



GS7000 Node RF Split Upgrade Application Note

Overview

Introduction

Cable operators have experienced an exponential rise in the requirement for more reverse path bandwidth due to the popularity of advanced, on-demand subscriber services. These operators need an upgrade path for deployed equipment to overcome this operational challenge.

Purpose

This application note describes the RF split upgrade procedure for 1 GHz GS7000 Nodes.

Note:

- We recommend performing this procedure in a lab bench environment rather than in the field. Making this type of product change in the field increases the risk of added network downtime resulting from troubleshooting any issues associated with the upgrade.
- The upgrade process described here includes verification of forward and reverse signals for each port. Our amplifier products generally perform acceptably without this verification. We recommend verification in this case to ensure that all component replacements are performed correctly; that all components perform as specified; and that the upgraded product meets customer expectations immediately when placed into service.

Should you need assistance with your upgrade, contact Cisco Services for support.



WARNING:

Avoid electric shock. Opening or removing this equipment cover may expose you to dangerous voltages. RF split upgrades should only be conducted on amplifiers that have been removed from the cable system, not on amplifiers actively in service.

Qualified Personnel

Only appropriately qualified and skilled service personnel should attempt to install, operate, maintain, and service this product.

 **WARNING:**
 Allow only qualified and skilled personnel to install, operate, maintain, and service this product. Otherwise, personal injury or equipment damage may occur.

Related Publications

You may find the following publication useful as you implement the procedures in this document:

- *Model GS7000 GainMaker Scaleable 4-Port Node Installation and Operation Guide*, part number OL-29643-01

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Before You Begin

Before you start the upgrade procedure, make sure that you have all of the components, tools, and equipment ready.

Components Required to Make the Split Change

Note: Part numbers differ depending on the desired final split. Upgrade kit part number GS7K-SPLTKT-85105= supports changing a GS7000 launch amplifier to an 85/105 MHz split. Each upgrade kit supports changing the frequency split of ten GS7000 launch amplifiers.

Each GS7000 split upgrade kit includes the following parts:

- (10) Reverse Amplifier Board
- (20) Non-mirrored Diplex Filters
- (20) Mirrored Diplex Filters

Tools and Equipment Required to Make the Split Change

- AC power source
- 1/2-inch socket driver
- Torx T-10 screwdriver
- Torx T-15 screwdriver
- Flat-head screwdriver
- Non-conductive tuning tool
- Torque wrench with 1/2-inch socket
- Test GS7000 Node housing and network analyzer or stealth meter
- Small cross head screwdriver
- Cable adapter, part number GS7K-SPLKT-CBL



Initial Steps

This section describes the steps for opening the node housing and documenting amplifier signal flows.

Opening the Housing

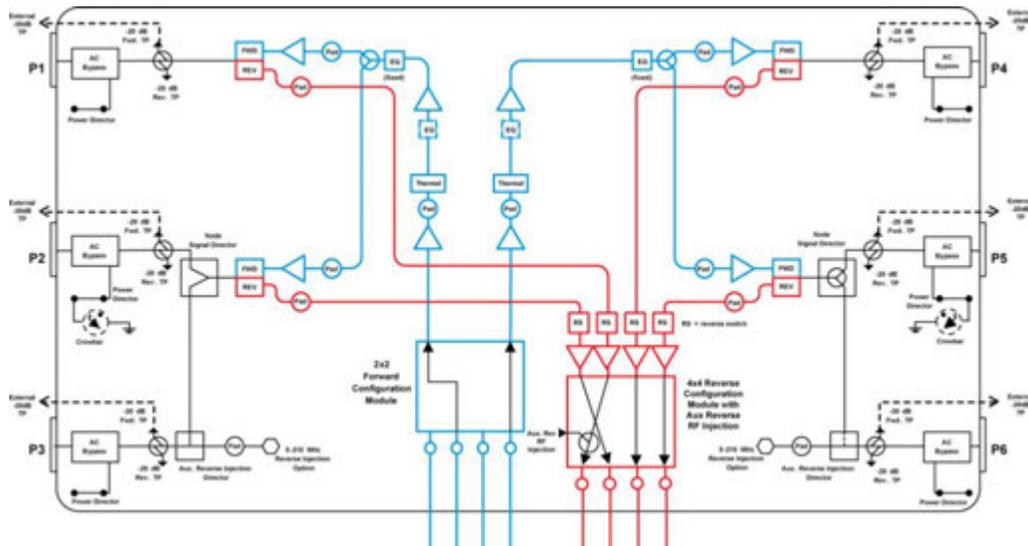
Open the housing as follows:

- 1 Remove the bolts securing the lid to the base.
- 2 Carefully open the lid to allow access to the inside of the housing.
- 3 Inspect gaskets on the cover flange and on the test port plugs.
- 4 Replace any gaskets showing signs of wear (cracked, twisted, pinched, or dry) with new, silicon-lubricated gaskets.

Verifying Signal Paths

To verify correct operation following the upgrade, you must know the input-to-output signal routing for each port on the node being upgraded.

The top deck of the RF Amp module includes a graphic overlay that provides a partial view of the signal flow from each receiver input port to at least one RF output port.



To fully define these signal flows, you must also take into account the forward configuration module (FCM) and other plug-ins installed in the amplifier.

The following table shows the input-to-output signal routing supported by each FCM.

Input-to-Output Signal Routing by FCM

FCM Configuration	Part Number on Module	Input Receiver Ports				Output Ports			
		1	2	3	4	1	2/3	4	5/6
1x4	4019273	X				X	X	X	X
1x4 w/Injection	4022272	X				X	X	X	X
1x4 Redundant	4019275	X				X	X	X	X
2x4 Redundant	4019279	X		W		W	W	X	X
2x4	4019277	X		W		W	W	X	X
3x4 (Rx 1,3,4)	4024784	X		W	Y	W	Y	X	X
3x4 (Rx 1,2,4)	4024786	X	Z		Y	Y	Y	Z	X
4x4	4019281	X	Z	W	Y	W	Y	Z	X

In this table, the letters W, X, Y, and Z identify the possible input-to-output routing from each receiver input port to each RF output port.

For example, if FCM part number 4024784 is installed:

- Signal applied to input port 1 (X) appears at two output ports: port 4 and either port 5 or 6, depending on which directional splitter is installed.
- Signal applied to input port 3 (W) appears at output port 1 only.
- Signal applied to input port 4 (Y) appears at either output port 2 or output port 3, depending on which directional splitter is installed.

By combining this information with visual inspection of the splitter(s) installed in the amplifier, you can determine where a test signal should appear as output when applied to each receiver input port.

Complete the Signal Path Table

Use the information provided above to list the corresponding output port number(s) for each receiver input port in the following table.

Signal Path Table

Rx Input Port	RF Output Port(s)
1	
2	
3	
4	

You will refer to this information when verifying correct operation following the upgrade.

Upgrading the RF Split in the GS7000 Node

Use spare or in-stock RF module units to perform these steps to upgrade out-of-service units. Then replace in-service RF modules with the upgraded RF module units. Return the replaced RF modules to stock so that they can become the next units for upgrade and swap procedures.



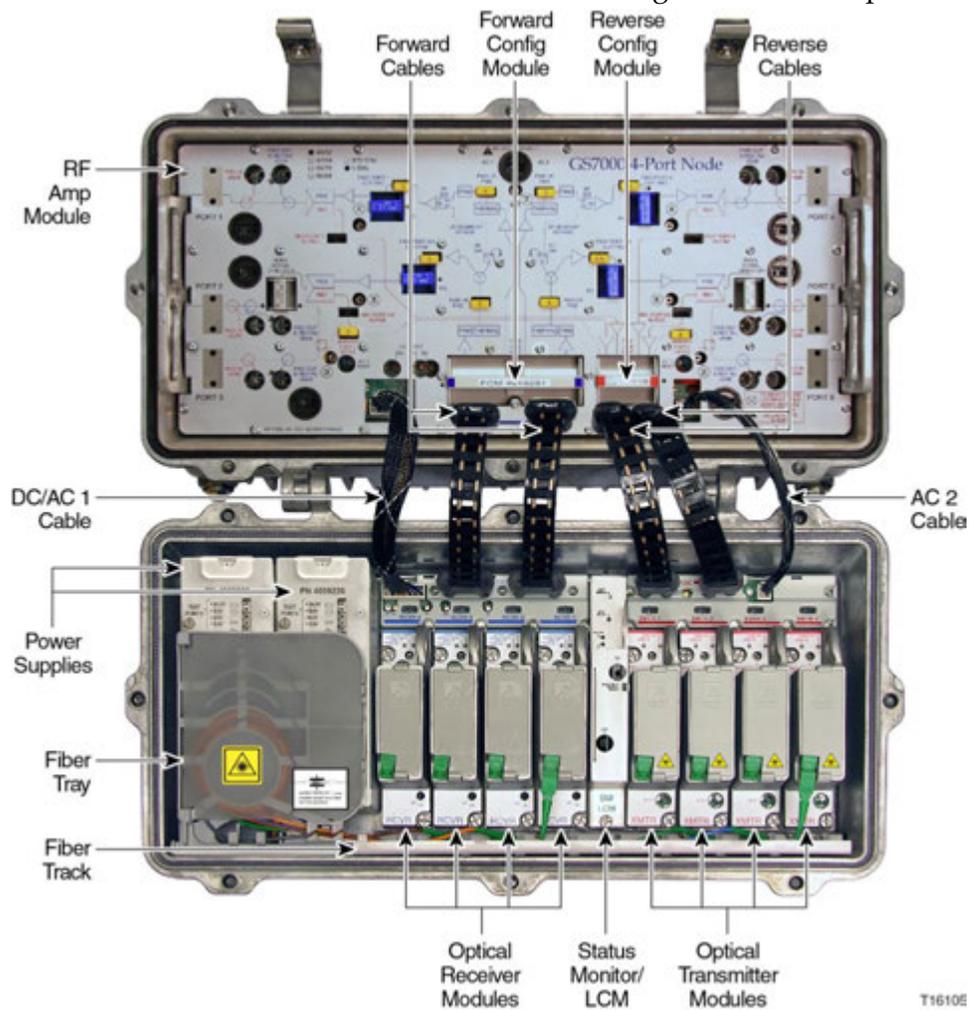
CAUTION:

To prevent electrostatic discharge (ESD) to electronic equipment, take ESD precautions, including the use of an ESD wrist or ankle strap or an anti-static mat.

To Upgrade the RF Amp Module

- 1 From the top of the amplifier, remove the Reverse Configuration Module (RCM) plug-in module from the RF Amp module.

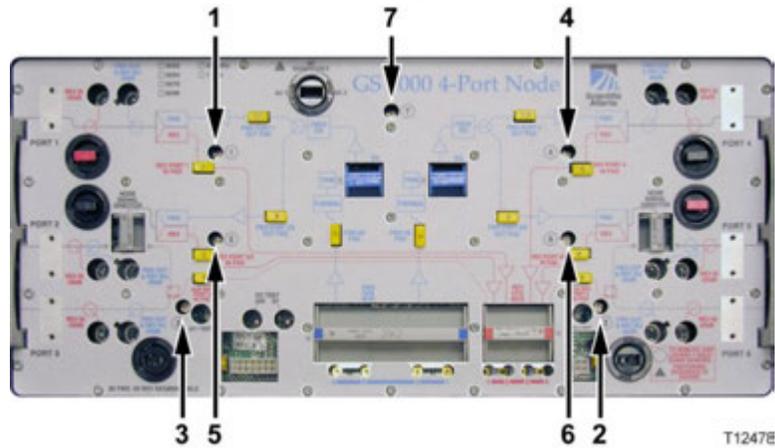
Note: The RCM must be removed before removing the reverse amplifier board.



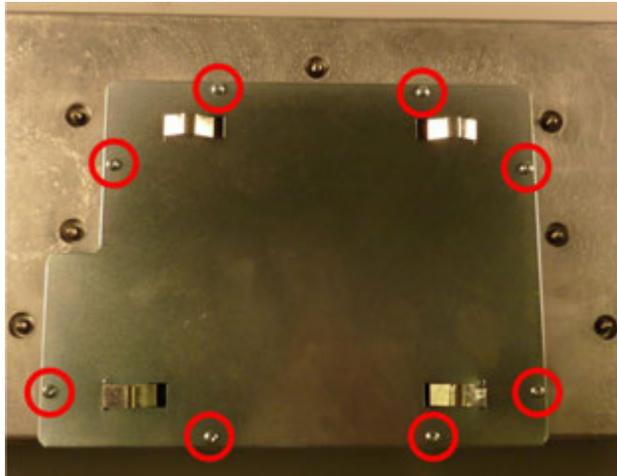
Upgrading the RF Split in the GS7000 Node

- 2 Disconnect any cables currently connected to the RF Amp module.
- 3 Remove the 7 screws securing the RF Amp module in the node housing, and then remove the module from the housing.

Note: For additional details as needed, see **RF Amplifier Assembly Replacement Procedure** in the *Model GS7000 GainMaker Scaleable 4-Port Node Installation and Operation Guide*, part number OL-29643-01.

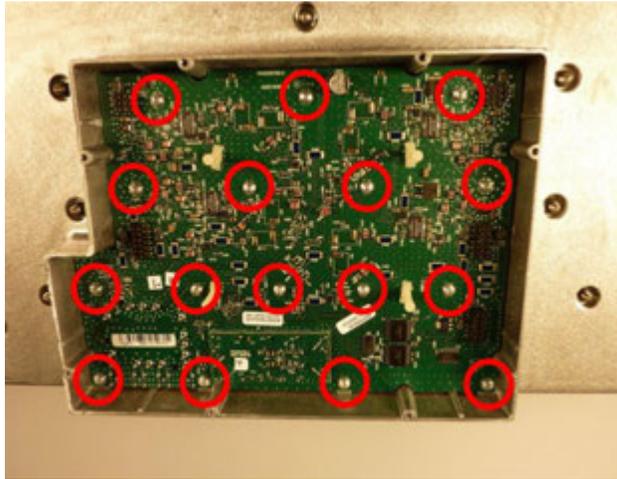


- 4 Turn over the RF Amp module.
- 5 Remove the 8 screws securing the reverse amplifier cover using a Torx T-10 screwdriver.



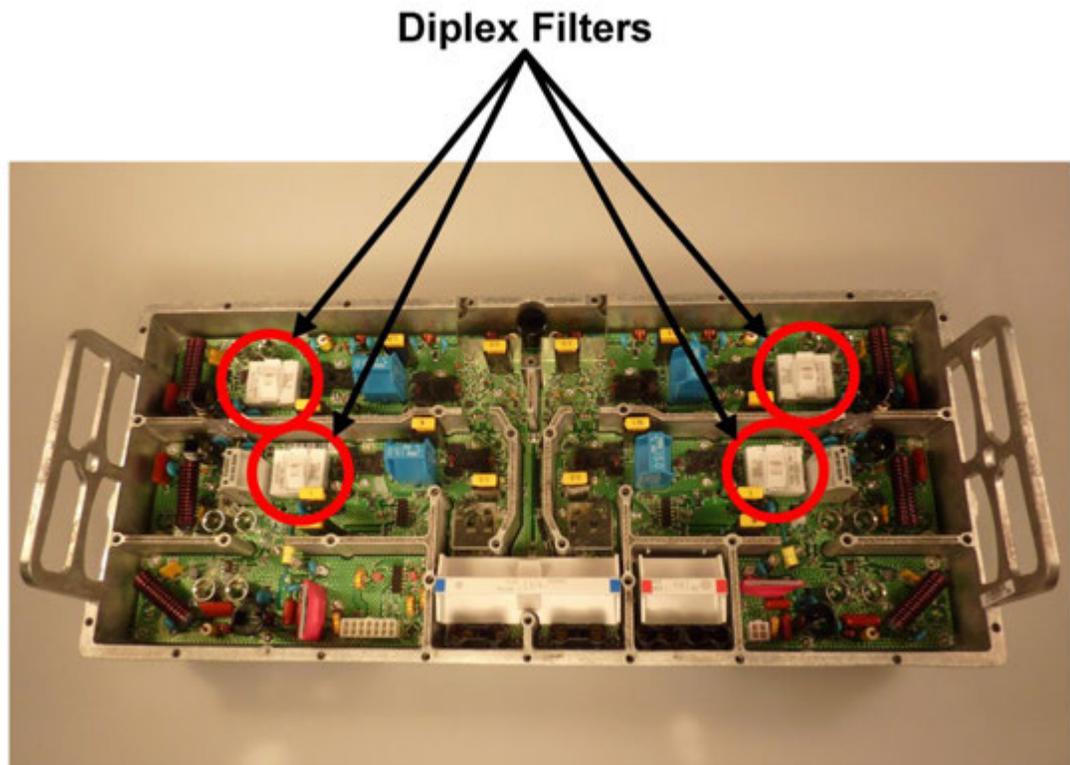
Upgrading the RF Split in the GS7000 Node

- 6 Using the T-10 screwdriver, remove the 16 screws securing the reverse amplifier board.



- 7 Remove the reverse amplifier board using the 4 white handles provided for this purpose.
Note: If the board is difficult to remove, try pushing on the top of the board (where the RCM installs).
- 8 Install the new reverse amplifier board. Use all of the screws removed previously, and tighten from 5 to 8 in-lb (0.56 to 0.90 Nm).
- 9 Replace the reverse amplifier cover. Use all of the screws removed previously, and tighten from 5 to 8 in-lb (0.56 to 0.90 Nm).
- 10 Turn the RF module back over.
- 11 Reinstall the RCM removed previously.

- 12 Using a Torx T-15 screwdriver, remove all 35 amplifier cover screws securing the RF amplifier module cover, and then remove the amplifier cover.
- 13 Remove the four (4) diplex filters using the plastic handle on the component. There are two (2) "mirrored" (blue PCB material) and two (2) "non-mirrored" (green PCB material) diplex filters.
Note: To facilitate removal of diplex filters near ports 2 and 5, first remove any neighboring jumpers.



- 14 Install the four (4) new diplex filters. Be careful to match the replacement (2) "mirrored" (blue PCB material) at locations A400 and A500 on the PCB and two (2) "non-mirrored" (green PCB material) at locations A300 and A200 on the PCB.
Note: Be sure to replace any jumpers removed when removing the old diplex filters.



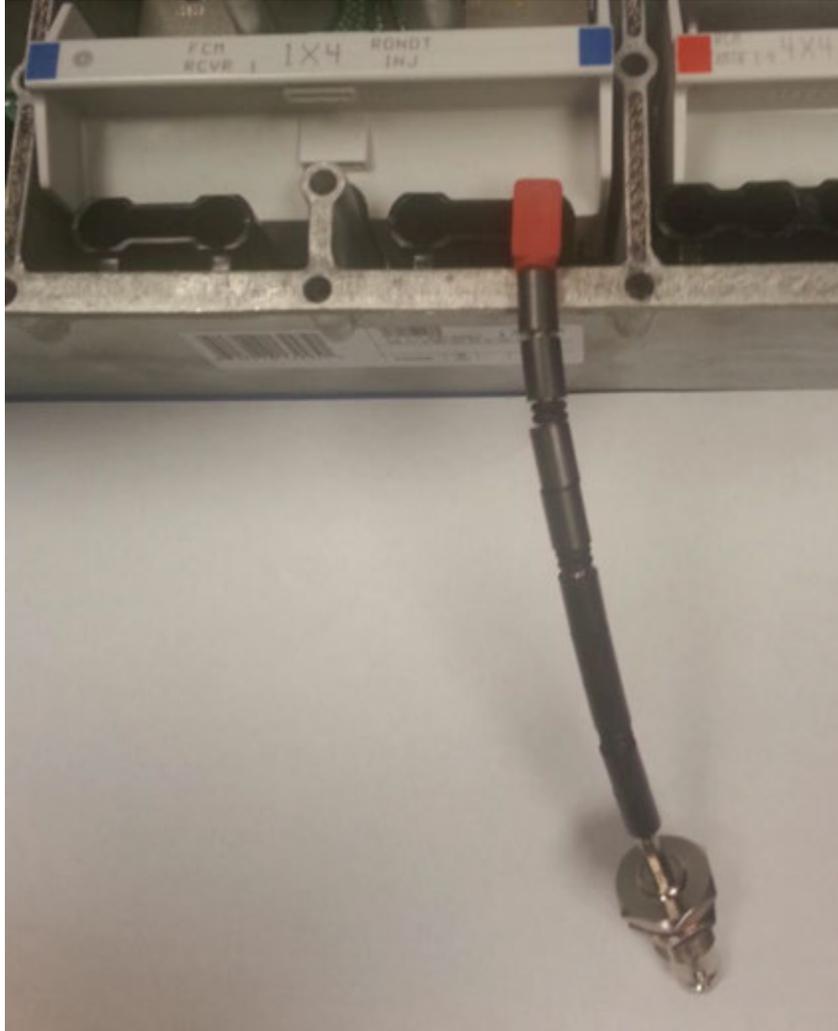
CAUTION:

Modifying an amplifier's split characteristics will impact the available channel lineup downstream from the upgraded amplifier.

Note: Properly dispose of all parts that you remove to protect the environment and avoid their reuse, which could impact network performance.

Upgrading the RF Split in the GS7000 Node

- 15 Install the RF module into the test GS7000 Node housing.
- 16 Attach a network analyzer or stealth meter to output port 1 of the RF Amp module.
- 17 Referring to the **Signal Path Table** that you completed at the end of *Verifying Signal Paths* (on page 4), connect the cable adapter (part number GS7K-SPLKT-CBL) from the RF test source to the input receiver port on the launch amplifier that corresponds to output port 1.



WARNING:

Potentially lethal voltages may be present inside the node. Follow appropriate safety precautions and practices to avoid electric shock when working inside the node.

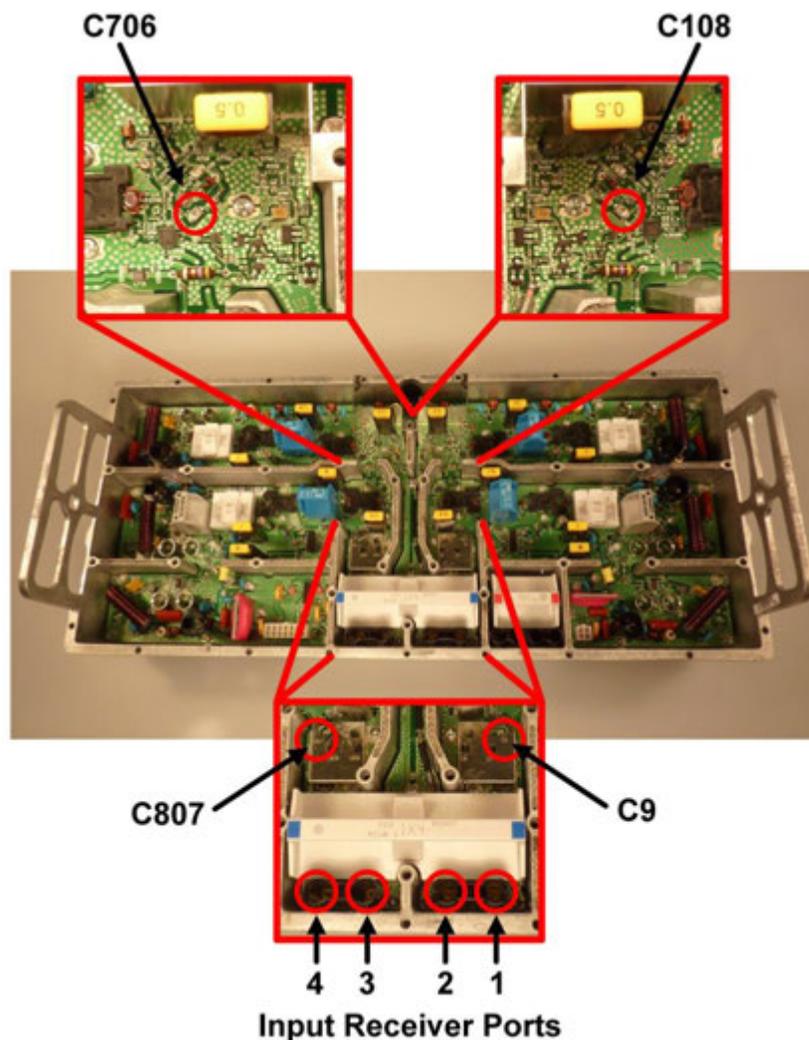
- 18 Complete the adjustment procedure described in *Forward Band Low End Peak Adjustment* (on page 11) for output port 1.
- 19 Repeat this adjustment procedure for each of the remaining output ports to fully verify correct operation.

Forward Band Low End Peak Adjustment

Complete the following procedure for each output port on the RF Amp module.

Note: Use the **Signal Path Table** at the end of *Verifying Signal Paths* (on page 4) to determine which receiver input port to use for each output port.

- 1 While looking at the S21 frequency response trace, use a non-conductive tuning tool to tune each of the four variable capacitors on the RF module to set the forward band low-end peak for its respective port(s), as follows:
 - For output port 1, adjust C706.
 - For output port 2 or 3, adjust C807.
 - For output port 4, adjust C108.
 - For output port 5 or 6, adjust C9.



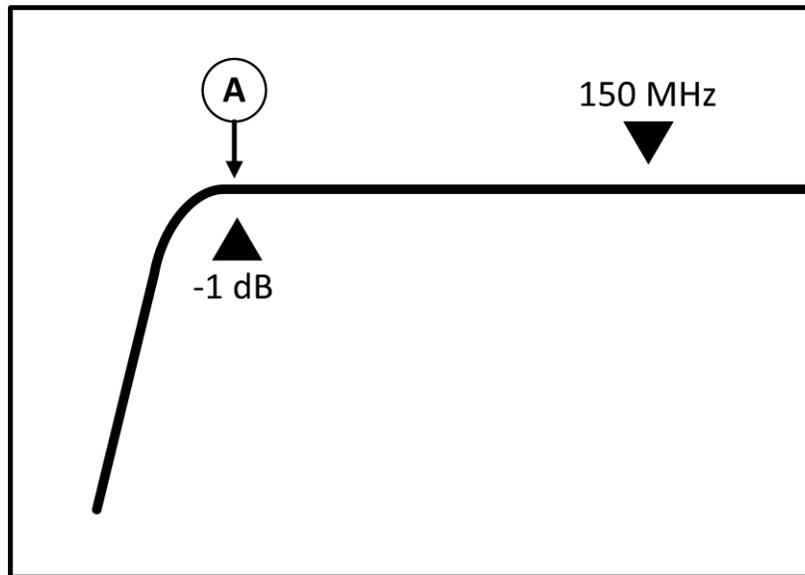
These components tune each of the ports to the desired start frequency of the forward band.

Upgrading the RF Split in the GS7000 Node

Note:

- For this adjustment, the analyzer should be set up to view the frequency range from roughly 50-200 MHz.
- Test and adjustment points vary depending on the FCM module being used. See *Verifying Signal Paths* (on page 4) for help identifying the appropriate test and adjustment points by FCM module.
- The RF module must be powered to be able to make these adjustments.

Confirm that the insertion loss at the upper frequency of the split (54, 70, 86, or 105 MHz) is less than 1 dB relative to a 150 MHz reference level. This measurement point is shown at "A" in the following figure.



As the signal is injected in to the receiver (or receivers, depending on the forward configuration used), you will adjust the forward band start frequency.

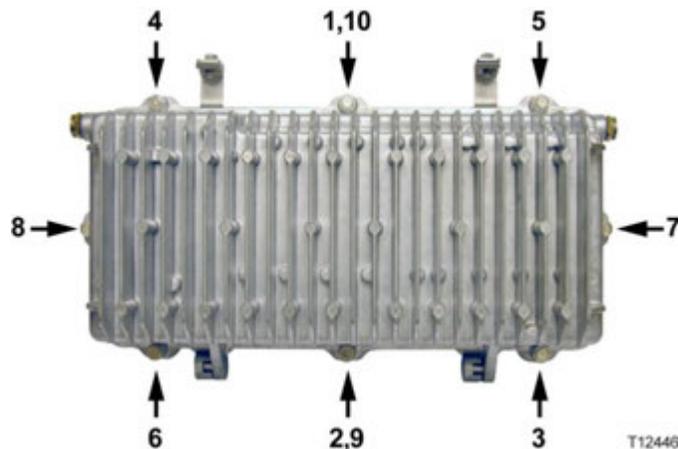
For example:

- In a 1x4 FCM configured node, all four output ports can be tuned by injecting the signal into the Rx1 injection port.
- In a 2x4 FCM configured node, ports 4 and 5/6 are tuned while injecting signal into the Rx1 injection port. Ports 1 and 2/3 are tuned while injecting signal into the Rx3 injection port.

On completing this procedure, the frequency response of all output ports is set. Continue with *To Install the Upgraded RF Amp Module* (on page 13) to reassemble the upgraded unit.

To Install the Upgraded RF Amp Module

- 1 Replace the amplifier cover and reinstall all 35 Torx T-15 amplifier cover screws; tighten the screws from 10 in-lb to 12 in-lb (1.12 Nm to 1.35 Nm).
Important: Reinstall the cover screws starting from the center and working toward the sides. Be careful to avoid stripping the threads of the housing. Improper installation of the amplifier module cover may result in RF signal degradation. Also be sure that all components clear the slots on the cover.
- 2 Change the split indicator information on the cover to reflect the new split configuration. To do this, either move the adhesive dot to the proper designation OR remove the dot and use a permanent marker to designate the new configuration.
- 3 Insert the upgraded RF amplifier module into the housing.
- 4 Secure the amplifier module to the housing by tightening the seven module retainer screws with a screwdriver from 6 in-lb to 9 in-lb (0.7 Nm to 1.0 Nm).
- 5 Inspect the housing gasket and all mating surfaces. Wipe off any excess dirt and debris.
- 6 Close the housing and finger-tighten all closure bolts.
- 7 Use a torque wrench with a 1/2-inch socket to tighten each closure bolt from 5 ft-lb to 12 ft-lb (6.8 Nm to 16.3 Nm).
- 8 Follow the numbered tightening sequence to tighten the closure bolts.



Note: For additional details as needed, see **RF Amplifier Assembly Replacement Procedure** in the *Model GS7000 GainMaker Scaleable 4-Port Node Installation and Operation Guide*, part number OL-29643-01.

For Information

For Information

If You Have Questions

If you have technical questions, contact Cisco Services at the following URL:

<http://www.cisco.com/web/services/>



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April 2014

Part Number OL-29941-01