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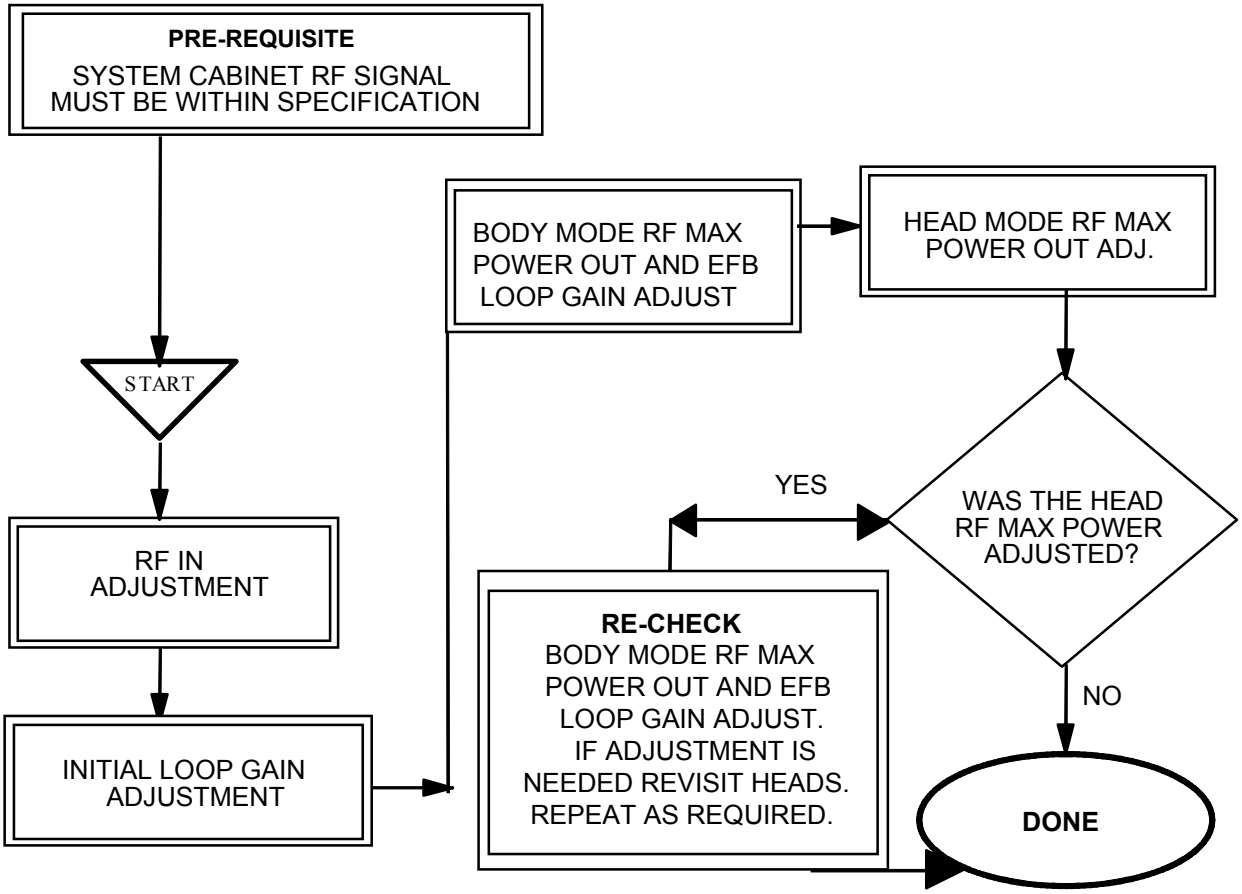
1- OVERVIEW AND FLOWCHART

This procedure calibrates the RF signal, at the SSM Analog Power Monitor (APM) Board for the 1.0T and 1.5T RF/PEN II Cabinet, to achieve Body and Head Maximum RF Power Output.

Note

8x 1.5T System Cabinets ONLY: Some System Cabinets with the 2148300-2 CERD may contain an external Probe Filter (used to correct EFB issues) connected at MR2A11J1 (located inside the rear of the System Cabinet at the I/F Panel). The 2148300-6 CERD contains an internal PROBE Filter. Do Not use the External Probe Filter with the -6 CERD.



RF MAX POWER OUT

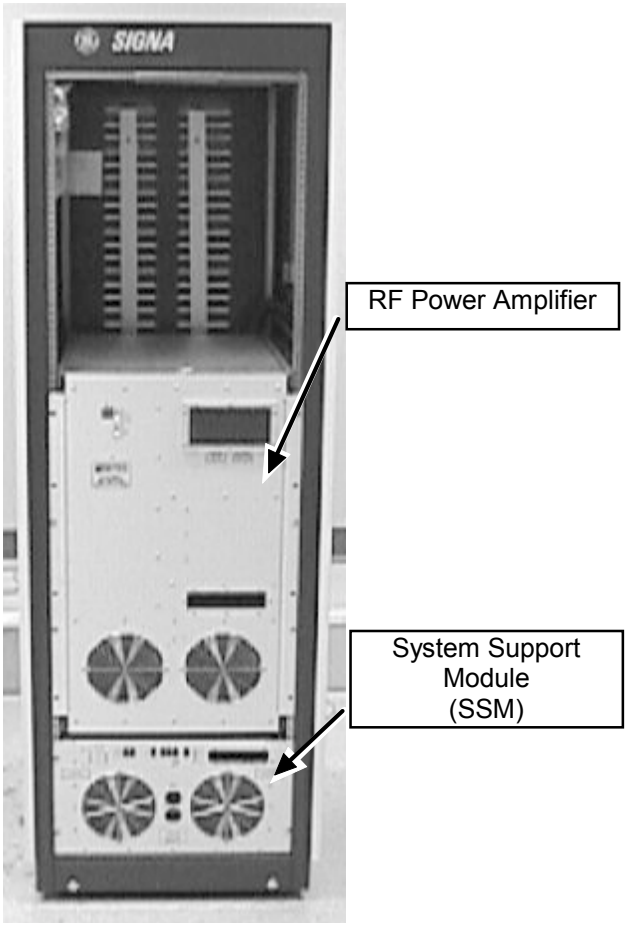
1.5T: BODY MODE, 16.0 kW, 72dBm, (Kit Card # 72)

1.5T: HEAD MODE, 2.0 kW, 63 dBm, (Kit Card # 63)

1.0T: BODY MODE, 7.50 kW, 68.8dBm, (Kit Card # 68.8)

1.0T: HEAD MODE, 750 W, 58.75 dBm, (Kit Card # 58)

CALIBRATION FLOWCHART
ILLUSTRATION 1-1



RF PEN II CABINET
ILLUSTRATION 1-2

The APM Board controls:

- RF In set-point level.
- Initial EFB Loop Gain level (Log Amp Error).
- Maximum Body RF Power Out and EFB Loop Gain value.
- Maximum Head RF Power Out value.
- Redundant RF power monitoring for Head, Body (factory set), and Multi-Nuclear Spectroscopy (MNS not discussed here).

1-1 Prerequisite — RF Signal (not a required check)

Minimum RF signal levels at the CERD into the RF/PEN 2 Cabinet. Refer to the following specification Tables and Illustration 1-2 for equipment setup. Setup protocol per Section 2-2.

The System Cabinet 8x ISE CERD Board RF signal must meet specifications per Table 1-1:

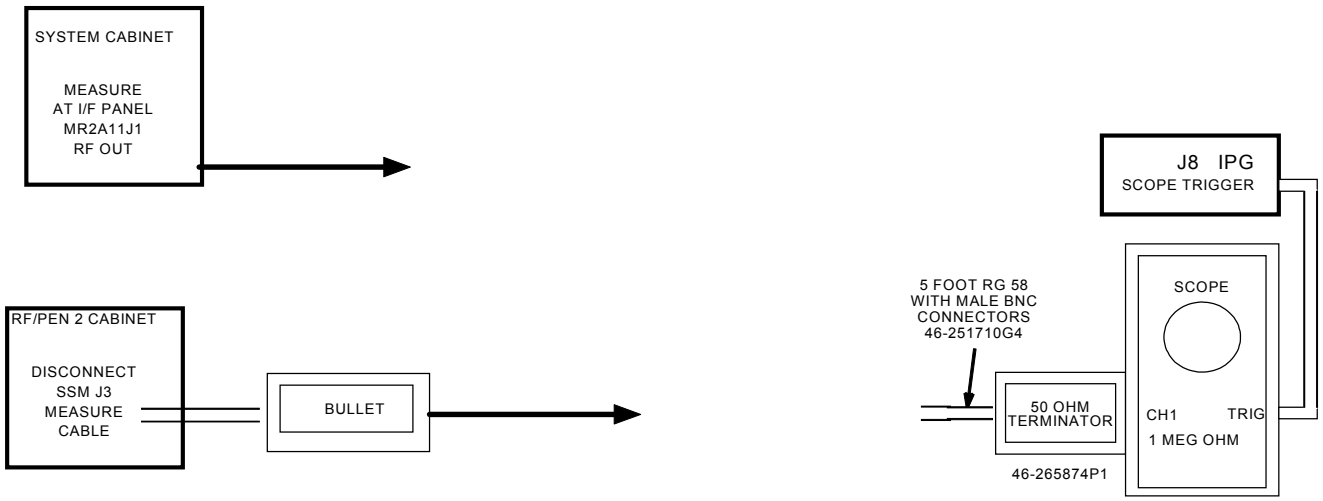
TABLE 1-1
CERD BOARD RF SIGNAL REQUIREMENT

DESCRIPTION	SPECIFICATION — RF POWER MEASUREMENT KIT	ALTERNATE SPECIFICATION
1.5T RF In	≥ 35.7 Minor Divisions (Appendix C, Section C-3)	0.893 to 1.12 VPP 3.0 dBm to 5.0 dBm
1.0T RF In	0.893 VPP to 1.12 VPP (Appendix C, Section C-2)	0.893 to 1.12 VPP 3.0 dBm to 5.0 dBm

The RF signal at the APM J3 cable connection must meet specifications per Table 1-2:

TABLE 1-2
SSM RF SIGNAL REQUIREMENT

DESCRIPTION	SPECIFICATION — RF POWER MEASUREMENT KIT	ALTERNATE SPECIFICATION
1.5T RF In	≥ 15.96 Minor Divisions (Appendix C, Section C-3)	≥ 0.399 VPP - 4.0 dBm minimum
1.0T RF In	≥ 0.399 VPP (Appendix C, Section C-2)	≥ 0.399 VPP - 4.0 dBm minimum



RF SIGNAL MEASUREMENTS
ILLUSTRATION 1-3

2- RF CALIBRATIONS

A Calibration Flowchart is available in the Overview section. The RF calibrations required within this section are continuous. All sub-sections must be performed unless otherwise instructed.

It is recommended that the "Dummy Load and Cables Calibration" procedure is performed before measuring RF Out.

Test points and pots are accessible on the rear panel of the SSM.

2-1 Tools and Instruments Required

It is recommended that the "Dummy Load and Cables Calibration" procedure is performed before measuring RF Out.

The RF Power Measurement Kit is the preferred method for RF measurements.

Refer to Table 2-1 for equipment required with the RF Power Measurement Kit or refer to Appendix A (Alternate Equipment Setup):

TABLE 2-1
EQUIPMENT REQUIRED IN ADDITION TO THE RF POWER MEASUREMENT KIT

Item	Description	Part Number
1.	100 MHz Scope (equivalent or greater) (oscilloscope probe required): • 468 • 2230 • 2232 • 2465 (300 MHz) • 2465A, 2465B (350 MHz, 400 MHz)	 • 46-183029P61 or 64 • 46-194427P222 • 46-194427P286 or 287 • 46-194427P464 • 46# not supplied
2.	RF Power Measurement Kit **NOTE:** G1 kit does not have the required 30 dB Dummy Load. • 50 ohm, 200 Watt, 30dB Attenuator Bird Model 8322	46-317724G1 or G2 • 46-255837P10 or • 46-317724P14
3.	Magnetic Shield (for sites with unshielded magnets)	• 46-317725G10
4.	Pot Tweeker	• 46-194427P361

2-2 RF In Adjustment

This sub-section will set the RF In Adjust pot to a specific RF level.

PROPERTY DAMAGE! TO PREVENT COIL AND ASSOCIATED SWITCH DAMAGE, REMOVE ALL PHANTOMS AND HARDWARE (I.E., HEAD COIL, SURFACE COIL...) FROM THE MAGNET BORE.

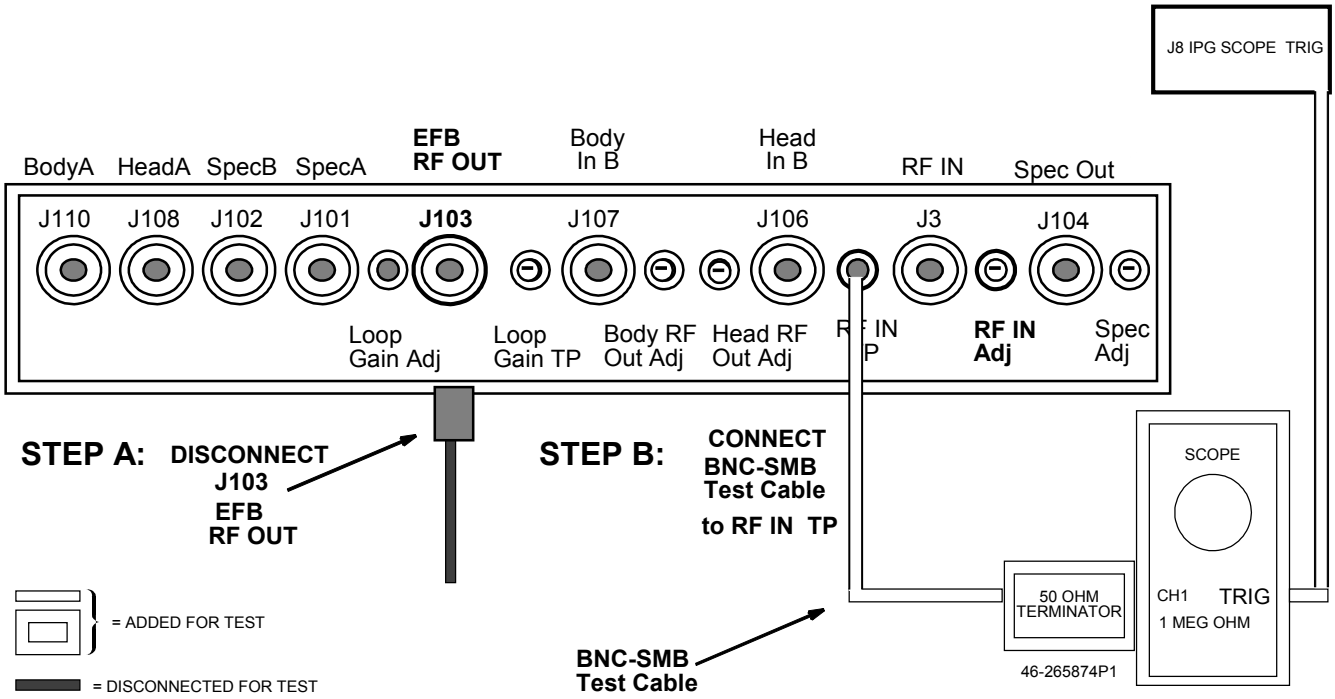
1. Prepare the system to scan as shown in Table 2-2, or refer to Appendix A (Alternate Equipment Setup).

TABLE 2-2
SCAN PRESCRIPTION - BODY APM CALIBRATION

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.
For Non- Service protocol refer to the Appendix A.

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **apm cals**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
B. At front enclosure:
Landmark in the Head area—remove any coils.
press **LANDMARK**.
press **MOVE TO SCAN**.
C. In the Patient Position Protocol field:
type **o.41.1<ENTER>**(o=Other, 41.1 =series) to load the body protocol
OR select **other** and select protocol **41** and select series **1**.
D. **[Save Series]**.
E. **[Research Operations]**.
[Setup Params]. Set TG to **50 [Done]**.
F. **[Research Operations]**.
[Display CVs]. Highlight CV Name and enter the following:
CV Name: **calmode<ENTER>**, CV Value: **5<ENTER>** (Dual Logamp Waveform).
CV Name: **ia_rf1<ENTER>**, CV Value: **32766<ENTER>** (sets 90º pulse full scale).
CV Name: **ia_rf2<ENTER>**, CV Value: **0<ENTER>** (turns off 180º pulse).
[Accept].
G. **[Research Operations] [Download]**.
H. **[Prepare to Scan]**.

2. Connect the system as shown in Illustration 2-1.



APM BOARD CONNECTIONS FOR RF IN ADJUSTMENT
ILLUSTRATION 2-1

3. **[Manual Prescan]**. Set TG to 200.

4. Set the RF IN ADJ pot (Clock-Wise to decrease, Counter-Clock-Wise to increase) until the Channel 1 measurement is set per Table 2-3:

TABLE 2-3
RF IN ADJ. POT SPECIFICATION

DESCRIPTION	SPECIFICATION WITH RF POWER MEASUREMENT KIT	ALTERNATE SPECIFICATION
1.5T sites	27.4 Minor Divisions (Appendix C, Section C-3)	0.685 VPP
1.0T sites	0.685 VPP	0.685 VPP

5. Set TG to 0. **[Done]**.

6. Disconnect the BNC to SMB test cable from the APM Board.

Note

The remaining sub-sections cannot be performed accurately if the BNC to SMB test cable is connected.

7. Re-connect the J103 coaxial cable (EFB RF OUT) at the rear of the SSM.

2-3 Initial EFB Loop Gain Adjustment

This sub-section will initially set the Log Amp Error waveform is set to the specific Preset DC Level via the Loop Gain Adj. pot. It will also verify the waveform is within a maximum and minimum DC voltage specification. See the Note below for further details on the interactive process.

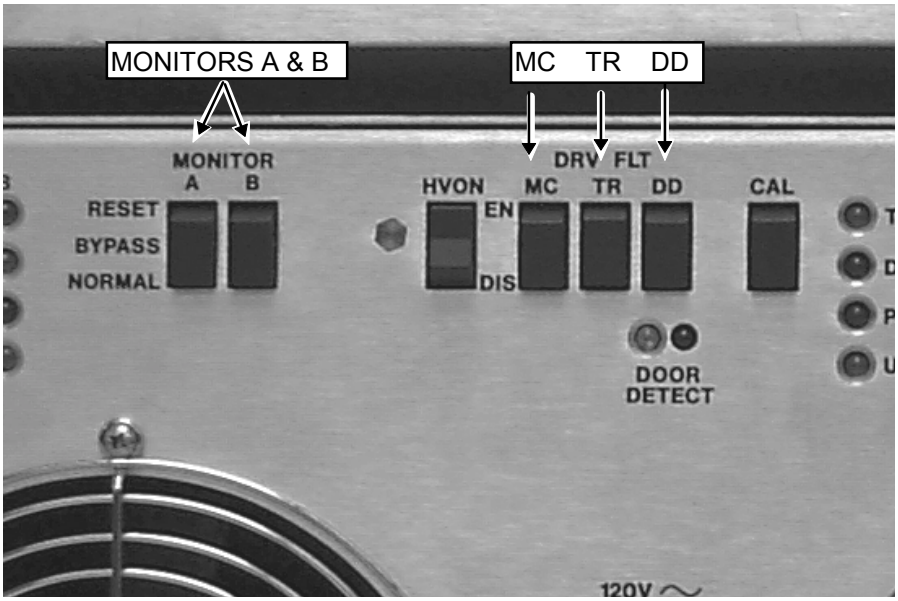
Note

The EFB Loop Gain Adjustment is interactively dependent on the Body and Head Power RF Out Adjustments. The EFB Loop Gain Adjustment will be initially preset at TG = 200. The Body Power RF Out level will be adjusted to the proper level interactively with the EFB Loop Gain Adjustment. The Head Power RF Out level will be adjusted to the proper level. The Body Power RF Out level will be re-adjusted to the proper level interactively with the EFB Loop Gain Adjustment. The Head Power RF Out will be re-visited. This interactive process (Body and EFB Loop Gain then Head) will continue until no further adjustments are required.

DANGER!!

PROPERTY DAMAGE! TO PREVENT COIL AND ASSOCIATED SWITCH DAMAGE, REMOVE ALL PHANTOMS AND HARDWARE (I.E., HEAD COIL, SURFACE COIL...) FROM THE MAGNET BORE.

1. See Illustration 2-2. On the front of the SSM place the:
   - 2 (two) power MONITOR switches (A and B) to the Bypass position.
   - 3 (three) DRV FLT switches to the disable faults (DIS) position.

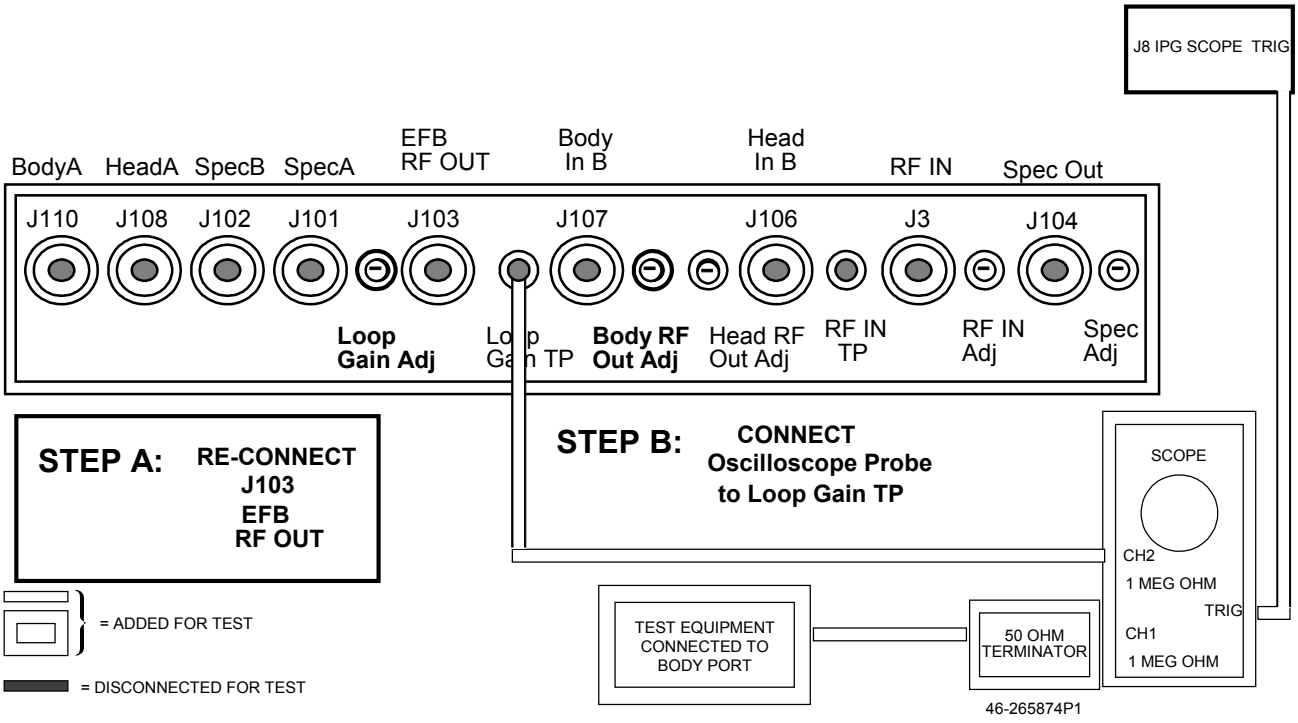


SSM FRONT PANEL SWITCH POSITIONS
ILLUSTRATION 2-2

DANGER!!

PERSONAL INJURY! TO PREVENT POSSIBLE RF BURN WHEN DISCONNECTING HELIAX CABLES FROM J2 "N" HEAD OR J2 "HN" BODY, VERIFY THAT THE SYSTEM IS NOT IN MANUAL PRESCAN OR SCANNING, THE SCAN DESKTOP ICON WILL DISPLAY THE "IDLE," MESSAGE.

2. Connect the system as shown on the Body Output RF Power Measurement Kit Card or refer to Appendix A (Alternate Equipment Setup):
   - 1.5T: — Body Output card 72 (16 kW, 72 dBm), refer to Appendix C, Section C-3.
   - 1.0T: — Body Output card 68.8 (7.5 kW, 68.8 dBm), refer to Appendix C, Section C-2.



OSCILLOSCOPE CONNECTION TO LOOP GAIN TP
ILLUSTRATION 2-3

3. Connect the system as shown in Illustration 2-3.

4. Set the ground reference for Channel 2 to a known graticule near the center of the oscilloscope display.

5. Oscilloscope set-up for EFB Loop Gain Adjustment:
   - Channel 1: approximately 0.2 Volts/Division.
   - Channel 2: 1 Meg Ohm input 0.5Volts/Div, main sweep approximately 1 msec/Div.
   - Enable the 20 MHz Bandwidth Limit selection for the Channel 2 measurement ONLY.

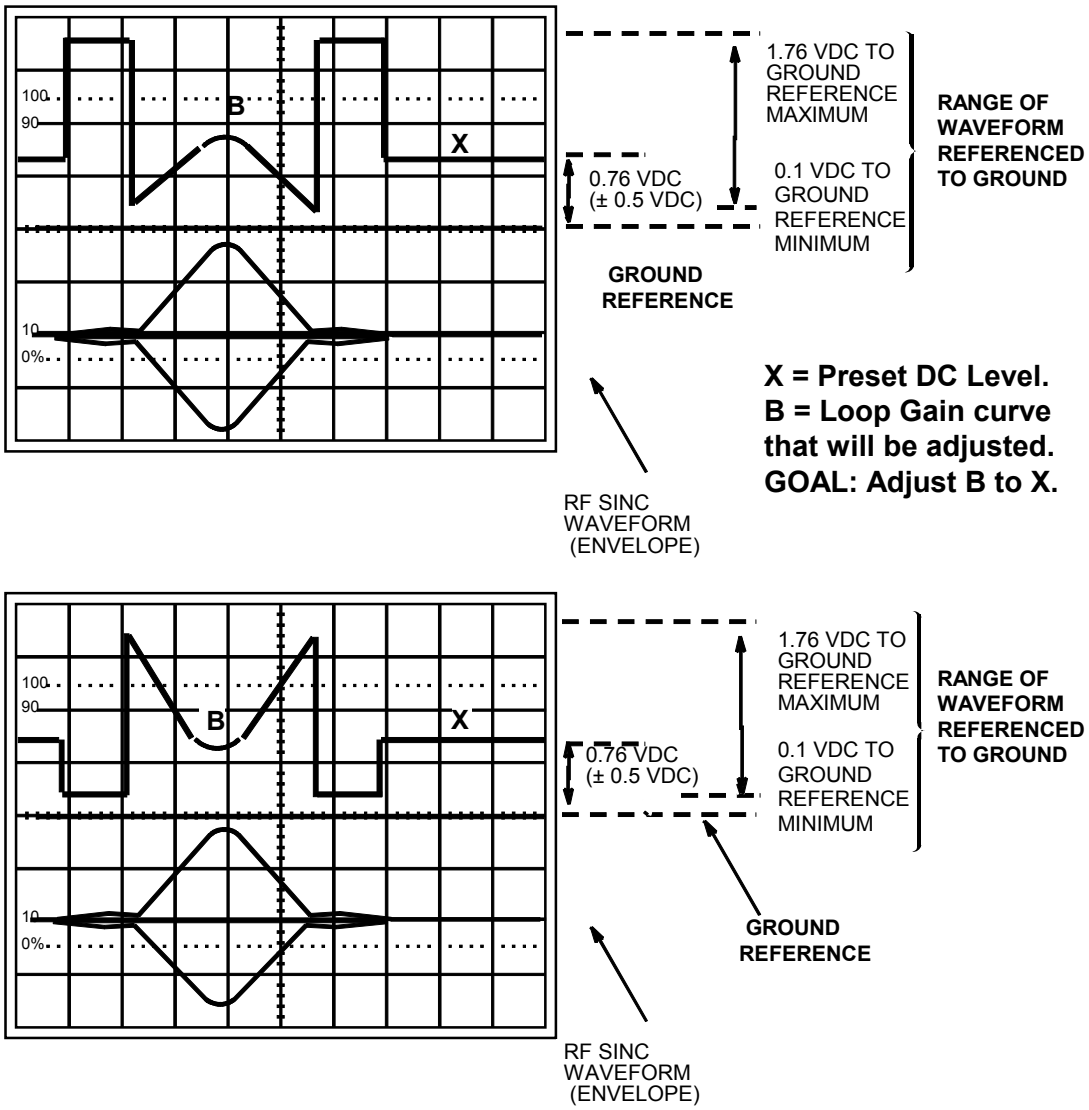
6. **[Manual Prescan]**. Set TG = 200. Adjust Loop Gain Adj. pot per step 7.

Note

If the RF Amplifier faults due to RF Amplitude during EFB Loop Gain, adjust Body RF Out Adj pot CW to reduce power. This will not correct all types of RF Amplifier faults.

Note

Some oscilloscopes with trace measurement capabilities may need to de-select Channel 1 to verify the DC measurements in this section. The Bandwidth Limit button enabled (limits frequency content to 20 MHz) will affect the Channel 1 signal display.



EFB LOOP GAIN INTER-ACTIVE ADJUSTMENT OSCILLOSCOPE DISPLAYS
ILLUSTRATION 2-4

7. Adjust Loop Gain Adj. pot. See Illustration 2-4. Measure the Channel 2 Loop Gain waveform (with respect to ground reference) per Table 2-4:

TABLE 2-4
EFB LOOP GAIN INTER-ACTIVE POT ADJUSTMENTS

SET LOOP GAIN ADJUST POT	
Adjust point **B** to the Preset DC level labeled **X** (B=X). • Point **B** (center of Loop Gain waveform curve that coincides with center of RF Sinc Pulse). • Preset DC level is labeled **X**.	
GROUND REFERENCE TO PRESET DC LEVEL MEASUREMENT	
0.76 VDC, ± 0.50 VDC • Absolute DC level (0.26 VDC to 1.26 VDC) as measured between ground reference and X.	
MINIMUM WAVEFORM VALUE	**MAXIMUM WAVEFORM VALUE**
0.10 VDC • Measured between ground reference and minimum DC Level of waveform.	1.76VDC • Measured between ground reference and maximum DC Level of waveform.

8. Decrease TG to 0 (zero). **[Done]**.

9. Disable the 20 MHz Bandwidth Limit selection (to properly view the Channel 1 RF Signal).

10. Do not disconnect the oscilloscope probe from the SSM and Channel 2 of the oscilloscope.

11. If any adjustment was performed proceed to next section.

2-4 Body Mode Maximum Power RF Output and EFB Loop Gain Adjustment

This sub-section will adjust the Body Maximum Power RF Out interactively with the EFB Loop Gain Adjustment.

1. **[Manual Prescan]**.

2. While viewing the RF Output power on the oscilloscope, increase the TG until achieving the Body Max Power RF Out or TG = 200, whichever comes first. Refer to Table 2-5 for process.

Note

Channel 1 requires the oscilloscopes full bandwidth capability. Disable the 20 MHz Bandwidth Limit selection.

TABLE 2-5
BODY RF OUT ADJ POT PROCESS

SITUATION	ACTION
• TG reaches 200. • Body RF Power is lower than the specified Body Max Power RF Out.	Turn the Body RF Out Adj. pot CCW to increase the RF Power Out.
• TG is less than 200. • Body RF Power Out reaches specified Body Max Power RF Out.	Turn the Body RF Out Adj. pot CW to decrease the RF Power Out.

Note

The steps below have been written repetitivly to insure the Body Power RF Out and the EFB Loop Gain adjustments are set properly.

3. Verify with TG set at 200; the Body RF Power Out meets the specified Body Max RF Power Output.

4. Enable the 20 MHz Bandwidth Limit selection (to properly view the Channel 2 signal).

5. Adjust the EFB Loop Gain pot per Table 2-4 (at TG = 200).

6. Disable the 20 MHz Bandwidth Limit selection (to properly view the Channel 1 RF Signal).

7. Verify with TG set at 200; the Body RF Power Out meets the specified Body Max RF Power Output.

8. Enable the 20 MHz Bandwidth Limit selection (to properly view the Channel 2 signal).

9. Adjust the EFB Loop Gain pot per Table 2-4 (at TG = 200).

10. Disable the 20 MHz Bandwidth Limit selection (to properly view the Channel 1 RF Signal).

11. Repeat the Body Power RF Out and EFB Loop Gain Adjustment process as required until no further adjustment is needed.

12. Decrease TG to 0 (zero). **[Done]**.
13. Verify scan desktop icon is displaying the “Idle” message.
14. Disconnect test equipment at the Body RF Out port.
15. Re-connect the Body RF Output per normal configuration.

2-5 Head Mode Maximum Power RF Output Adjustment

This sub-section will adjust the Head Maximum Power RF Out.

DANGER!!

PERSONAL INJURY! TO PREVENT POSSIBLE RF BURN WHEN DISCONNECTING HELIAX CABLES FROM J2 "N" HEAD OR J2 "HN" BODY, VERIFY THAT THE SYSTEM IS NOT IN MANUAL PRESCAN OR SCANNING, THE SCAN DESKTOP ICON WILL DISPLAY THE "IDLE," MESSAGE.

1. Connect the system per RF Power Measurement Kit Card or refer to Appendix A (Alternate Equipment Setup):
   - 1.5T — Head Output card 63 (2 kW, 63 dBm), refer to Appendix C, Section C-3.
   - 1.0T — Head Output card 58 (750 W, 58.8 dBm)), refer to Appendix C, Section C-2.
2. Prepare the system for scan as shown in Table 2-6 or Appendix A (Non- Service protocol).

TABLE 2-6
SCAN PRESCRIPTION - HEAD APM CALIBRATION

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.
For Non-Service protocol refer to the Appendix A.

A. **[New Series]**
   At Patient Protocols – select **other**.
B. In the protocol field, type **o.41.2<ENTER>** (o=Other, 41.2 =series) to load the head protocol **OR** select **[o.41] [Series 2] [Accept]**.
[OK] (if required).
C. **[Save Series]**.
D. **[Prepare to Scan]**.
E. **[Research Operations]**.
   [Setup Params]. Set TG to **50 [Done]**.
F. **[Research Operations]**.
   [Display CVs]. Highlight CV Name and enter the following:
   CV name: **calmode<ENTER>**, **5<ENTER>** (Dual Logamp Waveform).
   CV name: **ia_rf1<ENTER>**, **32766<ENTER>** (sets 90º pulse full scale).
   CV name: **ia_rf2<ENTER>**, **0<ENTER>** (turns off 180º pulse).
   [Accept].
G. **[Research Operations] [Download]**.
H. **[Prepare to Scan]**.

3. **[Manual Prescan]**.

4. While viewing the Head RF Output power on the oscilloscope, increase the TG until achieving the Head Max Power RF Out or TG = 200, whichever comes first. Refer to Table 2-7 for process.

TABLE 2-7
HEAD RF OUT ADJ POT PROCESS

SITUATION	ACTION
• TG reaches 200. • Head RF Power is lower than the specified Head Max Power RF Out.	Turn the Head RF Out Adj. pot CCW to increase the RF Power Out.
• TG is less than 200. • Head RF Power Out reaches specified Head Max Power RF Out.	Turn the Head RF Out Adj. pot CW to decrease the RF Power Out.

5. Verify with TG set at 200; the Head RF Power Out meets the specified Head Max Power RF Output.

6. Decrease TG to 0 (zero). **[Done]**.

7. Verify scan desktop icon is displaying the “Idle” message.

8. Disconnect test equipment at the Head RF Out port.

9. Re-connect the Head RF Output per normal configuration.

2-6 Repeat the Interactive Process

1. Repeat section 2-4 if the Head RF Out pot was adjusted. See Note for interactive process.

2. Repeat section 2-5 if either the Body Power RF Out or the EFB Loop Gain settings require adjustment. See Note for interactive process.

Note

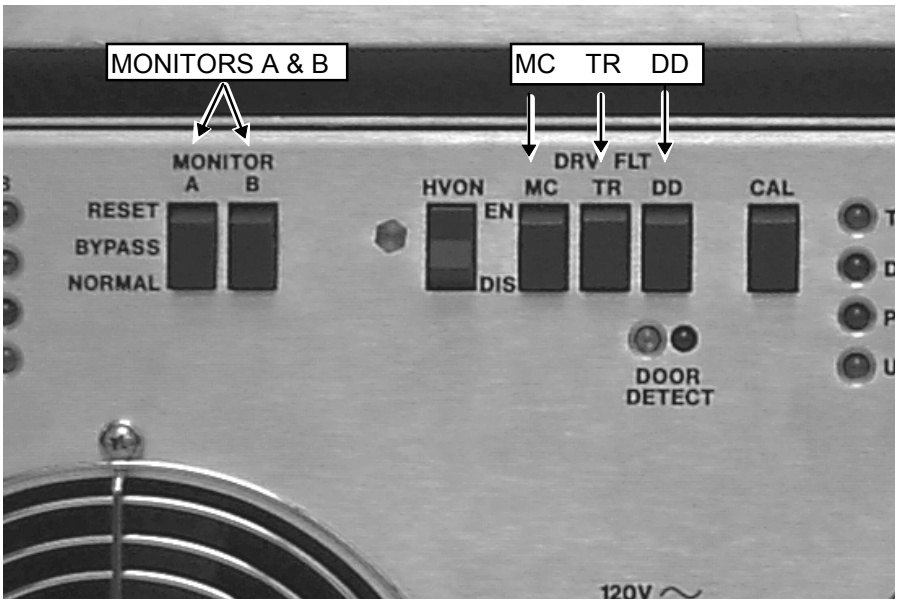
The EFB Loop Gain Adjustment is interactively dependent on the Body and Head Power RF Out Adjustments. The EFB Loop Gain Adjustment will be initially preset at TG = 200. The Body Power RF Out level will be adjusted to the proper level interactively with the EFB Loop Gain Adjustment. The Head Power RF Out level will be adjusted to the proper level. The Body Power RF Out level will be re-adjusted to the proper level interactively with the EFB Loop Gain Adjustment. The Head Power RF Out will be re-visited. This interactive process (Body and EFB Loop Gain then Head) will continue until no further adjustments are required. Ghosting issues have been reported if the interactive process is not performed.

3. Proceed to System Restoration.

3- SYSTEM RESTORATION

1. Verify that the system is not in manual prescan or scanning; the scan desktop icon will display the “Idle” message.

2. See Illustration 3-1. On the front of the SSM place the:
   - 2 (two) MONITOR switches (A and B) to the NORMAL position.
   - 3 (three) DRV FLT switches to the enable faults (EN) position



SSM FRONT PANEL SWITCH POSITIONS
ILLUSTRATION 3-1

3. Verify Head and Body heliax cables are connected per normal configuration.

4. Disconnect all test equipment.

5. Replace all covers and doors.

6. Perform one Body Scan and one Head scan to ensure proper operation.

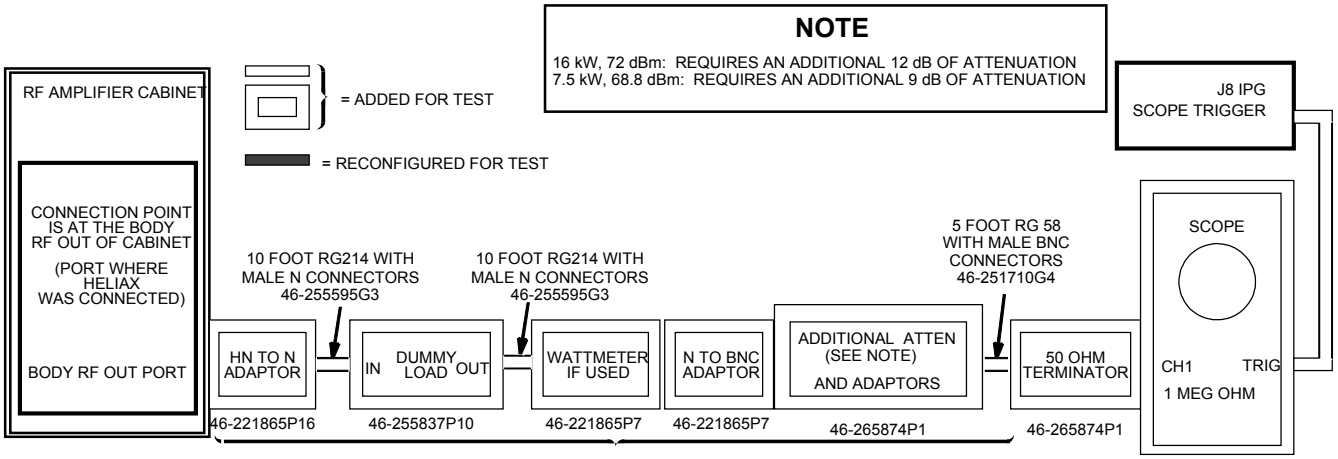
APPENDIX A — ALTERNATE EQUIPMENT SETUPS & NON- SERVICE PROTOCOLS

Note

For any RF measurements made using the Alternate Equipment Method a 300 MHz (or greater) oscilloscope is required. This is due to oscilloscope bandwidth limitations.

TABLE A-1
EQUIPMENT REQUIRED IF NOT USING THE RF POWER MEASUREMENT KIT

Item	Description	Part Number
1.	10 dB Rotary Step Attenuator (1 dB step increments) 70 dB Rotary Step Attenuator (10 dB step increments) **NOTE:** May be part of the SST Kit	46-255838P1 46-255838P2
2.	TPS RF Cable Kit BNC male to SMB female test cable	46-301549G1 or 46-301927G1 46-301549P5
3.	RF Test Cable Kit	46-255816G1
4.	100 MHz Scope (equivalent or greater) (oscilloscope probe required): • 468 • 2230 • 2232 • 2465 (300 MHz) • 2465A, 2465B (350 MHz, 400 MHz)	 • 46-183029P61 or 64 • 46-194427P222 • 46-194427P286 or 287 • 46-194427P464 • 46# not supplied
5.	Magnetic Shield (for sites with unshielded magnets)	46-317725G1
6.	Dummy Load: 50 ohm, 200 Watt, 30dB Attenuator Bird Model 8322	46-255837P10 or 46-317724P14
7.	Pot Tweeker	46-194427P361
8.	Wattmeter Kit (optional but not recommended)	46# not supplied



ALTERNATE BODY EQUIPMENT SETUP
ILLUSTRATION A-1

Note

Maximum RF Signal input for any scope is 30 dBm (10 Volts Peak, 20 VPP).

NON-SERVICE BODY PROTOCOL

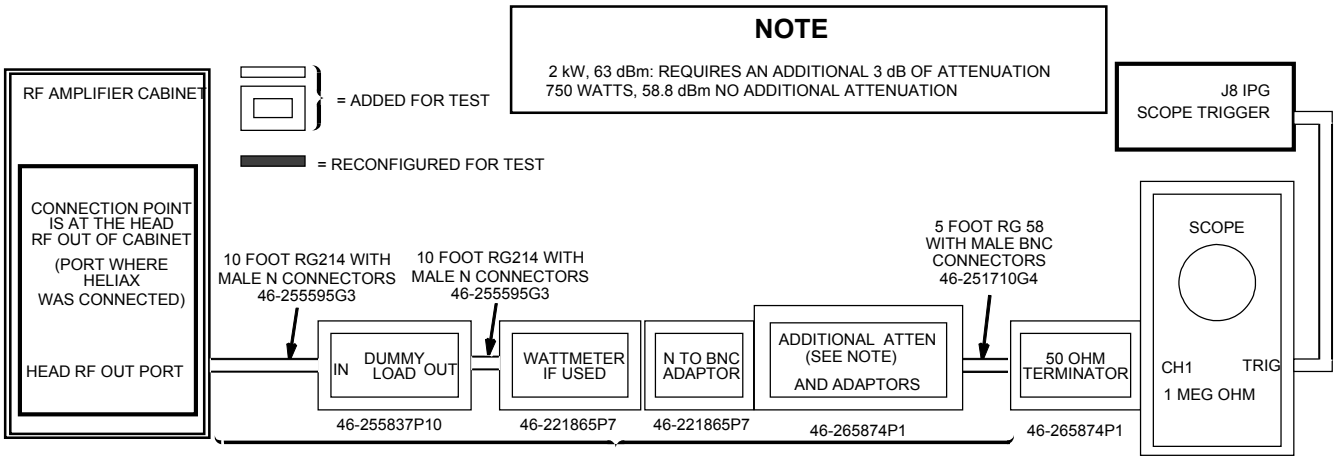
PATIENT REGISTER . **[New Pt]**
PATIENT INFORMATION
Patient Id **geservice**
Patient Name **body rf**
Weight (Lb) **300** ¬ *IMPORTANT* **[Landmark]**
Landmark **[>] [Sternal Notch]**

PATIENT PROTOCOLS **[Patient Position]**

PATIENT POSITION
Patient Position **[>] [Supine]**
Patient Entry **[>] [Head First]**
Coil **[...] [Body] [Accept]**
IMAGING PARAMETERS
Plane **[>] [Axial]**
Mode **[>] [2D]**
Pulse Seq **[...] [Spin Echo] [Accept]**
Imaging Options none (default)
Psd Name **cal**
Protocol no entry

SCAN TIMING
* of Echoes 1 (default)
TE **[25]**
TR **[55]**

SCANNING RANGE
FOV **[24]**
Slice Thickness **[5]**
Spacing **0**
Start **0**
End **0**
Slices 1 (default)
L/R Center 0 (default)
P/A Center 0 (default)
Table Delta 0.00 (default)
ACQUISITION TIMING
Freq **[256]**
Phase **[128]**
NEX **[2]**
Freq Dir **[>] [A/P]**
Auto Center Freq **[>] [Peak]**
(lowest window) **[Save Series]**
[Research Operations] [Display CVs]
Modify the following:
calmode **5**
ia_rf1 **32766** (90° maximum)
ia_rf2 **0** (180° minimum)
[Accept]
[Research Operations] [Setup Params]
Set TG **50 [Done]**
[Research Operations] [Download]
[Prepare to Scan]



ALTERNATE HEAD EQUIPMENT SETUP
ILLUSTRATION A-2

Note

Maximum RF Signal input for any scope is 30 dBm (10 Volts Peak, 20 VPP).

NON-SERVICE HEAD PROTOCOL

PATIENT REGISTER .	**[New Pt]**
PATIENT INFORMATION	
Patient Id	**geservice**
Patient Name	**head rf**
Weight (Lb)	**300** ¬ *IMPORTANT* **[Landmark]**
Landmark	**[>] [Sternal Notch]**
PATIENT PROTOCOLS	**[Patient Position]**
PATIENT POSITION	
Patient Position	**[>] [Supine]**
Patient Entry	**[>] [Head First]**
Coil	**[...] [Head] [Accept]**
IMAGING PARAMETERS	
Plane	**[>] [Axial]**
Mode	**[>] [2D]**
Pulse Seq	**[...] [Spin Echo] [Accept]**
Imaging Options	none (default)
Psd Name	**cal**
Protocol	no entry
SCAN TIMING	
* of Echoes	1 (default)
TE	**[25]**
TR	**[55]**

SCANNING RANGE	
FOV	**[24]**
Slice Thickness	**[5]**
Spacing	**0**
Start	**0**
End	**0**
# Slices	1 (default)
L/R Center	0 (default)
P/A Center	0 (default)
Table Delta	0.00 (default)
ACQUISITION TIMING	
Freq	**[256]**
Phase	**[128]**
NEX	**[2]**
Freq Dir	**[>] [A/P]**
Auto Center Freq	**[>] [Peak]**
(lowest window)	**[Save Series]**

[Research Operations] [Display CVs]

Modify the following:

calmode	**5**
ia_rf1	**32766** (90° maximum)
ia_rf2	**0** (180° minimum) **[Accept]**

[Research Operations] [Setup Params]
Set TG **50 [Done]**
[Research Operations] [Download]
[Prepare to Scan]

APPENDIX B — CALIBRATION REQUIREMENTS AFTER HARDWARE REPLACEMENT

TABLE B-1
RE-CALIBRATION REQUIREMENTS AFTER HARDWARE REPLACEMENT

Hardware Replaced	Required Calibration
Exciter Board or CERD	• RF In Adjustment
External Probe Filter (CERD, -2 exciter module only)	• RF In Adjustment
RF Amplifier	• Initial EFB Loop Gain Adjustment • Body RF Out and EFB Loop Gain Adjustment • Head RF Out Adjustment • Repeat the Interactive Process
APM Board (Analog Processor Module)	• Entire Procedure
Body Quad Directional Coupler	• Body RF Out and EFB Loop Gain Adjustment • Repeat the Interactive Process
Head Quad Directional Coupler	• Head RF Out Adjustment • Repeat the Interactive Process

APPENDIX C — RF POWER MEASUREMENT KIT USE

C-1 RF Formulas and 1.5T Division Conversions

The following RF Calculation Sequences have been provided.

1.5T Division Conversion example from section 2-2:

- 1.5T sites using the 1.5T Scope Calibrator and 100MHz Oscilloscope equipment:

$$\underline{1.00 \text{ VPP (4.0 dBm)}}_{\text{Set to 8 Major Div}} = \underline{0.125 \text{ VPP each Major Division}}_{\text{5 Minor Divisions}} = 0.025 \text{ VPP each Minor Division}$$

$$.7 \text{ dBm} = \frac{0.685 \text{ VPP}}{0.025 \text{ VPP each Minor Division}} = \textbf{27.4 Minor Divisions}$$

VP-P to dBm Calculation:

VP-P **[÷]** 0.632 **[=]** **[LOG]** **[*]** 20 **[=]** dBm.

dBm to VP-P Calculation:

dBm **[÷]** 20 **[=]** **[INV LOG]** **[*]** 0.632 **[=]** VP-P.

Example: Using 3.65 dBm, Scope Power reading listed on Kit card

3.65 **[÷]** 20 **[=]** (0.1825) **[INV LOG]** (1.5222991) **[*]** 0.632 **[=]** (0.9620931) VP-P.

dBm to Watts Calculation:

dBm **[÷]** 10 **[=]** **[INV LOG]** **[=]** **[*]** 0.001 **[=]** Total Watts.

C-2 RF Power Measurement Kit Use with 1.0T Systems --- Recalculation

The RF Power Measurement Kit contains a 1.5 Tesla Scope Calibrator. This is a 63.86 MHz oscillator that provides a 4 dBm (1.00 VP-P) output into "final" 50 ohms as measured on an oscilloscope. This 1.5T Scope Calibrator is not to be used with 1.0T systems.

Note

1.0T Sites with RF Power Measurement Kit cards that list "Div" (versus VP-P, mVP-P) for the Scope Reading must perform the re-calculation. Additional RF Formulas have been provided.

1.0T Sites with RF Power Measurement Kit cards that have "Div" (scope reading) listed can bypass this Section but must perform the following dBm (scope power) to VP-P calculation:

dBm **[÷]** 20 **[=]** **[INV LOG]** **[*]** 0.632 **[=]** VP-P.

Example: Using 3.65 dBm, Scope Power reading listed on Kit card

3.65 **[÷]** 20 **[=]** (0.1825) **[INV LOG]** (1.5222991) **[*]** 0.632 **[=]** (0.9620931) VP-P.

C-3 RF Power Measurement Kit Use with 1.5T Systems

1.5T sites using a 100 MHz oscilloscope must use the RF Power Measurement Scope Calibrator tool to characterize the oscilloscope display. This will compensate for any amplitude error associated with oscilloscope bandwidth limitations or frequency roll-off. The 1.5T Scope Calibrator provides a 63.86 MHz sine wave at +4 dBm/1.00 VPP (as measured on a 300 MHz oscilloscope with "final" 50 ohm termination).

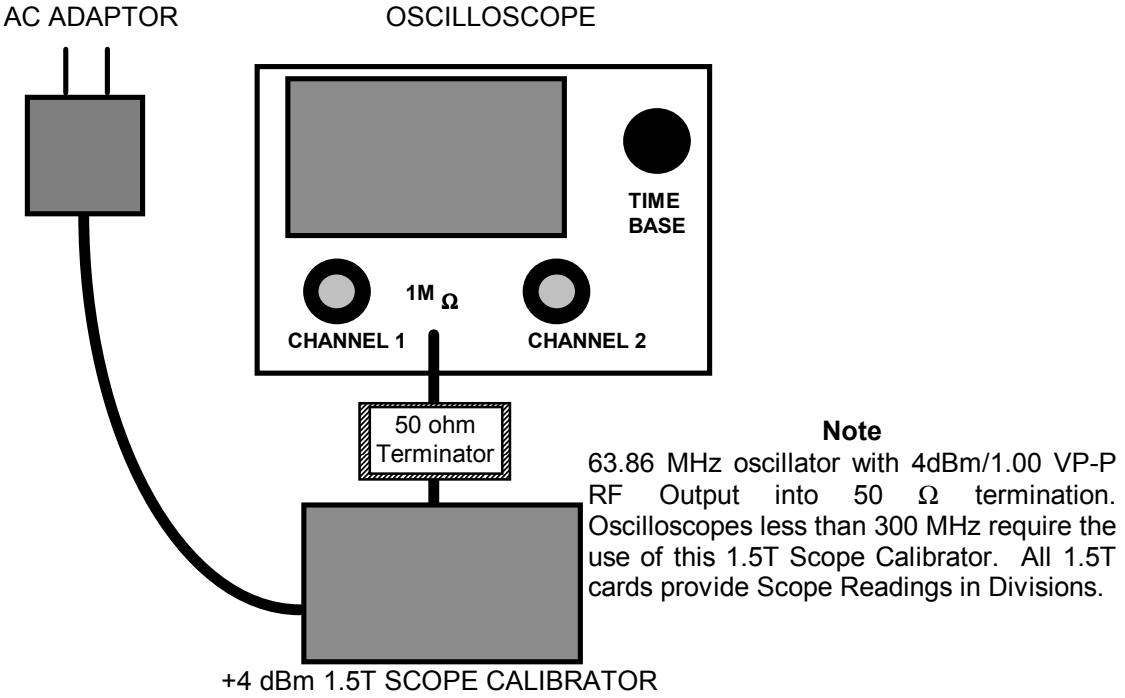
1. Verify the Bandwidth Limit button is not selected on the oscilloscope.

2. Verify Channel 1 is set to 1 M ohm input termination.

Note

When measuring RF signals: Use the 50 ohm terminator supplied with the RF Power Measurement Kit and set Channel 1 oscilloscope termination selection to 1 Meg ohm.

3. Connect the 1.5T Scope Calibrator via the 50 ohm terminator to the oscilloscope input. See Illustration C-1.



1.5T SCOPE CALIBRATOR CONNECTIONS
ILLUSTRATION C-1

4. Adjust the channel 1 vertical Volts/div control until amplitude of the waveform is slightly greater than 8 divisions.

5. Adjust the channel 1 vertical Volts/div variable control to achieve exactly 8 divisions.

Remove the 1.5T Scope Calibrator. Do not remove the 50 ohm terminator attached to the oscilloscope Channel 1 input.

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	June 11, 1998	Erbtec Engineering	Initial conversion to Word. (KK)
1	Dec. 17, 1998	K. Keshena	Added Calibrating Scope procedure. Added illustrations to identify PROBE Filter.
2	March 15, 1999	Resa Lambert (KK)	Standardized and corrected entire procedure.
3	March 26, 1999	Resa Lambert	Clarified Appendix equipment.
4	April 19, 1999	Resa Lambert	Removed all THS730 references.
5	Sept 22, 1999	Resa Lambert	Added TR of “55” to protocols. Removed all THS720 references. Corrected Section 2-3, step 6 note (CW instead of CCW). Added the interactive process for EFB Loop Gain at TG = 200. Removed absolute symbol.