



1.2 GHz 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 previously deployed HFC equipment to overcome this operational challenge.

Purpose

This application note describes the RF split upgrade procedure for 1.2 GHz GS7000 Nodes.

Note:

- You will note that the final instruction in the split change process calls for the verification of forward and reverse signal for each port. This optional verification is included to ensure that all component replacements with respect to the split upgrade were performed correctly and to ensure that all replacement components perform as specified.
- While our products and the components included in the split upgrade kit are designed to perform well without this verification, we suggest this extra step to ensure that products meet customer expectations immediately upon placement 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:

- *Cisco 1.2 GHz GS7000 Node Installation and Operation Guide*

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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 available.

Components Required to Make the Split Change

Note: Kit part numbers differ depending on the desired final split. Upgrade kit part number GS7K-SKT-1.2G-85= supports changing a 1.2 GHz GS7000 launch amplifier to an 85/105 MHz split.

- Each upgrade kit supports changing the frequency split for ten 1.2 GHz GS7000 launch amplifiers and will contain the following components Low Pass Filter Trim Module 40 ea
- High Pass Filter Trim Module 40 ea
- Non-mirrored Diplex Filter Module 20 ea
- Mirrored Diplex Filter Module 20 ea

Tools and Equipment Required to Make the Split Change

- 1/2-inch socket driver
- Flat-head screwdriver
- Phillips screwdriver
- Torque screwdriver
- Torque wrench with 1/2-inch socket

Tools and Equipment Required for Optional Performance Verification following the Split Change

- AC power source
- Test GS7000 Node housing and network analyzer or stealth meter
- Cable adapter, part number GS7K-SPLKT-CBL



Initial Steps

This section describes the steps for opening the node housing.

Opening the Housing

Open the housing as follows:

- 1 Loosen the bolts securing the lid to the base (8 places).
- 2 Carefully open the lid to allow access to the inside of the housing.
- 3 Inspect gaskets on the cover flange. Make sure the gaskets are clean and free of any debris. Prior to closing the node the environmental (black) gasket should be re-lubricated with silicon.
- 4 Replace any gaskets showing signs of damage (cracked, twisted, pinched, or dry) with new, silicon-lubricated gaskets.

Upgrading the RF Split in the GS7000 Node

Note: This upgrade procedure can be used in the field or to reduce network downtime you can 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.

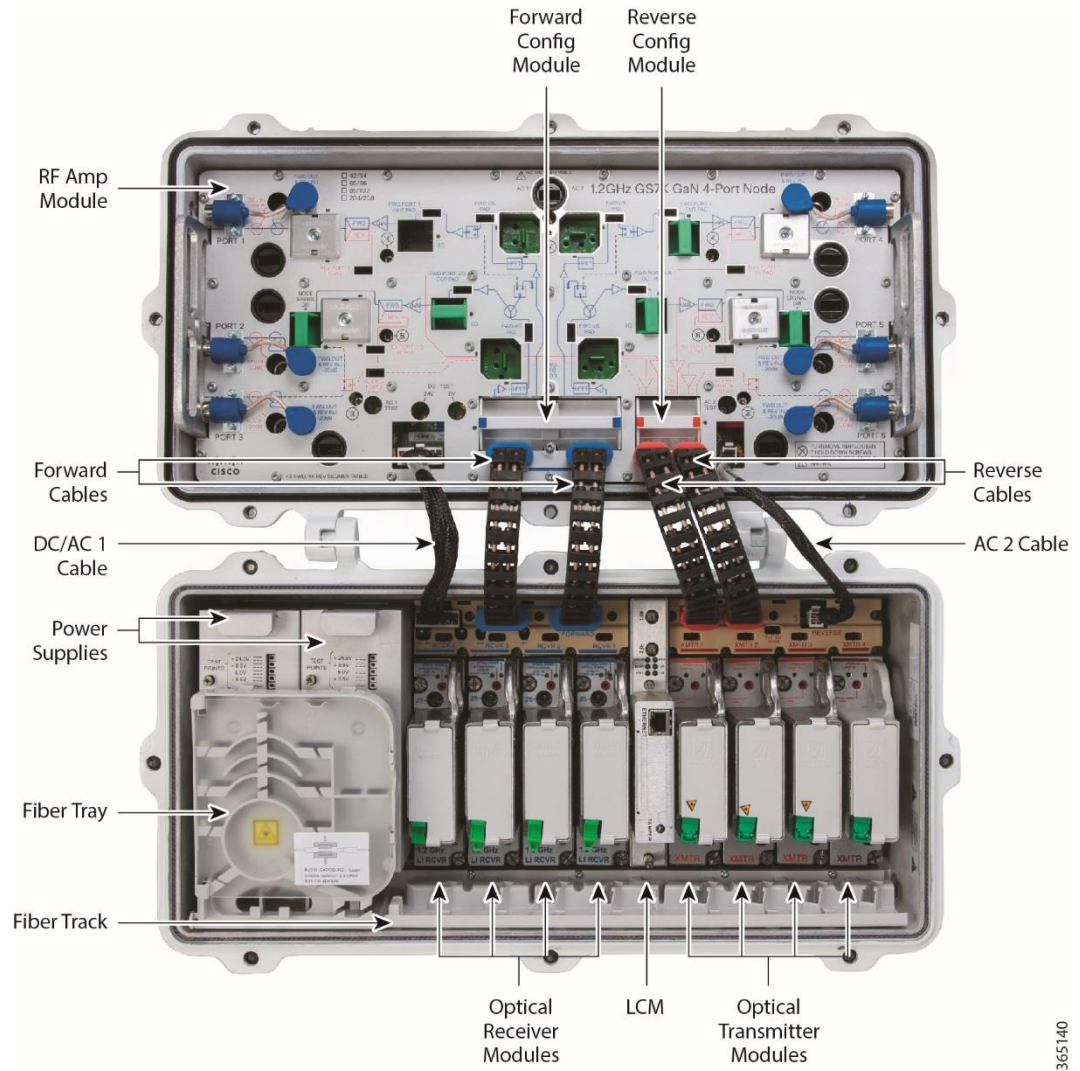


CAUTION:

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

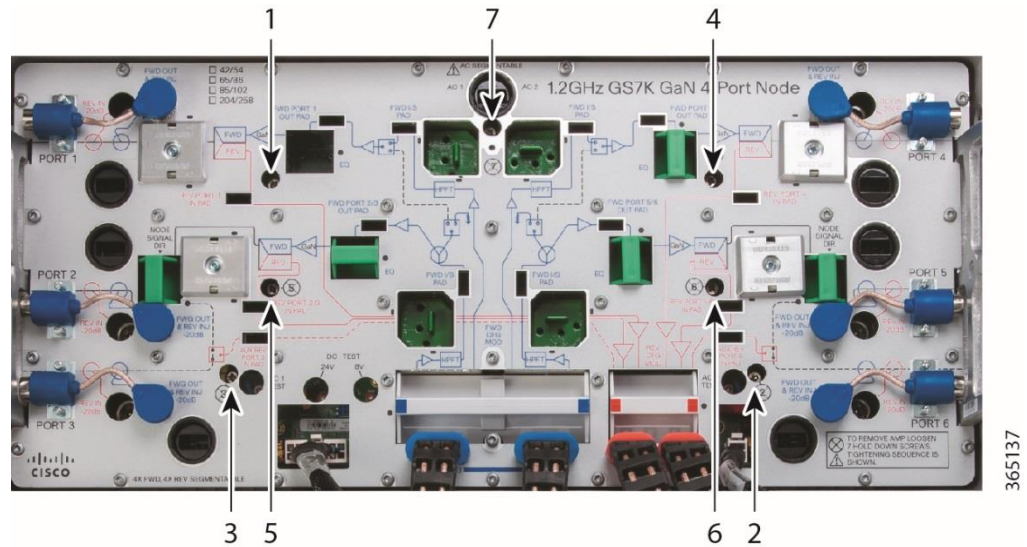
- 1 Disconnect all 6 cables currently connected to the RF Amp module.



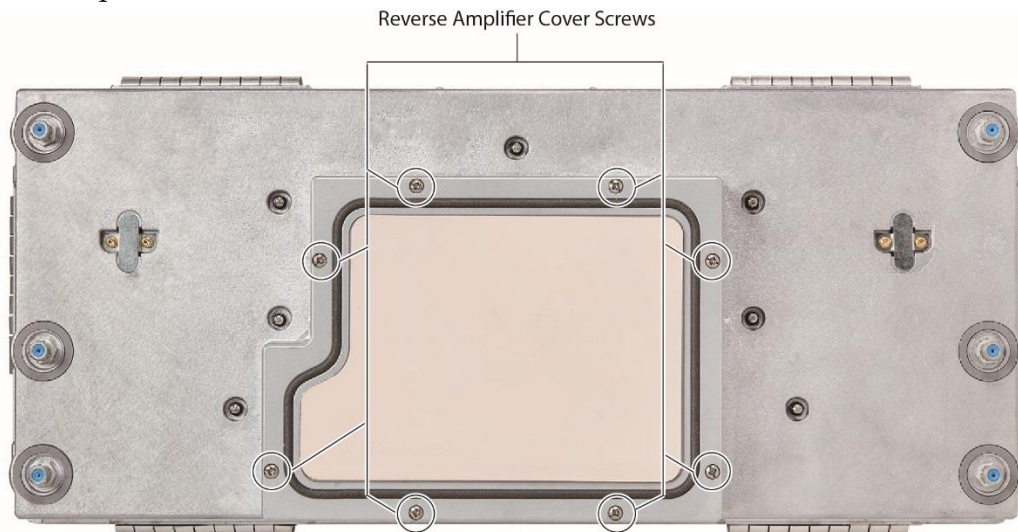
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- Remove the 7 screws securing the RF Amp module in the node housing, and then remove the module from the housing.

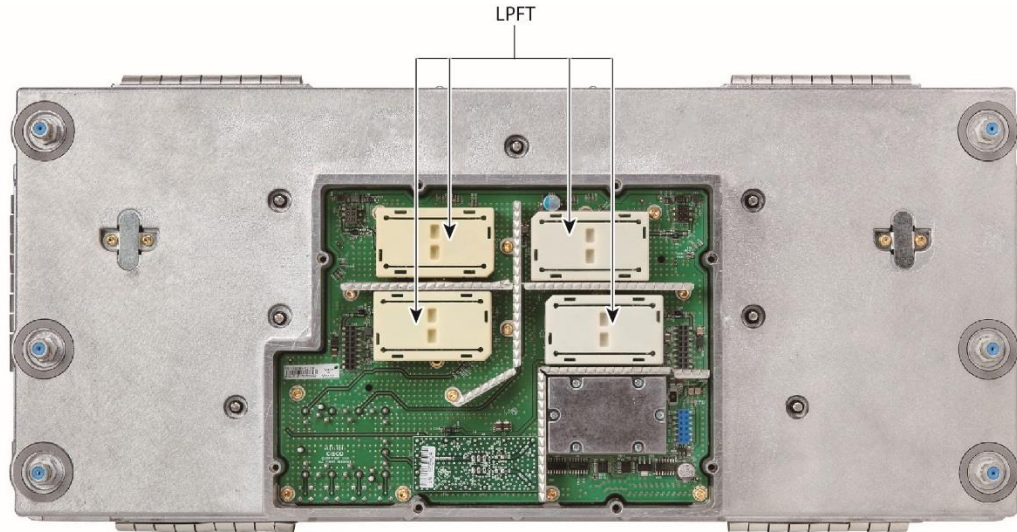
Note: For additional details as needed, see **RF Amplifier Assembly Replacement Procedure** in *Cisco 1.2 GHz GS7000 Node Installation and Operation Guide*.



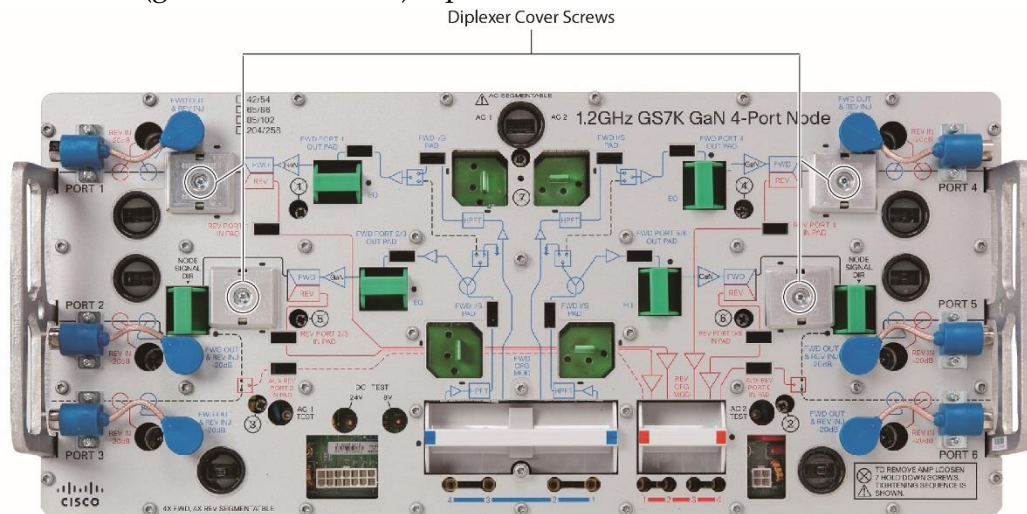
- Turn over the RF Amp module.
- Remove the 8 screws securing the reverse amplifier cover using either a Flat or Phillips Head screwdriver.



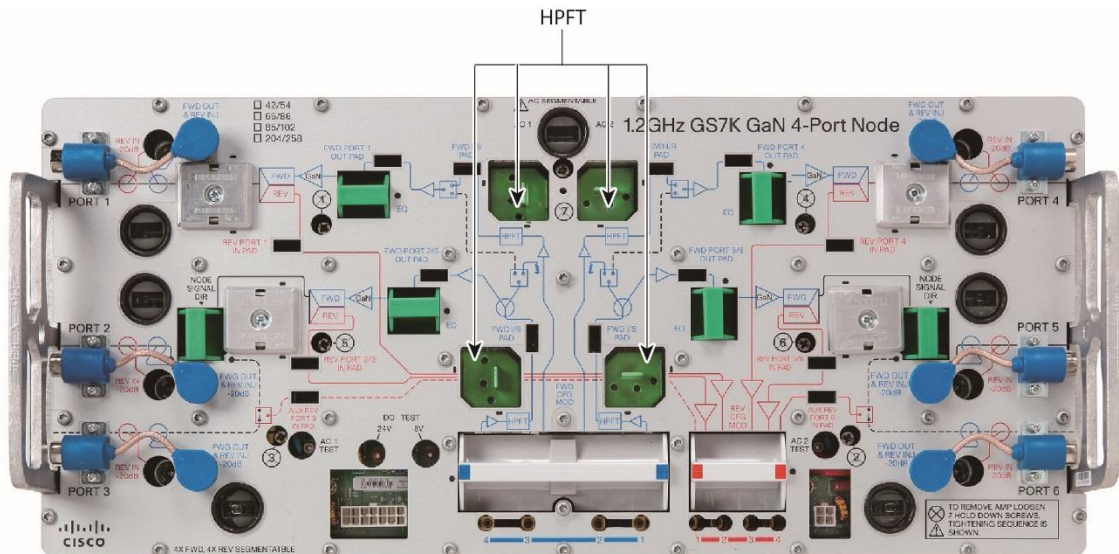
- Remove the existing Low Pass Filter Trim modules (4 places)



- Install the new split Low Pass Filter Trim modules.
- Replace the reverse amplifier cover. Use the 8 screws removed previously, and tighten at 11 - 14 in-lb (1.25 - 1.58 Nm).
- Turn the RF module over for access to top side.
- Loosen the screw on top of the diplexer 4 places and remove diplex filters. There are two (2) "mirrored" (blue PCB material) and two (2) "non-mirrored" (green PCB material) diplex filters.



- Install the four (4) new diplex filters. "Mirrored diplexers" (blue PCB material) are installed near ports 4 and 5, "non-mirrored diplexers" (green PCB material) are installed near ports 1 and 2. The diplexers have plastic guides which are keyed to aid in insertion. Tighten diplexer cover screws to 6 - 8 in-lb (0.68 - 0.9 Nm) to secure metal diplexer cover.
- Using Needle Nose pliers extract the High Pass Filter Modules (4 places).



- 12 Install new High Pass Filter Trim Modules (4 places) Note that the Trim Modules have plastic keying post which must be properly aligned for insertion.



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.

Optional Performance Verification Following the RF Split Change (this step may be skipped)

Forward Path RF Verification

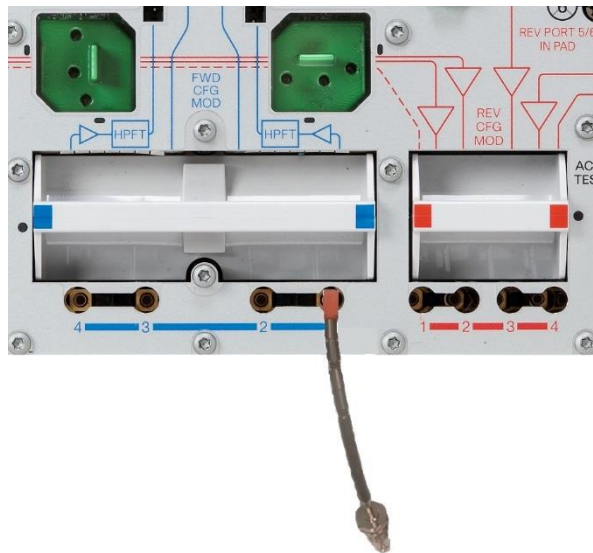
- 1 Install the RF module into the test GS7000 Node housing.
- 2 Verify the location of any AC Power shunts prior to applying AC Power.
Note that AC Power must be connected to port with a shunt installed and the AC Power will be also present at all other ports with shunts installed.
Energize the unit only after verifying the AC shunt configurations.



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.

- 3 Attach a network analyzer or stealth meter to output port of the RF Amp module (or to Forward Test Point location).
- 4 Note that the amplifier gain will be approximately 42dB (or 22 dB if measuring at test point location) in this configuration and analyzer port power setting will need to be set appropriately to prevent overdriving the unit or the analyzer.
- 5 Connect the cable adapter (part number GS7K-SPLKT-CBL) from the RF test source to the receiver input connector on the launch amplifier that corresponds to applicable output port.



- Verify the Forward Path RF performance for each port. Reference table below for standard configurations and RF Insertion Locations.

FCM Type	RX Cable RF Insert	Node Port/Cable Connection			
	Physical Location	Port 1	Port 2/3	Port 4	Port 5/6
1x4	O O O 1	1	1	1	1
2x4	4 O O 1	4	4	1	1
4x4	4 3 2 1	4	3	2	1

Note:

- “Node Port/Cable Connection” number corresponds to the “Rx Cable RF Insert” position when testing a specific port.
- Additional FCM signal routes are defined in *Cisco 1.2 GHz GS7000 Node Installation and Operation Guide*.

Reverse Path RF Verification

- Install the RF module into the test GS7000 Node housing.
- Attach a network analyzer RF Source cable to Node Output port of the RF Amp module.
- Connect the cable adapter (part number GS7K-SPLKT-CBL) from the appropriate transmitter cable connector to the stealth meter or analyzer receive port.
- Note that the Amplifier gain will be approximately 0dB in this configuration.
- Verify the Reverse Path RF performance for each port. Reference table below for standard RCM configurations and RF output locations.

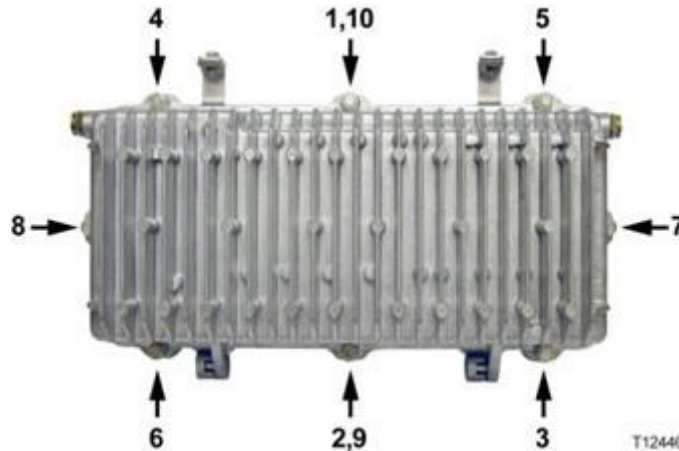
RCM Type	TX Cable RF Out	Node Port/Cable Connections			
	Physical Location	Port 1	Port 2/3	Port 4	Port 5/6
4x1	1 O O O	1	1	1	1
4x2	1 O 3 O	1	1	3	3
4x4	1 2 3 4	1	2	3	4

Note:

- “Node Port/Cable Connection” number corresponds to the “Tx Cable RF Out” position when testing a specific port.
- Additional RCM signal routes are defined in *Cisco 1.2 GHz GS7000 Node Installation and Operation Guide*.

To Re-install the Upgraded RF Amp Module

- 1 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.
- 2 Insert the upgraded RF amplifier module into the housing.
- 3 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). Note the tightening sequence which is marked on the amplifier cover. Repeat sequence to assure proper installation.
- 4 Inspect the housing gasket and all mating surfaces. Wipe off any excess dirt and debris.
- 5 Close the housing and finger-tighten all closure bolts.
- 6 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).
- 7 Follow the numbered tightening sequence to tighten the closure bolts.



Note: For additional details as needed, see **RF Amplifier Assembly Replacement Procedure** in *Cisco 1.2 GHz GS7000 Node Installation and Operation Guide*.

Appendix

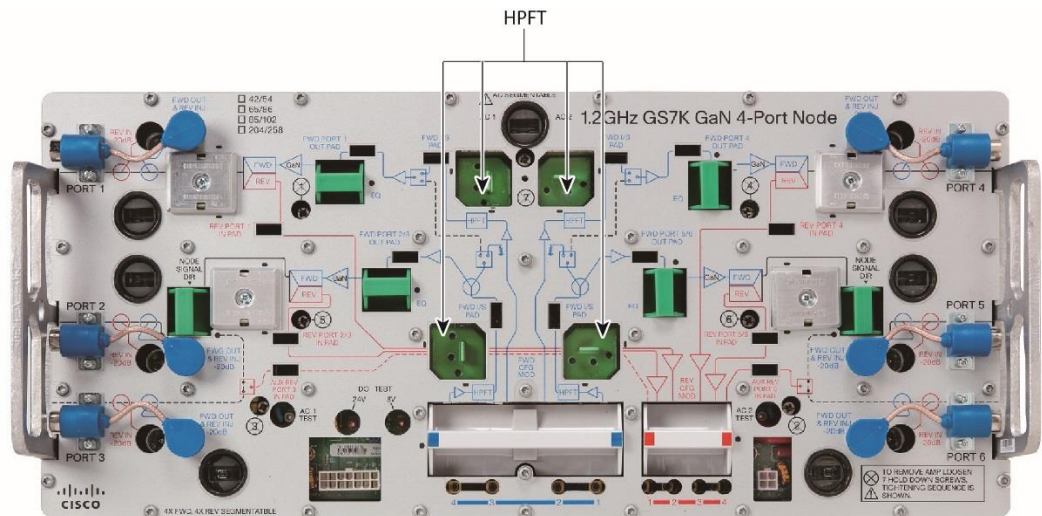
Forward Band Optimization

Typically the GS7000 node performance will be acceptable following a split upgrade with no additional optimization. If performance optimization is required, the following steps provide details on accomplishing this optimization.

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

Note: The High Pass Filter Trim modules near the top of the amplifier are active only for higher orders of segmentation. The lower 2 modules are active for all modes of segmentation.

- 1 While looking at the S21 frequency response trace, use a non-conductive tuning tool to tune each of the three variable capacitors on the High Pass Filter Trim modules to optimize the forward band response for its respective port(s), as follows:



- 2 Adjustment of the crossover region is most easily adjusted while monitoring a limited portion of the operating band. Generally a sweep of the region 50 MHz below and 150 MHz above the high pass crossover frequency offers a suitable view. Adjust the crossover cap for optimum response.

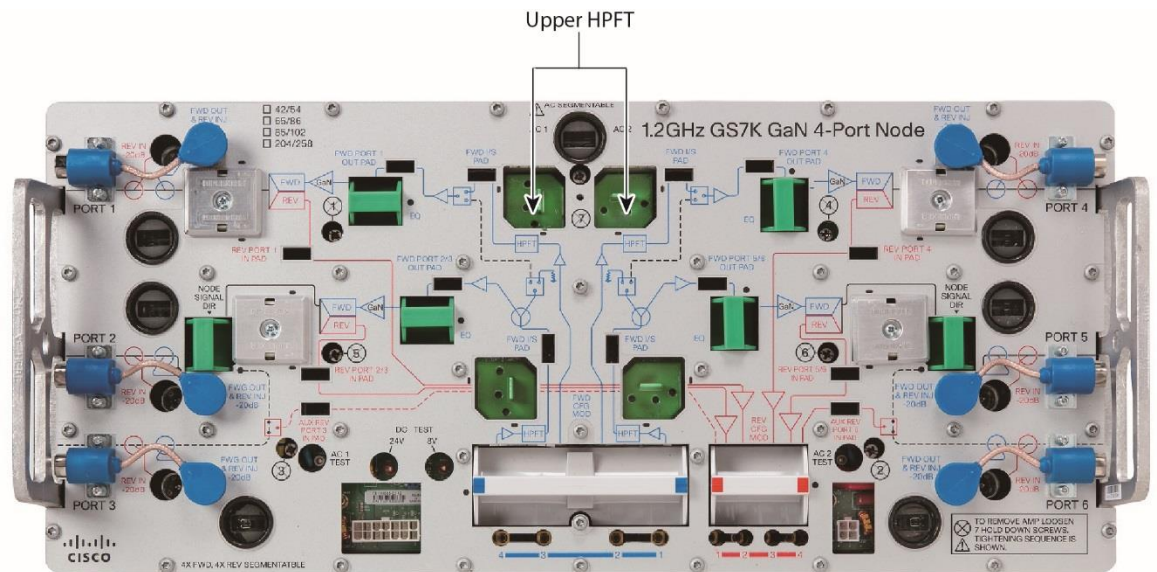
The 2 additional adjustments on the High Pass Filter Trim Modules are intended for optimizing the overall high frequency response.

- Adjustment of the remaining 2 capacitors requires a full bandwidth view. Adjust these 2 remaining capacitors as required to optimize for a smooth response across the band.
- A rise in gain at frequencies between 1GHz and 1.5GHz may be anticipated. This additional gain will be absorbed by losses between the Forward Receiver Module and the RF Amplifier.

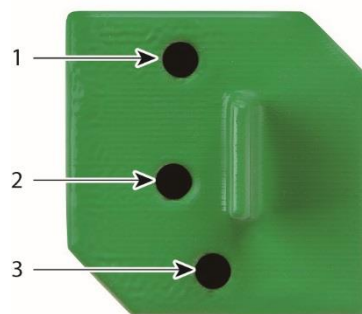
Note: Test and adjustment points vary depending on the FCM module being used.

For example:

- With a 1x4 FCM configured node, all four output ports can be tuned by injecting the signal into the Rx1 connector. Only the 2 lower HPFT Modules are adjusted for this mode.
- With a 2x4 FCM configured node, ports 4 and 5/6 are tuned while injecting signal into the Rx1 connector. Ports 1 and 2/3 are tuned while injecting signal into the Rx3 connector.
- With a 4x4 FCM configured node, ports 5/6 are adjusted using the lower right HPFT module with signal injected at Rx1 connector, port 4 is adjusted using the upper right HPFT module while injecting signal into Rx2 connector, port 1 is adjusted using the upper left HPFT module with signal injected at Rx3 connector, ports 2/3 are adjusted using the Lower left HPFT module with signal injected at Rx4 connector.



For the upper HPFT modules, only higher modes of segmentation needs HPFT modules adjustment.



As shown in the picture above, adjustment 1 is used to fill any dip in the forward band; adjustment 2 is used to optimize the response at the highest frequency in the forward band; adjustment 3 is used to optimize the response at the crossover to the forward band.

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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