

## RF Amplifier Calibration Procedure

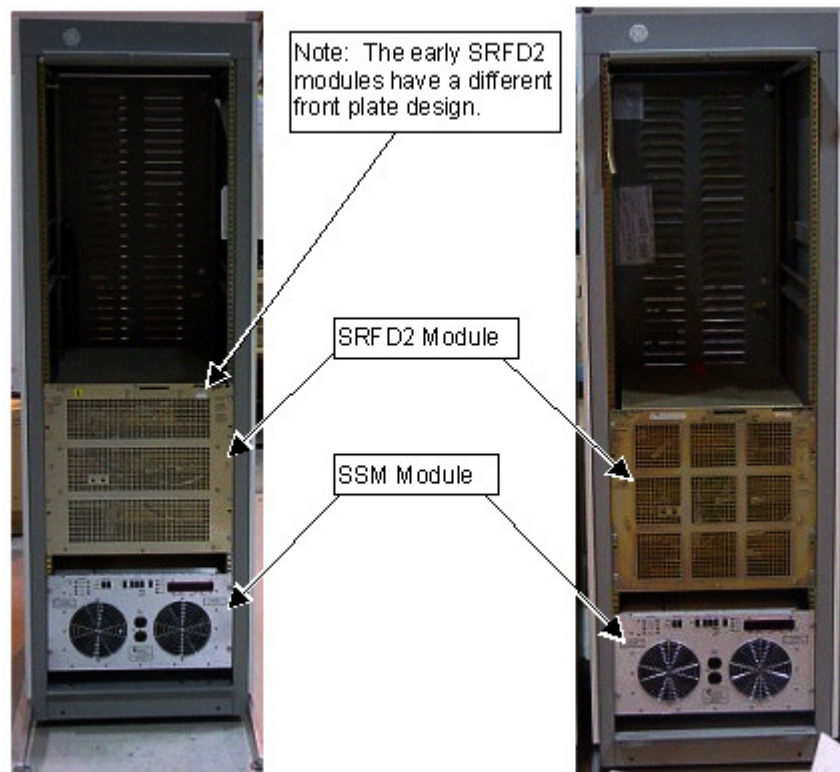
### 1.5T SRFD2 Max Power RF Out Setup and Calibration

This procedure describes how to calibrate the SRFD2 in a 1.5T system. Please see [Illustration 1](#) to confirm that the 1.5T SRFD2 cabinet pictured matches the cabinet to be checked and/or adjusted. The SRFD2 Cabinet contains the SRFD2 module and SSM but does not contain gradient hardware or a PDU. The SRFD2 should come from the factory pre-calibrated and, ideally, no initial calibration of the module in the field should be needed, however, this procedure must be performed to confirm that it is calibrated.

Calibration is done to prevent faults and to make sure that the SRFD2 is outputting the specified 16kW of RF body power and 2kW of RF head power. Adjustments may need to be made if any of the hardware in the RF chain has been replaced (See [Calibration Requirements After Hardware Replacements](#)), output levels have decreased with age, or if any of the measurements taken during the check are found not to meet specifications. The [head and body RF power levels](#) and, if in specification, no adjustments will be made. Next are [head and body power levels and the gain adjustments](#). Please see the flowchart in [Table 1](#). References are referred to in the procedure and provide extra information and directions to assist the user with accomplishing the RF power measurement task. [General Troubleshooting](#) provides helpful troubleshooting information in the event that a problem is encountered during the RF power check or calibration.

**NOTE:** The Body and Head Gain pots are in series with each other. The Body Gain pot is first in the series. The Head Gain pot is factory set so that the head gain is 9 dB less (63 dBm) than the body gain (72 dBm).

**Illustration 1:** 1.5T SRFD2 CABINET



## 1 Personnel Requirements

Required Persons	Preliminary Reqs	Procedure	Finalization
1	Timing Not Applicable	45 mins	Timing Not Applicable

## 2 Overview

Refer to the Tools and Test Equipment Section below for equipment required to measure power with the RF Power Measurement Kit or refer to *Alternate Equipment Setup*. The RF Power Measurement Kit is the preferred method for RF power measurement.

## 3 Preliminary Requirements

### 3.1 Tools and Test Equipment

Item	Qty	Eff	Part#	Manuf
Screwdriver, slotted (long & narrow)	1	-	-	-
100 MHz Scope (equivalent or greater)	1	-	46-183029P61	-
RF Power Measurement Kit	1	-	46-317724G1 or G2	-
50 ohm, 200 Watt, 30dB Attenuator (dummy load)	1	-	46-317724P14	-
RF Test Cables Kit	1	-	46-255816G1	-
Digital Multimeter (DMM)	1	-	46-194427P49	-
DMM Test Cable - BNC to Banana (optional)	1	-	2239139	-

### 3.2 Consumables

No consumables required.

### 3.3 Replacement Parts

No replacement parts required.

### 3.4 Safety



## POSSIBLE RF BURNS.

**POSSIBLE RF BURNS WHEN DISCONNECTING HELIAX CABLES FROM J3 OR J4 ON THE REAR OF THE SRFD2 MODULE.**

**PREVENT POSSIBLE RF BURNS WHEN DISCONNECTING HELIAX CABLES FROM J3 OR J4 ON THE REAR OF THE SRFD2 MODULE BY VERIFYING THAT THE SYSTEM IS NOT MANUALLY PRESCANNING OR SCANNING. VERIFY THAT THE SCAN DESKTOP ICON DISPLAYS THE “IDLE” MESSAGE.**

### 3.5 Required Conditions

No required conditions.

## 4 Procedure

### 4.1 Procedures Contained in this Document

1. Procedures describe in this document are:
  - o Body Gain Pot Adjustment, Body Gain Pot Adjustment.
  - o Head Gain Pot Adjustment, Head Gain Pot Adjustment

### 4.2 Body Gain Pot Adjustment

**NOTE:** PROPERTY DAMAGE! PREVENT COIL AND ASSOCIATED SWITCH DAMAGE, BY REMOVING ALL PHANTOMS AND HARDWARE (I.E., HEAD COIL, SURFACE COIL...) FROM THE MAGNET BORE.

1. Verify that the system is not scanning and that all coils have been removed from the magnet bore. See the two DANGER messages on this page.



**POSSIBLE RF BURNS.**



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2. If using the RF Power Measurement Kit then refer to the RF Power Measurement Kit laminated card set.
  - a. Look in the upper, right corner of each card and find the card labeled 72 (1.5T Body Output).

The body RF output connection is no longer to the non-existent EFB unit, as the older RF Power Measurement Kit cards show, but instead to the J4 output on the rear of the SRFD2 Module. An RF adapter is provided in the RF Power Measurement Kit to connect between the HN J4 body RF output and the RF Power Measurement Kit 40 dB N-connector coupler.

- b. Configure the system as shown in the illustration on the card.
  - c. Confirm that the rotary attenuator is set to the correct position indicated on the card.
3. If using the wattmeter or scope (NOT the RF Power Measurement Kit) to measure power then refer to *Alternate Equipment Setup* for the proper system body configuration.
  4. Prepare the system to scan in Body mode per *Non-Proprietary protocol*.
  5. Verify Body LED is illuminated on front of SRFD2 Module.
  6. [Manual Prescan][Scan TR]. Slowly increase TG to 200.

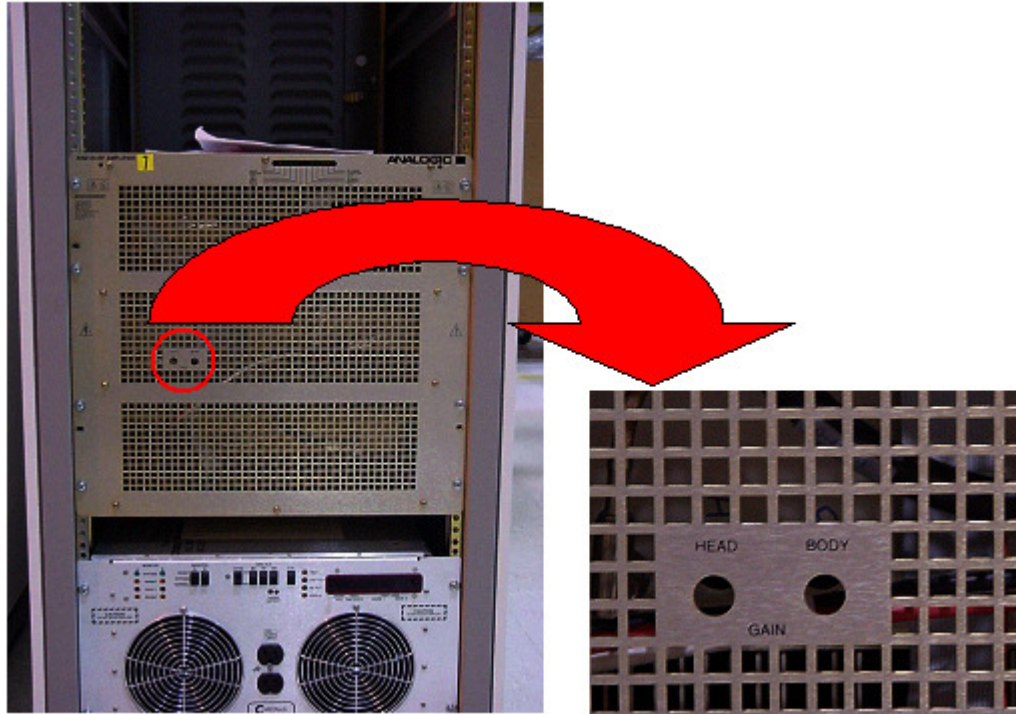
**NOTE:** Check the system center frequency NOW, especially if this is a new installation, and confirm that it consists of 8 digits and that it is correct. The RF amplifier will output a low and distorted RF waveform if center frequency is wrong due to a missing digit.

**NOTE:** If the RF Amplifier trips, adjust the Body Gain pot counter clockwise to reduce the RF output power and then increase the TG. Repeat this process until TG = 200 and the body RF output power is 16kW (72dBm).

**NOTE:** The Power Amplifier should be capable of 0.3dB to 0.4dB more than the required 72dBm RF Output. Improperly adjusted systems will trip if the gain is set above 72dBm creating a "Peak Power Fault".

7. Verify the Unblank LED on the front of the SRFD2 Module pulses on/off.

#### **Illustration 1: POT LOCATIONS ON SRFD2 MODULE**



8. If using the RF Power Measurement Kit, refer to the specified number of divisions printed on the RF Power Measurement Kit card 72 (1.5T Body RF Output) needed to achieve 16kW of RF power output. Adjust the Body Gain pot on the front of the SRFD2 so that the RF waveform displayed on the scope meets, but does not exceed, this number of divisions. See Illustration 1.
9. If using the wattmeter procedure then read the wattmeter display and calculate the RF output power from the formula below. The dummy load and cable loss factor was determined from the procedure in *Appendix F*. Adjust the Body Gain pot on the front of the SRFD2 Module until the RF output calculated from the formula meets, and does not exceed, the 16kW (72dBm) specification. See Illustration 1.

**Table 1:** RF Power Measurement (in watts) Using Wattmeter And Formula

Wattmeter reading (in watts) X dummy load and cable loss factor
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10. If using the oscilloscope procedure (NOT the RF Power Measurement Kit) then read the peak voltage ( $V_{peak}$ ) from the scope display and use the formula below or the Power Calculator Tool (located at E:\rf\power\pwrcalc.htm on the Service Methods CD-ROM) to calculate the RF output power. The dummy load and cable loss factors were determined from the procedure in *Dummy Load and Cables Calibration*. The scope correction factor was determined in *Appendix D*. Adjust the Body Gain pot on the front of the SRFD2 until the RF output calculated from the formula meets, and does not exceed, the 16kW (72dBm) specification. See Illustration 1.

**Table 2:** RF Power Measurement (in watts) Using Oscilloscope And Formula

$$\left( \frac{V_{\text{peak}}}{\text{scopecorrectionfactor}} \right)^2 \times \text{dummy load and cable loss factor}$$

11. Decrease TG to 0 (zero). [Done].
12. Replace the RF Body heliax cable.

### 4.3 Head Gain Pot Adjustment

**NOTE:** PROPERTY DAMAGE! PREVENT COIL AND ASSOCIATED SWITCH DAMAGE, BY REMOVING ALL PHANTOMS AND HARDWARE (I.E., HEAD COIL, SURFACE COIL...) FROM THE MAGNET BORE.

1. Verify that the system is not scanning and that all coils have been removed from the magnet bore. See the two DANGER messages on this page.



**POSSIBLE RF BURNS.**



**POSSIBLE RF BURNS WHEN DISCONNECTING HELIAX CABLES FROM J3 OR J4 ON THE REAR OF THE SRFD2 MODULE.**

**PREVENT POSSIBLE RF BURNS WHEN DISCONNECTING HELIAX CABLES FROM J3 OR J4 ON THE REAR OF THE SRFD2 MODULE BY VERIFYING THAT THE SYSTEM IS NOT MANUALLY PRESCANNING OR SCANNING. VERIFY THAT THE SCAN DESKTOP ICON DISPLAYS THE “IDLE” MESSAGE.**

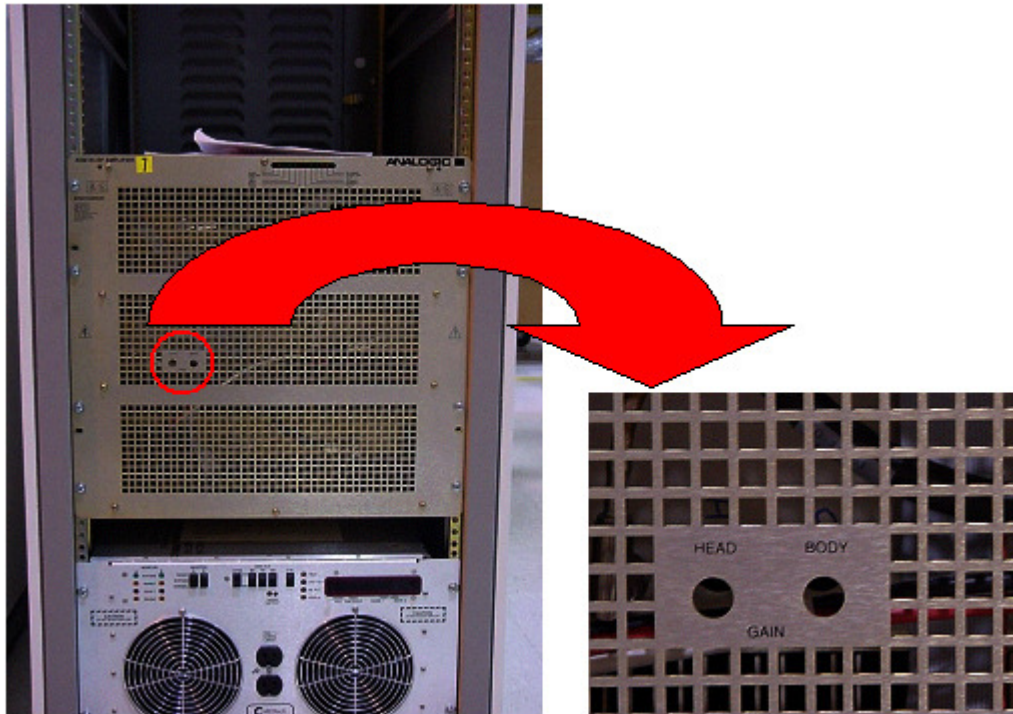
2. If using the RF Power Measurement Kit then refer to the RF Power Measurement Kit laminated card set.
  - a. Look in the upper, right corner of each card and find the card labeled 63 (1.5T Head Output).
 

**NOTE:** The head RF output connection is no longer to the non-existent EFB unit, as the reference cards in some of the older kits show, but instead to the J3 output on the rear of the SRFD2.
  - b. Configure the system as shown in the illustration on the card.
  - c. Confirm that the rotary attenuator is set to the correct position indicated on the card.
3. If using the wattmeter or scope (NOT the RF Power Measurement Kit) to measure power, refer to (*Alternate Equipment Setup*) for the proper system head configuration.
4. Prepare the system to scan in Head mode per *Non-Proprietary protocol*.
5. Verify Head LED is illuminated on front of SRFD2 Module.

**NOTE:** The Head Gain pot is directly affected by changes to the Body Gain pot. Adjust the Head Gain pot ONLY after completing final adjustment of the Body Gain pot.

6. [Manual Prescan][Scan TR]. Increase TG to 200.
7. Verify the Unblank LED on the front of the SRFD2 Module pulses on/off.

**Illustration 2:** POT LOCATIONS ON RFI MODULE



8. If using the RF Power Measurement Kit then refer to the specified number of divisions printed on the RF Power Measurement Kit card 63 (1.5T Head RF Output) needed to achieve 2kW of RF power output. Adjust the Head Gain pot on the front of the SRFD2 so that the RF waveform displayed on the scope meets, but does not exceed, this number of divisions. See Illustration 2.
9. If using the wattmeter procedure then read the wattmeter display and calculate the RF output power from the formula below. The cable loss factor was determined from the procedure in *Dummy Load and Cables Calibration*. Adjust the Head Gain pot on the front of the SRFD2 until the RF output calculated from the formula meets, and does not exceed, the 2kW (63dBm) specification. See Illustration 2.

**Table 3:** RF Power Measurement (in watts) Using Wattmeter And Formula

Wattmeter reading (in watts) X cable loss factor
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10. If using the oscilloscope procedure (NOT the RF Power Measurement Kit) then read the peak voltage ( $V_{peak}$ ) from the scope display and use the formula below or the Power Calculator Tool (located at Power Calculator. to calculate the RF output power. The dummy load and cable loss factor was determined from the procedure in *Dummy Load and Cable Calibration*. The scope correction factor was

determined in *Scopes with Less Than 300 MHz Bandwidth*. Adjust the Head Gain pot on the front of the SRFD2 module until the RF output calculated from the formula meets, and does not exceed, the 2kW (63dBm) specification. See Illustration 2.

**Table 4:** RF Power Measurement (in watts) Using Oscilloscope And Formula:

$\left( \frac{V_{\text{peak}}}{\text{scopecorrectionfactor}} \right)^2$
$\frac{\quad}{100} \quad \times \text{dummy load and cable loss factor}$

11. Decrease TG to 0 (zero). [Done][End Exam].
12. Verify that the scan desktop icon is displaying the "Idle" message.
13. Replace the RF Head Heliax cable.
14. Proceed to *System Restoration*.

## 5 Finalization

No finalization required.