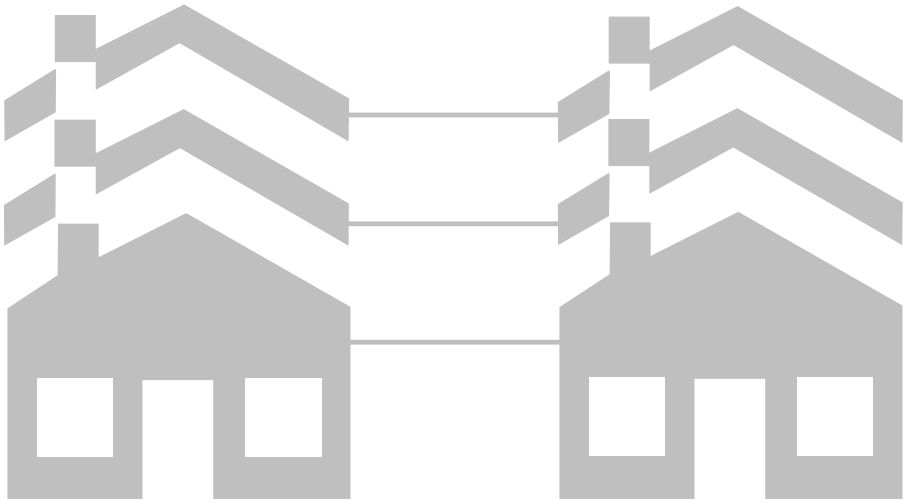
Installation and Operation Guide

Scientific Atlanta

750 MHz GaAs FET Line Extender III



Please read this entire guide

Please read this entire guide
Veuillez lire entièrement ce guide
Bitte das gesamte Handbuch durchlesen
Sírvase leer completamente la presente guía
Si prega di leggere completamente questa guida

Important

Please read this entire guide before you install or operate this product. Give particular attention to all safety statements.

Important

Veuillez lire entièrement ce guide avant d'installer ou d'utiliser ce produit. Prêtez une attention particulière à toutes les règles de sécurité.

Zu beachten

Bitte lesen Sie vor Aufstellen oder Inbetriebnahme des Gerätes dieses Handbuch in seiner Gesamtheit durch. Achten Sie dabei besonders auf die Sicherheitshinweise.

Importante

Sírvase leer la presente guía antes de instalar o emplear este producto. Preste especial atención a todos los avisos de seguridad.

Importante

Prima di installare o usare questo prodotto si prega di leggere completamente questa guida, facendo particolare attenzione a tutte le dichiarazioni di sicurezza.

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750 MHz GaAs FET Line Extender III
Installation & Operation Guide

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Contents

Safety Precautions v
Product Compliance vi
Warranty vii

Chapter 1 Introducing the 750 MHz GaAs FET Line Extender III

Overview 1-1
Description of the Line Extender III 1-2
Accessories 1-4
Illustrations 1-5
Block Diagram 1-6

Chapter 2 Installing and Configuring the 750 MHz GaAs FET Line Extender III

Overview 2-1

Section A - Installing the Housing

Overview 2-3
Before You Begin 2-4
Upgrading Existing Housing Seizures 2-6
Attaching Connectors 2-7
Attaching the Housing 2-8

Section B - Configuring the Amplifier Module

Overview 2-11
Installing Accessories 2-12
Installing Reverse Accessories 2-18
Restoring Jumpers 2-20

Section C - Installing the Amplifier Module

Overview 2-22
Installing the Amplifier Module in the Housing 2-23
Setting the Power Direction 2-24
Closing the Housing 2-25

Section D - Illustrations

Overview 2-26
Line Extender III 2-27

Continued on next page

Contents, Continued

Chapter 3 Balancing and Setup of the 750 MHz GaAs FET Line Extender III

Overview 3-1

Test Points 3-2

Balancing the Forward Path 3-3

Automatic Gain Control Setup 3-9

Frequency Response Shaping 3-11

Chapter 4 Customer Information

Overview 4-1

Customer Support 4-2

How to Return Products 4-3

Appendix A Technical Information

Overview A-1

Tilt Chart A-2

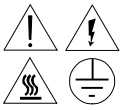
Equalizer Charts A-3

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 earth 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 fuse 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.

Fuse

Shunt fuses are provided with the product.

Service

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

Product Compliance

Electrical Safety

EN 50083-1:1993 and IEC 65:1985/EN 60065:1993: 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 50083-1:1993 and IEC 65:1985/EN 60065:1993.

EU Electromagnetic Capability

EN 50083-2: 1995: 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: 1995.

US Electromagnetic Capability

FCC Part 76 Subpart K: This equipment has been tested and found to comply with the limits for Part 76 of 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, may cause harmful interference to radio communications.

> ⚠ **Caution:**
>
> **Any changes or modifications to this equipment not expressively approved by Scientific-Atlanta could 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.

Warranty

Statement

We warrant good title to any hardware furnished under this Contract. For software, we warrant that we have the right to grant any software license granted. We warrant that services will be performed in a good and workmanlike manner. We also warrant that during the Warranty Period as defined below, each Item we deliver (other than separately licensed software and services) will be free from material defects in workmanship and materials and under ordinary use, conform in all material respects to its published specifications current at the time the Item was shipped.

Items may include refurbished goods, subassemblies, or components which we warrant as provided in this Warranty section.

Warranty Period

The Warranty Period begins on the date the Item is delivered and extends for 12 months for hardware and 90 days for software, parts and services. We will repair or replace, at our option, any product returned to us by Customers at their expense during the Warranty Period, which fails to satisfy this Warranty, unless the failure was the result of shipping; improper installation, maintenance or use; abnormal conditions of operation; attempted modification or repair by the Customer; or an act of God. We will reperform any services which do not conform to this Warranty provided we have received notice of non-conformance within the Warranty Period.

Limitation of Liability

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT. CUSTOMER'S SOLE REMEDY FOR ANY BREACH OF WARRANTY IS THE REPAIR OR REPLACEMENT, AT OUR OPTION, OF THE FAILED ITEM. WE SPECIFICALLY DISCLAIM ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, TO CUSTOMERS OF THE CUSTOMER.

Customer Responsibility

Customer must pay packing, crating, and transportation costs to and from the factory.

At Customer's request, we will make reasonable efforts to provide warranty service at the Customer's premises, provided the Customer pays our then current rates for field services and the associated travel and living expenses.

Claims Under This Warranty

In case of a claim under this warranty, Customer should do the following:

1. Notify us by giving the Item model number, serial number and details of the difficulty.
2. On receipt of this information, you will be given service data or shipping instructions.
3. On receipt of shipping instructions, forward the Item prepaid.
4. If the Item or fault is not covered by warranty, an estimate of charges will be furnished before work begins.

Disclaimer

EXCEPT FOR CLAIMS FOR PERSONAL INJURY CAUSED BY ITEMS FURNISHED HEREUNDER, WE SHALL NOT BE LIABLE TO CUSTOMER OR ANY OTHER PERSON OR ENTITY FOR INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, OR EXEMPLARY DAMAGES ARISING OUT OF OR IN CONNECTION WITH THIS TRANSACTION OR ANY ACTS OR OMISSIONS ASSOCIATED THEREWITH OR RELATING TO THE SALE OR USE OF ANY ITEMS OR SERVICES FURNISHED, WHETHER SUCH CLAIM IS BASED ON BREACH OF WARRANTY, CONTRACT, TORT OR OTHER LEGAL THEORY, AND REGARDLESS OF THE CAUSES OF SUCH LOSS OR DAMAGES OR WHETHER ANY OTHER REMEDY PROVIDED HEREIN FAILS. IN NO EVENT SHALL OUR TOTAL LIABILITY UNDER A CONTRACT EXCEED AN AMOUNT EQUAL TO THE TOTAL AMOUNT PAID FOR ITEMS PURCHASED UNDER SUCH CONTRACT.

Chapter 1
Introducing the 750 MHz GaAs FET Line Extender III

Overview

In This Guide

This guide is divided into four chapters and one appendix.

Chapter	Topic	See Page
Chapter 1	Introducing the 750 GaAs FET Line Extender III	1-1
Chapter 2	Installing and Configuring the 750 GaAs FET Line Extender III	2-1
Chapter 3	Balancing and Setup of the 750 GaAs FET Line Extender III	3-1
Chapter 4	Customer Information	4-1
Appendix A	Technical Information	A-1

Introduction

This chapter introduces you to the 750 MHz GaAs FET Line Extender III (LEIII) and contains the following topics.

Topic	See Page
Description of the 750 MHz GaAs FET Line Extender III	1-2
Accessories	1-4
Illustrations	1-5
Block Diagram	1-6

Description of the 750 MHz GaAs FET Line Extender III

Introduction

The 750 MHz GaAs FET LEIII is a low-cost, single-output, RF amplifier. It is designed primarily for use in feeder portions of the cable plant.

General Features

The 750 MHz GaAs FET LEIII provides many of the same features as previous line extender products, such as:

- Built-in reverse amplifier provides two-way operation for interactive services.
- Four -20 dB test points provide testing of forward and reverse input and output signals without disrupting normal operation.
- Backward compatibility with previous LE II housings provides reduced upgrade costs.
- Direct module plug-in to the housing provides superior amplifier heat sinking.
- Symmetrical housing and modules provide convenient mounting.
- Surge protection provides improved resistance to high voltage transients.
- Coated housing protects outdoor equipment in coastal areas and other corrosive environments.
- Two fuse shunts located in the amplifier are used to direct AC current to and from the line extender's input and output port.

Extended Features

The 750 MHz GaAs FET LEIII also provides the following additional features not found in previous line extender products.

- 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) and supports new services such as cable telephony.
- Directional coupler reverse test points provide greater reliability and accuracy in measuring and monitoring the reverse band.
- Fixed interstage equalizers provide for a flatter frequency response and easier balancing for end-of-line performance.
- Forward test points relocated outside of the diplex filter provide for easier reverse set-up through reverse signal injection.

Continued on next page

Line Extender III Listing

This table lists the available 750 MHz GaAs FET LEIII amplifier model.

Part Number	Amplification Split	Power Supply	Amplification Type
574754	5 MHz to 40 MHz (Reverse) 51 MHz to 750 MHz (Forward)	60/90 Volt	GaAs FET

Input and Output Ports

The LEIII has one input and one output port.

Configuration

The LEIII is configured with a 5-40 MHz reverse amplifier.

Test Points

The LEIII has four RF and two voltage test points.

Fuse Shunts

The LEIII has two fuse shunts located in the amplifier which are used to direct AC current to and from the amplifier's input and output ports.

Accessories

Line Extender III Accessories

750 MHz GaAs FET LEIIIs use the following accessories.

- A fixed interstage equalizer which places an up-tilt between the input and output hybrids
- THERMAL and AGC modules which perform thermal or automatic gain control
- Surge protection which provides improved resistance to high-voltage transients
- An optional coated housing which protects outdoor equipment in coastal areas and other corrosive environments
- A system trim which allows the operator to flatten the system frequency response to compensate for other parts of the distribution system

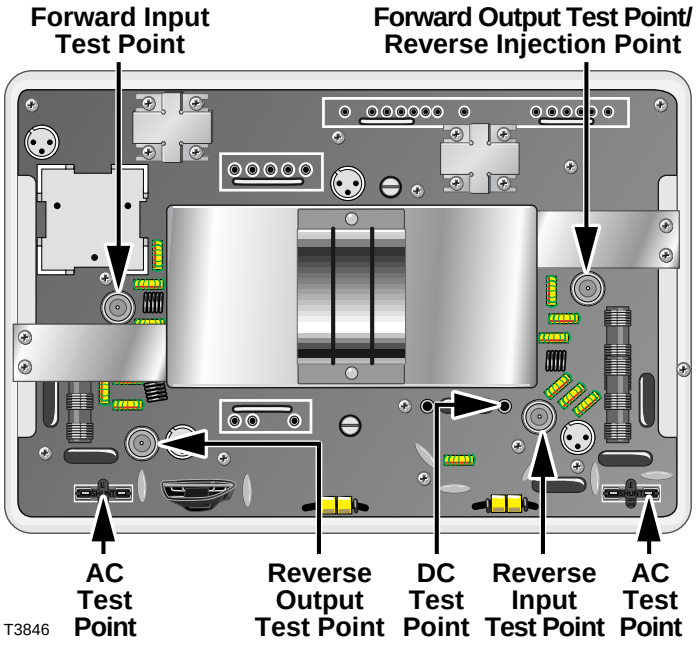
The following table lists the accessories used, their location in the amplifier module, and the jumper wires that must be removed before installing each accessory.

Accessory	Part Number	Location/Jumper to be Removed
Forward input attenuator pad	Various	AT1/no jumper
Forward interstage attenuator pad	Various	AT2/no jumper
Reverse input attenuator pad	Various	AT3/no jumper
Reverse output attenuator pad	Various	AT4/no jumper
Forward input EQ	501220 through 501234, 540016 through 540118	EQ1/no jumper
Cable simulators	562262 through 562269	EQ1/no jumper
12 dB fixed interstage EQ	546556	A4/W2
9 dB fixed interstage EQ	546557	A4/W2
12 dB thermal/EQ	546577	A4/W2
9 dB thermal/EQ	546578	A4/W2
12 dB AGC/EQ	562258	A4/W2 and W3
9 dB AGC/EQ	542378	A4/W2 and W3
System trim	Various	A5/W1
Surge protector	467351	A6/no jumper
Variable reverse EQ	511075, 511295, 511298	A7/W5
Fixed reverse EQ	545107 through 545118	A7/W5

Illustrations

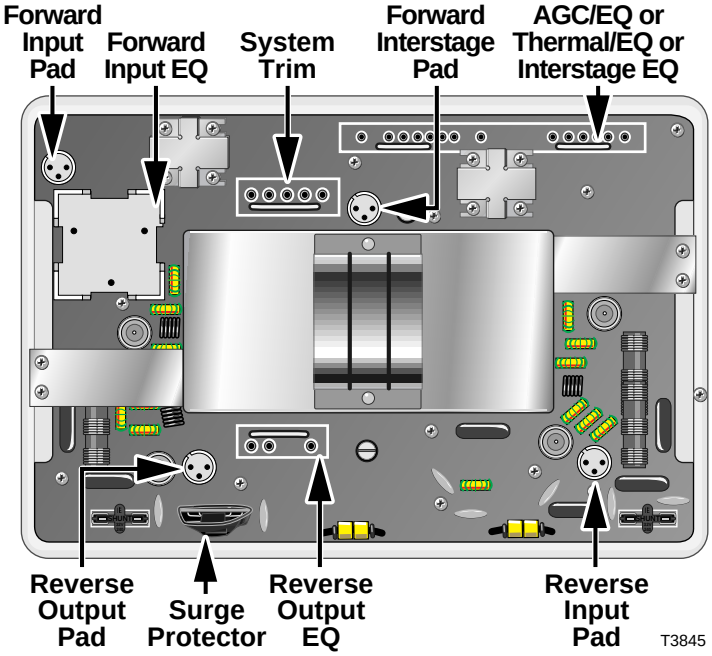
Test Points

The following diagram shows the test points of the LEIII.



Accessories

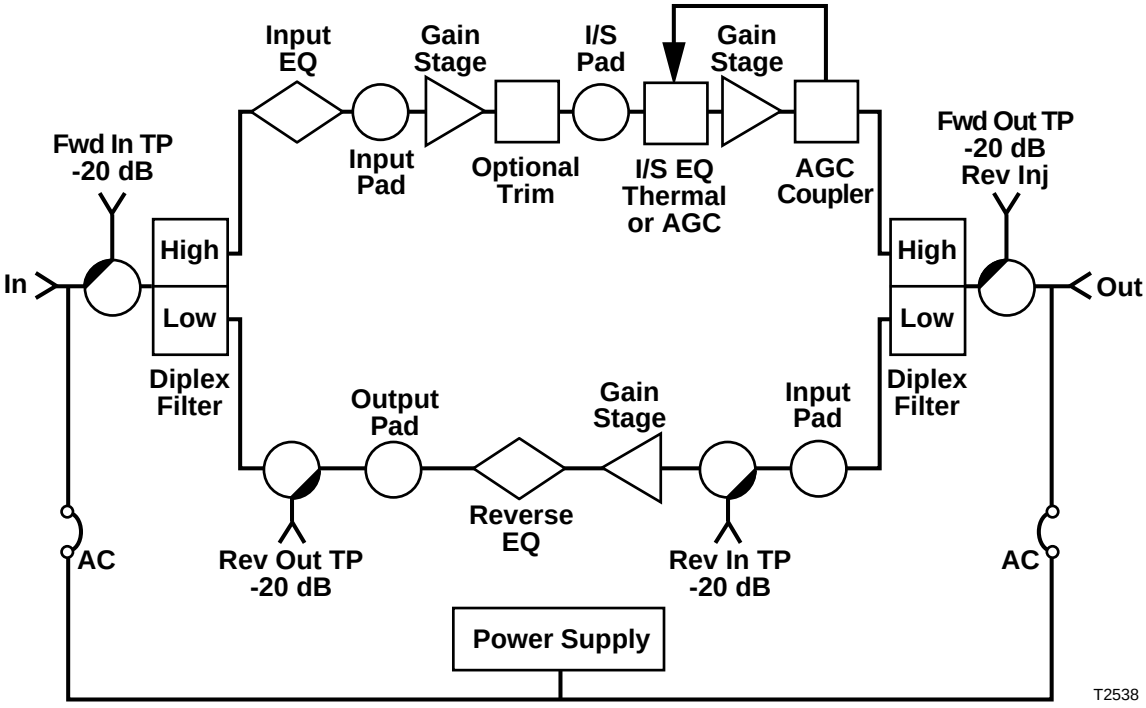
The following diagram shows the accessory locations of the LEIII.



Block Diagram

750 MHz GaAs FET LEIII Block Diagram

This is a block diagram of the LEIII.



Chapter 2
Installing and Configuring the 750 MHz GaAs FET Line Extender III

Overview

Introduction

This chapter is divided into four sections and gives step-by-step instructions on installing and configuring the Line Extender III (LEIII) in your cable system.

Section	Topic	See Page
A	Installing the Housing	2-3
B	Configuring the Amplifier Module	2-11
C	Installing the Amplifier Module	2-22
D	Illustrations	2-26

Section A
Installing the Housing

Overview

Scope of This Section

This section covers requirements and procedures needed to install the 750 MHz GaAs FET LEIII housing in the distribution system and contains the following topics.

Topic	See Page
Before You Begin	2-4
Upgrading Existing Housing Seizures	2-6
Attaching Connectors	2-7
Attaching the Housing	2-8

Before You Begin

Overview

This section covers requirements and procedures needed to install the 750 MHz GaAs FET LEIII housing in the distribution system.

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

- Prepared the installation site
- Properly 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
- Seizure wrench

Blue Label on Housing

Important: The 750 MHz GaAs FET LEIII module is marked with a blue label to indicate 15 ampere capability. This module must be used in conjunction with the proper LEIII housing, which is also marked with a blue label.

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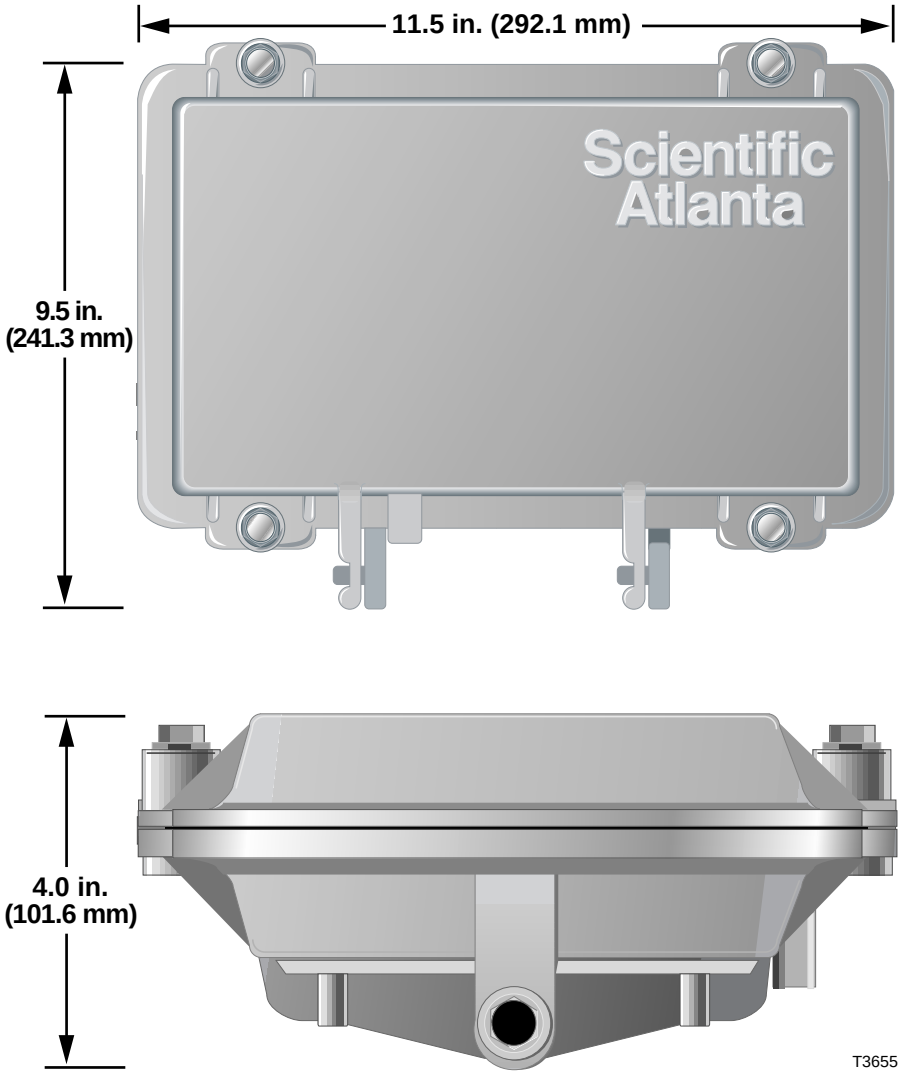
Measurements

The diagram below shows dimensions, in inches and millimeters, of the line extender housing. Use these measurements to calculate clearance requirements for your installation.



Upgrading Existing Housing Seizures

Introduction

The 750 MHz GaAs FET LEIII has a higher current-carrying capacity than earlier line extender products. If you are replacing an LEI or LEII with an LEIII, you must upgrade the housing to handle the higher current demands.

The 15 A 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. The F -connectors, seizures, and anvils are blue for ease of identification.

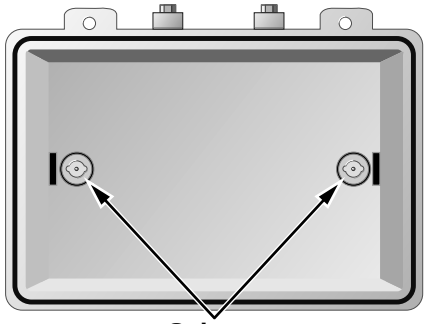
Installation Instructions

Follow these steps to upgrade a line extender housing to 15 A current capacity.

1. If a line extender module is installed in the housing, you must remove it before continuing.

   See **Installing the Amplifier Module** for information about installing the module and retaining screw locations.

2. Remove the seizures on either side of the housing, using a cable seizure wrench. See the diagram below.



3. Insert the seizures from the upgrade kit.
4. Is coaxial cable already connected to the housing?
   - If **yes**, tighten each seizure from 2 ft-lb to 5 ft-lb (2.7 Nm to 6.8 Nm).
   - If **no**, turn each seizure by hand, about halfway into the socket, and proceed to **Strand Mounting Procedure** or **Pedestal Mounting Procedure** later in this section.
5. Place the blue stickers from the kit on the outside of the housing between the ports to indicate upgrading has been completed.

Attaching Connectors

Trimming the Center Conductor

Before you start make sure the center pins of the coaxial cable connectors are trimmed to 1.25 inches (31.75 mm) from the shoulder of the connector.

Connecting the Coaxial Cable Pin Connector to the Line Extender Housing

Follow these steps to connect the coaxial cable to the line extender housing.

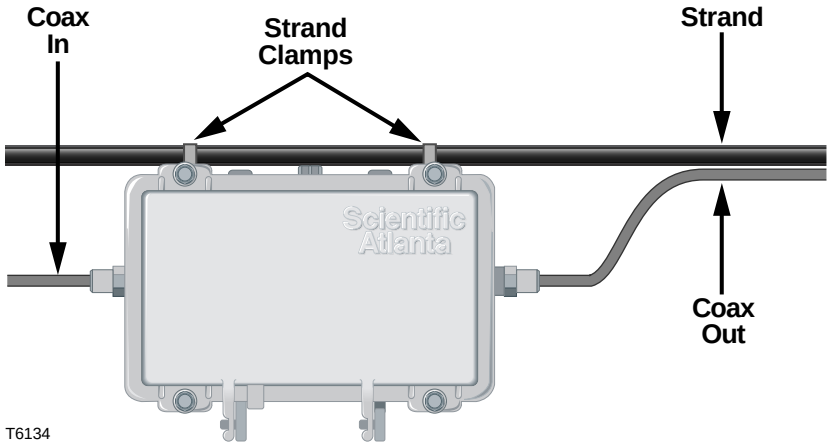
1. Begin this procedure with the line extender housing open.
2. If the coaxial cable connector center pin extends more than the length specified in **Trimming the Center Conductor**, trim the pin with heavy-duty wire cutters.
3. Insert the appropriate coaxial cable connector into the housing at the desired housing port. Tighten the connector nut according to 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 the other RF port.
6. Proceed to **Attaching the Housing**.

Attaching the Housing

Strand Mounting Procedure

Follow these steps to install the 750 MHz GaAs FET LEIII on an aerial strand.

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



6. Tighten the strand clamp bolts (using a 1/2-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 causes the housing to hang more closely to vertical.

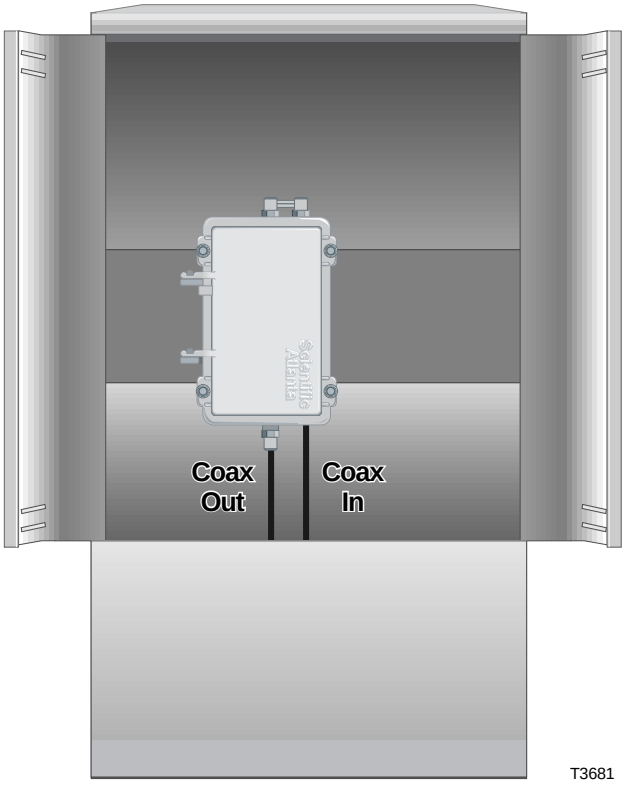
7. Connect the coaxial cable to the pin connector according to connector manufacturer's specifications.
8. Proceed to **Configuring the Amplifier Module.**

Continued on next page

Pedestal Mounting Procedure

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

1. Open the pedestal cover.
2. Loosen 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 in 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.

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 connector manufacturer's specifications.
6. Proceed to **Configuring the Amplifier Module.**

Section B
Configuring the Amplifier Module

Overview

Scope of This Section

This section covers requirements and procedures needed to configure the 750 MHz GaAs FET LEIII amplifier and contains the following topics.

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

Topic	See Page
Installing Accessories	2-12
Installing Reverse Accessories	2-18
Restoring Jumpers	2-20

Installing Accessories

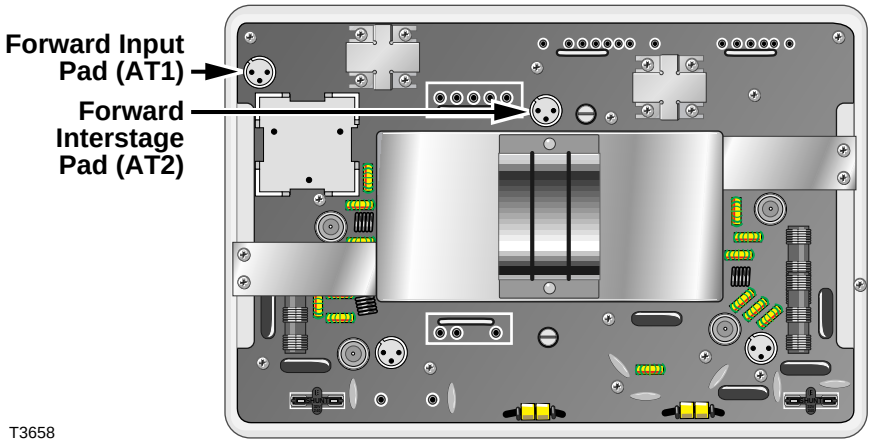
Installing Attenuator Pads

For best results, follow this installation procedure exactly.

Note : Pads are color-coded to denote their maximum application frequency as listed below.

- Blue - 5 MHz to 600 MHz (reverse path)
- Yellow - 5 MHz to 860 MHz (forward or reverse path)

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Install the pad(s) specified by the design print in the appropriate pad slot(s). Refer to the following illustration for exact pad locations.



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

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

Continued on next page

Forward Input Equalizer or Cable Simulator

For best results, follow this installation procedure exactly.

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Install the forward input equalizer or specified by the design print in the forward input equalizer slot. Refer to the illustration on the following page for the forward input equalizer slot location.

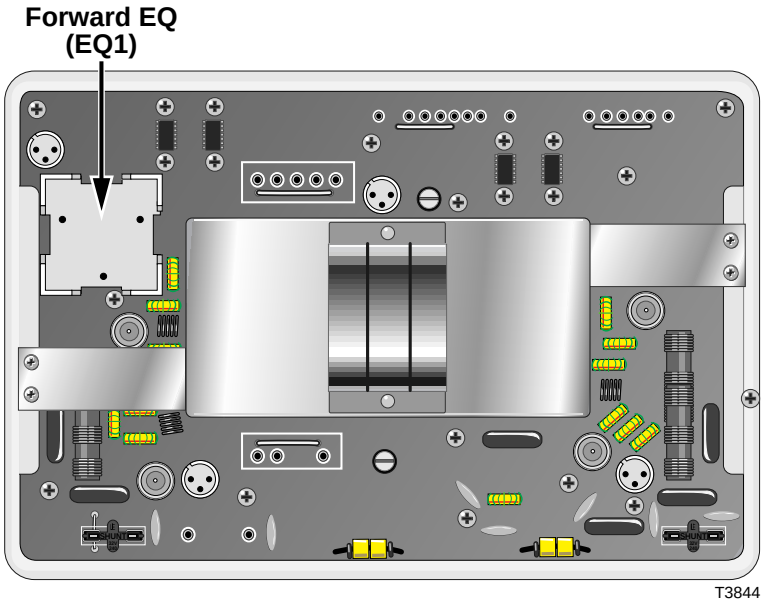
For:	Install part number:
0 dB - 750 MHz	036040
1.5 dB - 750 MHz	501220
3.0 dB - 750 MHz	501221
4.5 dB - 750 MHz	501222
6.0 dB - 750 MHz	501223
7.5 dB - 750 MHz	501224
9.0 dB - 750 MHz	501225
10.5 dB - 750 MHz	501226
12.0 dB - 750 MHz	501227
13.5 dB - 750 MHz	501228
15.0 dB - 750 MHz	501229
16.5 dB - 750 MHz	501230
18.0 dB - 750 MHz	501231
19.5 dB - 750 MHz	501232
21.0 dB - 750 MHz	501233
22.5 dB - 750 MHz	501234
24.0 dB - 750 MHz	540016
25.5 dB - 750 MHz	540017
27.0 dB - 750 MHz	540018

Continued on next page

2. cont. Or install the correct cable simulator specified by the design print for your system in the forward equalizer slot.

For:	Install part number:
1.5 dB - 750 MHz	562262
3.0 dB - 750 MHz	562263
4.5 dB - 750 MHz	562264
6.0 dB - 750 MHz	562265
7.5 dB - 750 MHz	562266
9.0 dB - 750 MHz	562267
10.5 dB - 750 MHz	562268
12.0 dB - 750 MHz	562269

Note: Be sure all the pins on the forward input equalizer or cable simulator bottom align with the pin holes in the forward input equalizer slot, allowing the forward input equalizer or cable simulator to install flat against the line extender amplifier module.



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

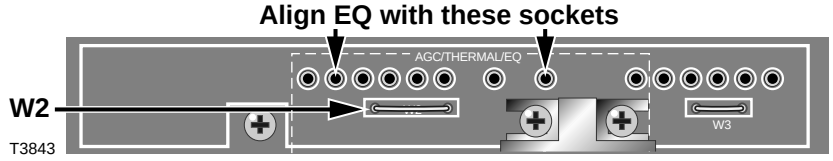
Continued on next page

Interstage Equalizer or Thermal/Equalizer

For best results, follow this installation procedure exactly.

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Using heavy wire cutters or snips, carefully cut and remove the **W2** jumper from the interstage or thermal equalizer slot.

   Install the interstage equalizer or thermal/equalizer specified by the design print in the interstage equalizer or thermal/equalizer slot. For the exact location of the interstage equalizer or thermal/equalizer, see the illustration below.



   Notes:

   - Either the interstage or thermal/equalizer may be installed at one time. It is not possible to install both of these accessories in the same 750 MHz GaAs FET LEIII unit.
   - Be sure all the pins on the interstage equalizer or thermal/equalizer bottom align with the pin holes outlining the interstage equalizer or thermal/equalizer slot, allowing the interstage equalizer or thermal/equalizer to install flat against the 750 MHz GaAs FET LEIII amplifier module.
   - The dotted lines on the PWB provide an outline for the location of these accessories. The dotted lines can be used as an alignment guide when plugging in the interstage equalizer or thermal/equalizer.

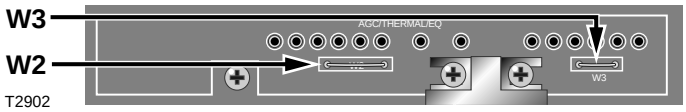
3. Install other options or accessories as desired, or proceed to **Installing the Amplifier Module.**

Continued on next page

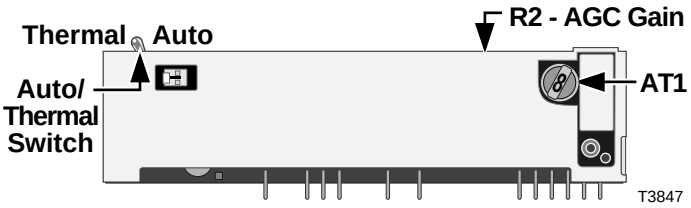
Automatic Gain Control (AGC) with Fixed Interstage Equalizer

For best results, follow this installation procedure exactly.

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Using heavy wire cutters or snips, carefully cut and remove jumpers **W2** and **W3** from the AGC slot.



3. Consult the design print and make sure the appropriate pad is properly installed in the attenuator socket **AT1** on the side of the AGC module. Refer to the following illustration for the exact location of the **AT1** attenuator socket.

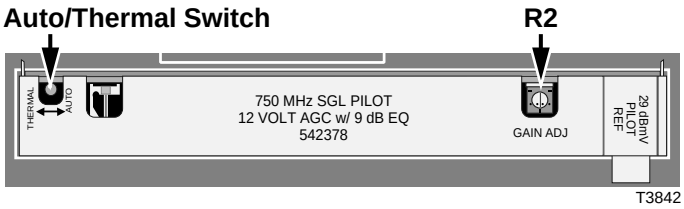


4. Install the AGC in the AGC slot.

   Notes:

   - The AGC module plugs into the circuit board in one direction only. You cannot plug it in backwards.
   - Be sure all the pins on the AGC bottom align with the pin holes in the AGC slot, allowing the AGC module to install flat against the 750 MHz GaAs FET LEIII amplifier module.

5. Set the switch on top of the AGC module to **THERMAL**. Refer to the following illustration for thermal switch location.



   Note: You will adjust **R2**, the gain control, during balance and alignment.

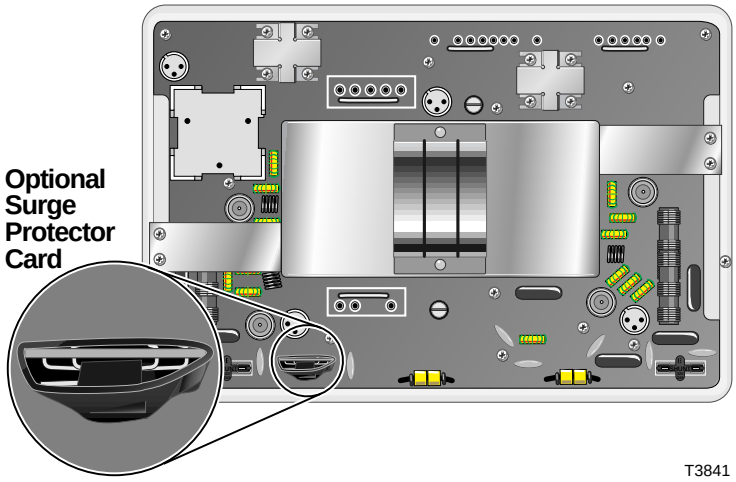
6. Install other options or accessories as desired, or proceed to **Installing the Amplifier Module.**

Continued on next page

Installing the Surge Protector

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

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Install the 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 pin holes in the surge protector slot, allowing the surge protector to install flat against the line extender 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.

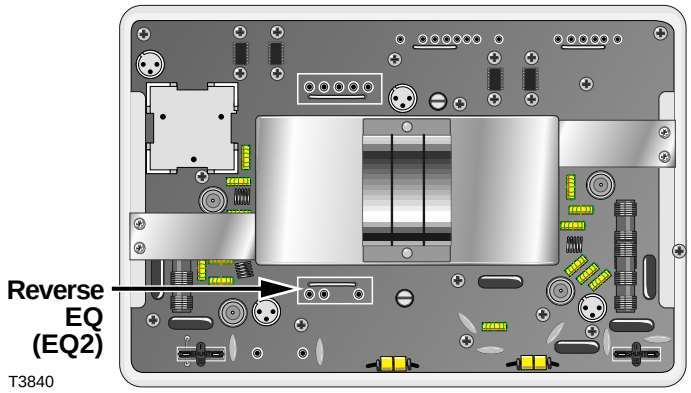
3. Install other options or accessories as desired, or proceed to **Installing the Amplifier Module.**

Installing Reverse Accessories

Installing the Fixed Reverse or Variable Reverse Equalizer

If the station requires a reverse equalizer, follow the steps in the table below.

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Cut the wire jumper, **W5**, at the **REVERSE EQ (EQ2)** location. Refer to the following illustration for the exact location of the reverse EQ.



Note: Clip the wire jumper away completely, as close as possible to the circuit board. Do not let the loose cutting fall into the amplifier circuitry.

3. Install the fixed or variable reverse equalizer specified by the design print for your system in the reverse equalizer slot.

For fixed reverse:	Install part number:
0 dB - 40 MHz	562658
1 dB - 40 MHz	545107
2 dB - 40 MHz	545108
3 dB - 40 MHz	545109
4 dB - 40 MHz	545110
5 dB - 40 MHz	545111
6 dB - 40 MHz	545112
7 dB - 40 MHz	545113
8 dB - 40 MHz	545114
9 dB - 40 MHz	545115
10 dB - 40 MHz	545116
11 dB - 40 MHz	545117
12 dB - 40 MHz	545118

Continued on next page

3. cont.

For variable reverse:	Install part number:
1.5 to 4.5 dB - 40 MHz	511075
4.5 to 7.5 dB - 40 MHz	511295
7.5 to 12.0 dB - 40 MHz	511298

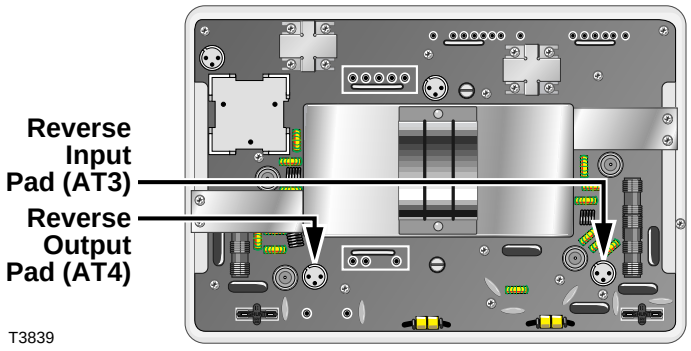
Note: Be sure all the pins on the equalizer bottom align with the pin holes in the equalizer slot, allowing the equalizer module to install flat against the line extender amplifier module.

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

Installing Reverse Attenuator Pads

For best results, follow this installation procedure exactly.

1. Begin this procedure with the housing open and the interior of the amplifier module exposed.
2. Install the pad(s) specified by the design print in the appropriate pad slot(s). Refer to the following illustration for exact pad locations.



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

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

Restoring Jumpers

Restoring Jumper Procedures

If you need to remove an installed interstage accessory, or replace one accessory with another, restore jumpers as follows:

IF you are...	**THEN install...**
removing a variable interstage EQ or interstage EQ/thermal	an interstage jumper (part number 501326) at location W2, OR solder a 22-AWG buss wire in location W2.
removing an AGC/variable interstage EQ	an interstage jumper (part number 501326) at location W2, and a mini-jumper (part number 081630) at location W3, OR solder a 22-AWG buss wire in locations W2 and W3.
restoring signal continuity after removing a reverse equalizer	plug in a 0 dB reverse equalizer (part number 562658), OR solder a 22-AWG buss wire in the REVERSE EQ jumper location.

Section C
Installing the Amplifier Module

Overview

Scope of This Section

This section covers requirements and procedures needed to install the 750 MHz GaAs FET LEIII amplifier into the housing and contains the following topics.

Topic	See Page
Installing the Amplifier Module in the Housing	2-23
Setting the Power Direction	2-24
Closing the Housing	2-25

Installing the Amplifier Module in the Housing

Overview

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

750 MHz GaAs FET LEIII 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 output ports are located directly across from each another.

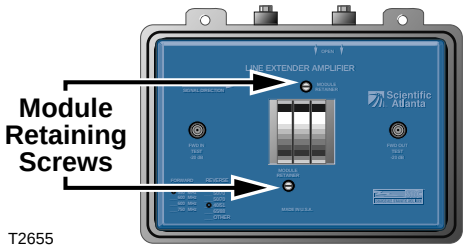
Installation Procedure

Follow these steps to install the amplifier module.

1. Begin this procedure with the line extender housing open.
2. Perform the following if you are working with an amplifier station where AC is present.
   - Install the fuse shunts in the amplifier *after* you install the amplifier module in the housing.
   - Remove the fuse shunts from the amplifier *before* you remove the amplifier module from the housing.

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

3. Orient the amplifier module so the forward signal direction (stamped on the module cover) is in the proper orientation for your installation.
4. Line up the RF connectors on the amplifier module and the housing, then push the amplifier module into the housing.
5. Secure the amplifier module to the housing by tightening the two module retainer screws with a flat-blade 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.



Setting the Power Direction

Installing and Removing Shunts

The amplifiers draw AC power (typically 60 V AC or 90 V AC) from the coaxial cable. This AC power comes from an external ferroresonant 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.

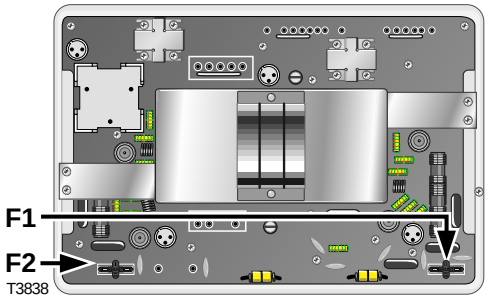
Set the power direction by not installing a shunt for the port for which you wish to block AC.

Note : A unique colored shunt is included with the unit. This is intended to be used to activate the port that supplies power. The colored 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 shunts are not removed from the amplifier before installing or removing the amplifier module from the housing.**

To select the power direction, follow these steps.

1. Begin this procedure with the interior of the amplifier module exposed.
2. Refer to the systems design print to determine AC capabilities and install the provided AC shunts in the required locations using the following table for reference.



- To pass AC through the input port , install a shunt in slot F1
- To pass AC through the output port, install a shunt in slot F2

3. Proceed to **Closing the Housing**.

Closing the Housing

Tightening the Closure Bolts

To tighten the closure bolts, follow the steps in the table below.

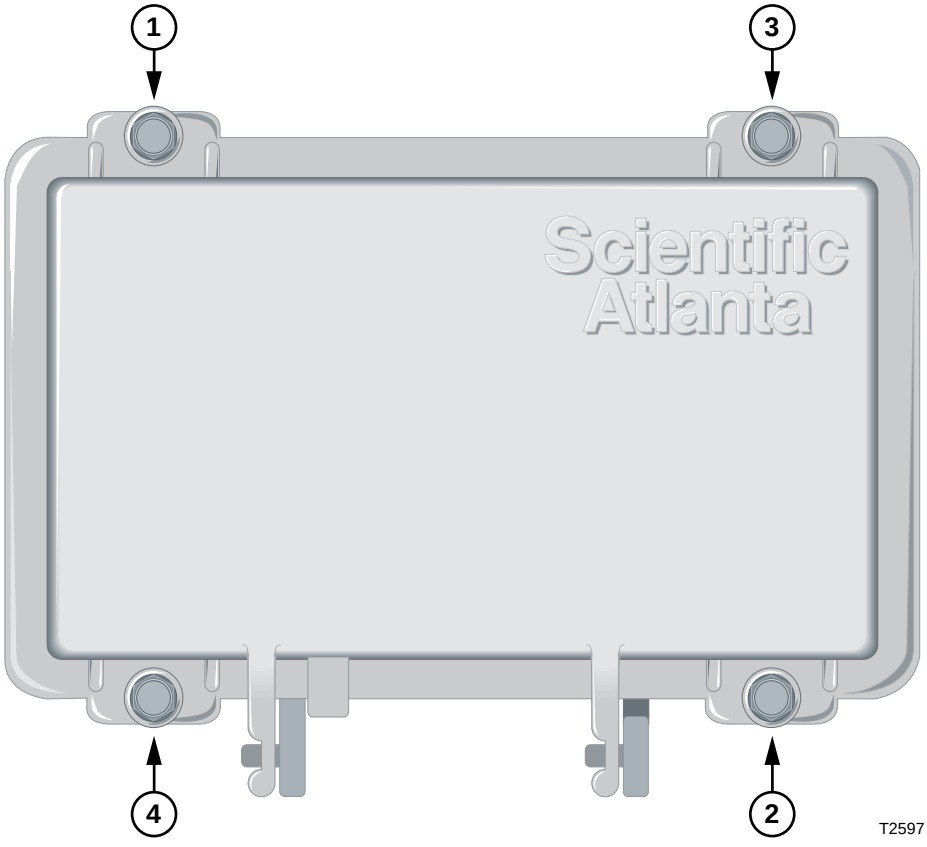
> ⚠ **Caution:**
>
> **Avoid moisture damage and RF leakage! Follow the procedure *exactly* as shown below to ensure a proper seal.**

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 housing.

Torquing Sequence

The following diagram shows the proper torquing sequence for the line extender housing.



Section D
Illustrations

Overview

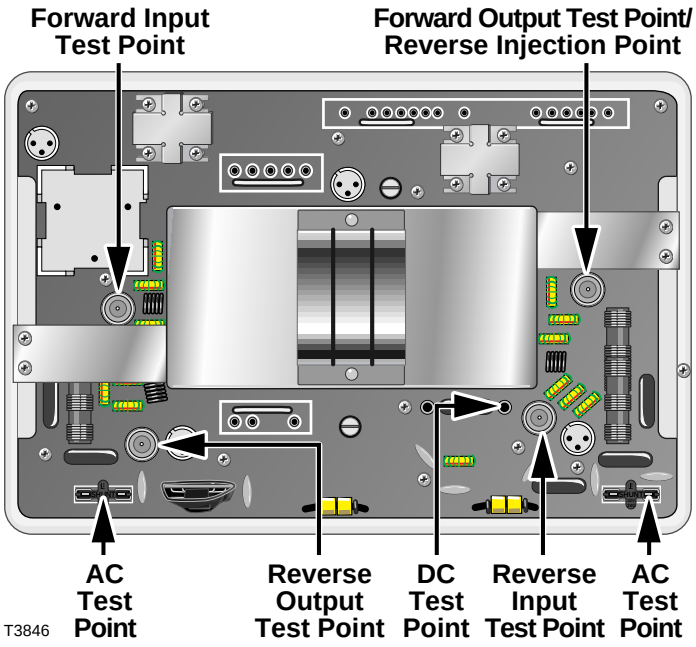
Scope of This Section

This section contains all the illustrations referred to in earlier sections in this chapter.

Topic	See Page
Line Extender III	2-27

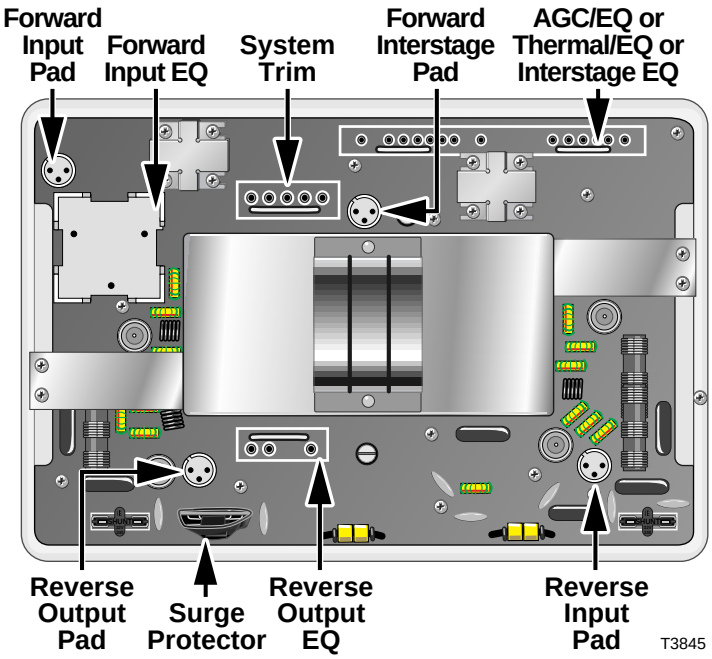
Test Points

The following diagram shows the location of test points for the LEIII.



Accessories

The following diagram shows the location of accessories for the LEIII.



Chapter 3
Balancing and Setup of the 750 MHz GaAs FET Line Extender III

Overview

Introduction

This chapter covers setup and balancing procedures for the Line Extender III (LEIII) and contains the following topics.

Topic	See Page
Test Points	3-2
Balancing the Forward Path	3-3
Automatic Gain Control Setup	3-9
Frequency Response Shaping	3-11

Test Points

Line Extender RF Test Points

There are four RF test points on the line extender. The following table lists each test point and what it corresponds to. The reverse test points are measured relative to the reverse station input and output.

Test Points	Levels
TP1	-20 dB RF test point corresponding to the forward input port
TP2	-20 dB RF test point corresponding to the forward output port
TP3	-20 dB RF test point corresponding to the reverse output port
TP4	-20 dB RF test point corresponding to the reverse input port

Line Extender Voltage Test Points

There are two voltage test points on the line extender. The following table lists each test point and what it corresponds to.

Test Points	Levels
AC TP	Typically 40 to 60 volts for 60 volt systems, or 60 to 90 volts for 90 volt systems
DC TP	Typically 12 volts DC

Balancing the Forward Path

Purpose

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

Before You Start

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

You need the following for balancing.

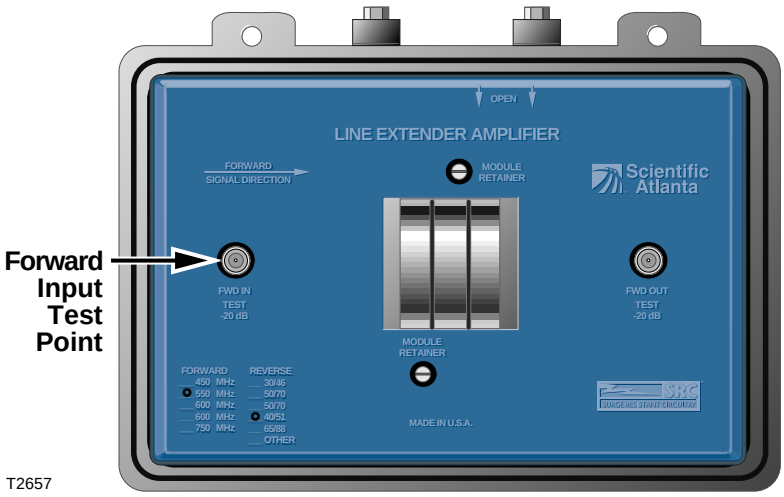
You need a ...	**To ...**
copy of the design print	determine expected input and output signal levels.
torque wrench with a 1/2-in. socket	open and close the line extender housing.
spectrum analyzer or signal analysis meter (SAM), capable of working with frequencies up to the highest design frequency	determine absolute and relative signal levels.
test point adapter (part number 501111) or an F-81 female-to-female adapter	access the test ports.
a length of 75 ohm cable, with F-connectors on each end	connect the test point adapter to the test equipment.
digital voltmeter (DVM)	test the power supply AC and DC voltages.

Continued on next page

Testing Input Signal Levels

Follow the steps in the table below to test the input signal level.

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



2. Measure the signal level at ...
   - the lowest frequency, specified in the system design, and
   - the highest channel 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 and proceed to **Determining Output Tilt**.

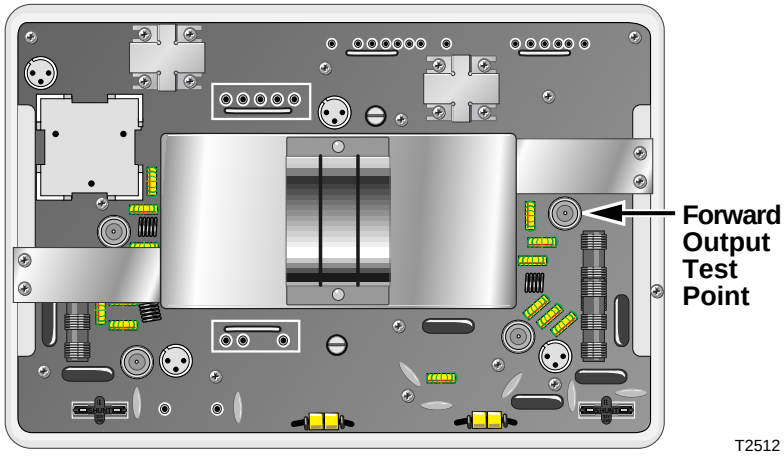
Continued on next page

Determining Output Tilt

To determine the output tilt of the 750 MHz GaAs FET LEIII amplifier module, follow the steps in the table below.

Note: Check the AGCs Thermal/Auto switch position. If an AGC/EQ is used in the station, be sure the Auto/Thermal switch is in the THERMAL position before setting output tilt and level.

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 frequencies.
5. Proceed to **Setting the Output Tilt**.

Continued on next page

Setting the Output Tilt

Forward input 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 MHz.
- Decreasing the equalizer value *increases* the level at lower frequencies, relative to the level at 750 MHz.

To select the proper forward input equalizer value, follow the steps in the table 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, then proceed to **Setting the Output Level**.
   - If the output tilt is more than the design tilt, then replace the EQ with a lower value.
   - If the output tilt is less than design tilt, then replace the EQ with a higher value.
3. Re-measure the output tilt, and return to step 1.

Continued on next page

Using a Cable Simulator to Set the Output Tilt

If the actual output tilt is still more than the design tilt when the forward input equalizer has been reduced to a 0 dB value, a cable simulator may be needed in place of the forward input equalizer. Cable simulators have tilt characteristics similar to cable (opposite that of equalizers).

To select the proper cable simulator value, follow the steps in the table 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, then proceed to **Setting the Output Level**.
   - If the output tilt is more than the design tilt, then replace the cable simulator with a higher value.
   - If the output tilt is less than design tilt, then replace the simulator with a lower 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 in the table below to select the proper pad values for the amplifier module. The output level of the amplifier module 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).
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, then proceed to step 5.
   - If the output level is more than design output level, then replace the forward input pad with a higher value.
   - If the output level is less than design output level, then replace the forward input pad with a lower value.
4. Repeat steps 2 and 3 until the output level is correct.
5. If the amplifier is equipped with an AGC proceed to Automatic Gain Control.

   If the amplifier is not equipped with an AGC proceed to **Adjusting the Frequency Response**.

Automatic Gain Control Setup

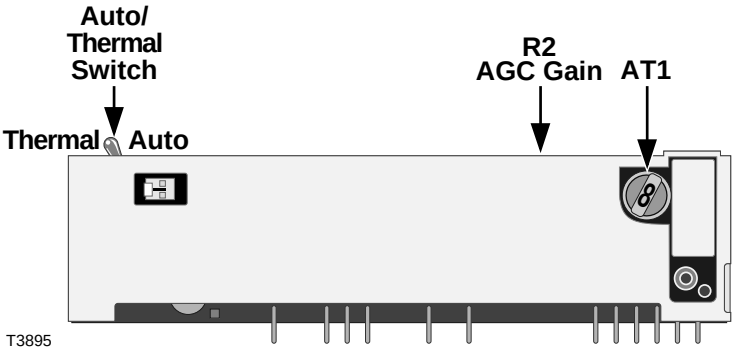
Overview

This section provides procedures for configuring the AGC in line extenders.

Note : The standard single-pilot AGC/variable interstage EQ uses channel 61 (445.25 MHz) as the pilot channel, and makes amplifier output adjustments based on the power level of this channel. You should activate the pilot channel with its final unscrambled video source before beginning balance and alignment.

Diagram

The following diagram shows the location of controls and attenuator sockets on the 750 MHz AGC module, 29 dBmV reference level.



Selecting the AGC Attenuator Value

AGC modules with 29 dBmV reference levels are designed to operate with amplifiers that have an output level of at least 29 dBmV at the pilot frequency (445.25 MHz).

IF the pilot output level is...	THEN insert a...
29 dBmV	0 dB pad in **AT1**. The AGC module is shipped with a 0 dB pad installed at **AT1**.
above 29 dBmV	pad into AT1 that is equal to the difference between the reference level and the output level.

Example:

If the output at the pilot frequency is 34 dBmV, then select the pad as follows:

34 dBmV - 29 dBmV = 5 dB

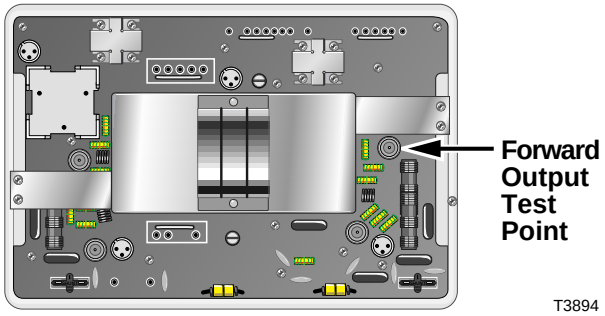
Insert a 5 dB pad in AT1.

Continued on next page

Aligning the AGC Module

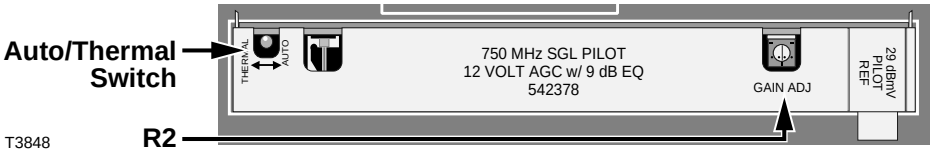
To align the AGC module, follow these steps.

1. Make sure that the Auto/Thermal switch on the AGC card is set to THERMAL.
2. Verify that the amplifier module has had the output tilt and level set, and has warmed up for about three hours.
3. Insert the test probe into the -20 dB forward output test point on the LEIII. See the following diagram for the test point location.



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

   Remember to add 20 dB to compensate for the test point loss.
5. Set the Auto/Thermal switch on the AGC module to AUTO.
6. Adjust the gain control potentiometer R2 on the AGC module to match the level you measured in step 4.



   Note: If you cannot reduce the output level far enough with the gain control potentiometer, increase the value of the (AT1) AGC attenuator to allow the proper adjustment of level.
7. Move the Auto/Thermal switch back and forth between the AUTO and THERMAL settings. Let the amplifier MODULE settle before reading signal levels.

   Result: The signal level should not vary when you switch between AUTO and THERMAL.
8. Set the Auto/Thermal switch to AUTO for operation.
9. Proceed to **Frequency Response Shaping**.

Frequency Response Shaping

Purpose

The purpose of this procedure is to verify (and if necessary, adjust for) the proper frequency response of the LEIII.

Preparation

To prepare the LEIII for frequency response shaping, follow these steps.

1. Open the LEIII housing to access the forward output test point.
2. Insert the test point adapter into the forward output test point.
3. If the LEIII has an AGC module installed, set the Auto/Thermal switch on the AGC module to Thermal.

What to do First

Use a sweep receiver or spectrum analyzer to observe the overall peak-to-valley shape of the response.

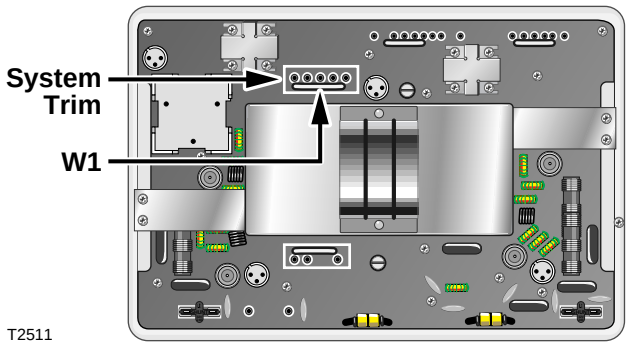
IF the peak-to-valley shape is...	**THEN...**
within the standards set for the system,	no further adjustments are necessary. Remove the test point adapter and close the station housing.
outside the standards set for the system,	proceed to **Adjusting the Frequency Response**.

Continued on next page

Adjusting the Frequency Response

To adjust the frequency response of the LEIII, follow these steps.

1. Open the LEIII module cover.
2. Select a system trim that has a frequency response opposite to that of the measured system response. This produces a net effect closer to a flat response.
3. Using heavy wire cutters or snips, carefully cut and remove jumper **W1** from the system trim location.



4. Install the system trim in the system trim slot. For the exact location of the system trim, refer to the illustration in the step above.

   Note : 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 LEIII amplifier module.
5. Adjust the system trim to produce the flattest frequency response.
6. Using the sweep receiver or spectrum analyzer, check the module output level and the tilt.
7. Is the module output level within design limits?
   - If **no**, reset the output tilt and/or level. Refer to **Setting the Output Tilt** and/or **Setting the Output Level** described earlier in this chapter.
   - If **yes**, proceed to step 8.
8. If the LEIII has an AGC module installed…
   - set the Auto/Thermal switch on the AGC module to AUTO, and
   - adjust R2 on the AGC module to match the output level measured in THERMAL mode.
9. Remove the test point adapter and close the amplifier module cover and housing.

Chapter 4
Customer Information

Overview

Introduction

This chapter contains information on how to obtain product support and how to return damaged products to Scientific-Atlanta.

In This Chapter

This chapter contains the following topics.

Topic	See Page
Customer Support	4-2
Returning Products	4-3

Customer Support

List of Telephone Numbers

If you have questions about this product, contact your distributor or sales agent for information. If further assistance is required, telephone your nearest Scientific-Atlanta office at one of the following telephone numbers.

The Americas		
United States	Scientific-Atlanta Technical Assistance Center, Atlanta, Georgia	• From within North America 1-800-722-2009 (toll-free) • From outside North America +1-770-903-5400 (direct)
United Kingdom and Europe		
United Kingdom	Kings Langley	• +44-1-923-266133 • +44-1-923-271420 (Technical Assistance Centre for Europe)

How to Return Products

Procedure

To return any Scientific-Atlanta product for repair or replacement, follow the steps in the table below. Products must have an RMA number to receive credit.

1. Telephone or fax Scientific-Atlanta and request a return material authorization (RMA) number.

   From within the United States:
   - Tel: 1-800-722-2009
   - Fax: 1-770-903-5888

   From Outside the United States:
   - Tel: +1-770-903-5300
   - Fax: +1-770-903-5888

   From Outside the United Kingdom:
   - Tel: +44-1-923-271460

2. Tag or identify the defective product and write a detailed description of the circumstances.

   Include the following information on the tag.
   - RMA number
   - Sales order
   - Purchase order (if available)
   - Date the product was received

3. Pack the product in its original container and protective packing material.

   Note: If the original container and packing material are no longer available, pack the product in a sturdy, corrugated box and cushion it with packing material.

Continued on next page

How to Return Products, Continued

4. Write the following information on the **outside** of the container.
   - Your name
   - Complete address
   - Telephone number
   - RMA number
   - Problem description

   Note: Absence of the RMA number may delay processing your product for repair. Include the RMA number in all correspondence.

5. Ship the product, prepaid and insured, via United Parcel Service (UPS), your postal service, or other freight carrier to the following address:

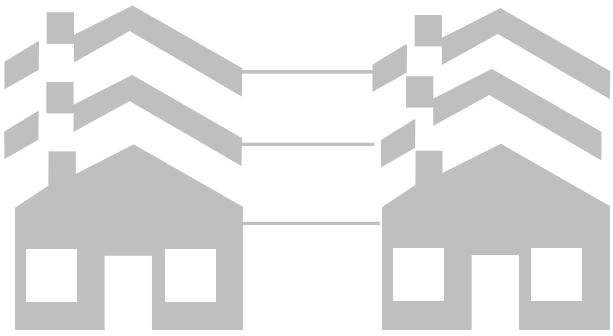
   Scientific-Atlanta, Inc.
   RMA Number _____
   Product Services
   4311 Communications Drive
   Norcross, GA 30093
   USA

   Note: Scientific-Atlanta, Inc. does not accept freight collect. Be sure to prepay all shipments.

750 MHz GaAs FET Line Extender III
Installation and Operation Guide

Appendix

- Appendix A - Technical Information



Appendix A
Technical Information

Overview

In This appendix

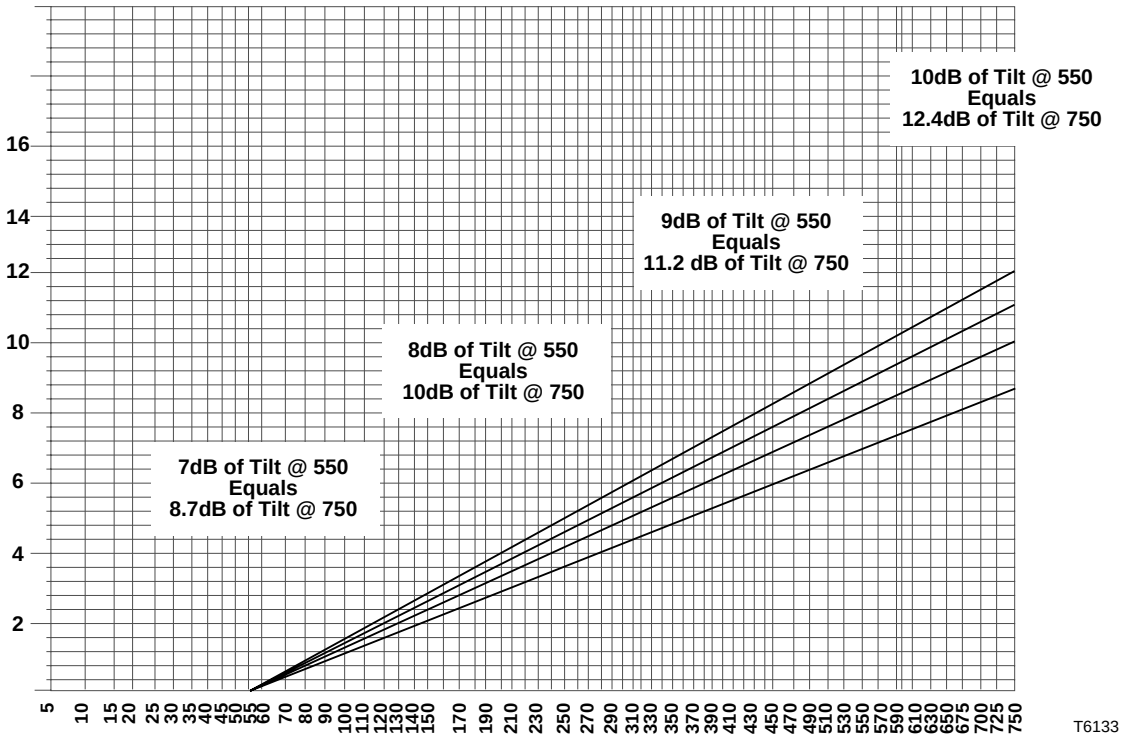
This appendix contains equalizer charts.

Topic	See Page
Tilt Chart	A-2
Equalizer Charts	A-3

Tilt Chart

Amplifier Output Tilt

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

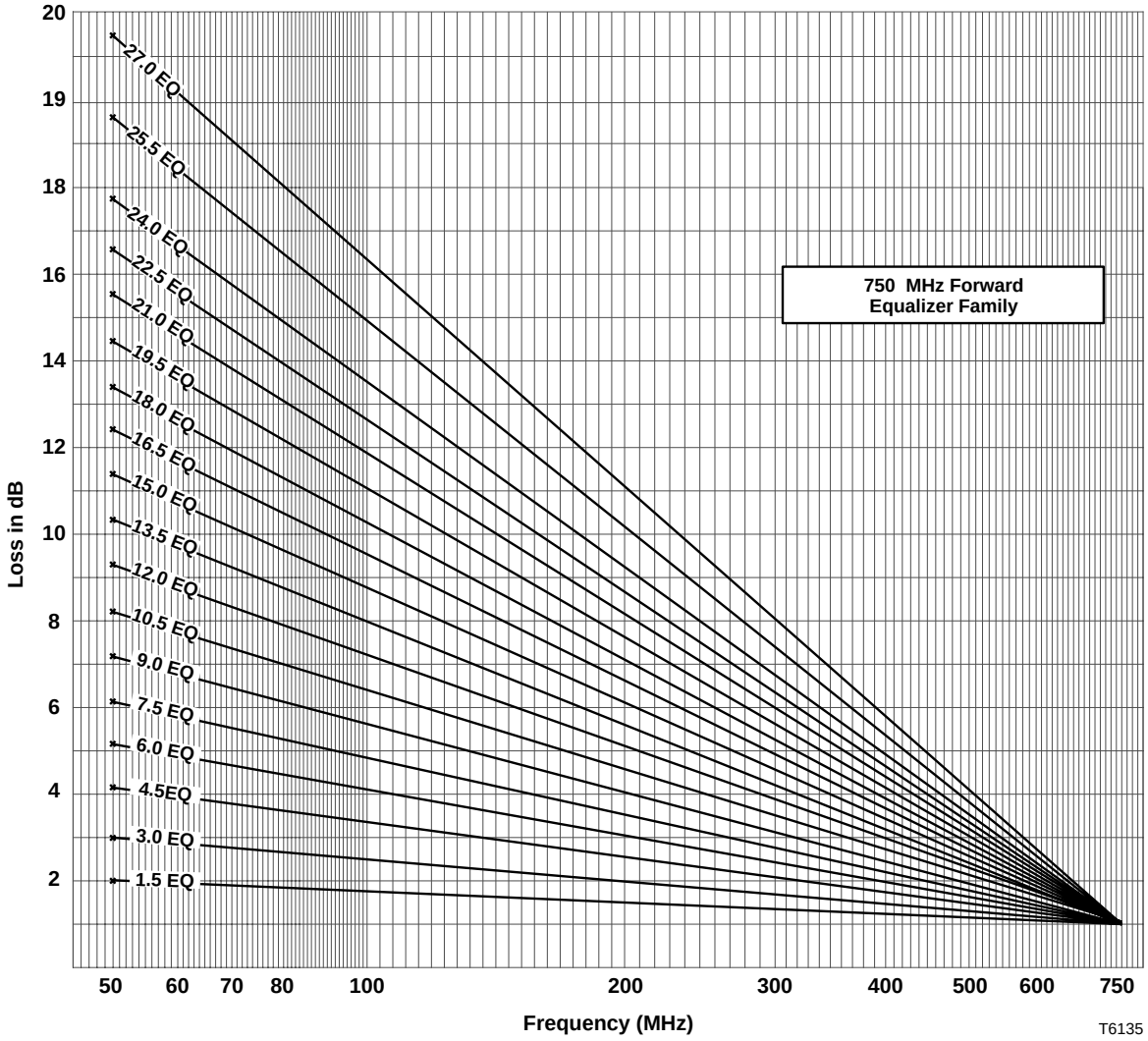


Example: If the amplifier operating levels are 42 dBmV with an operating tilt of 10 dB at 750 MHz, the operating level at the pilot frequency of 445.25 MHz would be 39 dBmV. This was found by taking the difference in tilt between 750 MHz and 445.25 MHz (10-7=3 dB). Then subtract the difference in tilt from the operating level (42-3=39 dBmV).

Equalizer Charts

750 MHz Forward Equalizer

The following diagram shows the 750 MHz forward equalizer chart.



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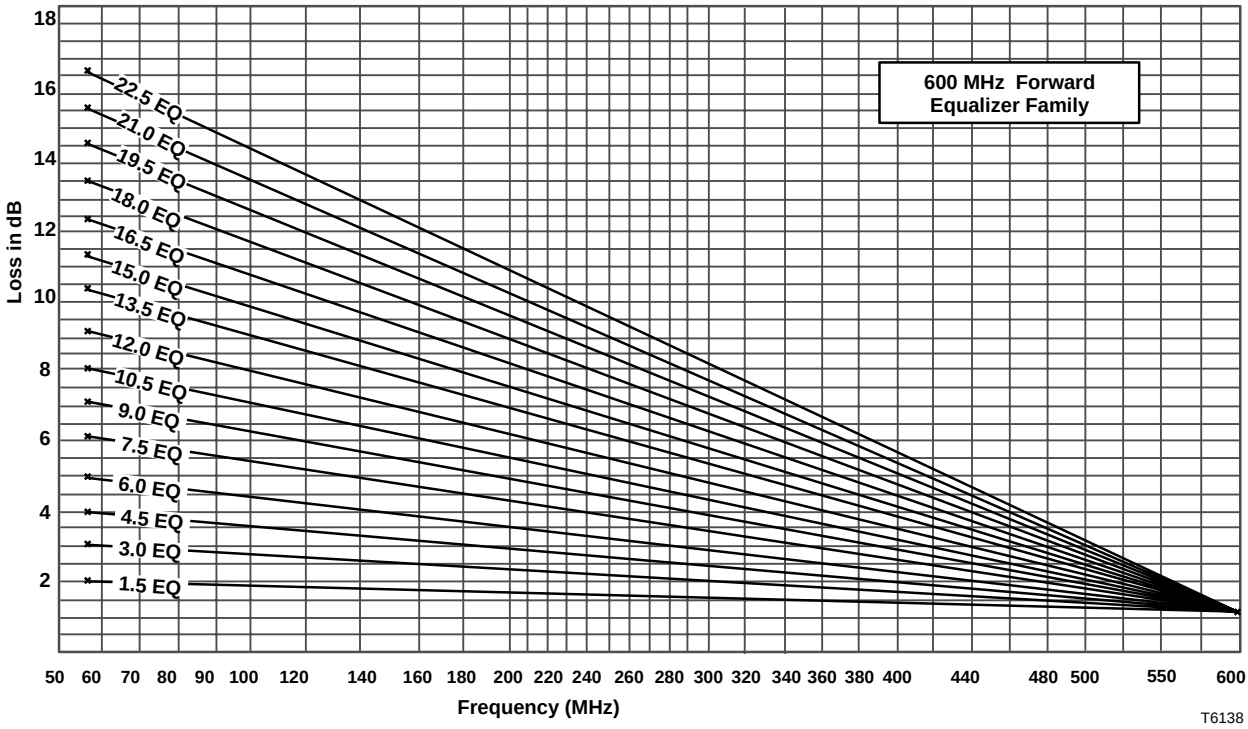
600 MHz Forward Equalizer

The following diagram shows the 600 MHz forward equalizer chart.



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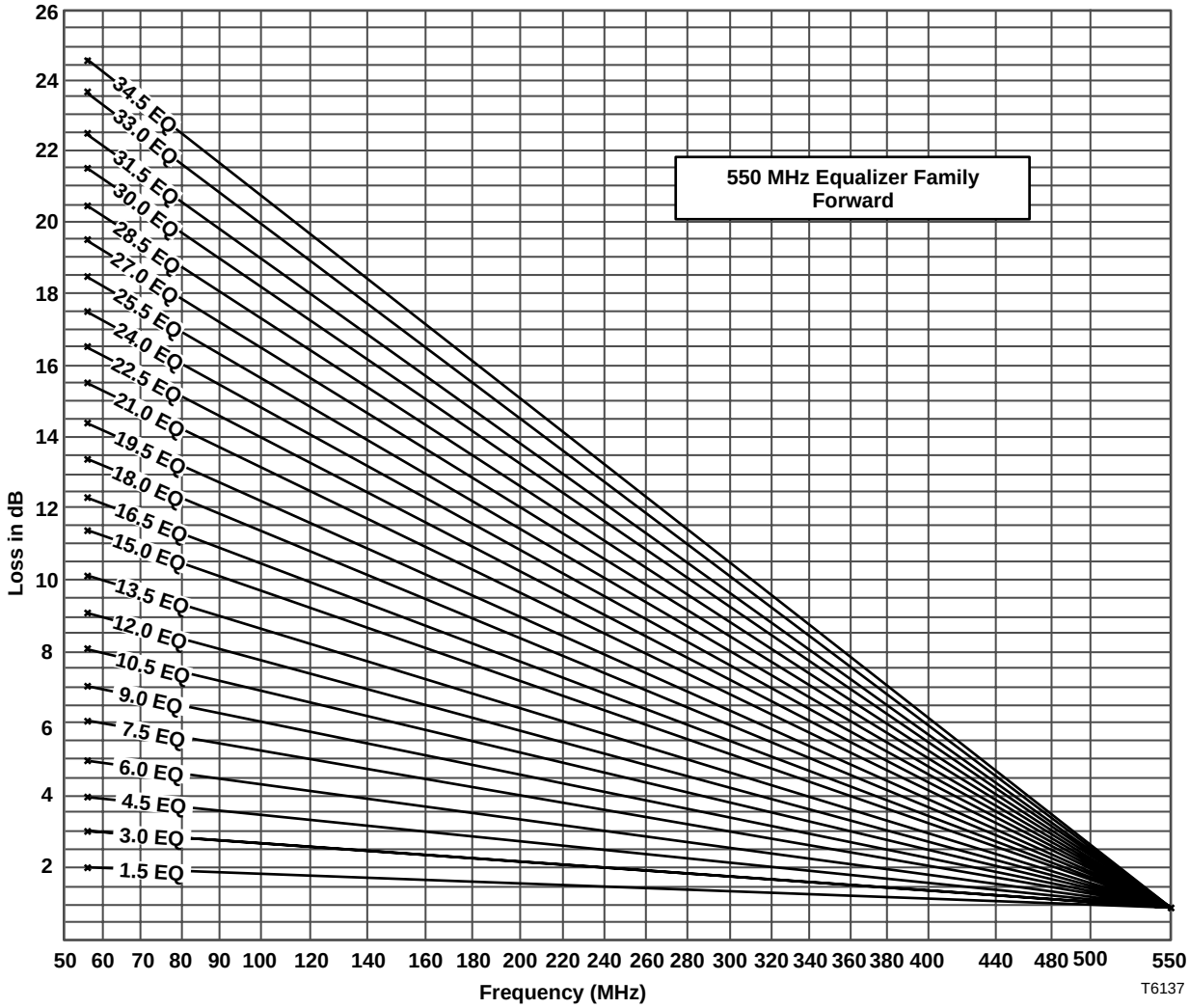
550 MHz Forward Equalizer

The following diagram shows the 550 MHz forward equalizer chart.



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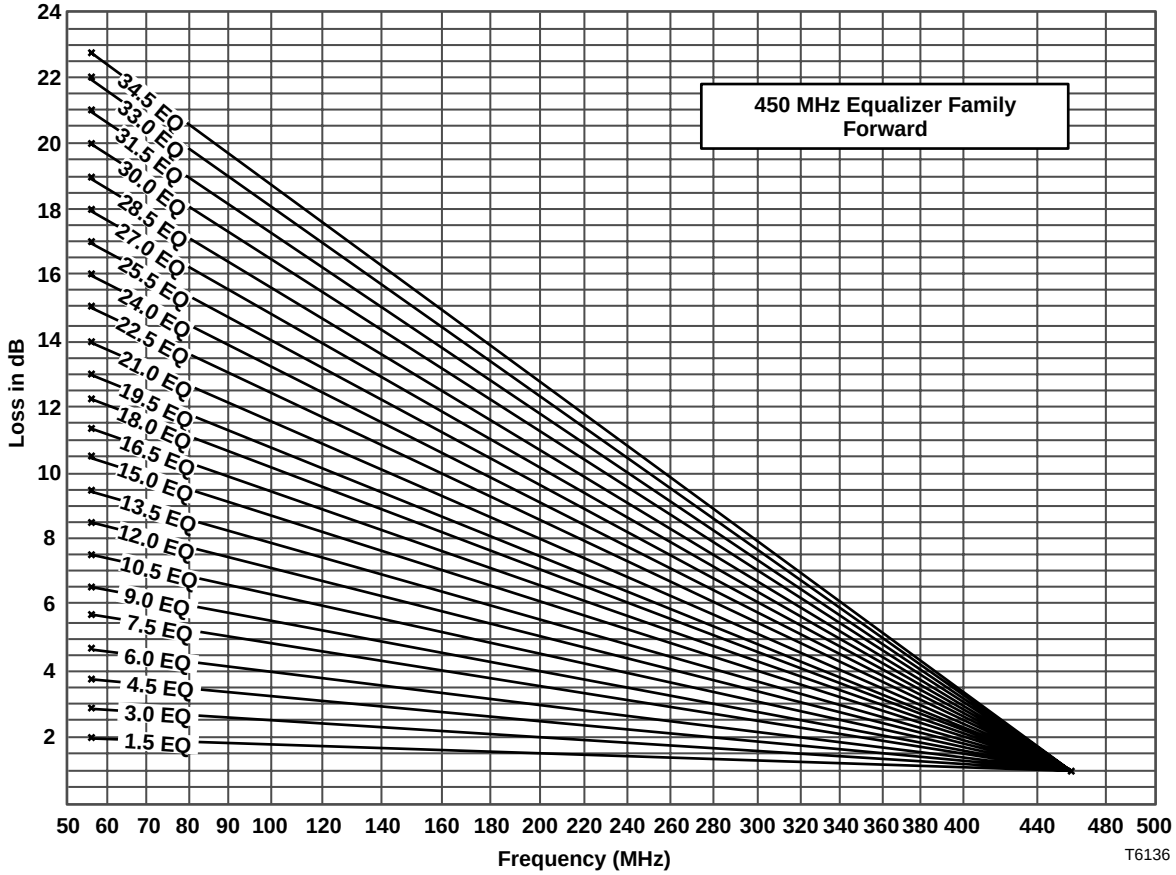
450 MHz Forward Equalizer

The following diagram shows the 450 MHz forward equalizer chart.



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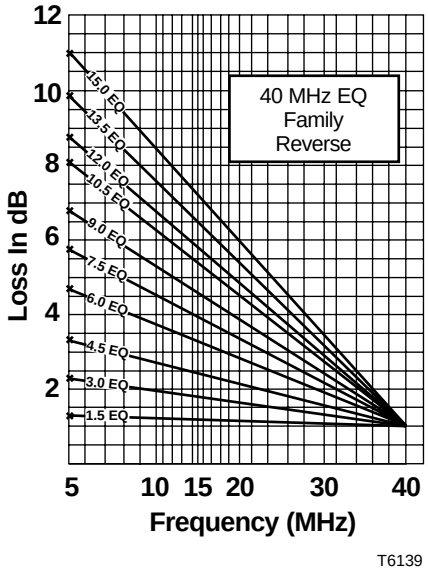
40 MHz Reverse Equalizer

The following diagram shows the 40 MHz reverse equalizer chart.



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