw in the hinge is in place and secure. The locking screw prevents separation of the lid from the base.

1. Unscrew the six ½-in. closure bolts until they are loose.



2. Open the housing.

   Note: The closure bolts will remain attached to the housing.

Closing the Housing

Closing the GainMaker Amplifier Housing

Follow these steps to close the GainMaker amplifier housing.

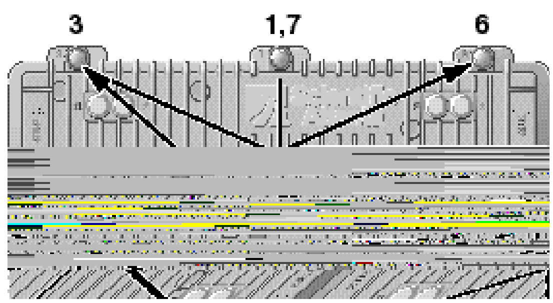
> ⚠ **CAUTION:**
>
> **Avoid moisture damage and RF leakage! Follow the procedure *exactly* as shown below to ensure a proper seal.**

1. Inspect the housing gasket and all mating surfaces. Wipe off any dirt and debris.
2. Close the housing and finger-tighten all closure bolts.
3. Use a torque wrench with a 1/2-in. socket to tighten each closure bolt from 5 ft-lb to 12 ft-lb (6.8 Nm to 16.3 Nm) each.

   The tightening sequence is shown in **Torquing Sequence**. Follow the numbered sequence to tighten the closure bolts.

Torquing Sequence

The following diagram shows the proper torquing sequence for the system amplifier housing's closure bolts.



Upgrading Existing Housing Seizures

Introduction

The GainMaker amplifiers have a higher current-carrying capacity than some earlier amplifier products. If you are replacing an earlier amplifier with a GainMaker amplifier, you may need to upgrade the housing bottom to handle the higher current demands.

The 15 A amplifier housings have silver-plated 0.063 in. diameter pins in the seizures. The plastic material in the seizures and anvils are glass filled in order to handle higher AC currents, as well as higher temperatures.

The 15 A amplifier modules have a newly designed RF connector that accepts 0.063 in. diameter pins that are rated for higher current applications.

Note: The RF connectors, seizures, and anvils are blue for ease of identification.

Installing the New Housing Seizures

Follow these steps to upgrade an amplifier housing to 15 A current capacity.

Important! The power shunts must be removed before installing the unit into a powered housing. With the shunts removed, it reduces the power surge to the components and F-connectors.

> ⚠ **CAUTION:**
>
> **RF connectors and housing seizure assemblies can be damaged if shunts are not removed from the amplifier before installing or removing the amplifier module from the housing.**

1. If an amplifier module is installed in the housing, you must remove it before continuing. Refer to **Removing the Amplifier Module from the Housing** in Section C of this Chapter.

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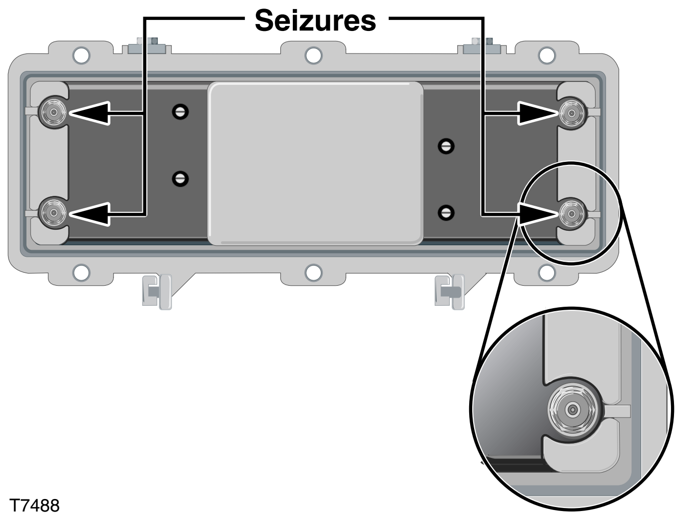
2. Using a 0.5-in. nut driver, remove the seizures from the housing. See the diagram below.



3. Using the 0.5-in nut driver, replace the new seizure screws from the upgrade kit onto the housing (part number 548775).

4. Is the coaxial cable connected to the housing?
   - If **yes**, tighten each seizure screw from 2 ft-lb to 5 ft-lb (2.7 Nm to 6.8 Nm).
   - If **no,** proceed to **Connecting the Coaxial Cable to the GainMaker Amplifier Housing.**

5. Place the blue stickers on the outside of the housing between the ports to indicate upgrading has been completed.

Upgrading an Existing Housing Lid

Introduction

The GainMaker amplifiers have a new style housing lid that allows easier access to the system amplifier power supply. If you are replacing an earlier amplifier with a GainMaker amplifier, you will have to replace the existing housing lid with a newer housing lid to accommodate the power supply for the GainMaker amplifier module.

Installing the New Housing Lid

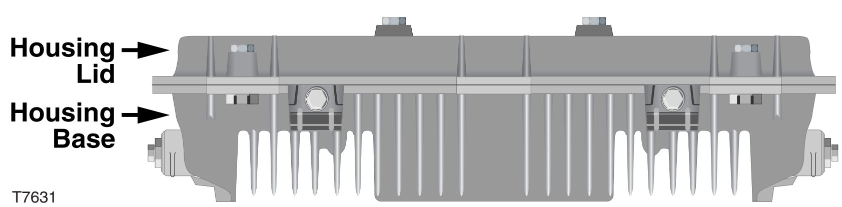
Follow these steps to upgrade an amplifier housing with the newer housing lid.

> **CAUTION:**
>
> **RF connectors and housing seizure assemblies can be damaged if shunts are not removed from the amplifier before installing or removing the amplifier module from the housing.**

> **WARNING:**
>
> **Before starting this procedure in an aerial or strand mounted application, be sure to clear the area below the housing of all people, and if possible, property.**

> **CAUTION:**
>
> **In an aerial or strand mounted application, you will need to take steps to ensure that the housing lid does not fall to the ground. See the following recommended procedure.**

1. Use a torque wrench to loosen the six housing bolts in the housing lid.



2. Firmly grasp the housing lid and open.

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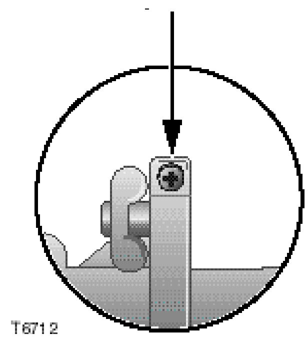
3. Using a screwdriver, remove the hinge screw from the housing hinge. The housing lid will now swivel completely open, allowing it to be removed from the housing base.

> ⚠ **WARNING:**
>
> **It is possible for the housing lid to separate from the housing base and fall to the ground, possibly causing injury or damage to persons or property below.**

Hinge Screw



Important: Place the old housing lid in a safe place until it can be disposed of properly.

4. Firmly grasp the new GainMaker housing lid and place it onto the housing bottom, swiveling it into place on the housing hinge.

> ⚠ **WARNING:**
>
> **It is possible for the housing lid to separate from the housing base and fall to the ground, possibly causing injury or damage to persons or property below.**

5. Using a screwdriver, replace the hinge screw in the housing hinge.

Installing the Power Supply

Preparing for Installation

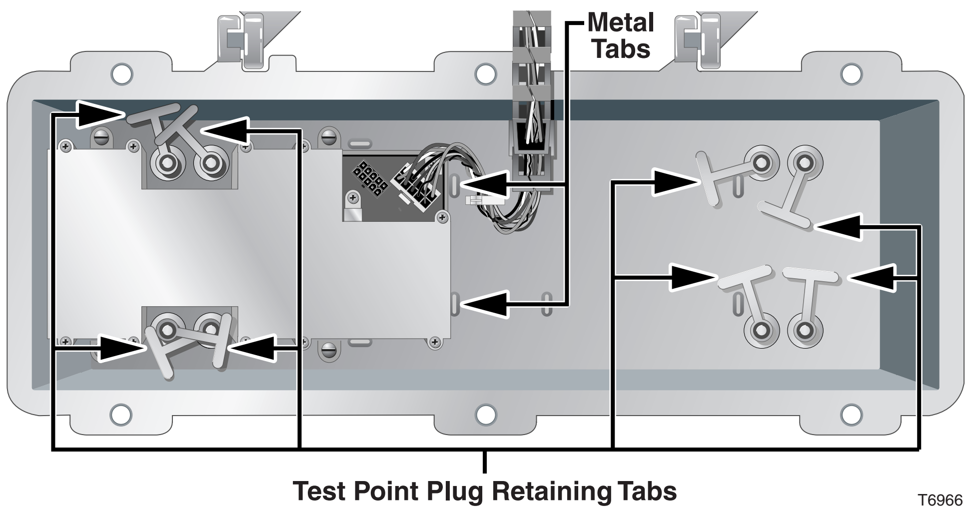
Important: The AC shunt power directors must be removed before installing the unit. With the AC shunt power directors removed; it reduces the power surge to the components and F-connectors.

> ⚠ **CAUTION:**
>
> **RF connectors and housing seizure assemblies can be damaged if AC shunt power directors are not removed from the amplifier before installing or removing the amplifier module from the housing.**

Installing the Power Supply Module

Follow this procedure to install the GainMaker amplifier power supply module in the GainMaker amplifier housing lid.

1. Start with the GainMaker amplifier housing open. The power supply is installed in the GainMaker amplifier housing lid.
2. Install the power supply module in the power supply cavity.



Notes:

- There is only one correct way to install the power supply module. Use the two metal tabs as a guide to position the power supply module correctly inside the power supply cavity.
- Be sure that the plastic retaining tabs that secure the test point plugs to the housing lid are not pinched between the power supply and the interior of the housing lid. This will make it difficult to open the test point plug.

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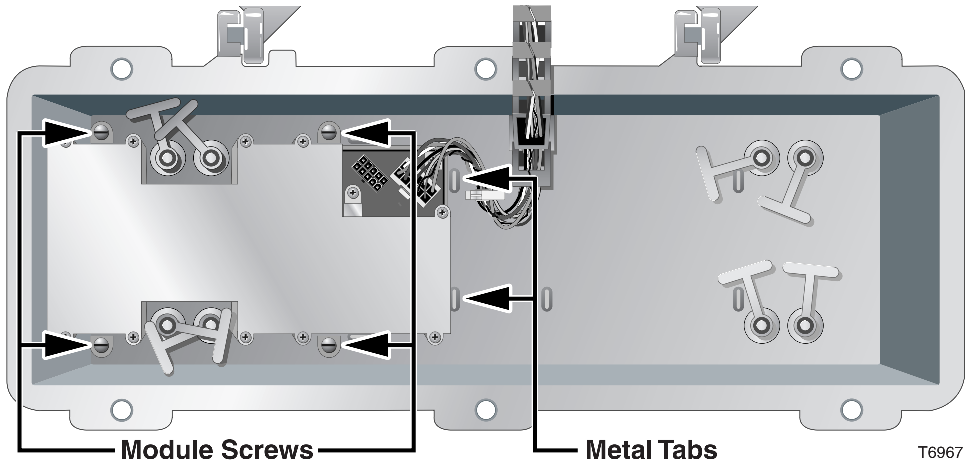
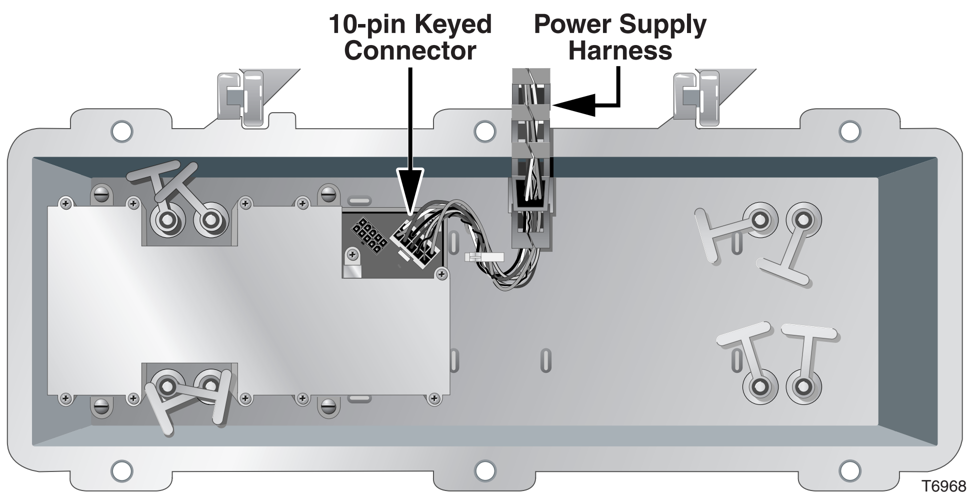
3. Tighten the four module screws on the power supply module to 6.2 in-lb (70 N-cm).



4. Attach the 10-pin keyed connector of the power cable and harness to the power supply module.



Note: The 10-pin keyed connector can be connected one way only. Be sure the connector installs securely to the power supply board.

5. Proceed to **Setting the Selectable AC Undervoltage Lockout Selector**.

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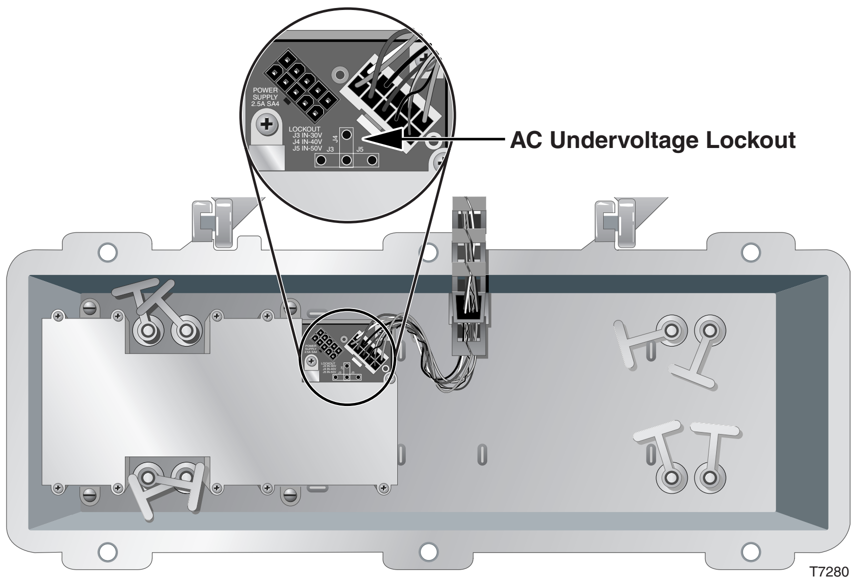
Setting the AC Undervoltage Lockout Selector

Set the AC Undervoltage Lockout Selector for your powering application as specified by your system engineering guidelines.

Undervoltage Lockout Setting	Application
30V Lockout	60 V AC System
40V Lockout	90 V AC System
50V Lockout	90 V AC System

1. Locate the AC Undervoltage Lockout Selector on the power supply in the GainMaker housing lid.



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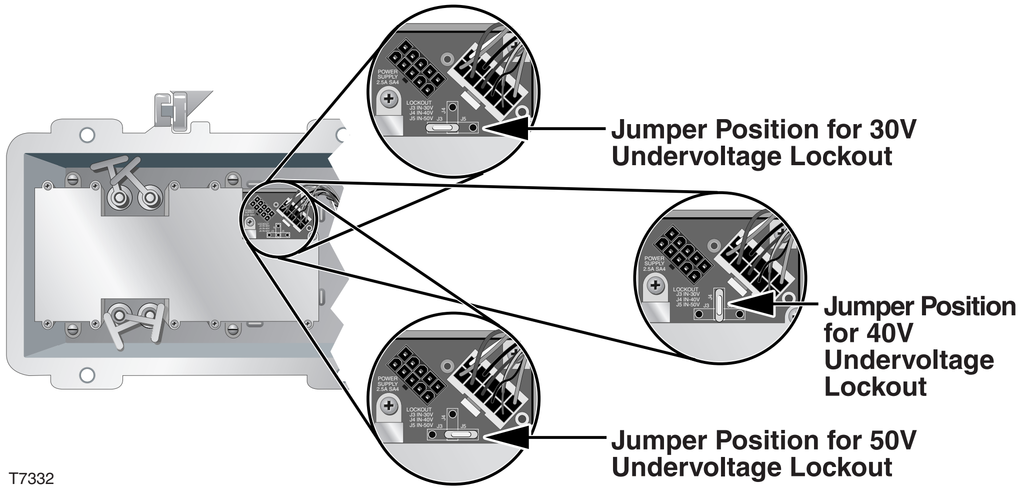
2. Set the AC Undervoltage Lockout Selector for your powering application as illustrated in the following diagram.



Note: The AC Undervoltage Lockout Selector positions are also noted on the power supply.

3. Proceed to **Attaching the Coaxial Connectors**.

Attaching the Coaxial Connectors

Trimming the Center Conductor

The GainMaker amplifier requires pin-type connectors for all RF connections.

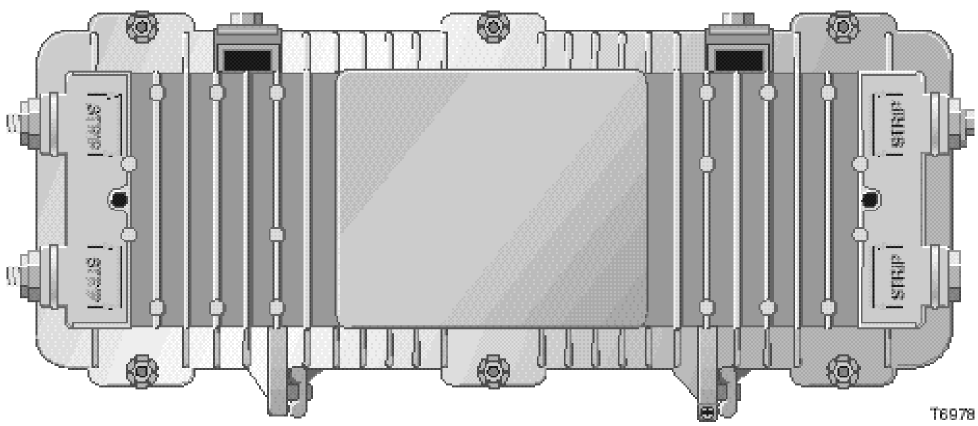
Standard pin connectors, with pins extending 1.5 in. to 1.6 in. (3.8 cm to 4.1 cm) from the connector shoulder, require no trimming. You must trim longer pins before inserting them into the housing.

To trim longer pins, follow the steps below.

1. Place the connector above the entry port so that it lines up with its installed position.
2. If the center conductor pin extends past the **STRIP** line on the housing, trim the pin flush to the **STRIP** line. See the section entitled **Center Conductor Trim Length**.

Center Conductor Trim Length

The following diagram shows a visual guide of the center conductor trim length.



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Connecting the Coaxial Cable to the GainMaker Amplifier Housing

Follow these steps to connect the coaxial cable to the GainMaker amplifier housing.

1. Begin this procedure with the amplifier housing open.
2. If the center conductor pin extends more than the length specified in **Trimming the Center Conductor**, trim the pin with heavy-duty wire cutters.
3. Insert the appropriate coaxial connector into the housing at the desired housing port. Tighten the connector nut according to the manufacturer's specifications.
4. Tighten the seizure screw from 2 ft-lb to 5 ft-lb (2.7 Nm to 6.8 Nm).
5. Repeat steps 2 through 4 for each RF port used.
6. If RF is present at an unused port, insert a 75 Ohm housing terminator into the port and tighten from 2 ft-lb to 4 ft-lb (2.7 Nm to 5.4 Nm).

   If RF is not present at an unused port, insert a housing plug into the port and tighten from 2 ft-lb to 4 ft-lb (2.7 Nm to 5.4 Nm).
7. Proceed to **Installing the Housing.**

Installing the Housing

Overview

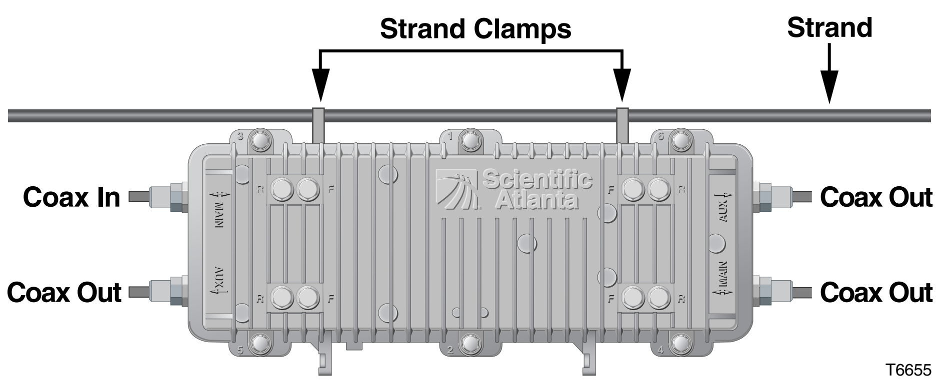
The following procedures detail how to install the GainMaker amplifier on a strand (aerial) or in a pedestal.

Strand (Aerial) Installation

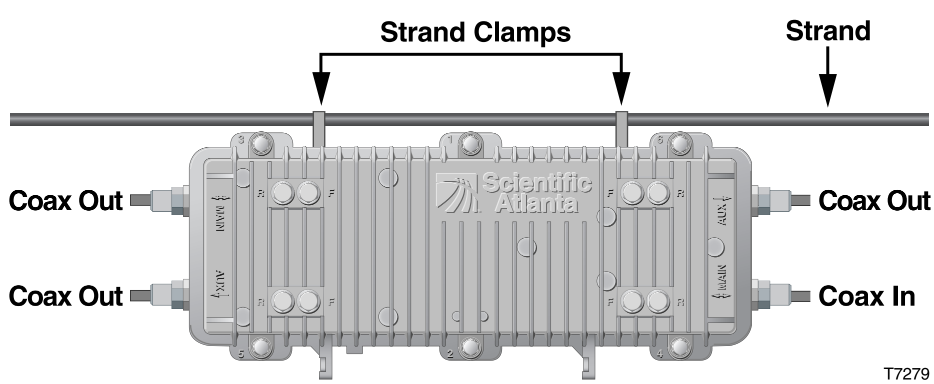
Follow these steps to install the housing on an (aerial) strand. The housing does not need to be opened for strand installation.

1. Loosen the strand clamp bolts.
2. Lift the housing into proper position on the strand.
3. Slip the strand clamps over the strand and finger-tighten the clamp bolts. This allows additional movement of the housing as needed.
4. Move the housing as needed to install the coaxial cable and connectors. See the diagram below for an example.

Signal Flow from Left to Right



Signal Flow from Right to Left



Note: Coax In may be switched with the Coax Out if you reverse the amplifier module and feed the signal from right to left.

Continued on next page

5. Tighten the strand clamp bolts (using a ½-inch torque wrench) from 5 ft-lb to 8 ft-lb (6.8 Nm to 10.8 Nm). Make sure there is good mechanical contact between the strand and the housing.

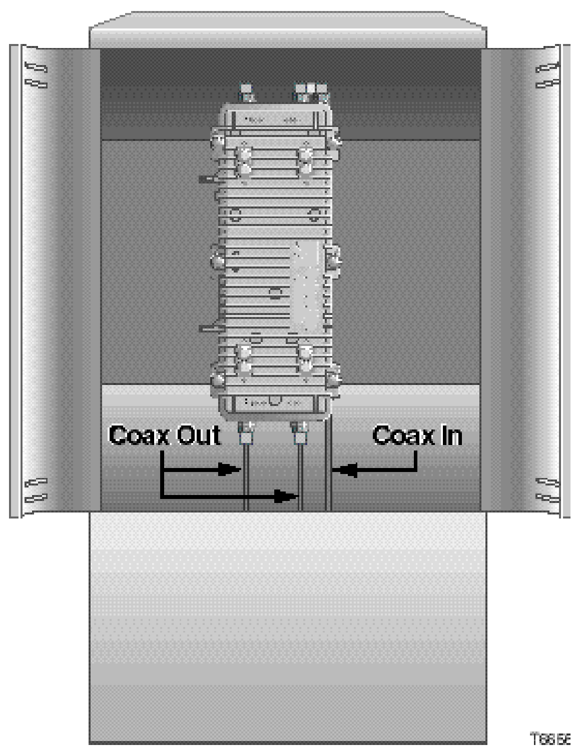
   Note: A slight tilt of the face of the housing is normal. Cable tension will cause the housing to hang more closely to vertical.

6. Connect the coaxial cable to the pin connector according to the connector manufacturer's specifications.
7. Proceed to Section B, **Configuring the GainMaker Amplifier Module.**

Pedestal Installation

Follow these steps to install the amplifier housing in a pedestal.

1. Remove the cover of the pedestal.
2. Remove the self-tapping bolts from the strand clamps and set the bolts and strand clamps aside.
3. Position the housing in the pedestal frame as shown below. Line up the self-tapping bolt holes on the bottom of the housing with the mounting holes on the bracket.



Note: The housing mounts to the bracket provided by the pedestal manufacturer.

Continued on next page

4. Secure the housing to the bracket by using the bolts that you removed in step 2. Use the strand clamps as spacers if necessary. Torque the bolts from 8 ft-lb to 10 ft-lb (10.8 Nm to 13.6 Nm).

5. Connect the coaxial cable to the pin connector according to the connector manufacturer’s specifications.

6. Proceed to **Configuring the GainMaker Amplifier Module.**

Section B
Configuring the GainMaker Amplifier Module

Overview

Scope of This Section

This section provides requirements and procedures for configuring the GainMaker amplifiers and contains the following topic.

Note: Install all desired accessories into the amplifier module before installing the amplifier module into the housing.

Installing Accessories

Installing the Attenuator Pads

To install the attenuator pads in the amplifier, follow the steps below.

Note: For best results, follow this installation procedure exactly.

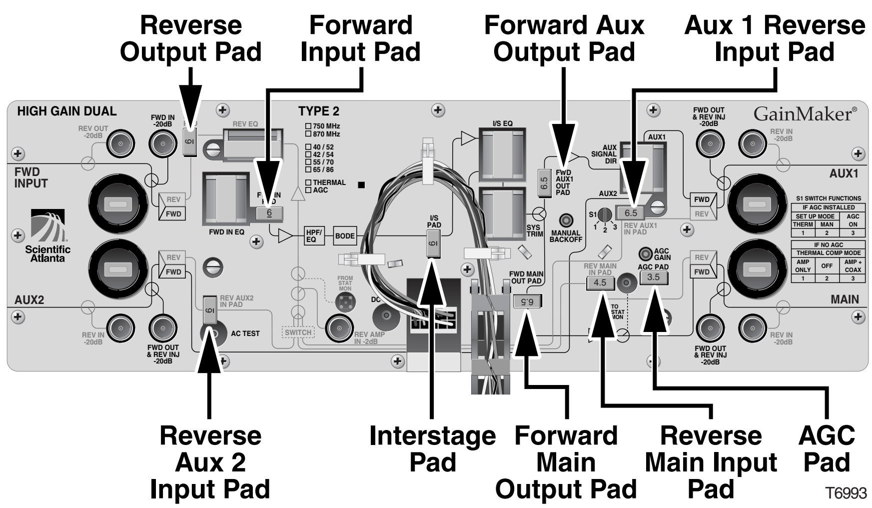
1. Begin this procedure with the housing open. Refer to **Opening the Housing** in Section A.

   Note: These accessories can be installed without removing the amplifier cover.

2. Install the pad(s) specified by the design print in the appropriate pad slot(s). For a list of available GainMaker amplifier accessory pad values and part numbers, see Appendix A.

   Notes:

   - Be sure all the pins on the attenuator pad bottom align with the pin holes in the attenuator pad slot, allowing the attenuator pad to install flat against the amplifier module.
   - The High Gain Dual system amplifier is shown here. Locations for attenuator pads are approximately the same for all GainMaker system amplifiers.
   - The forward aux output pad, forward interstage pad, and forward main output pad are installed at the factory to set the operational gain of the station. These pads should not be changed in the field, unless specified by system design.
   - The AGC pad is required for AGC equipped stations only.



3. Install other options or accessories as desired, or proceed to Section C, **Installing the Amplifier Module**.

Continued on next page

Installing the Equalizers

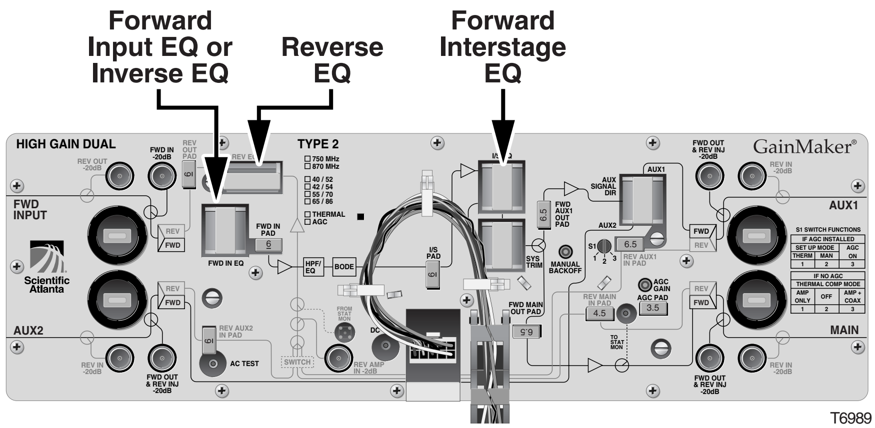
To install the equalizers in the amplifier, follow the steps below.

Note: For best results, follow this installation procedure exactly.

1. Begin this procedure with the housing open. Refer to **Opening the Housing** in Section A.

   Note: These accessories can be installed without removing the amplifier cover.

2. Install the forward input equalizer specified by the design print in the forward input equalizer slot. Or, install the correct inverse equalizer specified by the design print for your system in the forward input equalizer slot.



Notes:

- Be sure all the pins on the forward input equalizer or inverse equalizer bottom align with the pinholes in the equalizer slot, allowing the equalizer to install flat against the amplifier module.
- The same inverse equalizer is used for either 750 MHz or 870 MHz. The above chart shows the cable equivalent values at both frequencies.
- The High Gain Dual system amplifier is shown here. Locations for EQs are the same for all GainMaker system amplifiers.
- The forward interstage equalizer is installed at the factory and should not be changed in the field. While it is an 870 MHz equalizer, it is appropriate for use in both 870 MHz and 750 MHz system applications.
- The plug-in interstage equalizer and an on-board interstage equalizer combine to produce the total internal tilt for the station. The plug-in interstage equalizer value is different from one type of amplifier to another by design, in order to achieve optimum performance.

Continued on next page

3. Install the reverse equalizer specified by the design print in the reverse equalizer slot. For the exact location of the reverse equalizer, refer to the illustrations on the previous page.

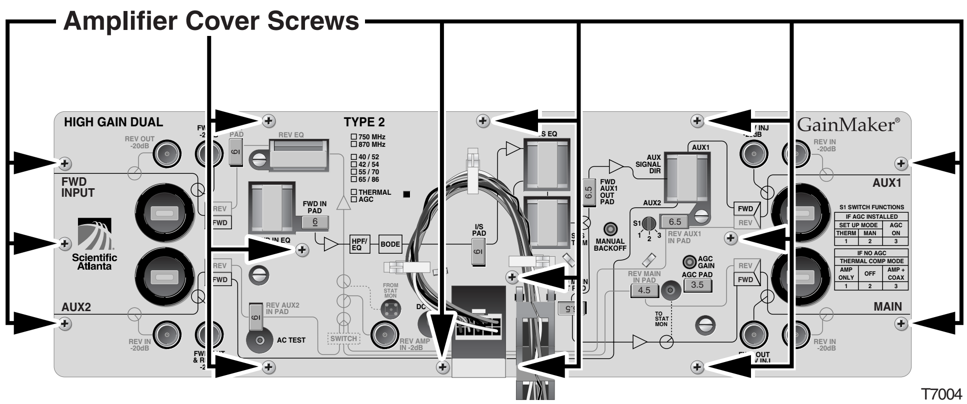
4. Install other options or accessories as desired, or proceed to Section C, **Installing the Amplifier Module**.

Installing the Surge Protector

To install the surge protector in the amplifier, follow the steps below.

1. Begin this procedure with the housing open. Refer to **Opening the Housing** in Section A.

2. Remove the amplifier cover by loosening the amplifier cover screws.



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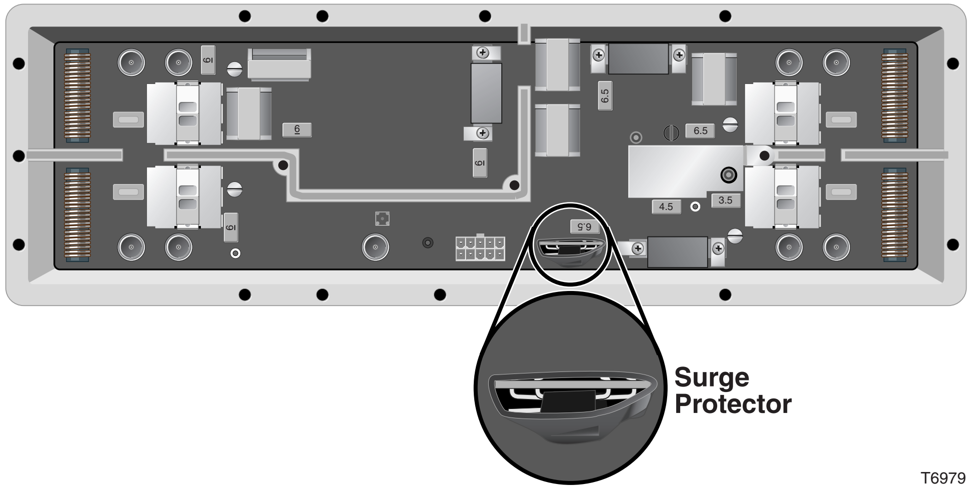
3. Install the crowbar surge protector in the surge protector slot. Refer to the illustration below.



Notes:

- Be sure all the pins on the surge protector bottom align with the pinholes in the surge protector slot, allowing the surge protector to install flat against the amplifier module.
- Make sure the components face the outside of the station (see the diagram above for proper positioning). Heat shrink tubing has been added to prevent shorting.

4. Replace the amplifier cover and tighten the amplifier cover screws from 10 in –lb to 12 in-lb (1.3 Nm to 1.4 Nm).

5. Install other options or accessories as desired, or proceed to **Section C, Installing the Amplifier Module**.

Continued on next page

Installing the Plug-in Signal Director (High Gain Dual and Low Gain Dual Only)

To install the signal director in the amplifier, follow the steps below.

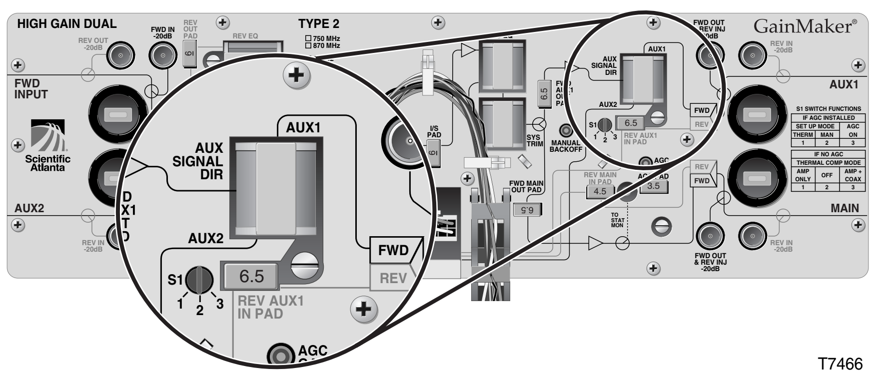
1. Open the housing. Refer to **Opening the Housing** in Section A.

   Note: This accessory can be installed without removing the amplifier cover.

2. Be sure to install the correct signal director for your system as specified by the design print.

If you are installing a ...	This will ...
Jumper, part number 589281	activate only one auxiliary port.
Splitter, part number 589357	activate both auxiliary ports with equal signal levels.
8 dB Coupler, part number 589363 or 12 dB Coupler, part number 589367	activate both auxiliary ports with differing signal levels.

3. Install the signal director in the signal director slot. Refer to the following diagram.



Important: Be sure the signal director is oriented in the proper direction for your system. Rotating the signal director in the slot will change which ports are activated with which signal. Refer to the following table to determine the orientation appropriate for your system installation.

Note: Be sure all the pins on the signal director bottom align with the pin holes in the signal director slot, allowing the signal director to install flat against the amplifier module.

Continued on next page

Jumper

To Activate the …	Orient the Jumper …
AUX 1 port	so that the word “Thru” on the jumper label is next to the word “AUX 1” on the amplifier module cover.
AUX 2 port	so that the word “Thru” on the jumper label is next to the word “AUX 2” on the amplifier module cover.

Splitter

To Activate the …	Orient the Splitter …
AUX 1 port and AUX 2 port	so that the word “AUX 1” on the jumper label is next to the word “AUX 1” on the amplifier module cover and so that the word “AUX 2” on the jumper label is next to the word “AUX 2” on the amplifier module cover.

Important: Do **NOT** reverse the Splitter in the signal director slot as this could degrade the amplifier signal.

8 dB Coupler

To Activate the …	Orient the Coupler …
AUX 1 port with an 8 dB “tap leg” signal and AUX 2 port with a “thru leg” signal	so that the “8” on the jumper label is next to the word “AUX 1” on the amplifier module cover and so that the word “Thru” on the jumper label is next to the word “AUX 2” on the amplifier module cover.
AUX 2 port with an 8 dB “tap leg” signal and AUX 1 port with a “thru leg” signal	so that the “8” on the jumper label is next to the word “AUX 2” on the amplifier module cover and so that the word “Thru” on the jumper label is next to the word “AUX 1” on the amplifier module cover.

Continued on next page

12 dB Coupler

To Activate the …	Orient the Coupler …
AUX 1 port with a 12 dB "tap leg" signal and AUX 2 port with a "thru leg" signal	so that the "12" on the jumper label is next to the word "AUX 1" on the amplifier module cover and so that the word "Thru" on the jumper label is next to the word "AUX 2" on the amplifier module cover.
AUX 2 port with a 12 dB "tap leg" signal and AUX 1 port with a "thru leg" signal	so that the "12" on the jumper label is next to the word "AUX 2" on the amplifier module cover and so that the word "Thru" on the jumper label is next to the word "AUX 1" on the amplifier module cover.

4. Install other options or accessories as desired, or proceed to Section C, **Installing the Amplifier Module.**

Section C
Installing the GainMaker Amplifier Module

Overview

Section Contents

This section provides requirements and procedures for installing the GainMaker amplifier module in the housing.

Installing the Amplifier Module in the Housing

Introduction

The amplifier module plugs into the strand-mounted or pedestal-mounted (bottom) half of the housing via RF connectors on the bottom side of the module.

Amplifier housings and amplifier modules are designed so you can orient the amplifier module conveniently for maintenance. The amplifier module is reversible since the input and main output ports are located diagonally across from each other. Therefore, you may orient all of the amplifier housings to open either to the road side or to the field side. The amplifier is then installed in the appropriate position, either right side up or upside down.

Procedure for Installing the Amplifier Module

Follow these steps to install the amplifier module in the housing.

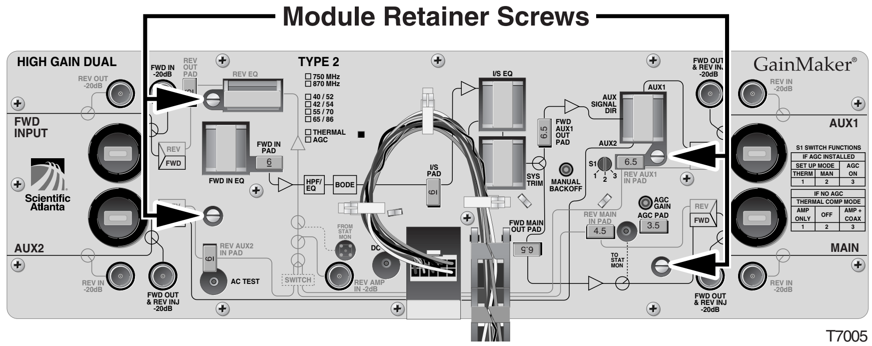
1. Perform the following if you are working with an amplifier station where AC is present.
   - Install the AC shunt power directors in the amplifier *after* you install the amplifier module in the housing.
   - Remove the AC shunt power directors from the amplifier *before* you remove the amplifier module from the housing.

   > ⚠ **CAUTION:**
   >
   > **Failure to follow these instructions may cause damage to the module's RF connectors and housing seizure assemblies.**

2. Orient the amplifier module so the **Input** and **Main Out** ports (the locations of which are stamped on the module cover) are in the proper corners for your installation.
3. Line up the RF connectors on the amplifier module and the housing, and then push the amplifier module into the housing.

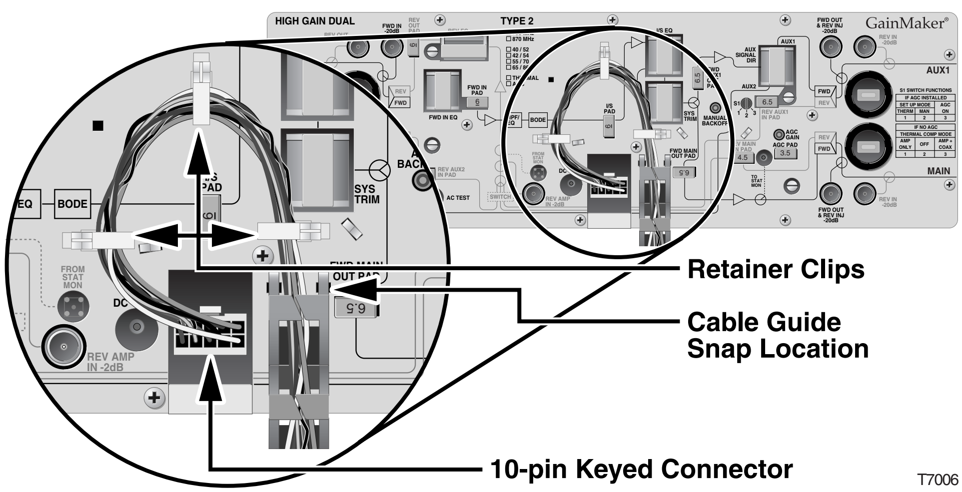
Continued on next page

4. Secure the amplifier module to the housing by tightening the four module retainer screws with a screwdriver from 6 in-lb to 9 in-lb (0.7 Nm to 1.0 Nm). See the following illustration for the location of the retainer screws.



5. Snap the cable guide into place on the housing lid and amplifier module.

6. Route the excess cable between the end of the molded power cable harness and the 10-pin keyed connector into the white plastic retainer clips on the module cover.



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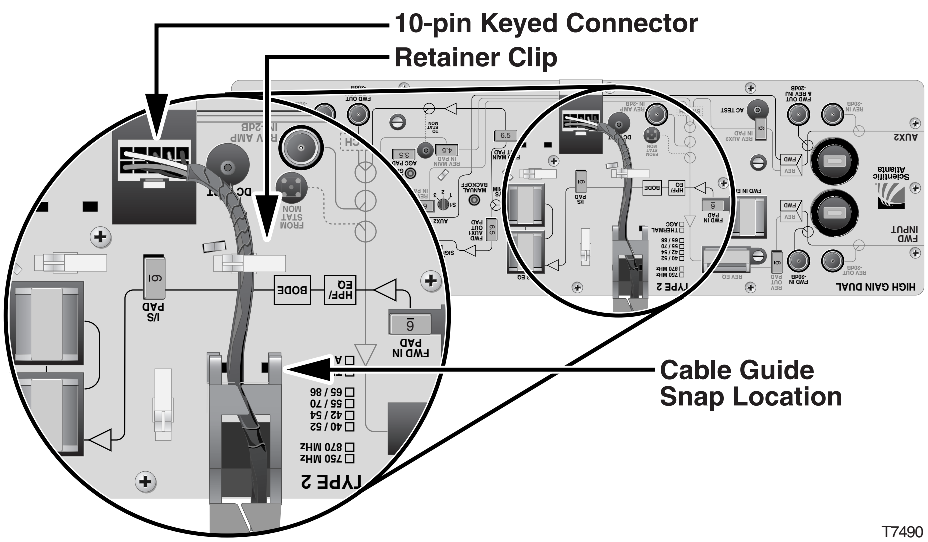
7. Attach the 10-pin keyed connector of the power cable harness to the amplifier module.

   Notes:

   - Depending upon the orientation of the amplifier module in the housing, your power cable harness routing may look like either the picture in the previous step or like the following illustration. Use the method best suited for your installation.
   - The 10-pin keyed connector can be connected one way only. Be sure the connector installs securely to the amplifier module.
   - Be sure that the power cable harness locking tabs are fully seated under the amplifier cover.



8. Proceed to **Procedure for Installing and Removing AC Shunt Power Directors.**

Removing the Amplifier Module from the Housing

Procedure for Removing the Amplifier Module

Follow these steps to remove the amplifier module from the housing.

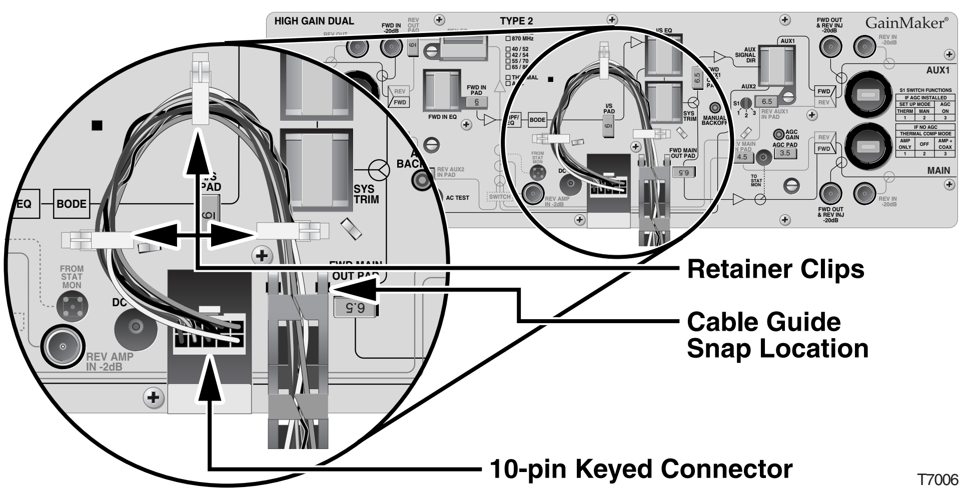
1. Is the amplifier housing open?
   - If **yes**, proceed to step 2.
   - If **no**:

     – Use a torque wrench to loosen the six housing bolts in the housing lid.

     – Open the housing.
2. If you are working with an amplifier station where AC is present, remove the AC shunt power directors from the amplifier before you remove the amplifier module from the housing.

> ⚠ **CAUTION:**
>
> **Failure to follow these instructions may cause damage to the module's RF connectors and housing seizure assemblies.**

3. Unplug the 10-pin keyed connector of the power cable harness from the amplifier module.



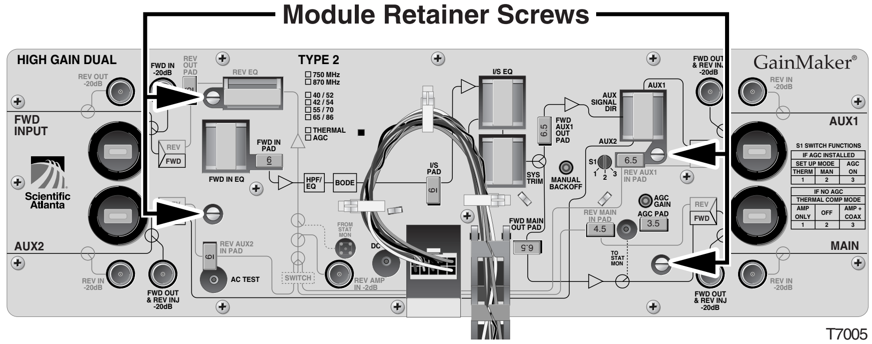
4. Remove the power cable harness from the white plastic retainer clips.

Continued on next page

5. Disconnect the power cable harness from the holes in the amplifier module cover.

   Note: The cable can remain plugged into the power supply module.

6. Using a flat-head screwdriver, loosen the four module retainer screws.



7. Depending on the type of amplifier cover screws on the amplifier module cover, use either a Phillips-head or T-15 Torx bit screwdriver to loosen the 14 screws, then remove the cover.

   Note: The screws are captive to the cover, so they will not become lost.

8. Remove the amplifier module from its housing, and place the amplifier module on a secure surface.

> ⚠ **WARNING:**
>
> **Avoid personal injury and damge to the amplifier module! Make sure you place the amplifier module on a secure surface.**

Installing and Removing AC Shunt Power Directors

Procedure for Installing and Removing AC Shunt Power Directors

The amplifiers draw AC power from the coaxial cable. This AC power comes from an external AC power supply.

Power can come from the input or output ports, and each amplifier can pass or block AC power flow on any port without affecting RF continuity. However, at least one port must pass AC power to bring power into the amplifier.

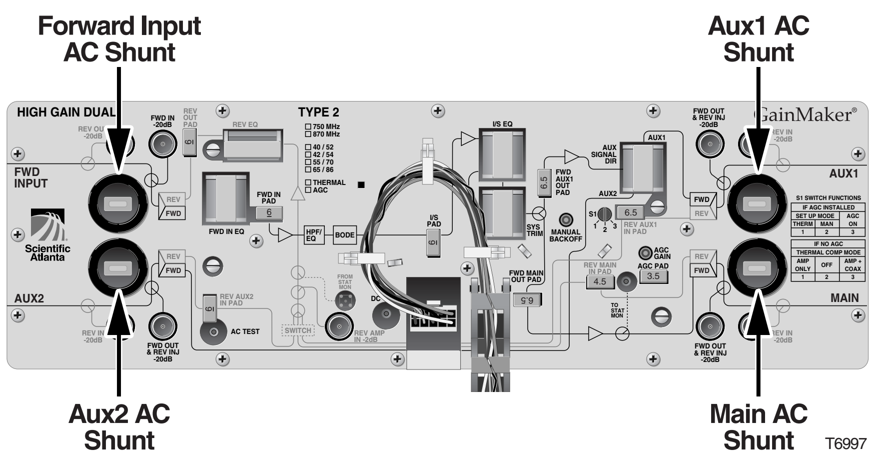
Set the power direction by installing AC shunt power directors for the ports through which you wish to pass AC.

Note: A red AC shunt power director is included with the unit. This is intended to be used to activate the port that supplies power. The red shunt identifies the shunt to be pulled to remove power for insertion and removal of the module.

> ⚠ **CAUTION:**
>
> **RF connectors and housing seizure assemblies can be damaged if AC shunt power directors are not removed from the amplifier before installing or removing the amplifier module from the housing.**

Follow these steps to remove and insert AC shunt power directors.

1. Open the Housing. Refer to **Opening the Housing** in Section A.
2. To remove a power director, pull it straight out from the amplifier module.
3. To insert a power director, refer to the systems design print to determine AC power routing and install the AC shunt power directors in the required locations. Refer to the following illustration.



4. Close the Housing. Refer to **Closing the Housing** in Section A.

Chapter 3
Balancing and Setup of the GainMaker System Amplifier

Overview

Introduction

This chapter is divided into three sections and provides instructions for selecting and implementing the correct balancing methods for the GainMaker System Amplifiers in your cable system.

Chapter Contents

Balancing sets the operating levels of the station to ensure proper performance.

Important: Read Section A for information on the equipment required for balancing, and how to decide which forward path balancing method is correct for your system installation.

Section A
Balancing Preparation

Overview

Introduction

Before beginning forward path balancing of the GainMaker amplifier station, it is important to review and understand the following information. It will help you decide which balancing process is appropriate for your style GainMaker amplifier station.

Section Contents

This section contains the following topics:

Preparing for Balancing

Before You Start

Before beginning balancing, make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

You need the following for balancing.

You need a ...	**To ...**
copy of the design print	determine expected input and output signal levels.
torque wrench with a 1/2-in. socket	open and close the system amplifier housing.
spectrum analyzer or signal analysis meter, capable of working with frequencies up to the highest design frequency	determine absolute and relative signal levels.
test point adapter (part number 562580) or an F-81 female-to-female adapter	access the test ports.
length of 75 Ohm cable, with F-connectors on each end	connect the test point adapter to the test equipment.
voltmeter	test the power supply AC and DC voltages.
1/8-in. flathead screw driver	Adjust switch 1, AGC Manual Backoff, and AGC Gain Control

Understanding Switch 1 Functions

Introduction

Switch 1 is a multifunction, three position switch. Switch 1 setting functions are determined by whether or not an AGC is installed in the station.

When an AGC is installed in the station, it is an AGC station. In an AGC station, Switch 1 provides two setup modes and one operational mode.

When there is no AGC installed in the station, it is a Thermal station. In a Thermal station, Switch 1 provides two operational modes.

Switch 1 Positions and Modes for AGC Stations

The mode you decide to use to balance an AGC station determines in which position you place Switch 1.

- Position 1 – Set the switch to this position for Thermal Setup Mode
- Position 2 - Set the switch to this position for Manual Setup Mode
- Position 3 – Set the switch to this position for AGC Operational Mode

Note: AGC Operational Mode is used only after the station has been initially balanced in either Thermal or Manual Setup Mode.

Bode Network

The Bode Network, or Bode, is an interstage variable attenuation and slope network whose loss characteristics are driven by DC control voltage.

The position of Switch 1 sets the DC control voltage driving the Bode according to the setup mode or operational mode required for the station.

Refer to the table on the next page for more information on choosing the correct switch position for your application.

Note: Consult your system's Technical Supervisor or Manager for more information about which choice of setup mode to use as this may be dictated by your System or Corporate Engineering Policy.

Continued on next page

Switch 1 Position Information for AGC Stations

Position 1 **Thermal Setup Mode**	**Position 2** **Manual Setup Mode**	**Position 3** **AGC Operational Mode**
A thermistor (thermal) driven circuit on the amplifier sets the DC control voltage that drives the Bode. This circuit detects the amplifier's internal temperature and generates the proper level of DC control voltage, setting the proper loss characteristics of the Bode with respect to the current outdoor temperature. **Note:** This is the same as the "Thermal" toggle switch setting on most prior AGCs.	The Manual Backoff potentiometer sets the DC control voltage that drives the Bode. Manually adjusting the Manual Backoff Potentiometer sets the proper loss characteristics of the Bode with respect to the current outdoor temperature. Manual adjustment is done by monitoring the amplifier RF output level and adjusting the potentiometer to reduce the gain "x" dB from the full gain (minimum loss) of the potentiometer setting. The value of "x" (gain reduction) is dependant upon outside temperature and is determined by consulting the **Manual Backoff Chart** in Section B. **Note:** This is the same as the "Manual" toggle switch setting on some prior AGCs.	The AGC detector circuit monitors the AGC pilot carrier level at the input to the AGC module. The detected AGC pilot carrier level variations cause a proportional variation of the DC control voltage that drives the Bode. **Important:** The switch must be left in this position after initial balancing in order for the AGC to function with the Bode properly. The AGC and Bode combination thus cause offsetting gain and slope variations to occur as needed, holding the actual amplifier output stable. **Note:** This is the same as the "Auto" toggle switch setting on all prior AGCs.
Note: AGC Operational Mode is used only after the station has been initially balanced in either Thermal or Manual Setup Mode.		

Continued on next page

Switch 1 Positions for Thermal Network Configured Stations

The mode of thermal compensation you select for a Thermal station will determine in which position you place Switch 1.

- Position 1 - Set the switch to this position if you prefer Amplifier Only Compensation Mode
- Position 2 - NOT USED
- Position 3 - Set the switch to this position if you prefer Amplifier and Coax Compensation Mode

Bode Network

The Bode Network, or Bode, is an interstage variable attenuation and slope network who's loss characteristics are driven by DC control voltage.

The position of Switch 1 sets the DC control voltage driving the Bode according to the setup mode or operational mode required for the station.

Refer to the table on the next page for more information on choosing the correct switch position for your application.

Note: Consult your system's Technical Supervisor or Manager for more information about which choice of setup mode may be dictated by your System or Corporate Engineering Policy.

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Switch 1 Position Information for Thermal Configured Stations

Position 1 **Amplifier Only**	**Position 2** **NOT USED**	**Position 3** **Amplifier and Coax**
A thermistor (thermal) driven circuit on the amplifier sets the DC control voltage that drives the Bode. This circuit detects the amplifier's internal temperature and generates the proper level of DC control voltage, setting the proper loss characteristics of the Bode with respect to the current outdoor temperature. **Note:** This switch position is meant to compensate for the temperature related level variations of the amplifier only. This switch position is normally selected when underground cable precedes the station, since such cable is subject to little temperature variation.	**Important:** Do not select this position. This position is reserved for stations with an AGC installed. While adjustments to the Manual Backoff potentiometer will affect amplifier gain with S1 in this position, once S1 is set to position number 1 or 3, the manual potentiometer setting will not affect proper thermal amplifier operation. Leaving the switch in this position disables the thermistor (thermal) driven circuit and enables the backoff potentiometer on the amplifier. This sets the DC control voltage that drives the Bode to a constant setting, irregardless of the current outdoor temperature. **Note:** This is a factory setting used to verify proper station gain with a given amount of manual gain backoff.	A thermistor (thermal) driven circuit on the amplifier sets the DC control voltage that drives the Bode. This circuit detects the amplifier's internal temperature and generates the proper level of DC control voltage, setting the proper loss characteristics of the Bode with respect to the current outdoor temperature. **Note:** This switch position is meant to compensate for the temperature related level variations of both the amplifier and the coaxial cable preceding the station. This switch position is normally selected when overhead cable precedes the station, since such cable is subject to temperature variation.
Note: Switch 1 in Position 2, and the backoff potentiometer, are used in AGC stations only.		

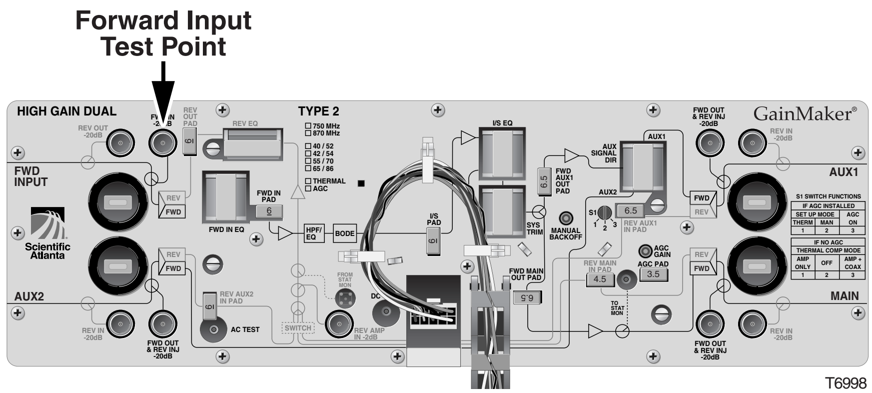
Verifying Amplifier Input Signal

Testing Input Signal Levels

Follow the steps below to test the input signal level.

Important: You cannot balance the amplifier without the proper input signals.

1. Connect the test equipment to the forward input test point shown in the diagram below.



2. Measure the signal level at the following frequencies:
   - The lowest frequency specified in the system design, and
   - The highest frequency specified in the system design.
3. Compare the measured levels to the design input levels on the system design sheet.

   Note: Add 20 dB to the measured levels to find the true levels. The test point attenuates input signals by 20 dB.
4. Are measured levels within the desired limits?

   If **yes**, proceed to step 5.

   If **no**, or if no signals are present, find the problem before proceeding. You cannot balance the amplifier without the proper input signals.
5. Remove the test point adapter from the forward input test point (leaving other equipment connectors intact).

Section B
Forward Path Balancing Procedures

Overview

Introduction

It is necessary to use the correct procedure for forward path balancing. Refer to **Selecting the Proper Procedure for Forward Path Balancing** for help on deciding which procedure best fits your system installation and amplifier type.

Section Contents

This section contains the following topics:

Selecting the Proper Procedure for Forward Path Balancing

Procedure Table

Refer to the following table to direct you to the proper starting point to balance your amplifier using your preferred method.

If you have …	**and you use …**	**go to …**
an amplifier configured with an AGC	manual setup mode for balancing and operation	3-11
an amplifier configured with an AGC	thermal setup mode for balancing and operation	3-21
a thermal amplifier (no AGC)	amplifier only compensation mode for balancing and operation	3-28
a thermal amplifier (no AGC)	amplifier and coax compensation mode for balancing and operation	3-32
an amplifier configured with an AGC	a trim network for balancing	3-38

Forward Path Balancing for AGC Stations using Manual Setup Mode

Before You Start

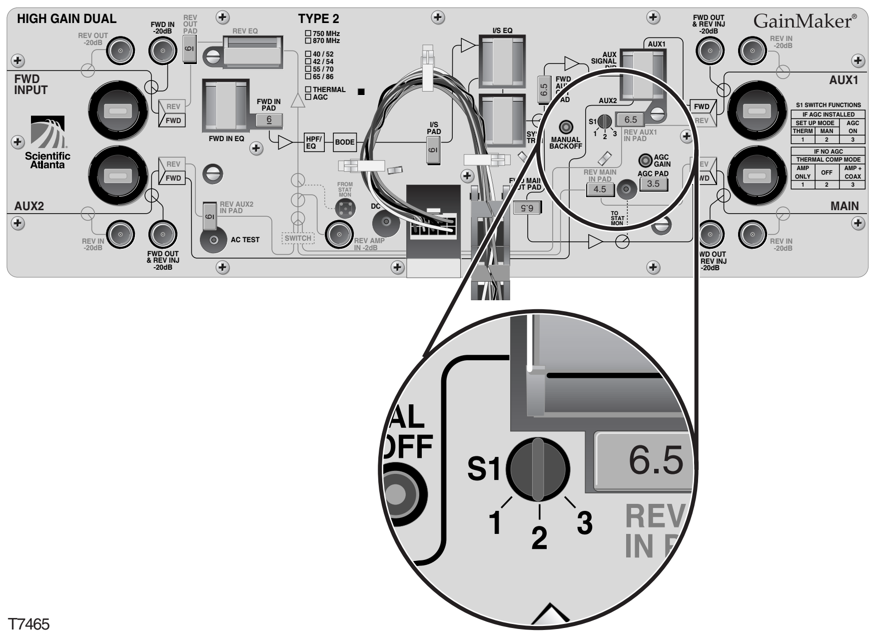
Before beginning balancing, make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

Setting the Manual Backoff Level

You must adjust the manual backoff level.

To set the manual backoff level, follow the steps below.

1. Connect an RF meter or spectrum analyzer to the forward output test point.
2. Set switch S1 to position number 2.



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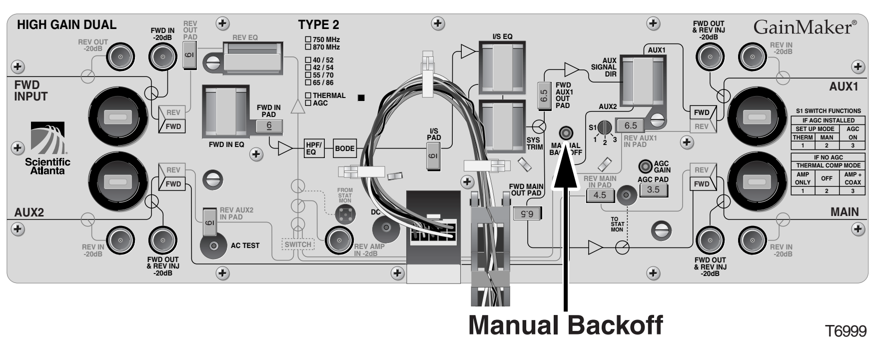
3. Turn the MANUAL BACKOFF potentiometer fully **counterclockwise** for maximum gain.



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4. Determine the outside temperature at the amplifier location.
5. Refer to the **Manual Backoff Chart** on the following page to find the proper manual backoff level for the current temperature and reference frequency.
6. Turn the MANUAL BACKOFF potentiometer **clockwise** to reduce the output level by the amount specified in the **Manual Backoff Chart**.

   Note: After making this adjustment, do not adjust the MANUAL BACKOFF potentiometer again.
7. Proceed to **Determining Output Tilt**.

Continued on next page

Manual Backoff Chart

The following table displays the manual backoff level for selected frequencies and various temperatures.

Temperature		Back-off level at ...			
		445.25MHz	**547.25 MHz**	**750 MHz**	**870 MHz**
60°C	140°F	0.0 dB	0.0 dB	0.0 dB	0.0 dB
55°C	131°F	0.4 dB	0.4 dB	0.5 dB	0.6 dB
50°C	122°F	0.7 dB	0.8 dB	1.0 dB	1.1 dB
45°C	113°F	1.1 dB	1.3 dB	1.5 dB	1.7 dB
40°C	104°F	1.5 dB	1.6 dB	2.0 dB	2.2 dB
35°C	95°F	1.9 dB	2.1 dB	2.5 dB	2.8 dB
30°C	86°F	2.3 dB	2.5 dB	3.0 dB	3.4 dB
25°C	77°F	2.6 dB	2.9 dB	3.5 dB	3.9 dB
20°C	**68°F**	**3.1 dB**	**3.4 dB**	**4.1 dB**	**4.5 dB**
15°C	59°F	3.4 dB	3.7 dB	4.5 dB	5.0 dB
10°C	50°F	3.7 dB	4.1 dB	5.0 dB	5.5 dB
5°C	41°F	4.1 dB	4.5 dB	5.4 dB	6.0 dB
0°C	32°F	4.4 dB	4.9 dB	5.9 dB	6.5 dB
-5°C	23°F	4.7 dB	5.2 dB	6.3 dB	7.0 dB
-10°C	14°F	5.1 dB	5.7 dB	6.7 dB	7.5 dB
-15°C	5°F	5.4 dB	6.0 dB	7.3 dB	8.0 dB
-20°C	-4°F	5.8 dB	6.4 dB	7.8 dB	8.5 dB
-25°C	-13°F	6.1 dB	6.8 dB	8.3 dB	9.0 dB
-30°C	-22°F	6.4 dB	7.2 dB	8.7 dB	9.5 dB
-35°C	-31°F	6.8 dB	7.6 dB	9.2 dB	10.0 dB
-40°C	-40°F	7.1 dB	8.0 dB	9.7 dB	10.5 dB

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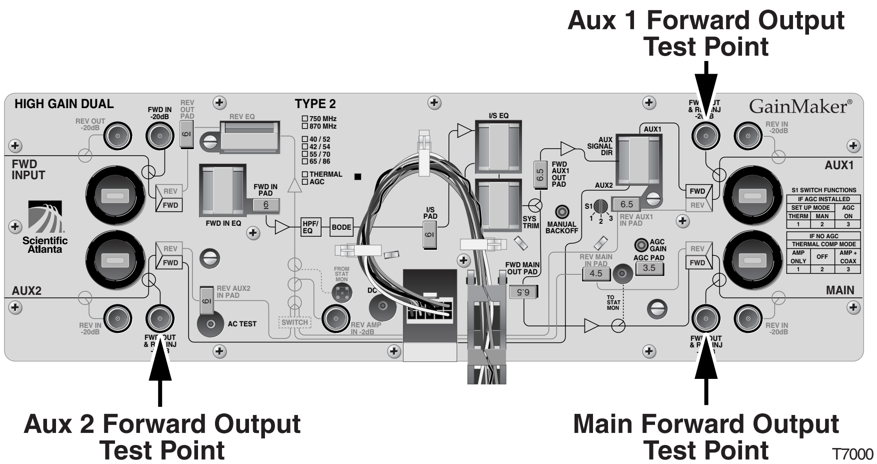
Determining Output Tilt

To determine the output tilt of the amplifier, follow the steps below.

1. Connect the test point adapter to the forward output test point shown in the diagram below.



2. Consult the design print to find the proper output tilt.
3. Measure the output signal levels at the frequencies you used in **Testing Input Signal Levels**.
4. To determine the actual output tilt, calculate the difference (in dB) between the levels of the lowest and highest specified frequencies.
5. Proceed to **Setting the Output Tilt**.

Setting the Output Tilt

Equalizers (EQs) are available in 1.5 dB (cable equivalent) increments. A 1.5 dB change in value changes the difference between low and high frequencies by approximately 1 dB.

- Increasing the equalizer value *reduces* the level at lower frequencies, relative to the level at 750/870 MHz.
- Decreasing the equalizer value *increases* the level at lower frequencies, relative to the level at 750/870 MHz.

To select the proper forward input equalizer value, follow the steps below.

1. Compare the calculated output tilt in step 4 of **Determining Output Tilt** with the design tilt (on the design print).

Continued on next page

2. Is the output tilt within ±0.5 dB of the design tilt?
   - If the output tilt is within ±0.5 dB of the design tilt, proceed to **Setting the Output Level**.
   - If the output tilt is more than design tilt, replace the forward input EQ with a lower value.
   - If the output tilt is less than design tilt, replace the forward input EQ with a higher value.
3. Re-measure the output tilt, and return to step 1.

Setting the Output Level

After setting the tilt, follow the steps below to select the proper pad values for the amplifier. Selecting the proper pad value sets the output level of the amplifier.

1. Connect the test probe to the forward output test point.
2. Measure the output level at the highest design frequency, and compare this level with the design level (on the design print).
3. Is the measured output level within ±0.5 dB of the design level?
   - If the output level is within ±0.5 dB of the design output level, proceed to step 5.
   - If the output level is more than the design output level, replace the forward input pad with a higher value pad.
   - If the output level is less than the design level, replace the forward input pad with a lower value pad.

Continued on next page

4. Repeat steps 2 and 3 until the output level is correct.

   Note: On the Low Gain Dual and High Gain Dual, the type of plug-in signal director installed directly affects the signal level measured at the Aux RF output test points. This is because the Aux RF output test points are located *after* the signal director in the forward RF signal path instead of *before* as in previous versions of system amplifiers (II, II+, and III). The test points now reflect the actual output of the port. It is important to determine if the Aux output level specified on the design print is the level before or after the signal director. If it is the level *after* the signal director (port output level), the test point should match the print design level. If it is the level *before* the signal director, the test point level should be "x" dB lower than the print design level, where "x" is the insertion loss of the signal director feeding the particular Aux port being balanced.

5. Proceed to **Automatic Gain Control Setup**.

Continued on next page

Forward Path Balancing for AGC Stations using Manual Setup Mode,
Continued

Automatic Gain Control Setup

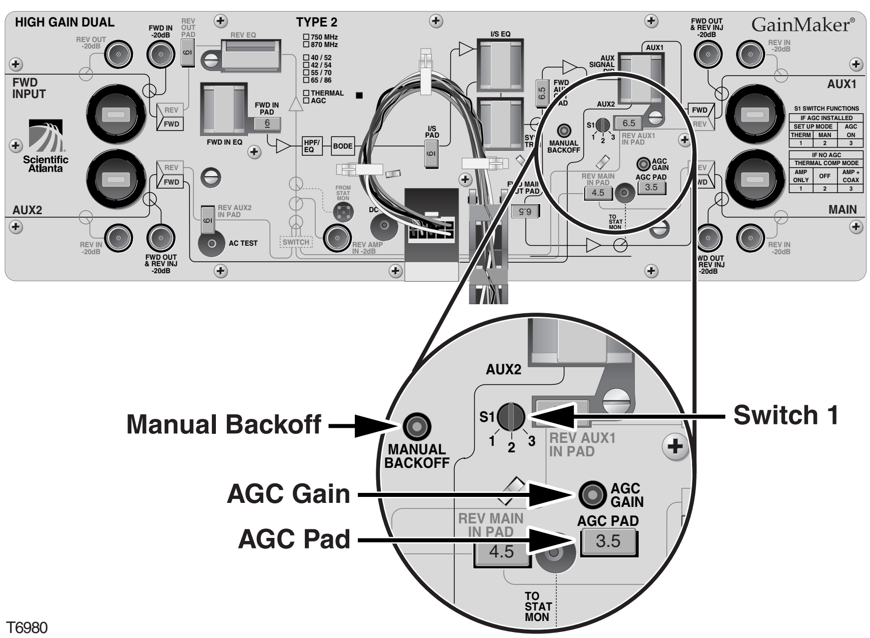
This section provides procedures for configuring and aligning the AGC in the GainMaker amplifiers. AGC attenuator values are required to select the proper AGC attenuator value based upon actual AGC pilot carrier output level.

Notes:

- Output levels are measured at the pilot frequency.
- The standard single-pilot AGC makes amplifier output adjustments based on the level of the pilot frequency carrier. You should activate the pilot carrier with its final unscrambled video source before beginning balance and alignment.

Diagram

The following diagram shows the location of the AGC related switch, controls, and AGC pad.



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Selecting the AGC Pad Value

Use one of the following formulas to determine the correct AGC pad value.

High Gain Dual, Low Gain Dual, and Balanced Triple

AGC Pad Value = RF output level @ pilot frequency (main output port) - 34 dB

Unbalanced Triple

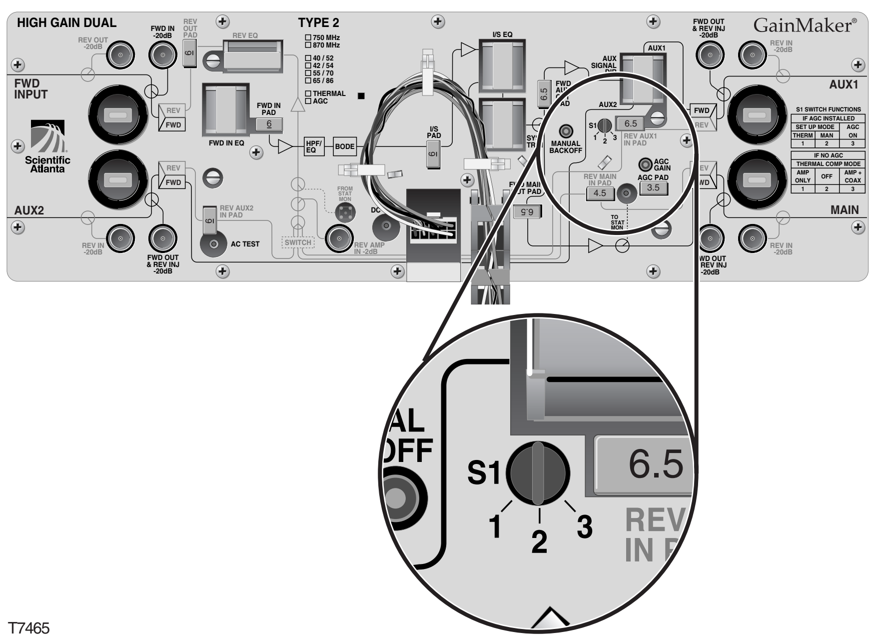
AGC Pad Value = RF output level @ pilot frequency (main output port) - 26 dB

Once you have determined the correct AGC pad value, install it in the amplifier in the AGC pad slot and proceed to **Aligning the AGC Module**. For the location of the AGC pad, refer to the diagram on the previous page.

Aligning the AGC Module

To align the AGC module, follow these steps.

1. Make sure that switch S1 is set to position number 2.



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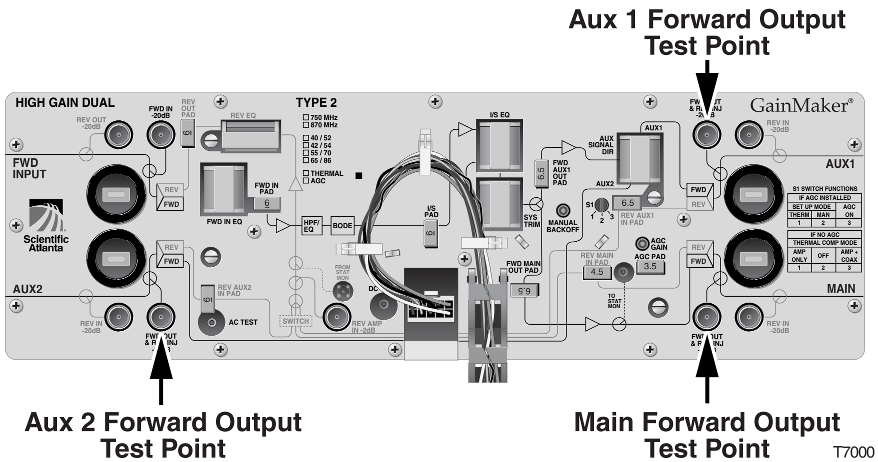
2. Insert the test probe into the -20 dB forward output test point on the amplifier.

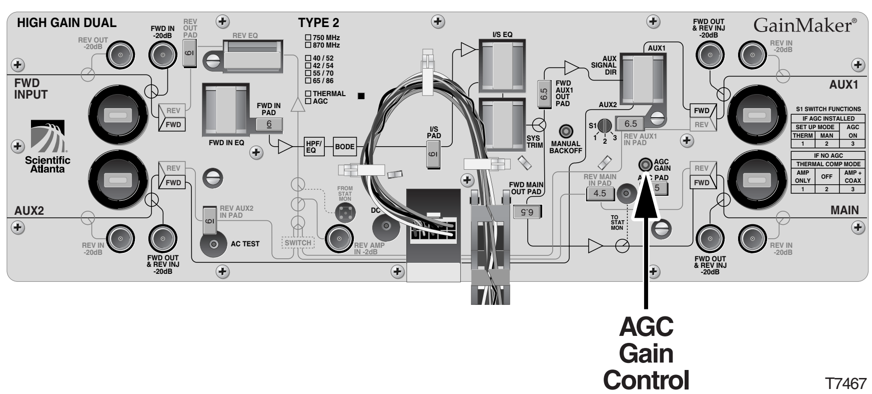


3. Measure and note the RF output level at the AGC pilot frequency.

Note: Remember to add 20 dB to compensate for the test point loss.

4. Set switch S1 to position number 3 for AGC operation.

5. Adjust the AGC gain control potentiometer to match the level you measured in step 3.



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6. Move switch S1 back and forth between position number 2 and position number 3.

   Important: Let the amplifier MODULE settle before reading signal levels.

   Result: The signal level should not vary when you switch between position number 2 and position number 3. If the signal level does vary, repeat steps 4-6 as needed until the signal level does not vary between position number 2 and position number 3.

7. Set switch S1 to position number 3 for AGC Operation Mode.

8. This concludes **Forward Path Balancing for AGC Stations using Manual Set-Up Mode**.

   Proceed to Section C, **Balancing the Reverse Path**.

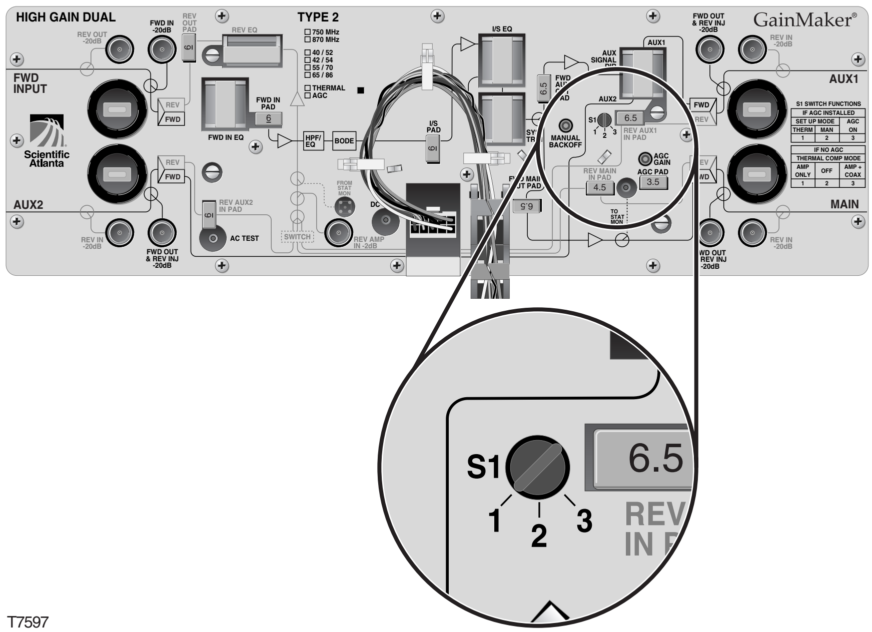
Forward Path Balancing for AGC Stations using Thermal Setup Mode

Before You Start

Before beginning balancing, make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

Setting Switch 1 for Thermal Setup Mode

You must set switch S1 to position number 1 to use Thermal Setup Mode.



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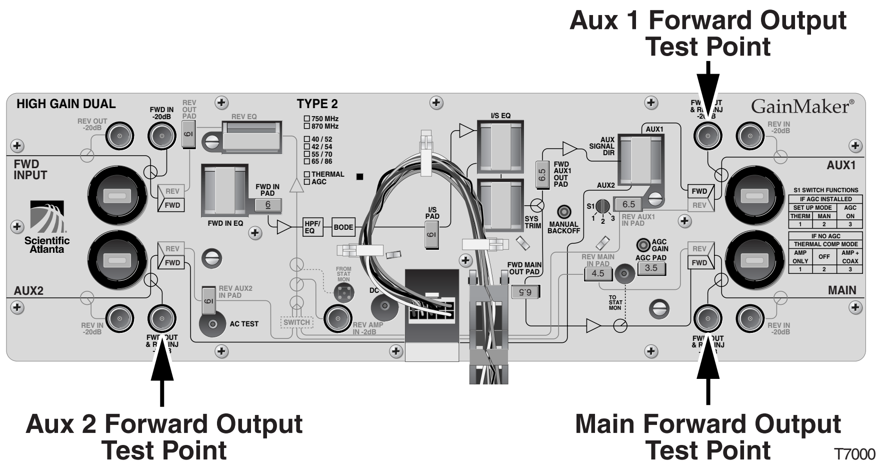
Determining Output Tilt

To determine the output tilt of the amplifier, follow the steps below.

1. Connect the test point adapter to the forward output test point shown in the diagram below.



2. Consult the design print to find the proper output tilt.
3. Measure the output signal levels at the frequencies you used in **Testing Input Signal Levels**.
4. To determine the actual output tilt, calculate the difference (in dB) between the levels of the lowest and highest specified frequencies.
5. Proceed to **Setting the Output Tilt**.

Continued on next page

Setting the Output Tilt

Equalizers (EQs) are available in 1.5 dB (cable equivalent) increments. A 1.5 dB change in value changes the difference between low and high frequencies by approximately 1 dB.

- Increasing the equalizer value *reduces* the level at lower frequencies, relative to the level at 750/870 MHz.
- Decreasing the equalizer value *increases* the level at lower frequencies, relative to the level at 750/870 MHz.

To select the proper forward input equalizer value, follow the steps below.

1. Compare the actual output tilt in step 4 of **Determining Output Tilt** with the design tilt (on the design print).
2. Is the output tilt within ±0.5 dB of the design tilt?
   - If the output tilt is within ±0.5 dB of the design tilt, proceed to **Setting the Output Level**.
   - If the output tilt is more than design tilt, replace the forward input EQ with a lower value.
   - If the output tilt is less than design tilt, replace the forward input EQ with a higher value.
3. Re-measure the output tilt, and return to step 1.

Setting the Output Level

After setting the tilt, follow the steps below to select the proper pad values for the amplifier. The output level of the amplifier is set by selecting the proper pad value.

1. Connect the test probe to the forward output test point.
2. Measure the output level at the highest design frequency, and compare this level with the design level (on the design print).

Continued on next page

3. Is the measured output level within ±0.5 dB of the design level?
   - If the output level is within ±0.5 dB of the design output level proceed to step 5.
   - If the output level is more than the design output level, replace the forward input pad with a higher value pad.
   - If the output level is less than the design level, replace the forward input pad with a lower value pad.
4. Repeat steps 2 and 3 until the output level is correct.

   Note: On the Low Gain Dual and High Gain Dual, the type of plug-in signal director installed will directly affect the signal level measured at the Aux RF output test points. This is because the Aux RF output test points are located *after* the signal director in the forward RF signal path instead of *before* as in previous versions of system amplifiers (II, II+, and III). The test points now reflect the actual output of the port. It is important to determine if the Aux output level specified on the design print is the level before or after the signal director. If it is the level *after* the signal director (port output level) the test point should match the print design level. If it is the level *before* the signal director, the test point level should be “x” dB lower than the print design level, where “x” is the insertion loss of the signal director feeding the particular Aux port being balanced.
5. Proceed to **Automatic Gain Control Setup**.

Automatic Gain Control Setup

This section provides procedures for configuring and aligning the AGC in the GainMaker amplifiers. AGC attenuator values are required to select the proper AGC attenuator value based upon actual AGC pilot carrier output level.

Notes:

- Output levels are measured at the pilot frequency.
- The standard single-pilot AGC makes amplifier output adjustments based on the level of the pilot frequency carrier. You should activate the pilot carrier with its final unscrambled video source before beginning balance and alignment.

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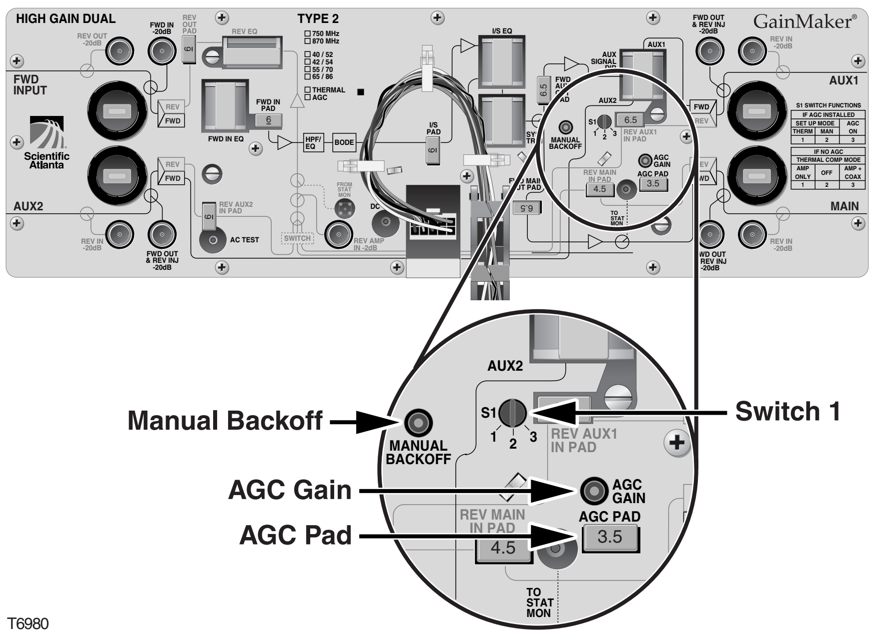
Diagram

The following diagram shows the location of the AGC related switch, controls, and attenuator pad.



Selecting the AGC Pad Value

Use one of the following formulas to determine the correct AGC pad value.

High Gain Dual, Low Gain Dual, and Balanced Triple

AGC Pad Value = RF output level @ pilot frequency (main output port) - 34 dB

Unbalanced Triple

AGC Pad Value = RF output level @ pilot frequency (main output port) - 26 dB

Once you have determined the correct AGC pad value, install it in the amplifier in the AGC pad slot and proceed to **Aligning the AGC Module**. For the location of the AGC pad, refer to the diagram on the previous page.

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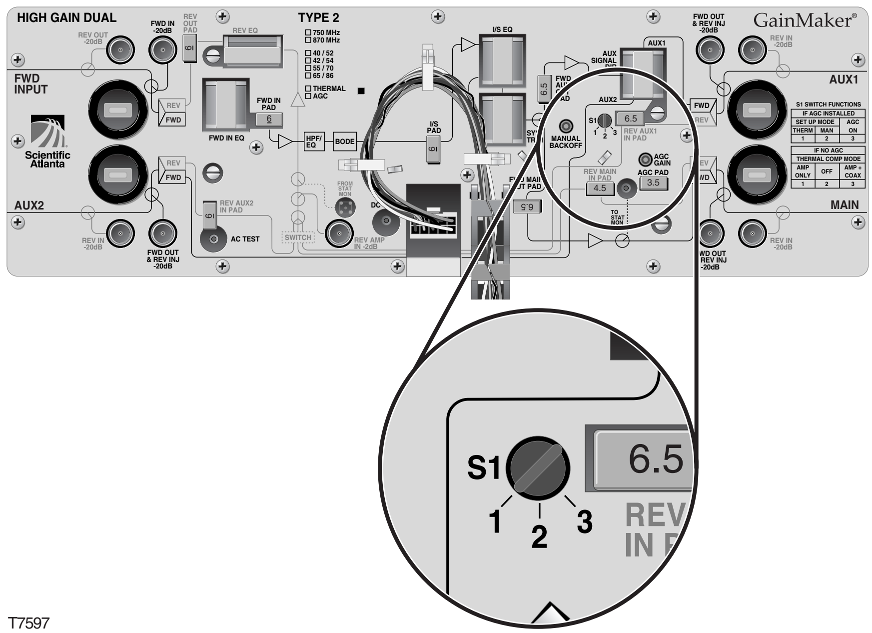
Aligning the AGC Module

To align the AGC module, follow the steps below.

1. Make sure that switch S1 is set to position number 1.



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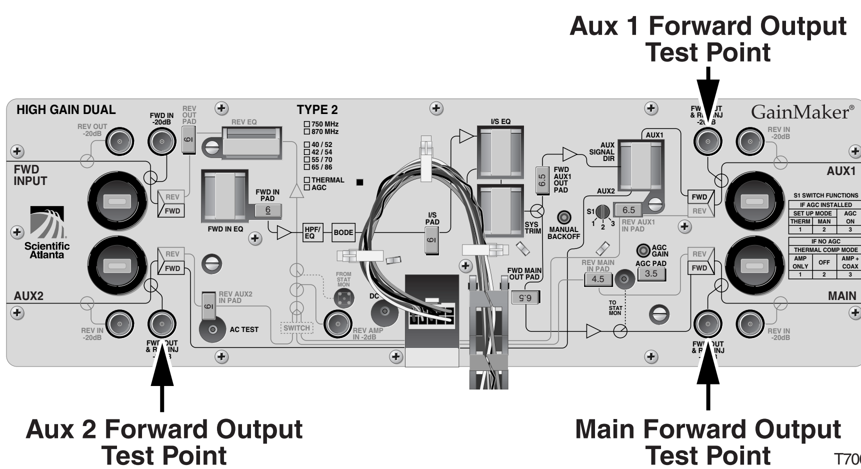
2. Insert the test probe into the -20 dB forward output test point on the amplifier.



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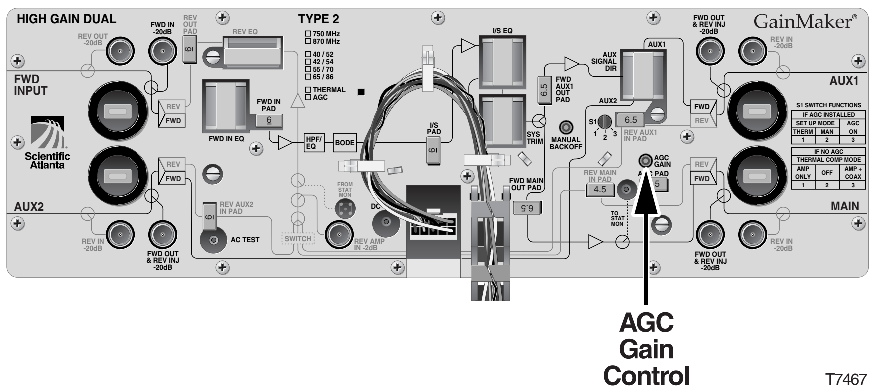
3. Measure and note the RF output level at the AGC pilot frequency.

   Note: Remember to add 20 dB to compensate for the test point loss.

4. Set switch S1 to position number 3 for AGC operation.

5. Adjust the AGC gain control potentiometer to match the level you measured in step 3.



6. Move switch S1 back and forth between position number 1 and position number 3.

   Important: Let the amplifier MODULE settle before reading signal levels.

   Result: The signal level should not vary when you switch between position number 1 and position number 3. If the signal level does vary, repeat steps 4-6 as needed until the signal level does not vary between position number 1 and position number 3.

7. Set switch S1 to position number 3 for AGC Operational Mode.

8. This concludes **Forward Path Balancing for AGC Stations using Thermal Set-Up Mode**.

   Proceed to Section C, **Balancing the Reverse Path**.

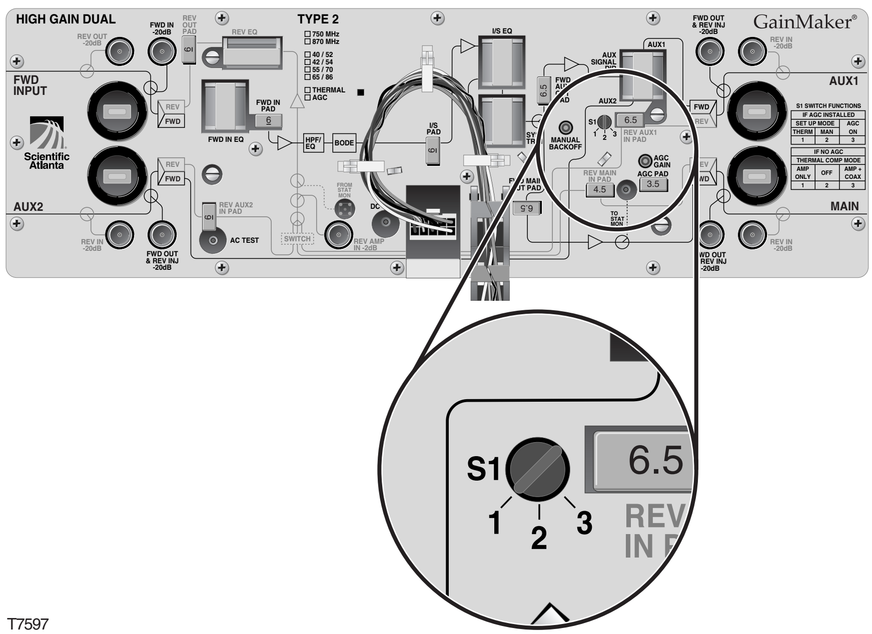
Forward Path Balancing for Thermal Stations using Amplifier Only Compensation Mode

Before You Start

Before beginning balancing, make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

Setting Switch 1 for Amplifier Only Compensation Mode

You must set switch S1 to position number 1 to use Amplifier Only Compensation Mode.



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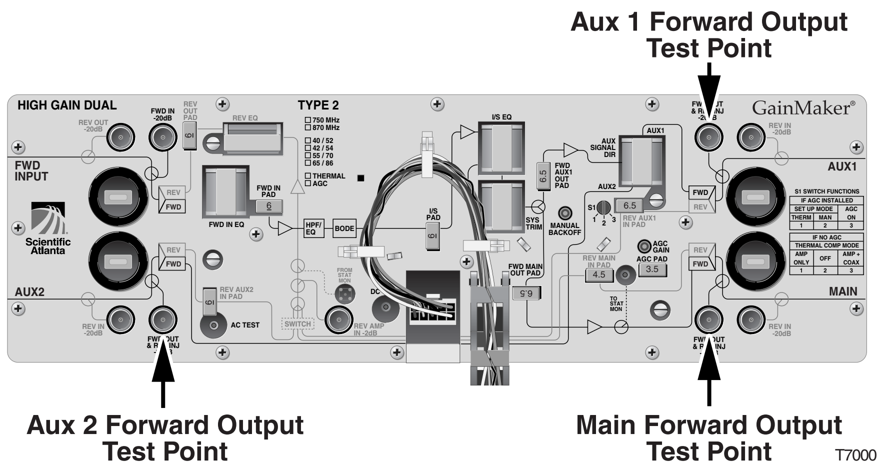
Forward Path Balancing for Thermal Stations using Amplifier Only Compensation Mode, Continued

Determining Output Tilt

To determine the output tilt of the amplifier, follow the steps below.

1. Connect the test point adapter to the forward output test point shown in the diagram below.



2. Consult the design print to find the proper output tilt.
3. Measure the output signal levels at the frequencies you used in **Testing Input Signal Levels**.
4. To determine the actual output tilt, calculate the difference (in dB) between the levels of the lowest and highest specified frequencies.
5. Proceed to **Setting the Output Tilt**.

Continued on next page

Setting the Output Tilt

Equalizers (EQs) are available in 1.5 dB (cable equivalent) increments. A 1.5 dB change in value changes the difference between low and high frequencies by approximately 1 dB.

- Increasing the equalizer value *reduces* the level at lower frequencies, relative to the level at 750/870 MHz.
- Decreasing the equalizer value *increases* the level at lower frequencies, relative to the level at 750/870 MHz.

To select the proper forward input equalizer value, follow the steps below.

1. Compare the actual output tilt in step 4 of **Determining Output Tilt** with the design tilt (on the design print).
2. Is the output tilt within ±0.5 dB of the design tilt?
   - If the output tilt is within ±0.5 dB of the design tilt, proceed to **Setting the Output Level**.
   - If the output tilt is more than design tilt, replace the forward input EQ with a lower value.
   - If the output tilt is less than design tilt, replace the forward input EQ with a higher value.
3. Re-measure the output tilt, and return to step 1.

Setting the Output Level

After setting the tilt, follow the steps below to select the proper pad values for the amplifier. The output level of the amplifier is set by selecting the proper pad value.

1. Connect the test probe to the forward output test point.
2. Measure the output level at the highest design frequency, and compare this level with the design level (on the design print).

Continued on next page

3. Is the measured output level within ±0.5 dB of the design level?
   - If the output level is within ±0.5 dB of the design output level proceed to step 5.
   - If the output level is more than the design output level, replace the forward input pad with a higher value pad.
   - If the output level is less than the design level, replace the forward input pad with a lower value pad.
4. Repeat steps 2 and 3 until the output level is correct.

   Note: On the Low Gain Dual and High Gain Dual, the type of plug-in signal director installed will directly affect the signal level measured at the Aux RF output test points. This is because the Aux RF output test points are located *after* the signal director in the forward RF signal path instead of *before* as in previous versions of system amplifiers (II, II+, and III). The test points now reflect the actual output of the port. It is important to determine if the Aux output level specified on the design print is the level before or after the signal director. If it is the level *after* the signal director (port output level) the test point should match the print design level. If it is the level *before* the signal director, the test point level should be "x" dB lower than the print design level, where "x" is the insertion loss of the signal director feeding the particular Aux port being balanced.
5. This concludes **Forward Path Balancing for Thermal Stations using Amplifier Only Compensation Mode**.

   Proceed to Section C, **Balancing the Reverse Path**.

Forward Path Balancing for Thermal Stations using Amplifier and Coax Compensation Mode

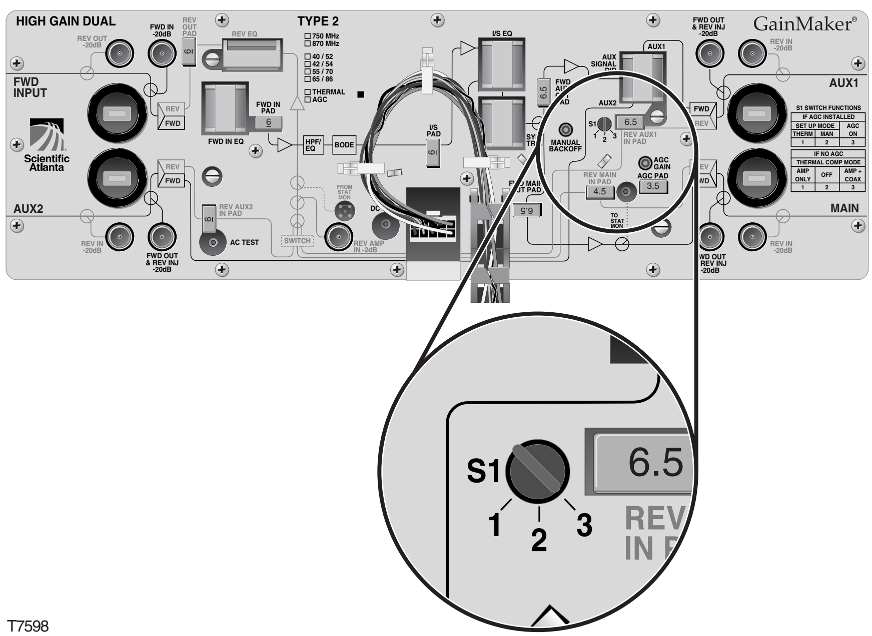
Before You Start

Before beginning balancing, make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

Note: If it is necessary to balance a thermal station using amplifier and coax compensation mode immediately after module installation (with little or no warm-up period), the output level should be set 1 dB lower than specified by the design print. This reduction in output level will be offset by internal amplifier gain increase as the thermal circuit in the amplifier warms up.

Setting Switch for Amplifier and Coax Compensation Mode

You must set switch S1 to position number 3 to use Amplifier and Coax Compensation Mode.



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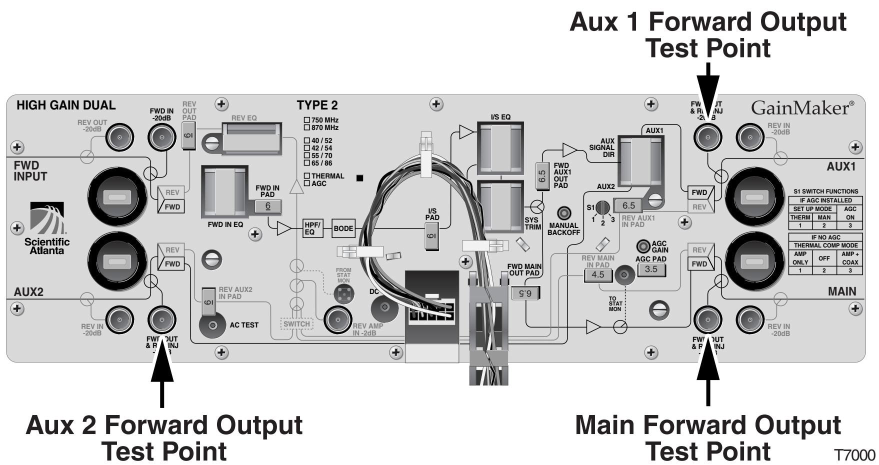
Forward Path Balancing for Thermal Stations using Amplifier and Coax Compensation Mode, Continued

Determining Output Tilt

To determine the output tilt of the amplifier, follow the steps below.

1. Connect the test point adapter to the forward output test point shown in the diagram below.



2. Consult the design print to find the proper output tilt.
3. Measure the output signal levels at the frequencies you used in **Testing Input Signal Levels**.
4. To determine the actual output tilt, calculate the difference (in dB) between the levels of the lowest and highest specified frequencies.
5. Proceed to **Setting the Output Tilt**.

Continued on next page

Forward Path Balancing for Thermal Stations using Amplifier and Coax Compensation Mode, Continued

Setting the Output Tilt

Equalizers (EQs) are available in 1.5 dB (cable equivalent) increments. A 1.5 dB change in value changes the difference between low and high frequencies by approximately 1 dB.

- Increasing the equalizer value *reduces* the level at lower frequencies, relative to the level at 750/870 MHz.
- Decreasing the equalizer value *increases* the level at lower frequencies, relative to the level at 750/870 MHz.

To select the proper forward input equalizer value, follow the steps below.

1. Compare the actual output tilt in step 4 of **Determining Output Tilt** with the design tilt (on the design print).
2. Is the output tilt within ±0.5 dB of the design tilt?
   - If the output tilt is within ±0.5 dB of the design tilt, proceed to **Setting the Output Level**.
   - If the output tilt is more than design tilt, replace the forward input EQ with a lower value.
   - If the output tilt is less than design tilt, replace the forward input EQ with a higher value.
3. Re-measure the output tilt, and return to step 1.

Continued on next page

Setting the Output Level

After setting the tilt, follow the steps below to select the proper pad values for the amplifier. Selecting the proper pad value sets the output level of the amplifier.

Note: If you are setting the output level of an amplifier that has not warmed for approximately 1 hour, proceed to **Setting the Output Level for a Cold Amplifier**.

1. Connect the test probe to the forward output test point.
2. Measure the output level at the highest design frequency, and compare this level with the design level (on the design print).
3. Is the measured output level within ±0.5 dB of the design level?
   - If the output level is within ±0.5 dB of the design output level proceed to step 5 of **Setting the Output Level for a Cold Amplifier**.
   - If the output level is more than the design output level, replace the forward input pad with a higher value pad.
   - If the output level is less than the design level, replace the forward input pad with a lower value pad.

Continued on next page

Setting the Output Level for a Cold Amplifier

After setting the tilt, follow the steps below to select the proper pad values for the amplifier. The output level of the amplifier is set by selecting the proper pad value.

Note: Using this procedure will result in a more accurate output level setting when balancing an amplifier using amplifier and coax compensation mode if the amplifier has had little or no warm-up period.

Important: For the most accurate output level setting, allow the amplifier to warm up for approximately 1 hour and use the standard **Setting the Output Level** procedure.

1. Connect the test probe to the forward output test point.
2. Measure the output level at the highest design frequency, and compare this level with the design level (on the design print) *minus 1 dB*.

   Result: The station output level must be 1 dB lower than the output level specified by the design print. This reduction in output level will be offset by internal amplifier gain increase as the thermal circuit in the amplifier warms up.
3. Is the measured output level within ±0.5 dB of the design level *minus 1 dB*?
   - If the output level is within ±0.5 dB of the design output level *minus 1 dB*, proceed to step 5.
   - If the output level is more than the design output level *minus 1 dB*, replace the forward input pad with a higher value pad.
   - If the output level is less than the design level *minus 1 dB*, replace the forward input pad with a lower value pad.

Continued on next page

4. Repeat steps 2 and 3 until the output level is correct.

   Note: On the Low Gain Dual and High Gain Dual, the type of plug-in signal director installed will directly affect the signal level measured at the Aux RF output test points. This is because the Aux RF output test points are located *after* the signal director in the forward RF signal path instead of *before* as in previous versions of system amplifiers (II, II+, and III). The test points now reflect the actual output of the port. It is important to determine if the Aux output level specified on the design print is the level before or after the signal director. If it is the level *after* the signal director (port output level) the test point should match the print design level. If it is the level *before* the signal director, the test point level should be "x" dB lower than the print design level, where "x" is the insertion loss of the signal director feeding the particular Aux port being balanced.

5. This concludes **Forward Path Balancing for Thermal Stations Using Amplifier and Coax Compensation Mode**.

   Proceed to Section C, **Balancing the Reverse Path**.

Forward Path Balancing using Trim Networks

Introduction

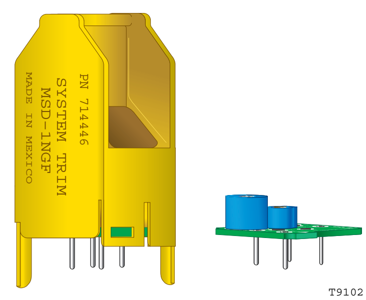
This section describes the procedure to follow when installing a trim network in a GainMaker System Amplifier.

Trim Network Description

A trim network allows you to adjust the amplifier's frequency response to be as uniform as possible across the entire output spectrum. The trim network can be adjusted (within limits) to cover a wide range of individual requirements. Type and use factor is determined by evaluating actual system frequency response. Refer to the frequency response plots in Appendix A for more information.

Trim Network Illustrations

The following table contains an illustration of the trim network used in a GainMaker System Amplifier.

Part Number/Model Number	Description	Illustration
714446 MSD-1NGF	Mid-Frequency Dual Peak	

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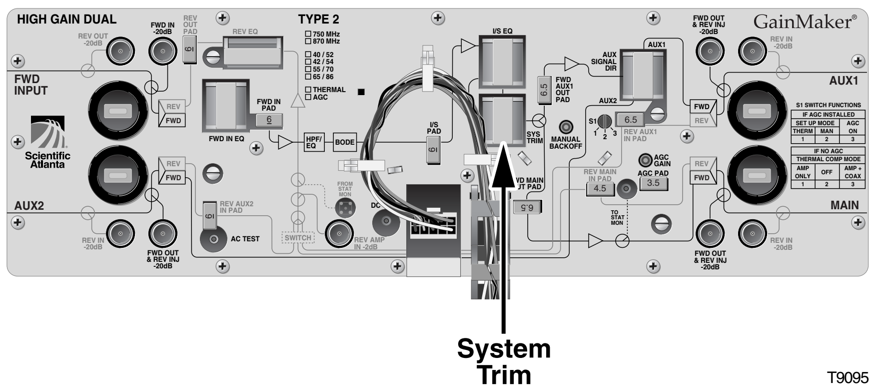
Installing a Trim Network in a GainMaker System Amplifier

Follow the procedures below to install a trim network in a GainMaker system amplifier module.

1. Open the housing. Refer to **Opening the Housing** in Section A of Chapter 2.
2. Switch the AGC to **THERMAL**.
3. Record the RF output levels.

   Note: The trim network location is labeled **SYS TRIM** on the module cover. Refer to the illustration below.



4. Remove jumper from system trim location.
5. Install the trim network into the system trim slot.

   Notes:

   - Be sure all the pins on the system trim bottom align with the pin holes in the system trim slot, allowing the system trim to install flat against the amplifier module.
   - Make sure the components face the outside of the station (See diagram above for proper positioning).

6. After tuning the trim network for the proper response, measure the RF output level.
7. Change the interstage pad or input pad to obtain the same RF output level as noted in step 3.
8. Switch the AGC module to **AUTO**.
9. Reset the AGC for proper output levels.
10. Close the housing. Refer to **Closing the Housing** in Section A of Chapter 2.

Section C
Reverse Path Balancing Procedures

Overview

Introduction

This section covers reverse RF amplifier cascade balancing. For the purpose of this document, balancing refers to the process of individually aligning each reverse amplifier station's gain and tilt characteristics in order to achieve reverse amplifier cascades that have optimum, repeatable transmission characteristics.

There are a variety of test equipment combinations that enable proper balancing of the reverse path. Regardless of the type of equipment used, the balancing process is fundamentally the same.

Section Contents

This section contains the following topics:

Preparing for Reverse Path Balancing

Balancing Sequence

Balancing should be completed in the following order.

- Reverse fiber link (node reverse optical transmitter to headend/hub reverse optical receiver).
- Individual reverse amplifier cascades that combine at the node. Start with the amplifier closest to the node, and work from that point outward towards the first reverse amplifier in each upstream cascade.

Injection of Test Signal(s)

During the balancing process, reverse RF test signals of known amplitude are injected into the reverse RF input path of the amplifier station (prior to the reverse amplification circuit). The injected signals are amplified and routed out the station's reverse RF output port in the upstream direction. The injected test signals pass through any previously balanced amplifiers in the reverse cascade, as well as the reverse fiber link, and arrive at the node's reverse optical receiver (typically located in the headend or hubsite).

Monitoring and Adjusting Received Amplitude and Tilt

The amplitude and tilt associated with the received signals are monitored at the headend or hub at an RF test point on the output of the reverse optical receiver associated with the particular node. The received amplitude and tilt of the test signals are compared to the desired (reference value) amplitude and tilt. Any deviation from reference value amplitude or tilt are then minimized by altering the (dB) value of the output pad or equalizer in the amplifier being balanced. This process is completed for each amplifier in the reverse cascade, working outward from the node.

Continued on next page

Methods of Generating and Monitoring Test Signals

The reverse RF test signals that are to be injected into the reverse path of the amplifier being balanced may be generated by the following.

- multiple CW signal (tone) generator
- reverse sweep transmitter

The amplitude and tilt of the received test signals at the output of the reverse optical receiver in the headend or hub may be measured and monitored using the following.

- spectrum analyzer (when using a CW generator for test signals)
- signal level meter (when using a CW generator for test signals)
- reverse sweep receiver (when using a reverse sweep transmitter for test signal)

The variance in relative amplitude and tilt of the received signal from desired (reference) may be relayed to the field technician via the following.

- radio (by a second technician in the headend/hub who is monitoring a spectrum analyzer or signal level meter)
- a dedicated forward TV channel, whose associated modulator has it's video input being generated by a video camera focused on the spectrum analyzer display
- an associated forward data carrier (if using a particular type of reverse sweep system)

If a portable reverse sweep generator with built in forward data receiver is used to generate the reverse test signals, only one technician is required to perform the balancing. This type of system is becoming increasingly popular due to it's ease of use.

In this case, the sweep system includes a combination reverse sweep receiver and forward data transmitter, which is located in the headend/hub. The frequency response characteristics of the received sweep signal (including relative amplitude and tilt) are converted by the headend sweep receiver to a data format, and transmitted in the forward RF path as a data carrier (by combining it into the forward headend combiner).

The portable sweep generator/data receiver that is injecting the test signal into the amplifier's reverse path in the field is simultaneously receiving the incoming data carrier via the forward RF path, and converting it back to a sweep display which represents what is being received by the headend unit.

Note: When using a reverse sweep system such as this, be sure to consult the manufacturer's guide to determine proper headend combining and to ensure proper telemetry levels.

Initial Reverse Path Balancing

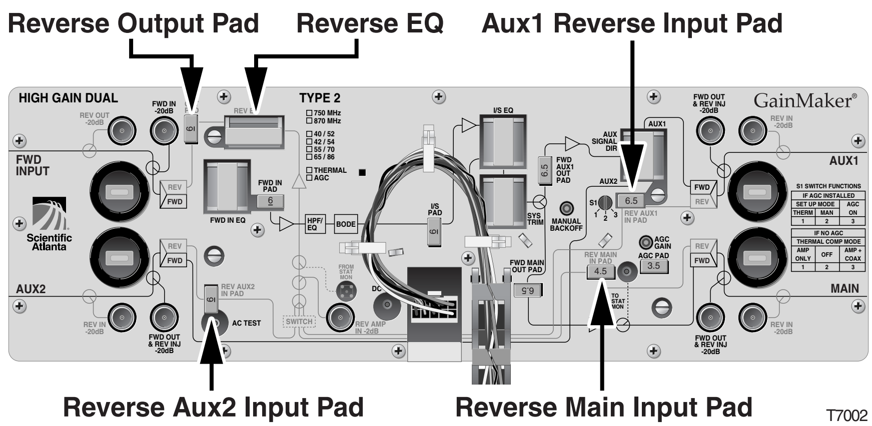
Preparing the Amplifier for Reverse Path Balancing

Balance all of the reverse amplifiers off a given reverse input port for the node being worked on. The reverse amplifiers should be balanced sequentially from the node outward.

Note: Make sure the reverse fiber link has been properly balanced before proceeding.

Ensure that the design value reverse output equalizer and reverse pads are installed in the appropriate reverse slots in the amplifier. Refer to the following diagram.

Note: Record the pad values for each input port for later use.



Proceed to **Calculate the Proper RF Signal Level**.

Calculate the Proper RF Signal Level

In order to calculate the correct RF signal level to inject, you must know the following:

- Design Reverse Port Input Level from the design print
- Total Injection Insertion Loss (20 dB)

To calculate the correct signal level to inject, add the total injection insertion loss to the design port input level.

Example:

Design amplifier reverse port input level = 19 dBmV
Total injection insertion loss = 20 dB

The design amplifier reverse port input level plus injection insertion loss equals correct RF signal level to inject.

19 dBmV + 20 dB = 39 dBmV

Set the signal generator output for + 39 dBmV.

Continued on next page

Important: When using a CW signal generator, inject at least two carriers, one at the low end and one at the high end of the reverse bandpass. In a reverse system with a 5 MHz to 40 MHz bandpass, the low frequency carrier should be in the 5 MHz to 10 MHz range and the high frequency carrier should be in the 35 MHz to 40 MHz range.

Important: The amplitude of the signal generator output can be set higher or lower than the level specified by the calculation above, but the difference between the actual output level and the level calculated above must be known. If the generator output is x dB higher (or lower) than the level calculated, then the reference (desired) level received at the headend or hub should also be x dB higher (or lower) than the original headend reference level.

Important: The station's reverse input pad values are selected during the reverse system design and are based on the need to minimize variations in return path losses for the various reverse inputs. Do not permanently alter the values of the reverse input pads without consulting a system designer.

While most system design prints should specify a design value reverse input pad for each port, the following chart provides guidelines for minimum reverse input pad values that should be installed for the High Gain and Low Gain Duals with an Auxiliary Signal Director (other than a jumper) installed in the amplifier module. Unlike previous versions of the High Gain and Low Gain Duals with plug-in signal directors, the GainMaker amplifier signal director creates loss in the forward path only. To equalize forward and reverse path losses, these minimum pad values are recommended on the associated reverse input ports.

Note: Design print values may be greater than the minimum recommended reverse input port pad values listed here.

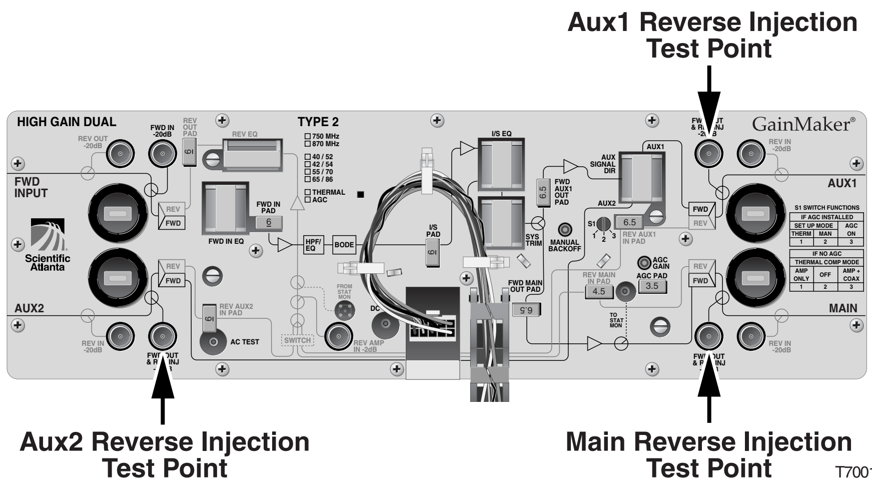
Signal Director	Tap Leg	Thru Leg
Splitter	3.5 dB	3.5 dB
DC-8	8.0 dB	2.0 dB
DC-12	12.0 dB	1.5 dB

Continued on next page

Important: In the GainMaker amplifier module, the reverse input pad comes after the reverse injection point in the reverse path. Temporarily replacing the design value reverse input pad on the port being balanced with a 0 dB pad allows the reverse injection level, and the receive levels at the monitoring end, to remain constant from amplifier to amplifier, and port to port.

An alternate to this method is to expect a receive level that is "x" dB lower than normal, where "x" is the value of the reverse input pad on the port being balanced, which you noted earlier in the reverse path balancing procedure.

Insert the appropriate signal amplitude from **Calculate the Proper RF Signal Level** into the reverse injection test point. Refer to the following diagram.



Proceed to **Completing Reverse Path Balancing**.

Completing Reverse Path Balancing

Final Procedure

Follow this procedure to complete the amplifier setup.

1. Monitor the tilt of the signals being received at the headend/hub reverse optical receiver's RF output test point.

   The tilt is the difference in signal level between the highest and lowest frequencies in the reverse passband (or between the highest and lowest frequency CW test signals).

   Most systems prefer to have minimal reverse tilt (flat levels) at the headend.

   To minimize tilt, alter the value of the amplifier's reverse output equalizer.

2. Monitor the amplitude (level) of the signals being received at the headend/hub reverse optical receiver's RF output testpoint.

   Compare the received level to the reference level desired.

   If using a sweep system that is "x" dB below standard CW carrier levels, be sure to consider that your receive level should also be "x" dB below the CW reference level.

   To adjust the receive level to make it match the desired reference level, alter the value of the amplifier's reverse output pad. Each 1 dB change (increase or decrease) in pad value should result in a corresponding 1 dB change (decrease or increase) in receive level.

3. Once the proper receive level and tilt of the test signals have been achieved, properly close the amplifier housing and repeat the process at the next reverse amplifier (in the downstream) cascade.

   Important: Reinstall design print value reverse input pads for any port whose input pad may have been temporarily replaced with a 0 dB value pad for reverse path balancing purposes.

   Work outward from the node, and outward from each external split in the coaxial plant, until all amplifiers in the cascade have been balanced.

   Repeat the process for all of the reverse amplifier cascades off any remaining active node ports until all reverse amplifiers feeding into the node have been balanced.

Chapter 4
Basic Troubleshooting

Overview

Introduction

This chapter contains steps you may take to troubleshoot the GainMaker System Amplifier.

In this Chapter

This chapter contains the following topics.

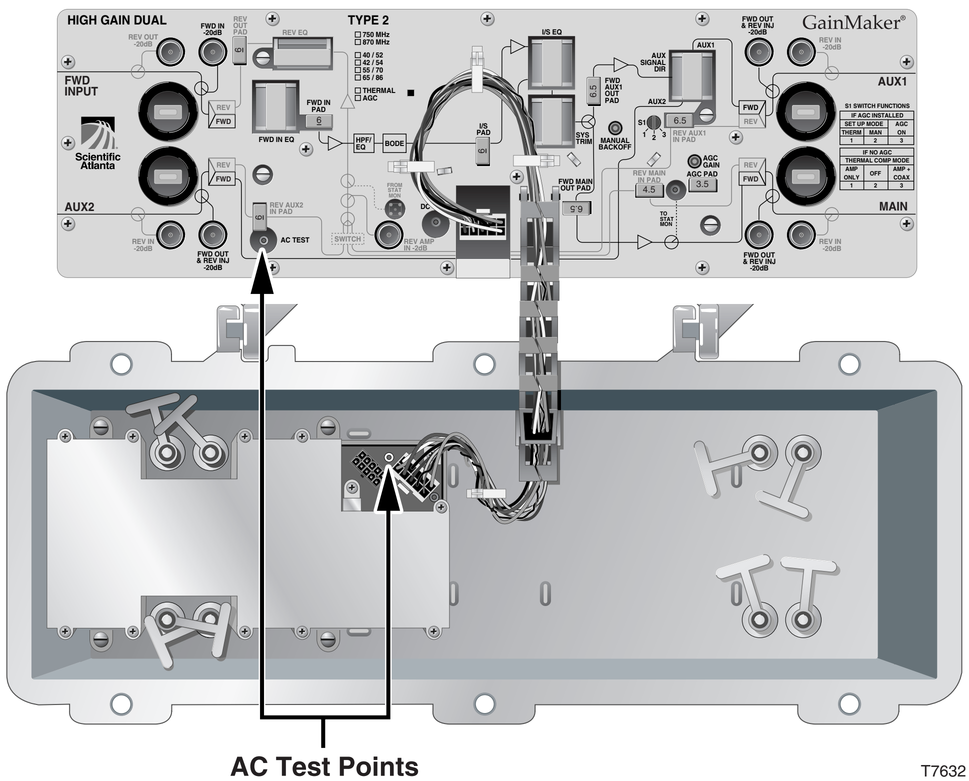
No AC Power

Introduction

AC power can be measured at the amplifier seizure screws, AC shunt power directors, amplifier module test points, power supply harness and AC test points.

AC Test Point Locations

The following diagram illustrates the AC test point locations for the GainMaker System Amplifier.



Continued on next page

Troubleshooting Table

Before you begin troubleshooting for no AC power, verify that there is proper AC power input coming into the amplifier and that the AC voltage lockout threshold is set to your system's powering requirements.

Problem	Solution
No AC at the housing seizure.	• Check the AC source. • Check the AC shunt power director configuration at the amplifier feeding AC to this amplifier. **Note:** Be sure and verify the AC shunt power director configuration for AC output at this amplifier as well. • Make sure the housing seizure is properly tightened.
AC at the housing seizure but not the AC shunt power director.	• Check and/or replace the AC shunt power director. • Check and/or replace the amplifier module.
AC at AC shunt power director but not amplifier test point.	• Check and/or replace the AC shunt power director. • Check and/or replace the amplifier module.
AC at amplifier test point but not power supply test point.	• Check and/or replace the power supply wiring harness. • Check and/or replace the power supply.

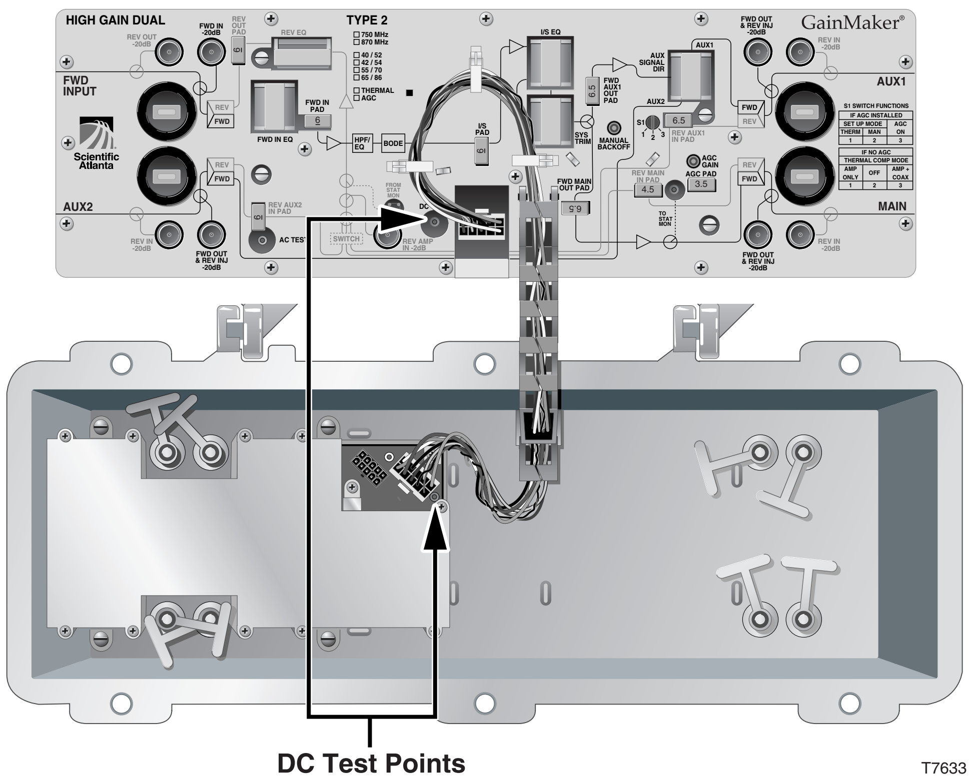
No DC Power

Introduction

DC power can be measured at the amplifier module test points, DC power supply test points, and power wiring harness.

DC Test Point Locations

The following diagram illustrates the DC test point locations for the GainMaker System Amplifier.



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Troubleshooting Table

Before you begin troubleshooting for no DC power, verify that there is proper AC power input coming into the DC power supply and that the AC voltage lockout threshold is set to your system's powering requirements.

Problem	Solution
No DC power at the power supply.	• Check and/or replace the power supply.
DC at the power supply but not the amplifier module.	• Check and/or replace the power wiring harness and/or the amplifier module. • Check and/or replace the power supply.

No Forward RF Signal

Introduction

The forward RF signal can be measured at the amplifier module forward input, and main, aux1, and aux2 forward output test points.

Troubleshooting Table

Before you begin troubleshooting for no forward RF signal, verify that the amplifier is receiving the proper forward RF input signal from the upstream amplifier.

Important: You cannot balance the amplifier without the proper forward RF input signal.

Problem	Solution
No forward RF signal at the forward input test point.	• Verify that the amplifier is receiving the proper forward RF input signal from the upstream amplifier. **Important:** You cannot balance the amplifier without the proper forward RF input signal.
There is a forward RF signal at the forward input test point but no signal at one or all of the forward output test points.	• Verify that the amplifier module is receiving the proper AC and DC voltages. Refer to **No AC Power** and **No DC Power** discussed earlier in this chapter. • Verify that all the proper accessories, pads, EQs, and signal directors (if applicable) are firmly installed in the correct locations. • Verify that the factory installed accessories are firmly installed in the correct locations. **Note:** Verifying factory installations involves removing the amplifier module cover. Reinstall the amplifier module cover properly or RF signal degradation may result. • Change the amplifier module.

No Reverse RF Signal

Introduction

The reverse RF signal can be measured at the amplifier module main, aux1, and aux2 reverse input, and reverse output test points.

Troubleshooting Table

Before you begin troubleshooting for no reverse RF signal, verify that the amplifier is receiving the proper reverse RF input signals from the downstream amplifiers at the amplifier module main, aux1, and aux2 reverse input test points.

Important: You cannot balance the amplifier without the proper reverse RF input signals.

Problem	Solution
No reverse RF signal at the reverse input test point(s).	• Verify that the amplifier is receiving the proper reverse RF input signals from the downstream amplifiers. **Important:** You cannot balance the amplifier without the proper reverse RF input signals.

Continued on next page

There are proper reverse RF signals at the main, aux1, and aux2 reverse input test points but no signal at the reverse output test point.	• Verify that the amplifier module is receiving the proper AC and DC voltages. Refer to **No AC Power** and **No DC Power** discussed earlier in this chapter. • Verify that the amplifier module is receiving the proper forward RF signal. Refer to **No Forward RF Signal** discussed earlier in this chapter. • Verify that all the proper accessories, pads, and Eqs are firmly installed in the correct locations. • Verify that the factory installed accessories are firmly installed in the correct locations. • Verify that the reverse switch (if applicable), or its jumpers are properly and firmly installed. **Note:** Verifying factory installations involves removing the amplifier module cover. Reinstall the amplifier module cover properly or RF signal degradation may result. • Change the amplifier module.

Low or Degraded Forward RF Signal

Introduction

The forward RF signal can be measured at the amplifier module forward input, and main, aux1, and aux2 forward output test points.

Troubleshooting Table

Before you begin troubleshooting for a low or degraded forward RF signal, verify that the amplifier is receiving the proper forward RF input signal from the upstream amplifier.

Important: You cannot balance the amplifier without the proper forward RF input signal.

Make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

Make sure you are using the proper tilt reference when setting levels. A 750 MHz or 870 MHz design balanced at 550 MHz requires a corrected tilt reference to compensate for the difference in carrier levels between 550 MHz and 750 MHz or 870 MHz. The tilt reference at 550 MHz will be lower than the tilt reference at 750 MHz or 870 MHz. Refer to the tilt charts in Appendix A for more information.

Important: If the amplifier cover was ever removed make sure it was properly reinstalled. Improperly reinstalling the amplifier module cover may result in RF signal degradation.

Problem	Solution
Low or degraded forward RF signal at the forward input test point.	• Verify that the amplifier is receiving the proper forward RF input signal from the upstream amplifier. **Important:** You cannot balance the amplifier without the proper forward RF input signal.

Continued on next page

There is a proper forward RF signal at the forward input test point but a low or degraded signal at one or all of the forward output test points.	• Verify that the amplifier module is receiving the proper DC voltages. Refer to **No DC Power** discussed earlier in this chapter. • Verify that Switch 1 is in the proper position for your amplifier module configuration. Refer to Chapter 3 for more information. • Verify that all the proper accessories, pads, EQs, and signal directors (if applicable) are firmly installed in the correct locations. • Verify that the factory installed accessories are firmly installed in the correct locations. **Note:** Verifying factory installations involves removing the amplifier module cover. Reinstall the amplifier module cover properly or RF signal degradation may result. • Change the amplifier module.

Low or Degraded Reverse RF Signal

Introduction

The reverse RF signal can be measured at the amplifier module main, aux1, and aux2 reverse input, and reverse output test points.

Troubleshooting Table

Before you begin troubleshooting for a low or degraded reverse RF signal, verify that the amplifier is receiving the proper reverse RF input signals from the downstream amplifiers at the amplifier module main, aux1, and aux2 reverse input test points.

Important: You cannot balance the amplifier without the proper reverse RF input signals.

Make sure you have configured the amplifier module according to the specifications in the design print and that the amplifier has warmed up for approximately 1 hour.

Make sure you are using the proper total tilt reference when setting receive levels. Refer to the reverse equalizer charts in Appendix A for more information.

Important: If the amplifier cover was ever removed, make sure it was properly reinstalled. Improperly reinstalling the amplifier module cover may result in RF signal degradation.

Problem	Solution
Low or degraded reverse RF signal at the reverse input test point(s).	• Verify that the amplifier is receiving the proper reverse RF input signals from the downstream amplifiers. **Important:** You cannot balance the amplifier without the proper reverse RF input signals.

Continued on next page

There are proper reverse RF signals at the main, aux1, and aux2 reverse input test points but a low or degraded signal at the reverse output test point.	• Verify that the amplifier module is receiving the proper DC voltages. Refer to **No DC Power** discussed earlier in this chapter. • Measure the main reverse input test point and the reverse output test point. Subtract the reverse amplifier gain and add the pad values and EQ insertion loss to verify proper reverse amplifier gain. • Verify that all the proper accessories, pads, EQs, and signal directors (if applicable) are firmly installed in the correct locations. • Verify that the factory-installed accessories are firmly installed in the correct locations. • Verify that the reverse switch and its jumpers are properly and firmly installed. **Note:** Verifying factory installations involves removing the amplifier module cover. Reinstall the amplifier module cover properly or RF signal degradation may result.

Continued on next page

Reverse RF signal still low or degraded.	• Verify any unused RF ports are properly terminated. • Use a spectrum analyzer to look at the reverse RF input signal spectral quality at each reverse input test point and compare it to the reverse RF output signal spectral quality. – If degradation is generated in the reverse amplifier, replace the reverse amplifier. – If degradation is generated by the downstream amplifier reverse RF signal, troubleshoot the RF amplifier feeding this station. • Change the amplifier module.

Chapter 5
Customer Information

Overview

Introduction

This chapter contains information on obtaining product support and returning damaged products to Scientific-Atlanta.

In This Chapter

This chapter contains the following topics.

Customer Support

Obtaining Support

IF...	THEN...
you have general questions about this product	contact your distributor or sales agent for product information or refer to product data sheets on www.scientificatlanta.com.
you have technical questions about this product	call the nearest Technical Service center or Scientific Atlanta office.
you have customer service questions or need a return material authorization (RMA) number	call the nearest Customer Service center or Scientific Atlanta office.

Support Telephone Numbers

This table lists the Technical Support and Customer Service numbers for your area.

Region	Centers	Telephone and Fax Numbers
North America	SciCare™ Services Atlanta, Georgia United States	For *Technical Support*, call: ▪ Toll-free: 1-800-722-2009 ▪ Local: 678-277-1120 (Press **2** at the prompt) For *Customer Service* or to request an RMA number, call: ▪ Toll-free: 1-800-722-2009 ▪ Local: 678-277-1120 (Press **3** at the prompt) ▪ Fax: 770-236-5477 ▪ E-mail: customer.service@sciatl.com
Europe, Middle East, Africa	Belgium	For *Technical Support*, call: ▪ Telephone: 32-56-445-197 or 32-56-445-155 ▪ Fax: 32-56-445-053 For *Customer Service* or to request an RMA number, call: ▪ Telephone: 32-56-445-133 or 32-56-445-118 ▪ Fax: 32-56-445-051 ▪ E-mail: elc.service@sciatl.com
Japan	Japan	▪ Telephone: 81-3-5908-2153 or +81-3-5908-2154 ▪ Fax: 81-3-5908-2155 ▪ E-mail: yuri.oguchi@sciatl.com
Korea	Korea	▪ Telephone: 82-2-3429-8800 ▪ Fax: 82-2-3452-9748 ▪ E-mail: kelly.song@sciatl.com
China (mainland)	China	▪ Telephone: 86-21-6485-3205 ▪ Fax: 86-21-6485-3205 ▪ E-mail: xiangyang.shan@sciatl.com

Continued on next page

Region	Centers	Telephone and Fax Numbers
All other Asia-Pacific countries & Australia	Hong Kong	▪ Telephone: 852-2588-4746 ▪ Fax: 852-2588-3139 ▪ E-mail: support.apr@sciatl.com
Brazil	Brazil	For *Technical Support*, call: ▪ Telephone: 55-11-3845-9154 ext 230 ▪ Fax: 55-11-3845-2514 For *Customer Service* or to request an RMA number, call: ▪ Telephone: 55-11-3845-9154, ext 109 ▪ Fax: 55-11-3845-2514 ▪ E-mail: luiz.fattinger@sciatl.com
Mexico, Central America, Caribbean	Mexico	For *Technical Support*, call: ▪ Telephone: 52-3515152599 ▪ Fax: 52-3515152599 For *Customer Service* or to request an RMA number, call: ▪ Telephone: 52-55-50-81-8425 ▪ Fax: 52-55-52-61-0893 ▪ E-mail: karla.lugo@sciatl.com
All other Latin America countries	Argentina	For *Technical Support*, call: ▪ Telephone: 54-23-20-403340 ext 109 ▪ Fax: 54-23-20-403340 ext 103 For *Customer Service* or to request an RMA number, call: ▪ Telephone: 770-236-5662 ▪ Fax: 770-236-5888 ▪ E-mail: veda.keillor@sciatl.com

Return Product for Repair

Introduction

You must have a return material authorization (RMA) number to return a product. Contact the nearest customer service center and follow their instructions.

Returning a product to Scientific Atlanta for repair includes the following steps:

- ***Obtaining an RMA Number and Shipping Address***
- ***Completing the Scientific Atlanta Transmission Networks Repair Tag***
- ***Packing and Shipping the Product***

Obtaining an RMA Number and Shipping Address

You must have an RMA number to return products.

RMA numbers are valid for 60 days. RMA numbers older than 60 days must be revalidated by calling a customer service representative before the product is returned. You can return the product after the RMA number is revalidated. Failure to comply with the above may delay the processing of your RMA request.

Complete the following steps to obtain an RMA number and shipping address.

1 Contact a customer service representative to request a new RMA number or revalidate an existing one.

Refer to ***Support Telephone Numbers*** to find a customer service telephone number in your area.

2 Provide the following information to the customer service representative:

- Your company name, contact, telephone number, email address, and fax number
- Product name, model number, part number, serial number (if applicable)
- Quantity of products to return
- A reason for returning the product and repair disposition authority
- Any service contract details

3 A purchase order number or advance payment to cover estimated charges will be requested at the time a customer service representative issues an RMA number.

Notes:

- For credit card or cash in advance customers, a proforma invoice will be sent to you upon completion of product repair listing all charges incurred.
- Customer service must receive a purchase order number within 15 days after you receive the proforma invoice.

Continued on next page

- In-warranty products can accrue costs through damage or misuse, cosmetics, or if no problem is found. Products incurring costs will not be returned to you without a valid purchase order number.

4 Once an RMA number has been issued, a confirmation e-mail or fax will be sent to you detailing the RMA number, product and product quantities authorized for return, together with shipping address details and RMA terms and conditions.

Note: Alternatively, you may obtain an RMA fax request form, complete and fax it to a customer service representative, or e-mail your completed request form to: customer.service@sciatl.com.

5 Go to ***Completing the Scientific Atlanta Transmission Networks Repair Tag***.

Completing the Scientific Atlanta Transmission Networks Repair Tag

Product returned for repair, both in-warranty and out-of-warranty, should have a repair tag attached to the product detailing the failure mode. A supply of tags can be obtained free of charge by calling a customer service representative.

The Scientific Atlanta Transmission Networks repair tag provides important failure information to the Scientific Atlanta repair department. This information will reduce the amount of time needed to repair the unit and return it to you. This information can also reduce the cost of out-of-warranty repairs.

It is best to have the Scientific Atlanta Transmission Networks repair tag completed by a person knowledgeable about the failure symptoms of the unit to be returned for repair. The tag should be securely attached to the failed unit with the elastic string, tape, or another method and returned to Scientific Atlanta.

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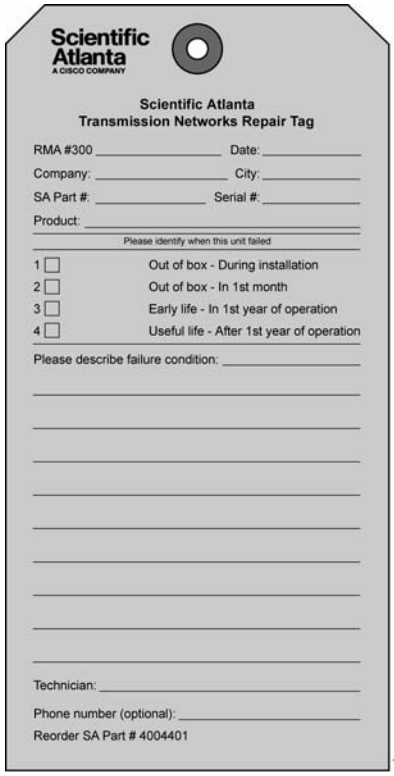

Scientific Atlanta
A CISCO COMPANY

Scientific Atlanta
Transmission Networks Repair Tag

RMA #300 ______ Date: ______
Company: ______ City: ______
SA Part #: ______ Serial #: ______
Product: ______

Please identify when this unit failed

1 ☐ Out of box - During installation
2 ☐ Out of box - In 1st month
3 ☐ Early life - In 1st year of operation
4 ☐ Useful life - After 1st year of operation

Please describe failure condition: ______

Technician: ______
Phone number (optional): ______
Reorder SA Part # 4004401

T11025

Complete the following steps to complete the Scientific Atlanta Transmission Networks repair tag.

1 Complete header information.

Scientific Atlanta
A CISCO COMPANY

Scientific Atlanta
Transmission Networks Repair Tag

RMA #300 ______ Date: ______
Company: ______ City: ______
SA Part #: ______ Serial #: ______
Product: ______

T11026

- RMA Number: Enter the RMA number provided by the Scientific Atlanta customer service representative. All RMA numbers start with "30" and are followed by 6 additional digits. An RMA number is required to return products to Scientific Atlanta.
- If you are the technician who is filling out this tag, you may not have the RMA number. Leave it blank for now. Someone else in your organization, who has the number, can fill it in later.

Continued on next page

- Date: Enter the date the unit was removed from service. If this date is unknown, enter the date you are completing the repair tag.
- Company and City: Enter the company name and city of the customer who owns the unit to be returned for repair.
- SA Part # and Serial #: Enter the part number and serial number of the unit you are returning for repair. The part number and serial number can usually be found on a bar code label on the outside of the unit. If this information can't be found leave this blank.
- Product: Enter the model description of the unit you are returning for repair. For example, Model 6940/44 Node, Multimedia Tap, RF Signal Manager, etc.

2 Complete time of failure information.

Please identify when this unit failed

1 ☐ Out of box - During installation
2 ☐ Out of box - In 1st month
3 ☐ Early life - In 1st year of operation
4 ☐ Useful life - After 1st year of operation

T11027

This information will help the repair technician understand the failure mode. If the time to failure is unknown, leave this information blank.

3 Complete the failure description and technician information:

Please describe failure condition: ____________

Technician: ____________

Phone number (optional): ____________

Reorder SA Part # 4004401

T11028

- Failure Description: Include as much information as possible. For example:
  – Which feature is not working or which specification is not being met? For example, does the problem affect audio, video, status monitoring and control, forward path, reverse path, cosmetics, all functions, etc.

Continued on next page

- If it is a multi-port product, which port is not working or if all ports are not working?
- If the unit has degraded performance or is completely failed.
- If the failure happens only at specific environmental conditions (i.e., at hot temperature).
- If the failure is intermittent or constant.
- How you were powering the unit when it failed? (DC vs. AC, voltage levels, etc.)

Important: Descriptions like “bad unit”, “failed”, or “no HBO” are not specific enough to be helpful.

- Technician and Phone Number: Enter the name and phone number of the technician completing the failure description information. A Scientific Atlanta representative may want to call this person to better understand the problem.

4 Attach the repair tag to the unit you are returning for repair. Use the elastic string provided, tape, or another method to securely attach the tag.

5 Go to ***Packing and Shipping the Product***.

Packing and Shipping the Product

Follow these steps to pack the product and ship it to Scientific Atlanta.

1 Are the product’s original container and packing material available?

- If yes, pack the product in the container using the packing material.
- If no, pack the product in a sturdy, corrugated box, and cushion it with packing material.

Important: You are responsible for delivering the returned product to Scientific Atlanta safely and undamaged. Shipments damaged due to improper packaging may be refused and returned to you at your expense.

Note: PLEASE DO NOT RETURN ANY POWER CORDS, ACCESSORY CABLES, OR OTHER ACCESSORY PRODUCTS. Instructions for ordering replacement power cords, accessory cables, or other accessories can be provided by a customer service representative.

2 Write the following information on the outside of the shipping container:

- RMA number
- Your name
- Your complete address

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- Your telephone number
- "Attention: Factory Service"

Important: The RMA number should be clearly marked on all returned product, boxes, packages, and accompanying paperwork. RMAs received by the factory service receiving department that are not clearly marked may experience delays in the processing of RMA requests. All returned product should be marked to the attention of Factory Service.

3 Ship the product to the address provided by the customer service representative in the confirmation e-mail or fax.

Note: Scientific Atlanta does not accept freight collect. Be sure to prepay and insure all shipments. For both in-warranty and out-of-warranty repairs, you are responsible for paying your outbound freight expense, any applicable import and/or export duties and taxes. Scientific Atlanta will pay the return freight expense for in-warranty repairs.

International Shipments: International shipments should be consigned to Scientific-Atlanta, Inc. with the notified party on the Airway Bill stated as "Expeditors International for Customs Clearance".

4 On receipt of product returned under an RMA number, a receipt notification e-mail or fax will be sent to you by Repair Receiving confirming receipt of product and quantities received. Please check the receipt notification to assure the product and quantity of product received by Scientific Atlanta matches what you shipped.

Appendix A
Technical Information

Overview

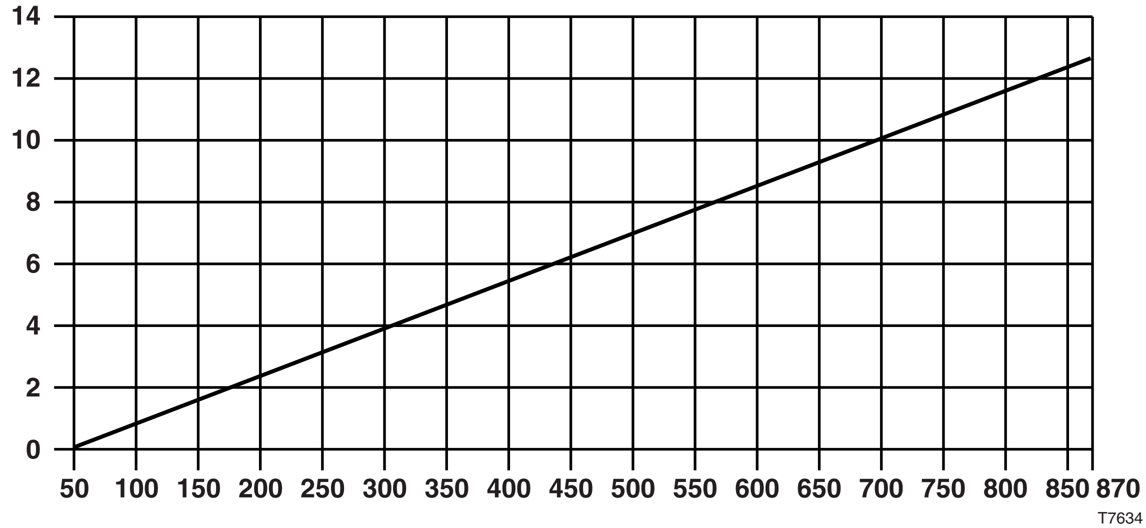
Appendix Contents

This appendix contains tilt, forward equalizer, and reverse equalizer charts.

“Linear” Tilt Charts

Amplifier Output “Linear” Tilt Chart for 870 MHz

The following chart can be used to determine the operating level at a particular frequency considering the operating linear tilt.



Example: If the amplifier’s 870 MHz output level is 47.5 dBmV with a linear operating tilt of 12.5 dB (from 50 to 870 MHz), the corresponding output level at 650 MHz would be 44 dBmV. This was found by taking the difference in tilt between 870 and 650 MHz (12.5 - 9 = 3.5 dB). Then subtract the difference in tilt from the operating level (47.5 - 3.5 = 44 dBmV).

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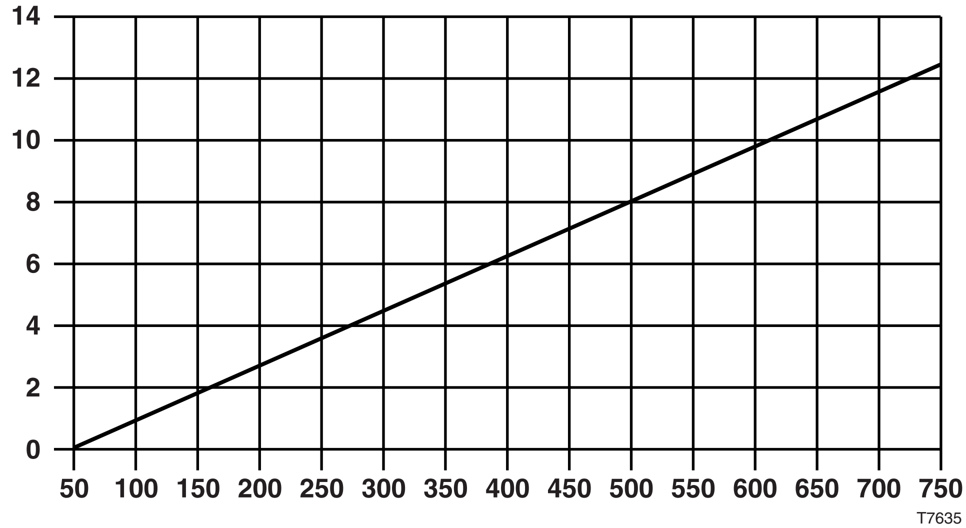
Amplifier Output “Linear” Tilt Chart for 750 MHz

The following chart can be used to determine the operating level at a particular frequency considering the operating linear tilt.



Example: If the amplifier’s 750 MHz output level is 46 dBmV with a linear operating tilt of 12.5 dB (from 50 to 750 MHz), the corresponding output level at 550 MHz would be 42.5 dBmV. This was found by taking the difference in tilt between 750 and 550 MHz (12.5 - 9 = 3.5 dB). Then subtract the difference in tilt from the operating level (46 - 3.5 = 42.5 dBmV).

Forward Equalizer Charts

870 MHz Forward Equalizer

The following table shows the 870 MHz forward equalizer loss.

EQ Value	Insertion Loss at (MHz)									Total Tilt
(dB)	870	750	600	550	450	300	216	108	52	(52-870 MHz)
1.5	1.0	1.1	1.3	1.3	1.5	1.7	1.8	2.0	2.2	**1.2**
3.0	1.0	1.2	1.6	1.7	1.9	2.3	2.6	3.0	3.3	**2.3**
4.5	1.0	1.4	1.9	2.0	2.4	3.0	3.4	4.1	4.5	**3.5**
6.0	1.0	1.5	2.1	2.4	2.9	3.7	4.2	5.1	5.7	**4.7**
7.5	1.0	1.6	2.4	2.7	3.3	4.4	5.0	6.1	6.9	**5.9**
9.0	1.0	1.7	2.7	3.1	3.8	5.0	5.8	7.1	8.1	**7.1**
10.5	1.0	1.8	3.0	3.4	4.3	5.7	6.6	8.1	9.2	**8.2**
12.0	1.0	2.0	3.3	3.7	4.7	6.4	7.5	9.2	10.4	**9.4**
13.5	1.0	2.1	3.6	4.1	5.2	7.0	8.3	10.2	11.6	**10.6**
15.0	1.0	2.2	3.8	4.4	5.6	7.7	9.1	11.2	12.8	**11.8**
16.5	1.0	2.3	4.1	4.8	6.1	8.4	9.9	12.2	13.9	**12.9**
18.0	1.0	2.5	4.4	5.1	6.6	9.1	10.7	13.3	15.1	**14.1**
19.5	1.0	2.6	4.7	5.5	7.0	9.7	11.5	14.3	16.3	**15.3**
21.0	1.0	2.7	5.0	5.8	7.5	10.4	12.3	15.3	17.5	**16.5**
22.5	1.0	2.8	5.3	6.1	8.0	11.1	13.1	16.3	18.6	**17.6**
24.0	1.0	2.9	5.6	6.5	8.4	11.7	13.9	17.3	19.8	**18.8**
25.5	1.0	3.1	5.8	6.8	8.9	12.4	14.7	18.4	21.0	**20.0**
27.0	1.0	3.2	6.1	7.2	9.4	13.1	15.5	19.4	22.2	**21.2**

Continued on next page

750 MHz Forward Equalizer

The following table shows the 750 MHz forward equalizer loss.

EQ Value (dB)	Insertion Loss at (MHz)								Total Tilt (52-750 MHz)
	750	600	550	450	300	216	108	52	
1.5	1.0	1.2	1.2	1.4	1.6	1.7	2.0	2.1	**1.1**
3.0	1.0	1.4	1.5	1.7	2.2	2.5	3.0	3.3	**2.3**
4.5	1.0	1.5	1.7	2.1	2.8	3.2	3.9	4.4	**3.4**
6.0	1.0	1.7	2.0	2.5	3.4	4.0	4.9	5.5	**4.6**
7.5	1.0	1.9	2.2	2.9	4.0	4.7	5.9	6.7	**5.7**
9.0	1.0	2.1	2.4	3.2	4.6	5.5	6.9	7.9	**6.9**
10.5	1.0	2.2	2.7	3.6	5.2	6.2	7.8	9.0	**8.0**
12.0	1.0	2.4	2.9	4.0	5.8	7.0	8.8	10.2	**9.2**
13.5	1.0	2.6	3.2	4.4	6.4	7.7	9.7	11.3	**10.3**
15.0	1.0	2.8	3.4	4.7	7.0	8.5	10.7	12.5	**11.5**
16.5	1.0	2.9	3.6	5.1	7.6	9.2	11.7	13.6	**12.6**
18.0	1.0	3.1	3.9	5.5	8.2	10.0	12.7	14.8	**13.8**
19.5	1.0	3.3	4.1	5.9	8.8	10.7	13.7	15.9	**14.9**
21.0	1.0	3.5	4.4	6.2	9.4	11.4	14.7	17.1	**16.1**
22.5	1.0	3.7	4.6	6.6	10.0	12.2	15.7	18.2	**17.2**
24.0	1.0	3.8	4.8	7.0	10.6	12.9	16.7	19.4	**18.4**
25.5	1.0	4.0	5.1	7.4	11.2	13.7	17.6	20.5	**19.5**
27.0	1.0	4.2	5.3	7.7	11.8	14.4	18.6	21.7	**20.7**

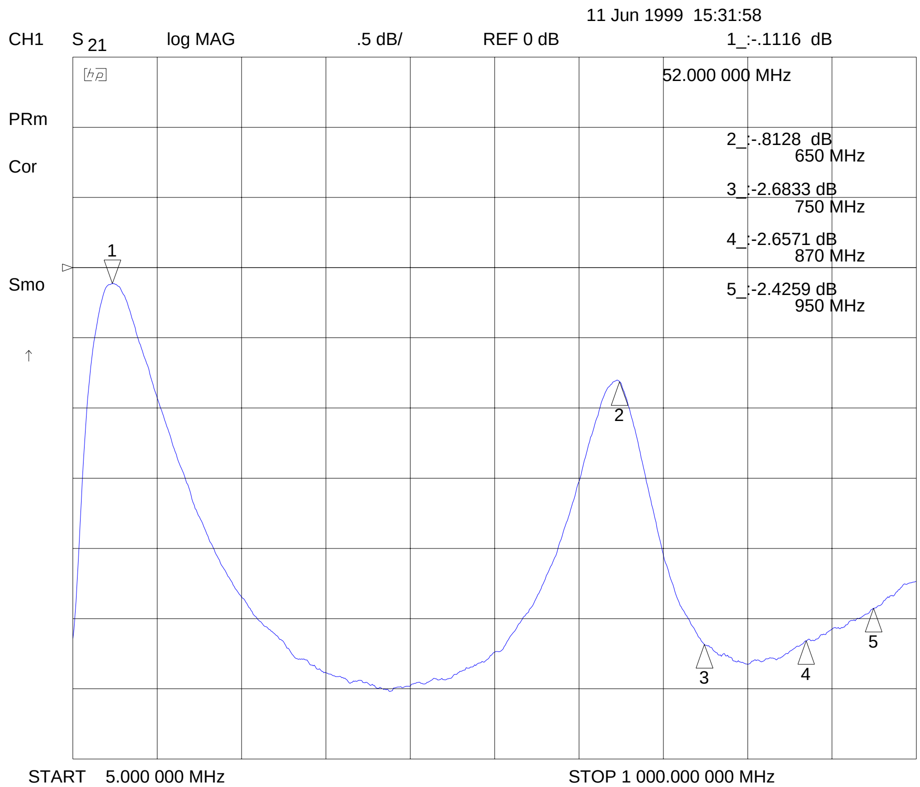
Trim Network Response Plots

Introduction

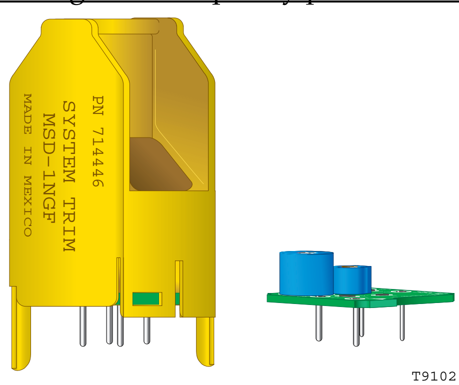
The following are the frequency response plots for the GainMaker System Amplifier Trim Network.

MSD-1NGF - part number 714446

Mid-Frequency Dual Peak



Adjusting C1 changes the high-end frequency peak from 650 MHz to 950 MHz.



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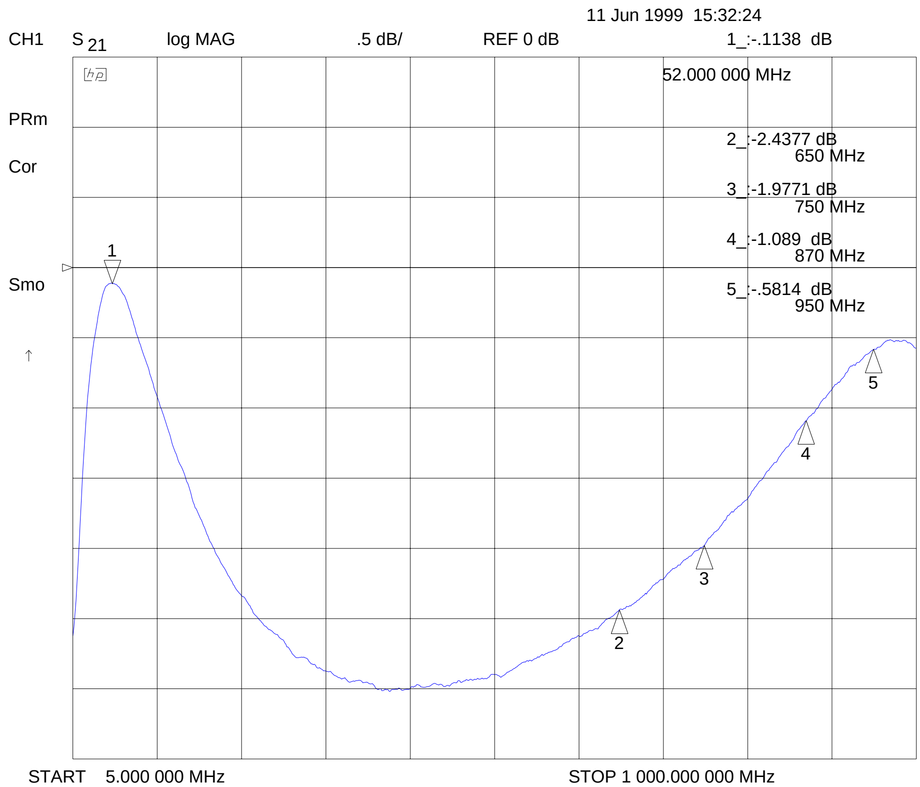
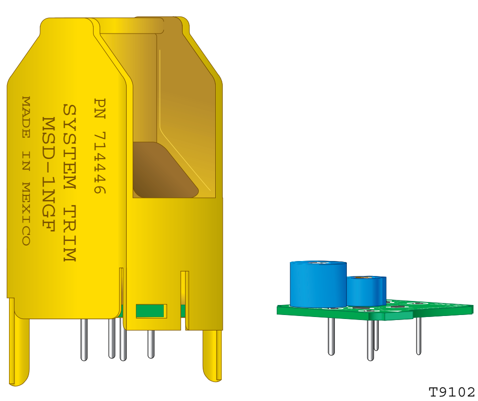
MSD-1NGF - part number 714446, continued

Mid-Frequency Dual Peak



Adjusting C1 changes the high-end frequency peak from 650 MHz to 950 MHz.



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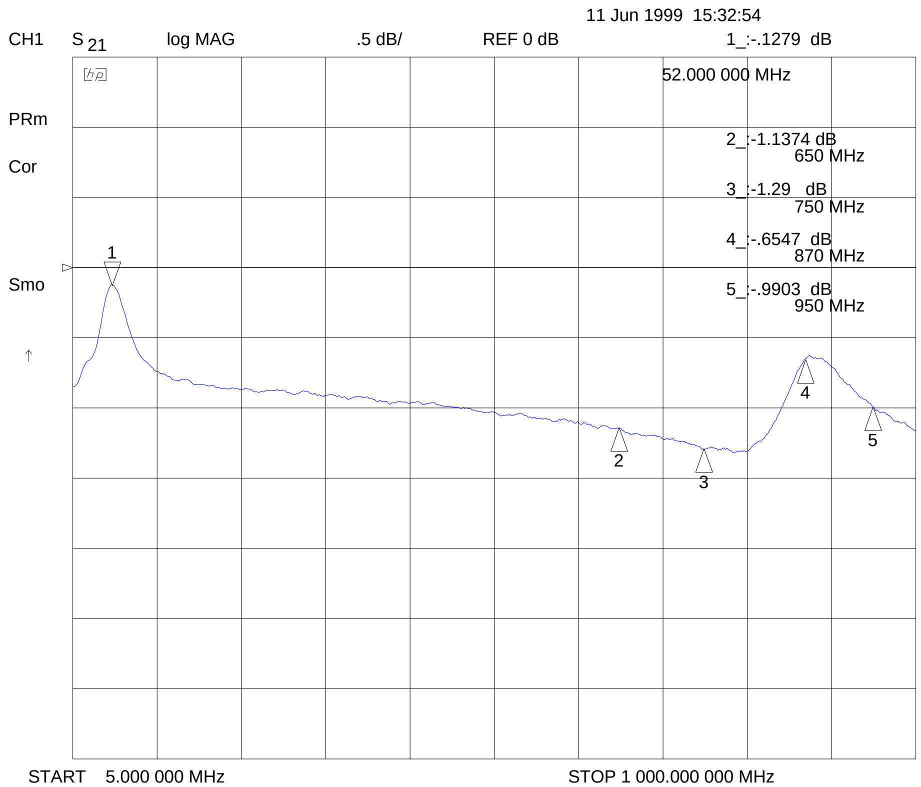
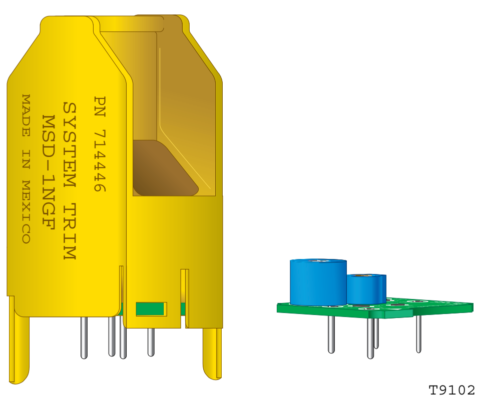
MSD-1NGF - part number 714446, continued

Mid-Frequency Dual Peak



<u>Adjusting R2 changes the depth of the mid-band dip without changing the location of the peaks.</u>



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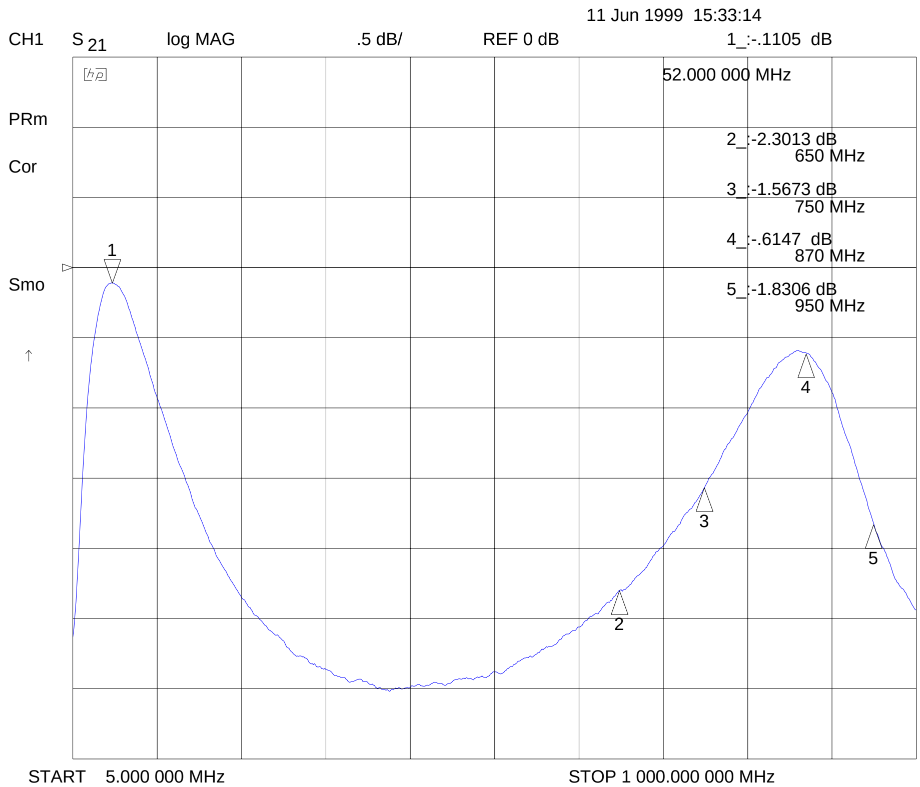
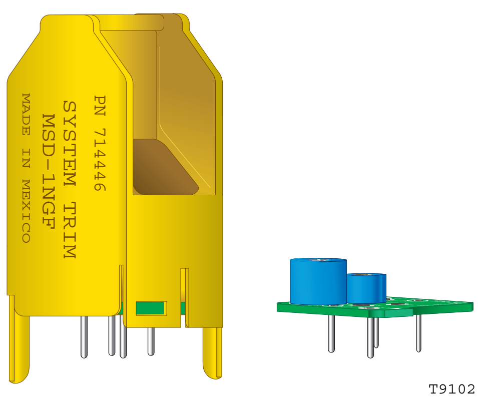
MSD-1NGF - part number 714446, continued

Mid-Frequency Dual Peak



Adjusting R2 changes the depth of the mid-band dip without changing the location of the peaks.



42 MHz and 40 MHz Reverse Equalizer

The following table shows the 42 MHz reverse equalizer loss.

Note: The 42 MHz reverse equalizer also works as a 40 MHz reverse equalizer in systems that use 5-40 MHz reverse amplifiers.

EQ Value	EQ Value	Insertion Loss at (MHz)									Total Tilt	Total Tilt
(dB) 42 MHz	(dB) 40 MHz	42	40	35	30	25	20	15	10	5	(5-42 MHz)	(5-40 MHz)
1	**1**	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.7	**0.7**	**0.7**
2	**2**	1.0	1.0	1.1	1.3	1.4	1.6	1.8	2.0	2.3	**1.3**	**1.3**
3.1	**3**	0.9	1.0	1.2	1.4	1.6	1.9	2.2	2.5	3.0	**2.1**	**2.0**
4.1	**4**	0.9	1.0	1.3	1.6	1.9	2.2	2.6	3.0	3.6	**2.7**	**2.6**
5.1	**5**	0.9	1.0	1.3	1.7	2.1	2.5	3.0	3.5	4.3	**3.4**	**3.3**
6.1	**6**	0.9	1.0	1.4	1.8	2.3	2.8	3.4	4.1	4.9	**4.0**	**3.9**
7.2	**7**	0.8	1.0	1.5	2.0	2.5	3.1	3.8	4.6	5.6	**4.8**	**4.6**
8.2	**8**	0.8	1.0	1.5	2.1	2.7	3.4	4.2	5.1	6.2	**5.4**	**5.2**
9.2	**9**	0.8	1.0	1.6	2.2	2.9	3.7	4.6	5.6	6.9	**6.1**	**5.9**
10.2	**10**	0.8	1.0	1.7	2.4	3.2	4.0	5.0	6.1	7.5	**6.7**	**6.5**
11.3	**11**	0.7	1.0	1.7	2.5	3.4	4.3	5.4	6.6	8.2	**7.5**	**7.2**
12.3	**12**	0.7	1.0	1.8	2.7	3.6	4.6	5.8	7.1	8.9	**8.2**	**7.9**

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42 MHz and 40 MHz Thermal Reverse Equalizer at 25°C Ambient

The following table shows the 42 MHz and 40 MHz thermal reverse equalizer loss.

EQ Value	EQ Value	Insertion Loss at (MHz)									Total Tilt	Total Tilt
(dB) 42 MHz	(dB) 40 MHz	42	40	35	30	25	20	15	10	5	(5-42 MHz)	(5-40 MHz)
1	**1**	1.6	1.6	1.7	1.7	1.8	1.9	2.0	2.1	2.3	0.7	0.7
2	**2**	1.7	1.7	1.8	2.0	2.1	2.3	2.5	2.7	3.0	1.3	1.3
3.1	**3**	1.8	1.9	2.1	2.3	2.5	2.8	3.1	3.4	3.9	2.1	2.0
4.1	**4**	1.9	2.0	2.3	2.6	2.9	3.2	3.6	4.0	4.6	2.7	2.6
5.1	**5**	1.8	1.9	2.2	2.6	3.0	3.4	3.9	4.4	5.2	3.4	3.3
6.1	**6**	1.8	1.9	2.3	2.7	3.2	3.7	4.3	5.0	5.8	4.0	3.9
7.2	**7**	1.7	1.9	2.4	2.9	3.4	4.0	4.7	5.5	6.5	4.8	4.6
8.2	**8**	1.8	2.0	2.5	3.1	3.7	4.4	5.2	6.1	7.2	5.4	5.2

55 MHz Reverse Equalizer

The following table shows the 55 MHz reverse equalizer loss.

EQ Value	Insertion Loss at (MHz)											Total Tilt
(dB)	55	50	45	40	35	30	25	20	15	10	5	(5-55 MHz)
1	1	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.7	**0.7**
2	1	1.1	1.2	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	**1.4**
3	1	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.7	3.1	**2.1**
4	1	1.2	1.4	1.6	1.8	2.1	2.3	2.6	3.0	3.3	3.8	**2.8**
5	1	1.2	1.5	1.7	2.0	2.3	2.6	3.0	3.4	3.9	4.5	**3.5**
6	1	1.3	1.6	1.9	2.3	2.6	3.0	3.4	3.9	4.5	5.2	**4.2**
7	1	1.3	1.7	2.0	2.5	2.9	3.3	3.8	4.4	5.1	5.9	**4.9**
8	1	1.4	1.8	2.2	2.7	3.2	3.7	4.3	4.9	5.7	6.7	**5.7**
9	1	1.4	1.9	2.3	2.9	3.4	4.0	4.7	5.4	6.2	7.4	**6.4**
10	1	1.5	2.0	2.5	3.1	3.7	4.3	5.1	5.9	6.8	8.1	**7.1**
11	1	1.5	2.1	2.6	3.3	3.9	4.7	5.5	6.4	7.4	8.8	**7.8**
12	1	1.6	2.2	2.8	3.5	4.2	5.0	5.9	6.9	8.0	9.5	**8.5**

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65 MHz Reverse Equalizer

The following table shows the 65 MHz reverse equalizer loss.

EQ Value	Insertion Loss at (MHz)													Total Tilt
(dB)	**65**	**60**	**55**	**50**	**45**	**40**	**35**	**30**	**25**	**20**	**15**	**10**	**5**	**(5-65 MHz)**
1	1	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.7	**0.7**
2	1	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.2	2.5	**1.5**
3	1	1.1	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.9	3.2	**2.2**
4	1	1.2	1.4	1.5	1.7	1.9	2.1	2.3	2.6	2.8	3.1	3.5	3.9	**2.9**
5	1	1.2	1.4	1.6	1.9	2.1	2.4	2.7	3.0	3.3	3.7	4.1	4.7	**3.7**
6	1	1.3	1.5	1.8	2.0	2.3	2.7	3.0	3.3	3.7	4.2	4.7	5.4	**4.4**
7	1	1.3	1.6	1.9	2.2	2.5	2.9	3.3	3.6	4.2	4.7	5.3	6.1	**5.1**
8	1	1.3	1.7	2.0	2.4	2.8	3.2	3.6	4.1	4.7	5.2	5.9	6.9	**5.9**
9	1	1.4	1.8	2.2	2.6	3.0	3.5	4.0	4.5	5.1	5.8	6.6	7.6	**6.6**
10	1	1.4	1.8	2.3	2.7	3.2	3.7	4.3	4.9	5.5	6.3	7.2	8.3	**7.3**
11	1	1.4	1.9	2.4	2.9	3.5	4.0	4.6	5.3	6.0	6.8	7.8	9.0	**8.0**
12	1	1.5	2.0	2.5	3.1	3.7	4.3	5.0	5.7	6.5	7.4	8.4	9.8	**8.8**

GainMaker Amplifier Accessory Part Numbers

Attenuator

The following table provides part numbers and pad values for the GainMaker amplifier.

Attenuator Pad	Part Number
0 dB - 750/870 MHz	589693
0.5 dB - 750/870 MHz	589694
1.0 dB - 750/870 MHz	589695
1.5 dB - 750/870 MHz	589696
2.0 dB - 750/870 MHz	589697
2.5 dB - 750/870 MHz	589698
3.0 dB - 750/870 MHz	589699
3.5 dB - 750/870 MHz	589700
4.0 dB - 750/870 MHz	589701
4.5 dB - 750/870 MHz	589702
5.0 dB - 750/870 MHz	589703
5.5 dB - 750/870 MHz	589704
6.0 dB - 750/870 MHz	589705
6.5 dB - 750/870 MHz	589706
7.0 dB - 750/870 MHz	589707
7.5 dB - 750/870 MHz	589708
8.0 dB - 750/870 MHz	589709
8.5 dB - 750/870 MHz	589710
9.0 dB - 750/870 MHz	589711
9.5 dB - 750/870 MHz	589712
10.0 dB - 750/870 MHz	589713
10.5 dB - 750/870 MHz	589714
11.0 dB - 750/870 MHz	589715
11.5 dB - 750/870 MHz	589716
12.0 dB - 750/870 MHz	589717
12.5 dB - 750/870 MHz	589718

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13.0 dB - 750/870 MHz	589719
13.5 dB - 750/870 MHz	589720
14.0 dB - 750/870 MHz	589721
14.5 dB - 750/870 MHz	589722
15.0 dB - 750/870 MHz	589723
15.5 dB - 750/870 MHz	589724
16.0 dB - 750/870 MHz	589725
16.5 dB - 750/870 MHz	589726
17.0 dB - 750/870 MHz	589727
17.5 dB - 750/870 MHz	589728
18.0 dB - 750/870 MHz	589729
18.5 dB - 750/870 MHz	589730
19.0 dB - 750/870 MHz	589731
19.5 dB - 750/870 MHz	589732
20.0 dB - 750/870 MHz	589733
20.5 dB - 750/870 MHz	589734

750/870 MHz Forward Equalizers

The following table provides part number and pad values for the 750/870 MHz forward equalizers.

Value	870 MHz Forward EQ	750 MHz Forward EQ
0 dB	589260	589260
1.5 dB	589261	589306
3.0 dB	589262	589307
4.5 dB	589263	589308
6.0 dB	589264	589309
7.5 dB	589265	589310
9.0 dB	589266	589311
10.5 dB	589267	589312

Continued on next page

12.0 dB	589268	589313
13.5 dB	589269	589314
15.0 dB	589270	589315
16.5 dB	589271	589316
18.0 dB	589272	589317
19.5 dB	589273	589318
21.0 dB	589274	589319
22.5 dB	589275	589320
24.0 dB	589276	589321
25.5 dB	589277	589322
27.0 dB	589278	589323

750/870 MHz Inverse Equalizers

The follwing table provides part number and pad values for the GainMakr amplifier 750/870 MHz inverse equalizers.

Inverse EQ	Part Number
1.4/1.5 dB - 750/870 MHz	589325
2.9/3.0 dB - 750/870 MHz	589326
4.2/4.5 dB - 750/870 MHz	589327
5.5/6.0 dB - 750/870 MHz	589328
6.9/7.5 dB - 750/870 MHz	589329
8.4/9.0 dB - 750/870 MHz	589330
9.8/10.5 dB - 750/870 MHz	589331
11.1/12.0 dB - 750/870 MHz	589332
12.6/13.5 dB - 750/870 MHz	589333
13.8/15.0 dB - 750/870 MHz	589334

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Reverse Equalizers

The following table provides part number and pad values for the GainMaker amplifier reverse equalizers.

Value	40/42 MHz	55 MHz	65 MHz
0 dB	712719	712719	712719
1 dB	589628	712679	589736
2 dB	589629	712680	589737
3 dB	589630	712681	589738
4 dB	589631	712682	589739
5 dB	589632	712683	589740
6 dB	589633	712684	589741
7 dB	589634	712685	589742
8 dB	589635	712686	589743
9 dB	589636	712687	589744
10 dB	589637	712688	589745
11 dB	589638	712689	589746
12 dB	589639	712690	589747

Glossary

Term, Acronym, Abbreviation	Meaning
A	Ampere (amp) is the unit of measure for electrical current.
AC	Alternating current
AC/RF	Alternating current radio frequency
Adapter	The terminal installed for reception of services.
Addressable	The ability to control an individual unit in a system of many similar units.
AFC	Automatic frequency control
AGC	Automatic Gain Control
ALT	Alternate
AMPL	Amplitude
Amplifier Cascade	Two or more amplifiers in a series, the output of one feeding the input of another.
Assy.	Assembly
ATC	Automotive fuse
ATP	Accepted test plan
Attenuation	A decrease in signal magnitude occurring in transmission from one point to another or in passing through a loss medium.
Attenuator	Plug-in pad. It is a device designed to reduce signal strength by an amount specified in dB.
AUX	Auxiliary
Baseband	The original frequency span of a signal before it is modified for transmission or otherwise manipulated.
Baud (Bd)	The number of times a state change occurs per second on a communications channel.

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Beamwidth	The included angle between two rays (usually the half-power points) on the radiation pattern, which includes the maximum lobe, of an antenna.
BER	Bit error rate
BERT	Bit error rate test
BIOS	Basic Input/Output System
BIST	Built-in self-test
Bit	Short for Binary Digit. Can be either a "one" or a "zero".
Blanking level	The amplitude of the front and back porches of the composite video signal.
BNC	A coaxial connector that uses a bayonet type attachment to secure the cable. It is also known as Baby "N" connector.
BPF	Bandpass filter
Bps	Bits per second - The total number of bits sent in a second of time.
BPSK	Binary phase-shift keying
BW	Bandwidth
CCW	Counterclockwise
CF	Continuous feed
Circuit switching	The type of signal switching traditionally used by telephone companies to create a physical connection between a caller and a called party.
CISC	Complex Instruction Set Computer - A computer that uses many different types of instructions to conduct its operations, i.e., IBM PCs, Apple Macintoshs, IBM 370 mainframes.

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CIU	Customer Interface Unit
C/N or CNR	Carrier-to-noise ratio
Compression	The non-linear change of gain at one level of a signal with respect to the change of gain at another level for the same signal. Also, the elimination of redundant information from an audio, data, or video signal to reduce transmission requirements.
CSO	Composite second order
C/T	Carrier-to-noise temperature ratio
CW	Continuous wave
dB	Decibel
dBc	Decibels of gain relative to a reference carrier
dBm	Decibels relative to 1 milliwatt
dBi	Decibels of gain relative to an isotropic radiator
dBuV	Decibels relative to 1 microvolt
dBW	Decibels relative to 1 watt
dBmV	Decibels relative to 1 millivolt
DC	Direct Current
DC	Directional coupler
DES	Data Encryption Standard
Deviation	The peak difference between the instantaneous frequency of the modulated wave and the carrier frequency, in an FM system.
Differential gain	The difference in amplification of a signal (superimposed on a carrier) between two different levels of carrier.

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Diplex filter	A filter which divides the frequency spectrum into a high frequency segment and a low frequency segment so that two different signals can be sent down the same transmission path.
Distribution	The activities associated with the movement of material, usually finished products or service parts, from the manufacturer to the customer.
Distribution System	Part of a cable system consisting of trunk and feeder cables used to carry signals from headend to subscriber terminals.
Down link	A transmission path carrying information from a satellite or spacecraft to earth.
DP	Data processing
DPU	Digital processing unit
DSP	Digital signal processor
DSR	Digital Storage and Retrieval System
D to U	Desired to Undesired signal ratio
DTMF	Dual Tone Multiple Frequency
Duplexer	A device which permits the connection of both a receiver and a transmitter to a common antenna.
DVB	Digital voltmeter
EC	The European Community
ECM	Entitlement Control Message
EEPROM	Electrically Erasable Programmable Read-Only Memory
Emission designer	An FCC or CCIR code that defines the format of radiation from a transmitter.
EPROM	Erasable Programmable Read-Only Memory
EQ	Equalizer

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Equalization	The process of compensating for an undesired result. For example, equalizing tilt in a distribution system.
ERP	Effective radiated power
Ext	External
FAOC	Frequency agile output converters
FET	Field-effect transistor
FITT	Forward Intermediate Terminating Trunk
FM	Frequency modulation
Forward	Signal direction from the headend to the set-top terminal.
Frequency	The number of similar shapes in a unit of time. For example, the number of sine waves moving past a fixed point in a second.
Frequency Agile	The ability to change from one frequency to another without changing components.
Frequency Modulation	A system of modulation where the instantaneous radio frequency of the carrier varies in proportion to the instantaneous amplitude of the modulating signal while the amplitude of the radio frequency carrier is independent of the amplitude of the modulating signal.
Frequency Response	The effect that changing the frequency has on the magnitude of a signal.
Frequency Reuse	A technique in which independent information is transmitted on orthogonal polarizations to "reuse" a given band of frequencies.
Frequency Stability	A measure of the departure from nominal frequency value of a signal, with respect to time, temperature, or other influence.
FSM	Field strength meter
FSK	Frequency-shift keying
FTP	File Transfer Protocol
GaAs FET	Gallium arsenide field-effect transistor

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Gain	An increase in signal relative to a reference.
HGBD	High Gain Balanced Triple
HGD	High Gain Dual
HGD RC	High Gain Dual Reverse Conditioner
Hertz	A unit of frequency equal to one cycle per second.
I/O	Input/output
IC	Integrated circuit
ICP	Internal Control Program – A series of policies to protect company sensitive and export controlled information.
IDR	Intermediate Data Rate
IEC	International Electrotechnical Commission
IF	Intermediate frequency
IFL	Interfacility link
K	Kelvin is a measure of temperature. Zero K equals –273 degrees Centigrade or –459 degrees Fahrenheit.
KB	KiloByte
ft-lb	Foot-pound
in-lb	Inch-pound
LE	Line extender
LED	Light-emitting diode
LGD	Low Gain Dual
LIFO	Last-in, first-out
Mbps	Megabits per second
Multipath (multipath transmission)	The phenomenon which results from a signal traveling from point to point by more than one path so that several copies of the signal arrive at the destination at different times or at different angles.

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N/C	Not connected
Nanosecond	1 thousandth of a microsecond
Nm	Newton meter
NIU	Network Interface Unit
OEM	Original equipment manufacturer
OOB	Out of band
PA	Power amplifier
PCB	Printed circuit board
PCM	Pulse code modulation
PDI	Pressure Differential Indicator
PLL	Phase-lock loop It is an electronic servo system controlling an oscillator to maintain a constant phase angle relative to a reference signal.
PROM	Programmable Read Only Memory
PWB	Printed wiring board
PWR	Power
QAM	Quadrature amplitude modulation A frequency modulation technique used by digital video channels to deliver digital broadcast and interactive services over noisy bands in the RF spectrum.
QPR	Quadrature partial response
QPSK	Quadrature phase-shift keying
RC	Reverse conditioner
RCVR	Receiver
Reverse or return	Signal flow direction toward the headend.
RF	Radio frequency

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RF Bypass	A bypass feature that allows subscribers to view a clear analog channel while recording a digital or analog channel on a VCR.
RFI	Radio frequency interface
RMA	Return material authorization
RMS	Root mean square
Router	A device which examines a packet and routes the packet to an output port appropriate to the packet destination.
RS	Reed-Solomon (coding) Remote sensing
RX	Receive
SA	Spectrum analyzer System amplifier
SAM	Signal analysis meter
SAT	Site acceptance test
SET	Secure electronic transaction
Scattering	Random directional change of a wave or part of a wave caused by an irregular reflecting surface or by passing through an inhomogeneous transmission medium.
SM	Status monitor
SMC	Status monitoring and control
SMIU	Status Monitor Interface Unit
SMU	Server Management Unit
S/N or SNR	Signal-to-noise ratio
SNMP	Simple Network Management Protocol

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Splitter	A device which divides power from an input to deliver multiple outputs or combines multiple inputs into one output.
Spread Spectrum	A modulation technique to spread a narrow band signal over a wide band of frequencies.
Spurious	Anything other than the desired result
SSPA	Solid-state power amplifier
Sweep generator	A signal source which can automatically vary its frequency continuously from one frequency to another.
Synchronous transmission	A method of sending information over a path and separating discrete characters and symbols by a precise separation in time.
Torque	Force applied to bolt or screw to tighten the device.
TS	Transport Stream
TTCN	True tilt correction network
TX	Transmit
UBT	Unbalanced Triple
UBT RC	Unbalanced Triple Reverse Conditioner
UPS	Uninterruptible power supply
UTP	Unshielded twisted pair
uV Microvolt	One millionth of a volt
V	Volt
V AC	Volts alternating current
V DC	Volts direct current
VBR	Variable bit rate
W	Watts

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