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1- OVERVIEW

RFT is a RF loopback test that quickly evaluates stability, magnitude and phase linearity, droop, pulse fidelity, and bandwidth of the RF transmit chain in a Signa system.

It is recommended that TPS Loopback Baseline Data Test be performed first. Run Body Sense Loop Baseline Data Test and Head Sense Loop Baseline Data Test next.

The receive line is not verified in this procedure.

For additional information, refer to Section 7-1 RFT Analysis or 8-1 RFT Overview.

IMPORTANT!

The RFT linearity analysis portion of RFT should enable a tighter linearity specification which is required when the configuration file is Solid State RF Amp Type. This may not be corrected in the .rdf files for linearity.

Note

Before running any RFT test, disable the TNS (Transient Noise Suppressor).

2- REQUIRED TOOLS

Refer to Tables 2-1, 2-2, 2-3, and 2-4 for the kits required and their contents.

TABLE 2-1
UNIVERSAL SST KIT 46-320383G1 — G7 CONTENTS

Item	Description	Part Number	Quantity
1	Cable, 5ft., RG58, with BNC Connectors	46-251710G4	5
2	Cable, 1ft., RG58, with BNC Connectors	46-282803G16	2
3	Cable, 0.5 ft., RG58, with BNC Connectors	46-251920G4	1
4	Cable, 5ft., RG188, with BNC Male/SMB Female	46-301549P5	1
5	DC Power Supply for Switchable Attenuator	46-320385P1	1
6	Switchable Attenuator	46-288458G1	1
7	1.0T RF Sense Loop (Only in G4 & G6 Kits)	46-321434G1	1
8	1.5T RF Sense Loop (Only in G1/G2/G3/G4/G5 Kits)	46-288446G1	1
9	Head Carriage Sense Loop "L" Bracket	2102499	1
10	Attenuator, Variable 0-10 dB (1dB steps)	46-255838P3	1
11	Attenuator, Variable 0-1 dB (0.1dB steps)	46-255838P7	1
12	Velcro Pads	46-307152P1	3
13	Case of Connectors	46-301042G1	1

TABLE 2-2
RF POWER MEASUREMENT KIT CONTENTS

Item	Description	Part Number
1.	RF Power Measurement Kit **NOTE:** G1 kit does not contain the 30 dB Load. 50 ohm, 200 Watt, 30dB Attenuator Bird Model 8322	46-317724G1 or G2 46-255837P10 or 46-317724P14
2.	RF Cable Test Kit **NOTE:** For 1.5T RF/PDU or SRF Cabinet: N Female to N Female, 50 ohm Type, Adapter	46-255816G1 46-265875P2
3.	0-10 dB Rotary Step Attenuator, (variable 1 dB steps)	46-255838P1

TABLE 2-3
QTUNE KIT (46-287308G1/G2/G3) CONTENTS
(USED FOR RFT COIL TUNING CHECK ONLY)

Item	Description	Part Number	Quantity
1	Sense Coil Holder (for Head Coil) (G1 Kit only)	46-287006P1	1
2	Sense Coil Holder (for Head Coil) (G2 & G3 Kit only)	46-307899P1	1
3	1.0T RF Sense Loop (Only in G3 Kit)	46-321434G1	2
4	1.5T RF Sense Loop (Only in G1/G2/G3 Kits)	46-288446G1	2

TABLE 2-4
OTHER ITEMS NEEDED

Item	Description	Part Number	Quantity
1	50-ohm, 30 dB, 200 Watt, Dummy Load **NOTE:** Dummy Load (Body T/R Switch & Hybrid Output) test requires 2 (two) Dummy Loads.	46-255837P10	1
2	Grafidy Holder Base Plate	46-271410G1	1
3	Attenuator, Variable 0-70 dB (10dB steps)	46-255838P2	1
4	N-Shorting Caps *This part is supplied with the Coil Tune Extension kit	* 46-265916P1	2

3- BODY AND HEAD BASELINE LOOPBACK DATA TESTS

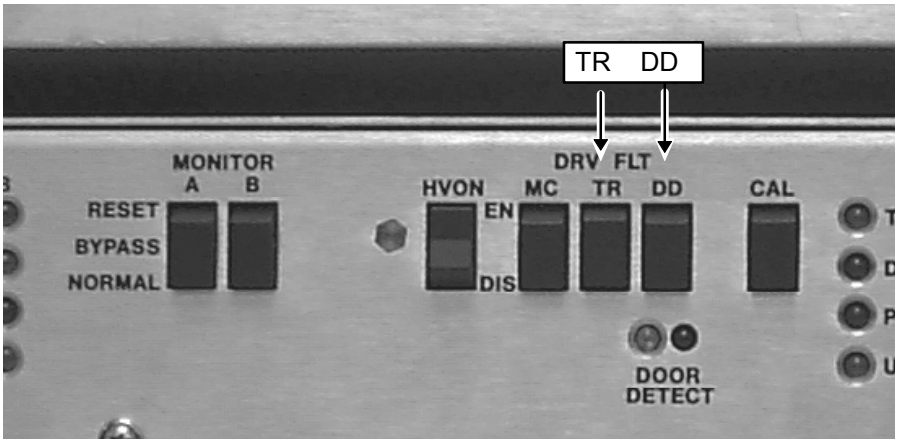
3-1 Initial Setup Requirements

CAUTION

EQUIPMENT DAMAGE POSSIBILITY! The Switchable Attenuator contains ferrous switch relays. Do not take the Switchable Attenuator into the magnet room; doing so can cause damage to the switch relays.

1. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

2. See Illustration 3-1. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 3-1

3-2 TPS Loopback Baseline Data Test

This test verifies the Exciter and Receiver hardware is good. TPS Loopback Baseline Data Test is performed in the Body mode. Results from this test are referenced automatically by subsequent RFT tests, therefore, this test is performed first. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-2-1, Table 3-2.

1. Ensure the TNS and SSM are set up as described in section 3-1.

WARNING!

EQUIPMENT DAMAGE! CONNECT SWITCHABLE ATTENUATOR BEFORE CONNECTING SENSE LOOP TO PREVENT DAMAGE TO TPS RECEIVER BOARD. ALSO, LEAVE SWITCH S1 (PREAMP BIAS) ON SWITCHABLE ATTENUATOR IN "OUT" (DEFAULT) POSITION OR THE INTERNAL PROTECTIVE DC BLOCKER IS BYPASSED. (WITH S1 OUT, DS1 "BIAS ON" LED SHOULD BE OFF AFTER SWITCHABLE ATTENUATOR IS CONNECTED.

Note

On some Switchable Attenuators: DS1 should always be OFF. If necessary, push in S1, then remove J5 power to restore the DS1 to OFF (DS1 latches).

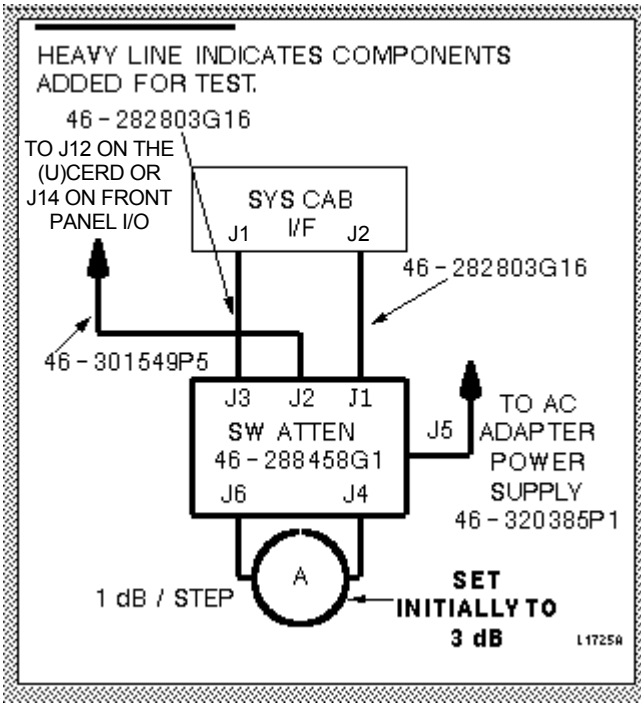
Note

As used in this procedure, the Switchable Attenuator attenuates by 30 dB. It also contains a DC block.

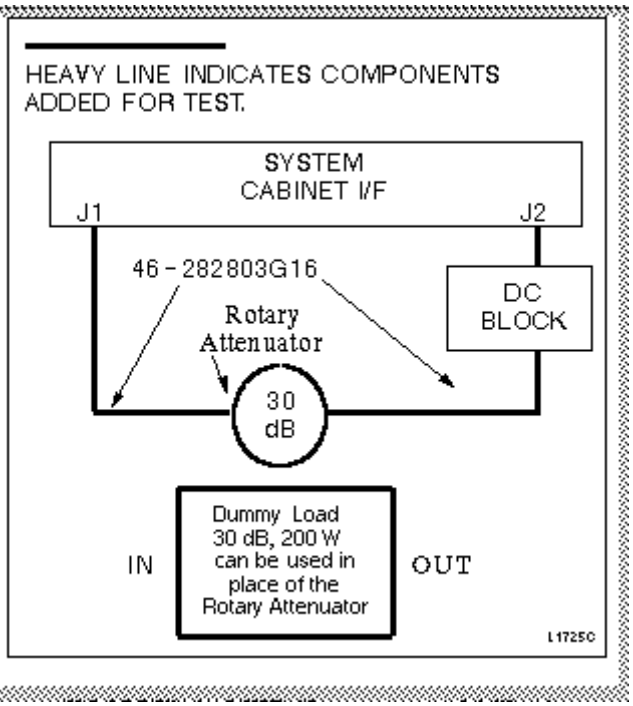
2. Install the Switchable Attenuator, 46-288458G1, at the rear of the Systems Cabinet as shown in Illustration 3-2A.

-Or-

Install the 0 to 100 dB Variable Attenuator, 46-255838P3 and the DC Block, 46-301549P15, at the rear of the Systems Cabinet as shown in Illustration 3-2B (Alternate Hardware Setup). Set the attenuator initially to 30dB. This alternate hardware setup will perform the TPS Loopback test without the use of the Switchable Attenuator. The alternate hardware setup is useful if attempting to identify a hardware problem associated with the Switchable Attenuator.



TPS LOOPBACK SETUP
ILLUSTRATION 3-2A



ALTERNATE HADWARE SETUP FOR TPS LOOPBACK
ILLUSTRATION 3-2B

3. Prepare the system to scan in Body mode per Table 3-1.

TABLE 3-1
BODY SCAN PROTOCOL: TPS LOOPBACK BASELINE DATA TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen].
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **0<ENTER>**.
CV Name: **Sense Loop**, CV Value: **0<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **1<ENTER.**
CV Name: **BW Cal**, CV Value: **1<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 15
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

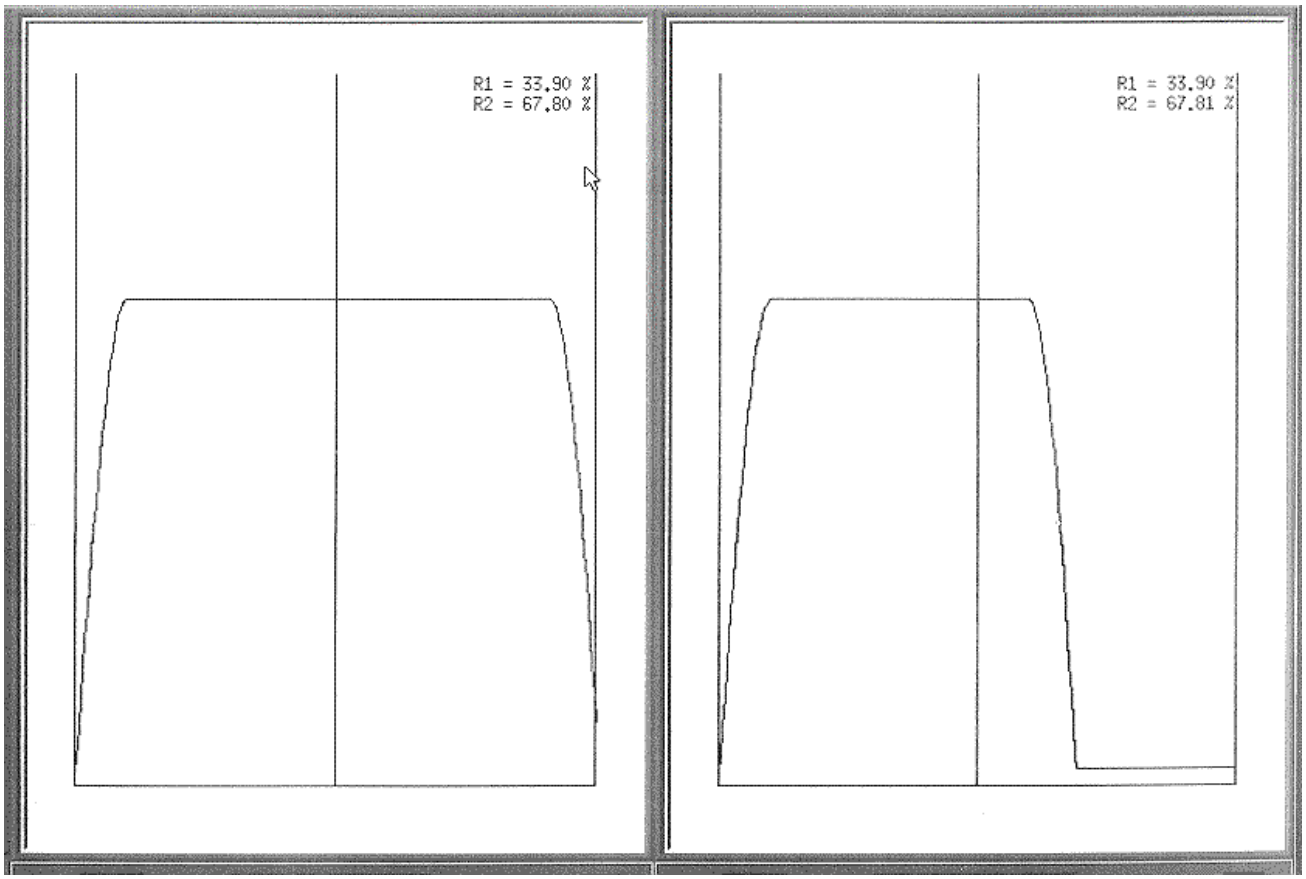
F. **[Research Operations] [Download]**.

4. **[Manual Prescan].**

5. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

There are four frames of rectangular pulses. Two of these pulses will be viewed, one in each window. Illustration 3-3 shows an example of the pulses.



TPS LOOPBACK MANUAL PRESCAN SIGNAL DISPLAY (EXAMPLE)
ILLUSTRATION 3-3

Note

The basic signal shown in Illustration 3-3 will be displayed during any of the tests on the following pages while in prescan.

Note

If the signal level is low (~2%), check the AC adapter power supply for power to the switchable attenuator.

6. Set TG to 200.

IMPORTANT!

For TPS Loopback Set Up ONLY (Illust. 3-2A): The R2 Power Spectrum signal should be between 40% & 90%. This may require attenuator A to be set to 0 dB.

7. Select **[Done]**.

8. Select **[Scan]**. Scan time is approximately 5 minutes and 30 seconds.

9. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in Appendix A.

10. If not proceeding to the next sub-section, go through the Restoration Checklist provided in Section 6.

3-2-1 TPS Loopback Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-2:

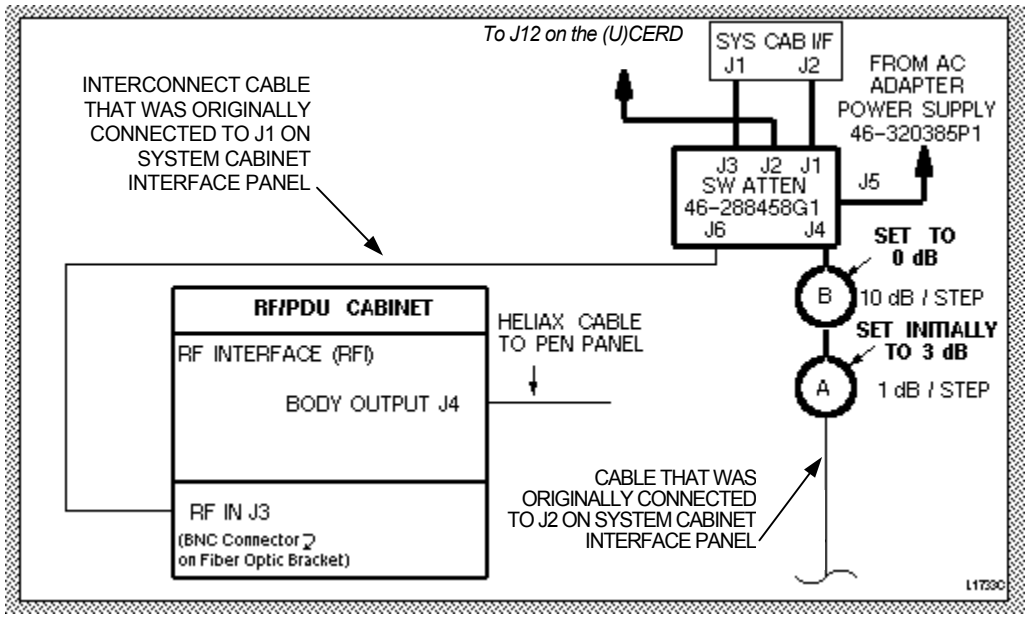
TABLE 3-2
TPS LOOPBACK CONTROL VARIABLES

User CV Name	Baseline	**Stability T/S**	**Linearity T/S**
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**0**	**0**	**0**
Sense Loop	**0**	**0**	**0**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
Stab/Grad	**4**	**4**	**0**
Bandwidth	**1**	**0**	**1**
BW Cal	**1**	**0**	**0**

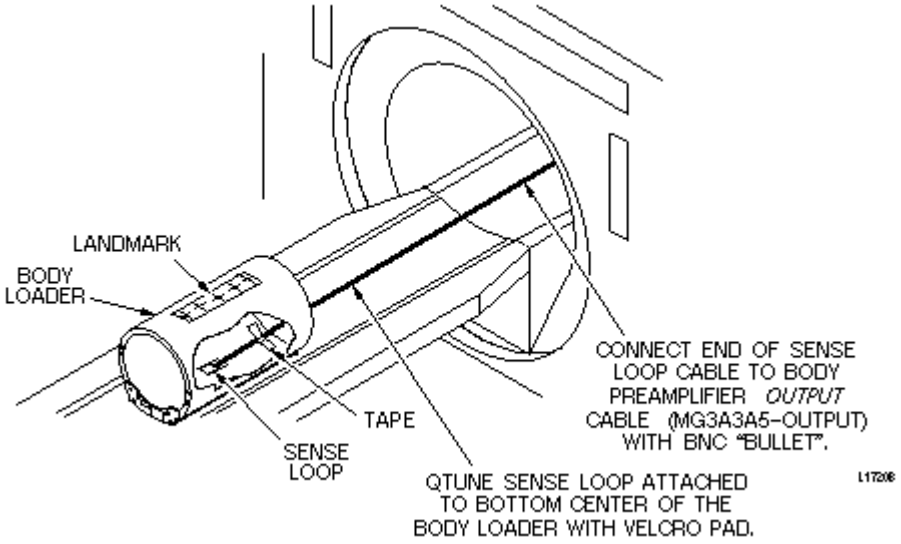
3-3 Body Sense Loop Baseline Data Test

This test evaluates the health of the Body Transmit chain and the RF field in the bore. If this test passes, the Body Transmit chain is good. TPS Loopback Baseline Data Test is performed first. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-3-1, Table 3-4.

1. Prepare the system per sub-section 3-1 (TNS and SSM).
2. Refer to Illustrations 3-4 and 3-5 for the hardware setup.



BODY SENSE LOOP SET-UP
ILLUSTRATION 3-4



BODY COIL HARDWARE SET-UP
ILLUSTRATION 3-5

3. Prepare the system to scan in Body mode per Table 3-3.

TABLE 3-3
BODY SCAN PROTOCOL: BODY SENSE LOOP BASELINE

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark per Illustration, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen].
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **4<ENTER>**.
CV Name: **Sense Loop**, CV Value: **1<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **1<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

4. **[Manual Prescan]**.

5. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

Plot Type = **Magnitude**
Plot Gain = **1**
Plot Type = **Magnitude**
Plot Gain = **1**

6. Advance TG to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

7. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

8. **Select [Done]**.

9. **Select [Scan]**. Scan time is approximately 1 minute, 56 seconds.

10. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

11. If not proceeding to next subsystem, go through the Restoration Checklist provided in Section 6.

3-3-1 Body Sense Loop Test Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-4:

TABLE 3-4
BODY SENSE LOOP CONTROL VARIABLES

User CV Name	Baseline	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**4**	**4**	**4**
Sense Loop	**1**	**1**	**1**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
Stab/Grad	**4**	**4**	**0**
Bandwidth	**1**	**0**	**1**
BW Cal	**0**	**0**	**0**

3-4 Head Sense Loop Baseline Data Test

This test evaluates the health of the Head Transmit chain and the RF field in the bore. If this test passes, the Head Transmit chain is good. TPS Loopback Baseline Data Test is performed first. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-4-1, Table 3-6.

1. Prepare the system per sub-section 3-1 (TNS and SSM).
2. Prepare the system to scan in Head mode per Table 3-5.

TABLE 3-5
HEAD SCAN PROTOCOL: HEAD SENSE LOOP BASELINE DATA TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark per Illustration, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.2<ENTER>**(o=Other, 16.2 =series) to load the head protocol
OR select **other** and select protocol **16** (RF test)and select series **2** (Head scan).

C. In the Additional Parameters field:
[User CVs Screen] .
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **2<ENTER>**.
CV Name: **Sense Loop**, CV Value: **1<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **0<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

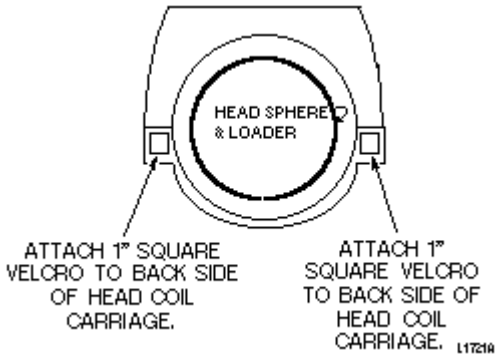
E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

3. See Illustration 3-6, 3-7 and 3-8 for the head setup.

   a. Attach Velcro as shown in Illustration 3-6.

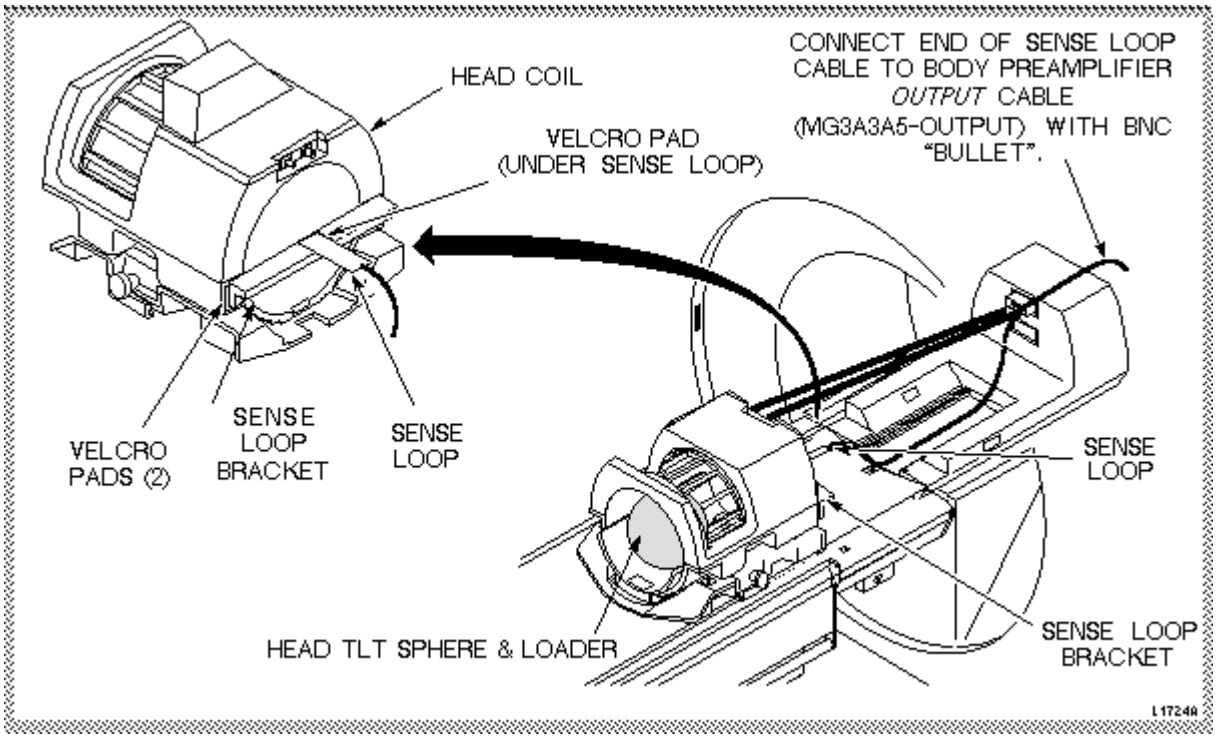


VELCRO ATTACHEMENT
ILLUSTRATION 3-6

   b. Position sense loop per Illustration 3-7. DO NOT use tuning ring. Position the sense loop on the sense loop bracket as shown.

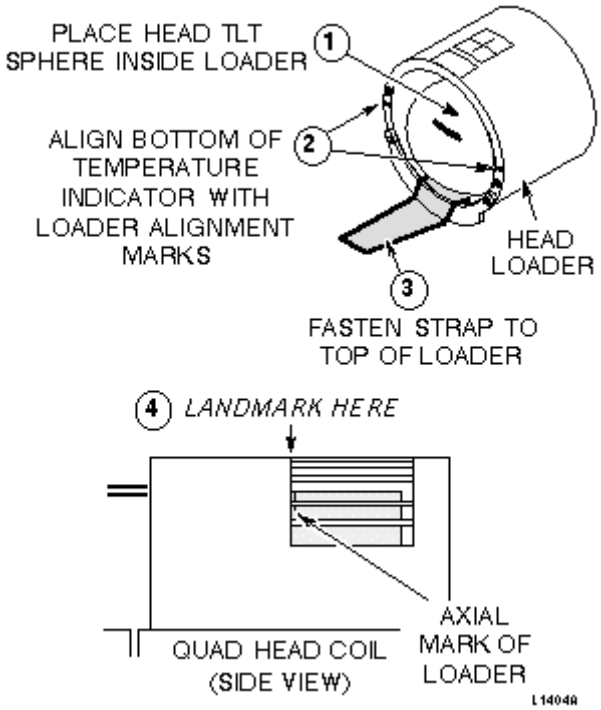
WARNING!

FOR THIS TEST CONFIGURATION, DO NOT PLACE THE SENSE LOOP IN THE HEAD COIL. THE HEAD COIL ASSEMBLY MAY BE DAMAGED.



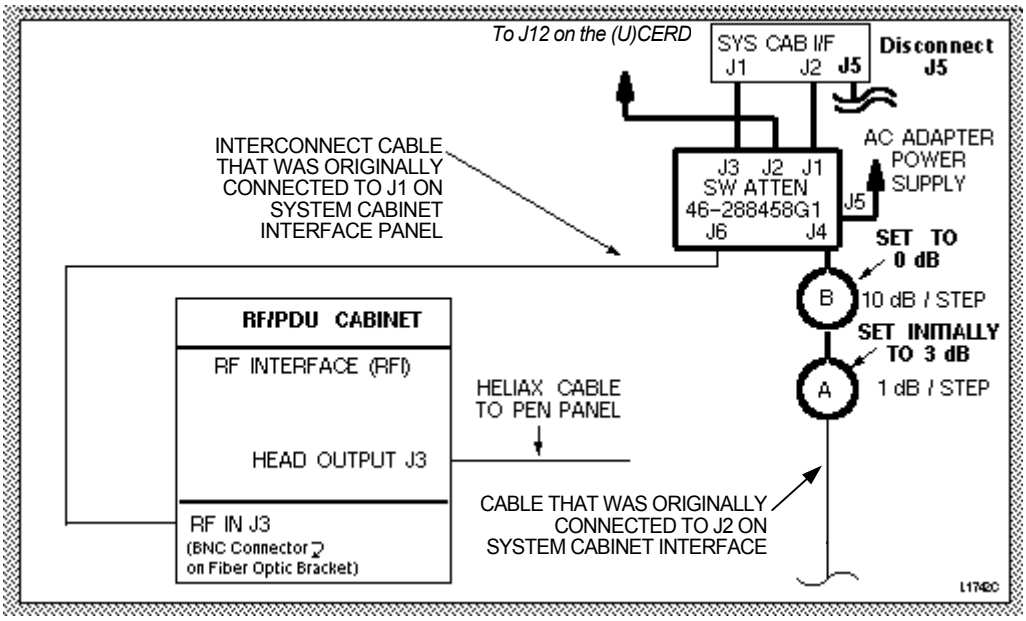
POSITIONING SENSE LOOP AT HEAD COIL
ILLUSTRATION 3-7

c. Position and landmark Head TLT Sphere in the Loader per Illustration 3-8. DO NOT use tuning ring.



POSITIONING HEAD TLT SPHERE INSIDE THE HEAD LOADER
ILLUSTRATION 3-8

4. See Illustration 3-9 for the hardware setup.



HEAD SENSE LOOP SETUP
ILLUSTRATION 3-9

Note

Be certain that the cable to J5 is disconnected as shown in Illustration 3-9. Failure to disconnect the cable at J5 may result in RF Linearity failures only in head mode.

5. **[Manual Prescan]**.

6. From the "Windows" Menu bar on the Manual Prescan window, select "**Two Windows**".

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

7. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 over-range. Do NOT adjust R1 or R2.

8. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 40 & 85%. Do NOT adjust R1 or R2.

9. Select **[Done]**.

10. Select **[Scan]**.

11. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

12. If not proceeding to next sub-section, go through the Restoration Checklist provided in Section 6.

3-4-1 Head Sense Loop Test Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-6:

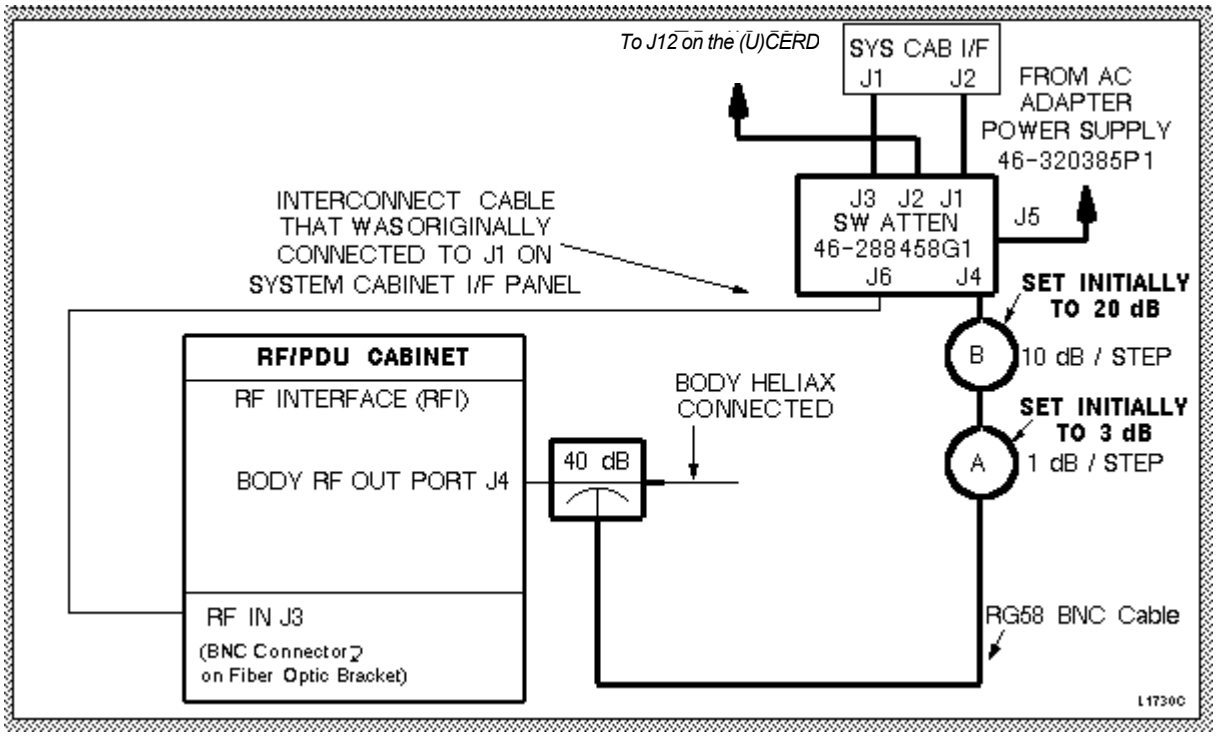
TABLE 3-6
HEAD SENSE LOOP CONTROL VARIABLES

User CV Name	Baseline	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**2**	**2**	**2**
Sense Loop	**1**	**1**	**1**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
Stab/Grad	**4**	**4**	**0**
Bandwidth	**0**	**0**	**0**
BW Cal	**0**	**0**	**0**

3-5 Body Coil Load Baseline Data Test

This test evaluates the health of the Body Transmit chain out to the Body Coil with the RF Amplifier loaded by the coil, however, it does not evaluate the RF field in the bore. TPS Loopback Baseline Data Test is performed first. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-5-1, Table 3-8.

1. Prepare the system per sub-section 3-1 (TNS and SSM).
2. See Illustration 3-10 for the hardware setup.



BODY COIL LOAD LOOPBACK SETUP
ILLUSTRATION 3-10

3. Prepare the system to scan in Body mode per Table 3-7.

TABLE 3-7
BODY SCAN PROTOCOL: BODY COIL LOAD BASELINE DATA TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen].
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **4<ENTER>**.
CV Name: **Sense Loop**, CV Value: **0<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **0<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

4. **[Manual Prescan]**.

5. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

Plot Type = **Magnitude**
Plot Gain = **1**
Plot Type = **Magnitude**
Plot Gain = **1**

6. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 over-range. Do NOT adjust R1 or R2.

7. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

8. Select **[Done]**.

9. Select **[Scan]**.

10. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

11. If not proceeding to next sub-section, go through the Restoration Checklist provided in Section 6.

3-5-1 Body Coil Load Test Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-8:

TABLE 3-8
BODY COIL LOAD CONTROL VARIABLES

CV Name	Baseline	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**4**	**4**	**4**
SenseLoop	**0**	**0**	**0**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
StabGrad	**4**	**4**	**0**
Bandwidth	**0**	**0**	**0**
BW Cal	**0**	**0**	**0**

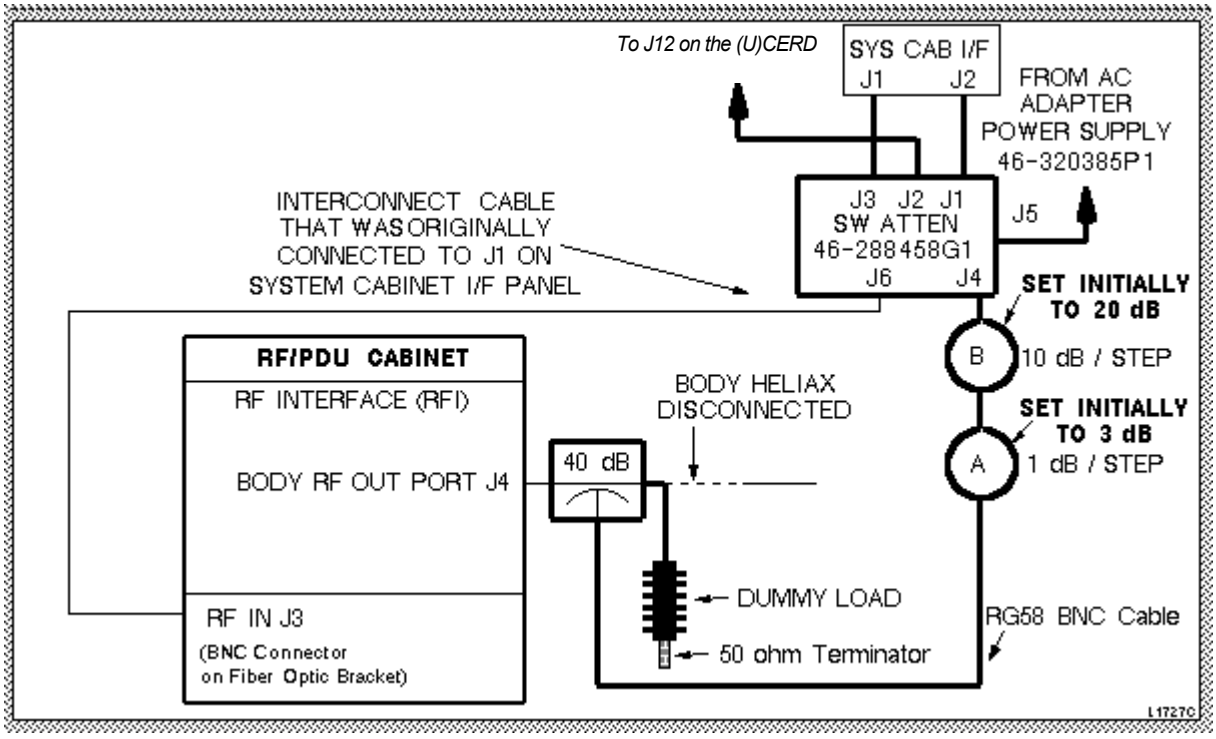
3-6 Body Dummy Load Baseline Data Test

This test evaluates the Body Transmit chain up to the Body RF Out at the RF/PDU or SRF Cabinet with the RF Power Amplifiers RFI Output loaded by a 50 ohm Dummy Load. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-6-1, Table 3-10.

Refer to 3-6-2 for RF Power Amplifier Isolation Dummy Load Test.

1. Prepare the system per sub-section 3-1 (TNS and SSM).

2. See Illustration 3-11 for the hardware setup.



BODY DUMMY LOAD LOOPBACK SETUP
ILLUSTRATION 3-11

3. Prepare the system to scan in Body mode per Table 3-9.

TABLE 3-9
BODY SCAN PROTOCOL: BODY DUMMY LOAD BASELINE

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen]
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **3<ENTER>**.
CV Name: **Sense Loop**, CV Value: **0<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **0<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

4. **[Manual Prescan]**.

5. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

6. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

7. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

8. **[Done]**.

9. **[Scan]**.

10. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

11. If not proceeding to next sub-section, go through the Restoration Checklist provided in Section 6.

3-6-1 Body Dummy Load Test Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-10:

TABLE 3-10
BODY DUMMY LOAD CONTROL VARIABLES

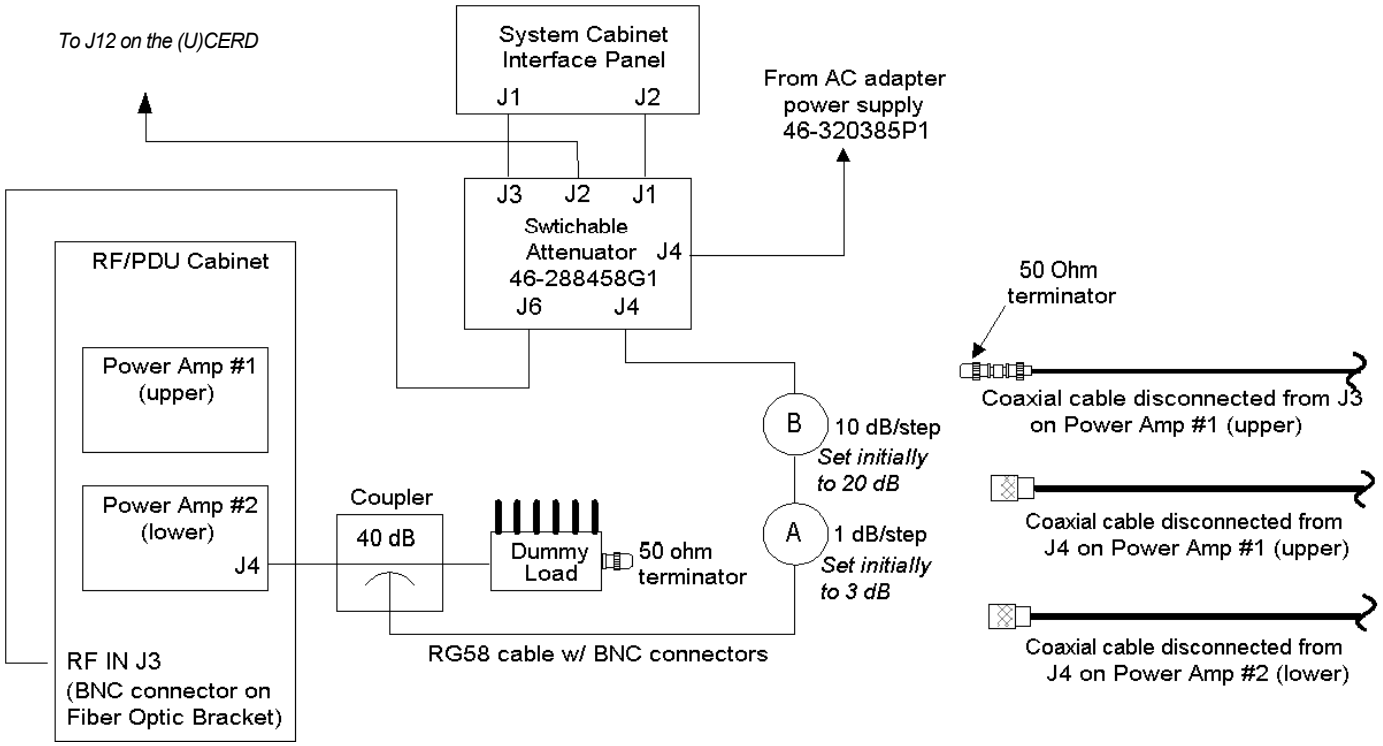
User CV Name	Baseline	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**3**	**3**	**3**
Sense Loop	**0**	**0**	**0**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
Stab/Grad	**4**	**4**	**0**
Bandwidth	**0**	**0**	**0**
BW Cal	**0**	**0**	**0**

3-6-2 Body Power Amplifier Isolation Dummy Load Test

Note

If the Normal Dummy Load Baseline Data Test fails, the troubleshooting would continue further to isolate the specific FRU within the RF /PDU Cabinet (RF Power Amplifier, or RFI, or bad internal RF cables). The TPS Loopback Test is a pre-requisite to any of the RFT procedures.

1. Prepare the system per sub-section 3-1 (TNS and SSM). Refer to Illustration 3-12 for the hardware setup.



BODY POWER AMPLIFIER #2 (LOWER) ISOLATION DUMMY LOAD TEST SETUP
ILLUSTRATION 3-12

2. Prepare the system to scan in Body mode per Table 3-9.
3. Disconnect the cable from J3 (RF IN) on Power Amp #1 (upper). Terminate this coaxial cable with a 50 ohm terminator.
4. Disconnect the cables from J4 (RF OUT) on both Power Amps (upper #1 and lower #2).
5. Connect the 30 dB Dummy Load and 40 dB Coupler test hardware (as shown in Illustration 3-12), directly to the J4 (RF OUT) connection at Power Amplifier #2 (lower). Do not connect to the RFI.

Note

Do not use the RF/PDU internal RF Out cables for this test setup. The 1.5T cables between the RFI (J11 Amp1 Drive and J12 Amp2 Drive) and the Power Amplifiers (J4 RF Out at each power amp) may be special Impedance Matching cables to compensate for the RFI input impedance. Cables of this type should be specially labeled. These cables cannot be swapped end to end or the impedance match will be lost. RF Power Amp end of cable is RG216-type while RFI end of cable is RG214-type.

6. **[Manual Prescan]**.

7. From the "Windows" Menu bar on the Manual Prescan window, select "**Two Windows**".

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

8. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

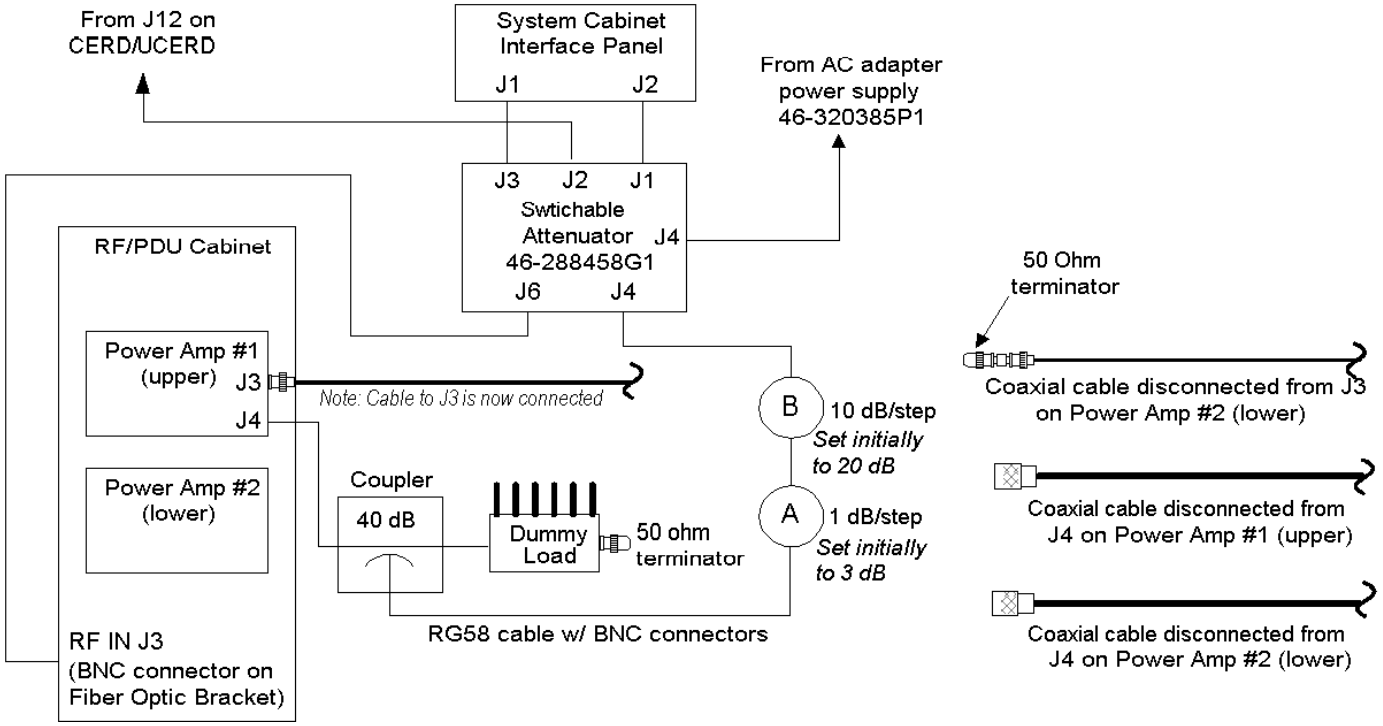
9. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

10. **[Done]**.

11. **[Scan]**.

12. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

13. Re-perform this section to verify the condition of the upper RF Power Amplifier (#1). Refer to Illustration 3-13 for the hardware setup.



BODY POWER AMPLIFIER #1 (UPPER) ISOLATION DUMMY LOAD TEST SETUP
ILLUSTRATION 3-13

- Remove the 50 ohm terminator from the J3 (RF IN) coaxial cable for Power Amp #1 (upper).
- Reconnect the J3 coaxial cable to J3 (RF IN) on Power Amp #1 (upper).
- Remove the 30 dB Dummy Load and 40 dB Coupler test hardware from the J4 (RF OUT) connection at Power Amplifier #2 (lower).
- Disconnect the coaxial cable from the J3 (RF IN) connector at Power Amp 2 (lower). Terminate this J3 coaxial cable with a 50 ohm terminator.
- Connect the 30 dB Dummy Load and 40 dB Coupler test hardware, shown in Illustration 3-13, directly to the J4 (RF OUT) connection on Power Amplifier #1 (upper).
- Perform the Body Power Amplifier Isolation Dummy Load Test.

14. Restore the system by connecting all RF Output cables and all RF Input cables to their original connectors on the Power Amplifiers and the RFI.

15. If not proceeding to next sub-section, go through the Restoration Checklist provided in Section 6.

3-7 Head Coil Load Baseline Data Test

This test evaluates the health of the Head Transmit chain out to the Head Coil with the RF Amplifier loaded by the coil, however, it does not evaluate the RF field in the bore. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-7-1, Table 3-12.

1. Prepare the system per sub-section 3-1 (TNS and SSM).
2. Prepare the system to scan in Head mode per Table 3-11.

TABLE 3-11
HEAD SCAN PROTOCOL: HEAD COIL LOAD BASELINE DATA TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.2<ENTER>**(o=Other, 16.2 =series) to load the head protocol
OR select **other** and select protocol **16** (RF test) and select series **2** (Head scan).

C. In the Additional Parameters field:
[User CVs Screen]
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **2<ENTER>**.
CV Name: **Sense Loop**, CV Value: **0<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **0<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

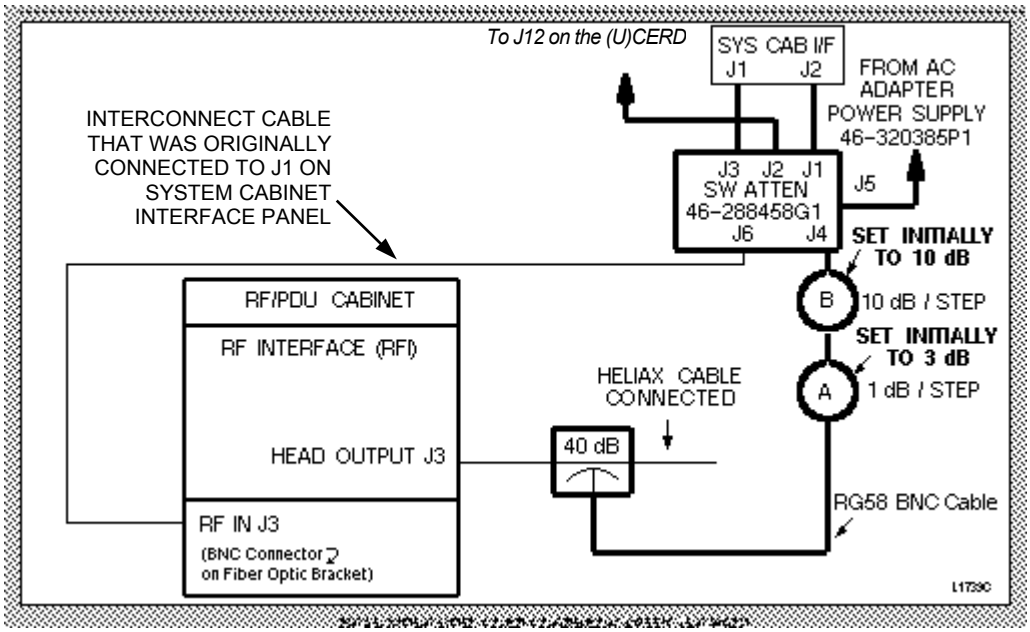
D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

3. See Illustration 3-14 for the hardware setup.



HEAD COIL LOAD LOOPBACK SETUP
ILLUSTRATION 3-14

4. **[Manual Prescan]**.

5. From the "Windows" Menu bar on the Manual Prescan window, select "**Two Windows**".

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

6. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 over-range. Do NOT adjust R1 or R2.

7. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

8. Select **[Done]**.

9. Select **[Scan]**.

10. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

11. If not proceeding to next sub-section, perform System Restoration.

3-7-1 Head Coil Load Test Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-12:

TABLE 3-12
HEAD COIL LOAD CONTROL VARIABLES

User CV Name	Baseline	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**2**	**2**	**2**
Sense Loop	**0**	**0**	**0**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
Stab/Grad	**4**	**4**	**0**
Bandwidth	**0**	**0**	**0**
BW Cal	**0**	**0**	**0**

3-8 Head Dummy Load Baseline Data Test

This test evaluates the Head Transmit chain up to the Head RF Out at the RF/PDU or SRF Cabinet with the RF Amplifier loaded by a 50 ohm Dummy Load. Control Variables for Stability and Linearity troubleshooting are listed in Sub-Section 3-8-1, Table 3-14.

1. Prepare the system per sub-section 3-1 (TNS and SSM).
2. Prepare the system to scan in Head mode per Table 3-13.

TABLE 3-13
HEAD SCAN PROTOCOL: HEAD DUMMY LOAD BASELINE DATA TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.2<ENTER>**(o=Other, 16.2 =series) to load the head protocol
OR select **other** and select protocol **16** (RF test) and select series **2** (Head scan).

C. In the Additional Parameters field:
[User CVs Screen]
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **1<ENTER>**.
CV Name: **Sense Loop**, CV Value: **0<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **1<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **1<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **4<ENTER>**.
CV Name: **Bandwidth**, CV Value: **0<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

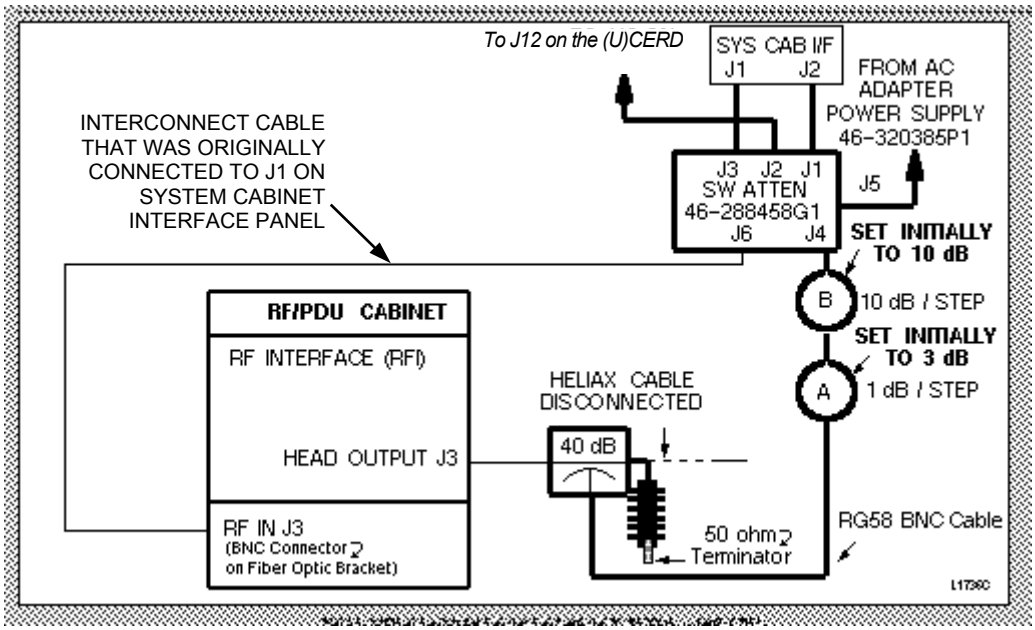
D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

3. See Illustration 3-15 for the hardware setup.



HEAD MODE, DUMMY LOAD LOOPBACK SETUP
ILLUSTRATION 3-15

4. **[Manual Prescan]**.

5. From the "Windows" Menu bar on the Manual Prescan window, select "**Two Windows**".

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

6. Advance TG to 200, while adjusting variable attenuators A and B to prevent R1 and R2 over-range. Do NOT adjust R1 or R2.

7. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

8. Select **[Done]**.

9. Select **[Scan]**.

10. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

11. If not proceeding to next sub-section, perform System Restoration.

3-8-1 Head Dummy Load Test Stability and Linearity Control Variables

1. Control Variables for Stability and Linearity troubleshooting are listed in Table 3-14:

TABLE 3-14
HEAD DUMMY LOAD CONTROL VARIABLES

User CV Name	Baseline	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**	**1**
RFAmpMode	**1**	**1**	**1**
Sense Loop	**0**	**0**	**0**
StabNoGrad	**1**	**1**	**0**
Lin&Fidlty	**1**	**0**	**1**
Stab/Grad	**4**	**4**	**0**
Bandwidth	**0**	**0**	**0**
BW Cal	**0**	**0**	**0**

4- COIL TUNING SENSE LOOP TESTS

The Coil Tuning Sense Loop Tests evaluate the coils (body or head) resonant frequency and quality factor (q=cf/bw).

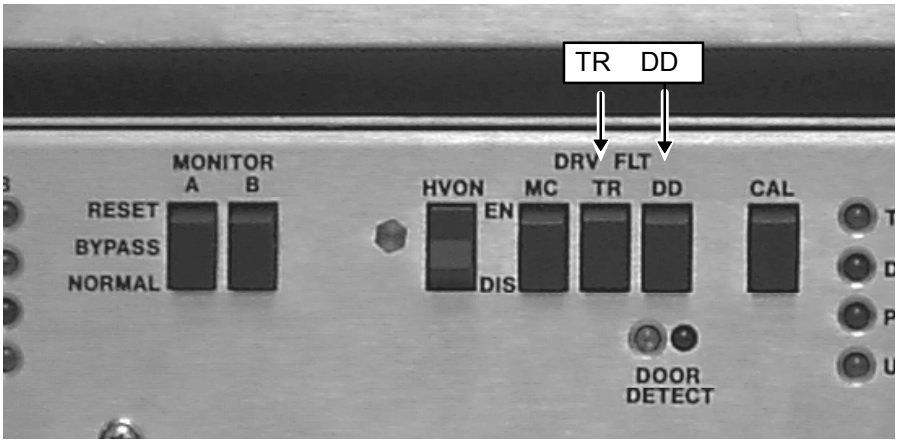
4-1 Body Coil Tuning Sense Loop Test

1. Setup the initial hardware using the following steps:

   a. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

   b. Refer to Illustration 4-1, at the front of the SSM place the DRV FLT switches as follows:

- TR switch to the DIS (disable faults) position.
- DD switch to the DIS (disable faults) position.



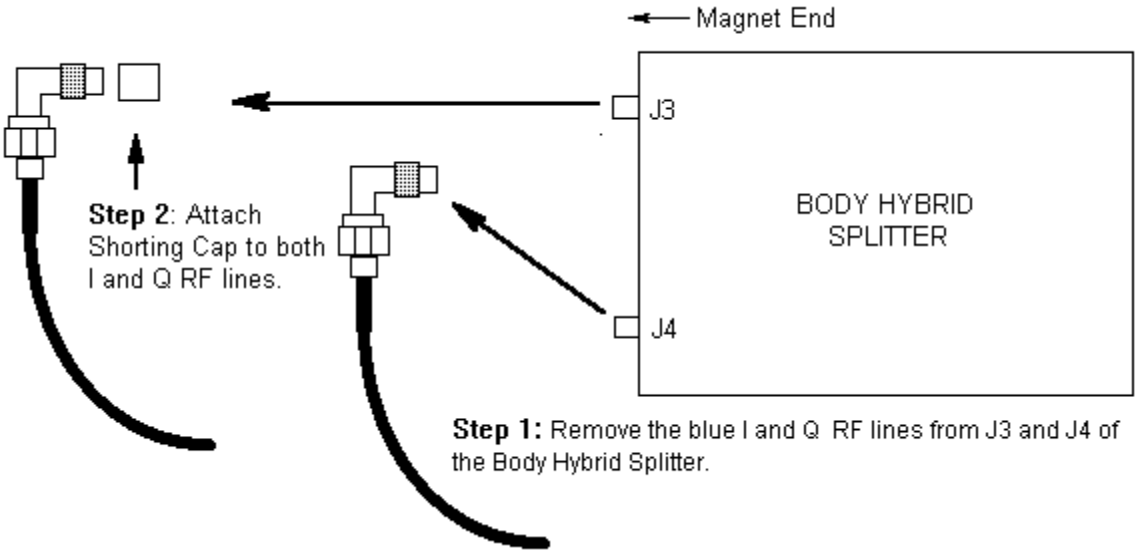
SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 4-1

2. For an accurate Body Coil Tuning reading, the Body Hybrid Splitter must be electrically isolated from the Body Coil. Remove the blue I and Q RF lines from J3 and J4 of the Body Hybrid Splitter.

d. Once the I and Q lines have been removed, attach an N Shorting Cap (46-265916P1) to each line. Refer to Illustration 4-2.

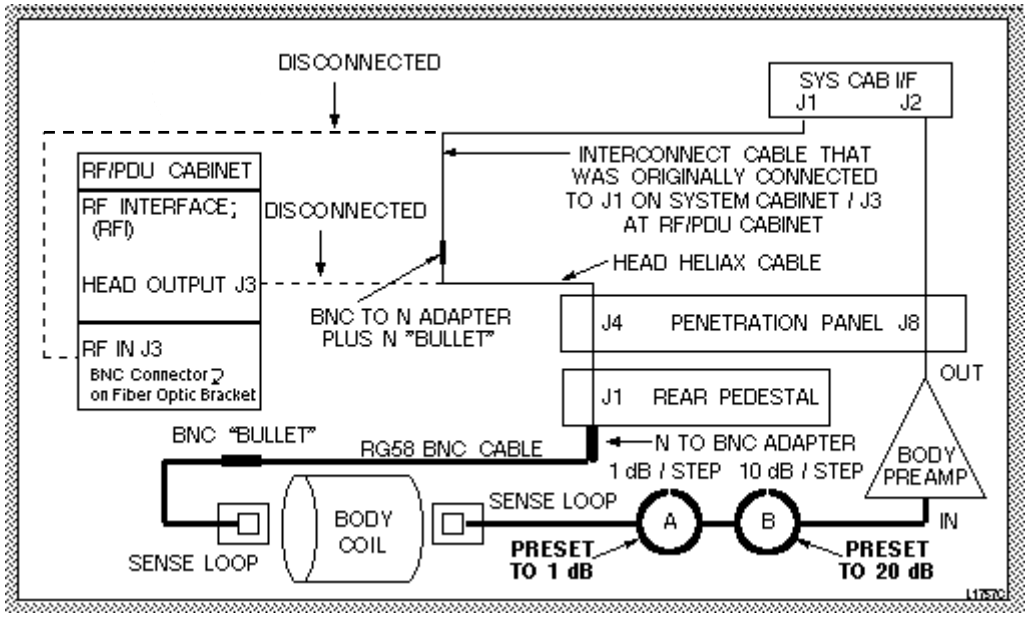
Note

The N Shorting cap is supplied with the Coil Tune Extension kit (46-265917G1).



TERMINATING I & Q RF LINES WITH SHORTING CAPS
ILLUSTRATION 4-2

3. Connect system as shown in Illustration 4-3 and 4-4.



BODY COIL TUNE SENSE LOOP CHECK
ILLUSTRATION 4-3

a. Position the Sense coils per Illustration 4-4 using sticky backed Velcro.

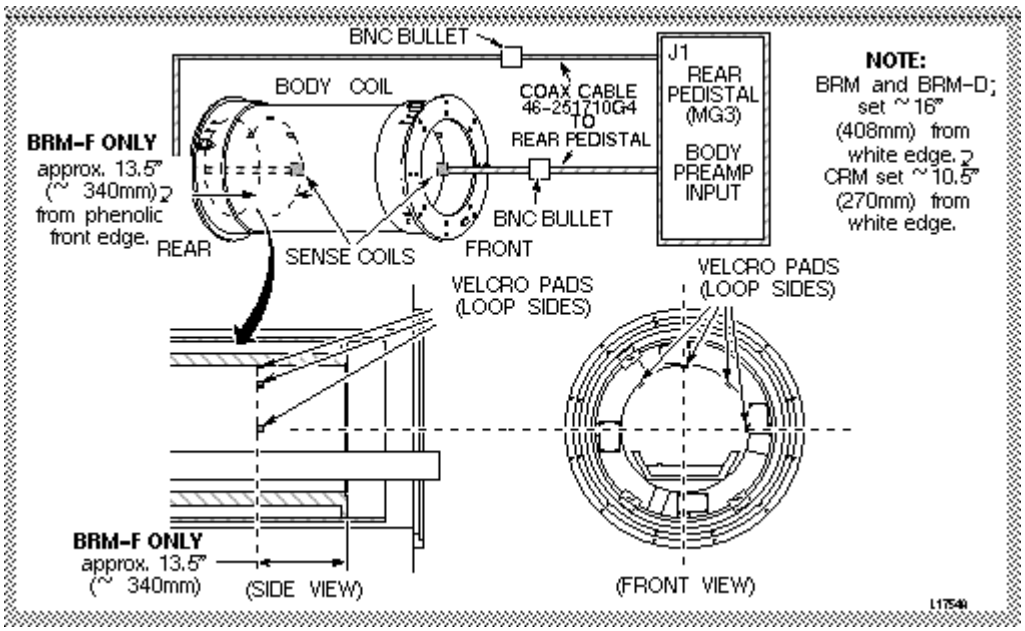
b. RF Coil type identified by part number (not description) on the sticker at rear of the Coil Assembly, see Table 4-1 for help:

TABLE 4-1
SENSE COIL POSITIONING

RF Coil Type	Part Number	Measure in from RF Coil Tube edge:	Measured Value
BRM or BRM/D	**46-328500G1** **46-328500G2**	Front edge of RF Coil Tube (white). Cone edge and RF Coil Tube meeting place.	In approximately 16 inches (approximately 408 mm)
CRM	**2186651**	Front edge of RF Coil Tube (white). Cone edge and RF Coil Tube meeting place.	In approximately 10.5 inches (approximately 270 mm)
BRM/F	**2218111** **2218111-2**	Front edge of RF Coil Tube (white). Cone edge and RF Coil Tube meeting place.	In approximately 0.9 inches (in tenths) or 7/8 inches (approximately 2.2 mm)

Note

When routing the cables for the Sense Coils, try to lay them as straight as possible and without crossing them. Crossed cables will affect data collection due to crosstalk. The sense coils must be positioned correctly or tuning problems will occur. Placing the sense coils too far into the Body Coil will cause over-coupling (creating 2 false peaks). Placing the sense coils too far out of the Body Coil will cause a decrease in frequency and sensitivity. Ensure that the sense coil foil run is placed the proper distance in per Table 4-1, Sense Coil Positioning).



SENSE COIL POSITIONING
ILLUSTRATION 4-4

4. Prepare the system to scan in Body mode per Table 4-2.

TABLE 4-2
BODY SCAN PROTOCOL: BODY COIL TUNING SENSE LOOP TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen].
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **7<ENTER>**.
CV Name: **Sense Loop**, CV Value: **1<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **0<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **0<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **0<ENTER>**.
CV Name: **Bandwidth**, CV Value: **1<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Start **[Manual Prescan].**

6. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain =**1**
   Plot Type = **Magnitude**
   Plot Gain =**1**

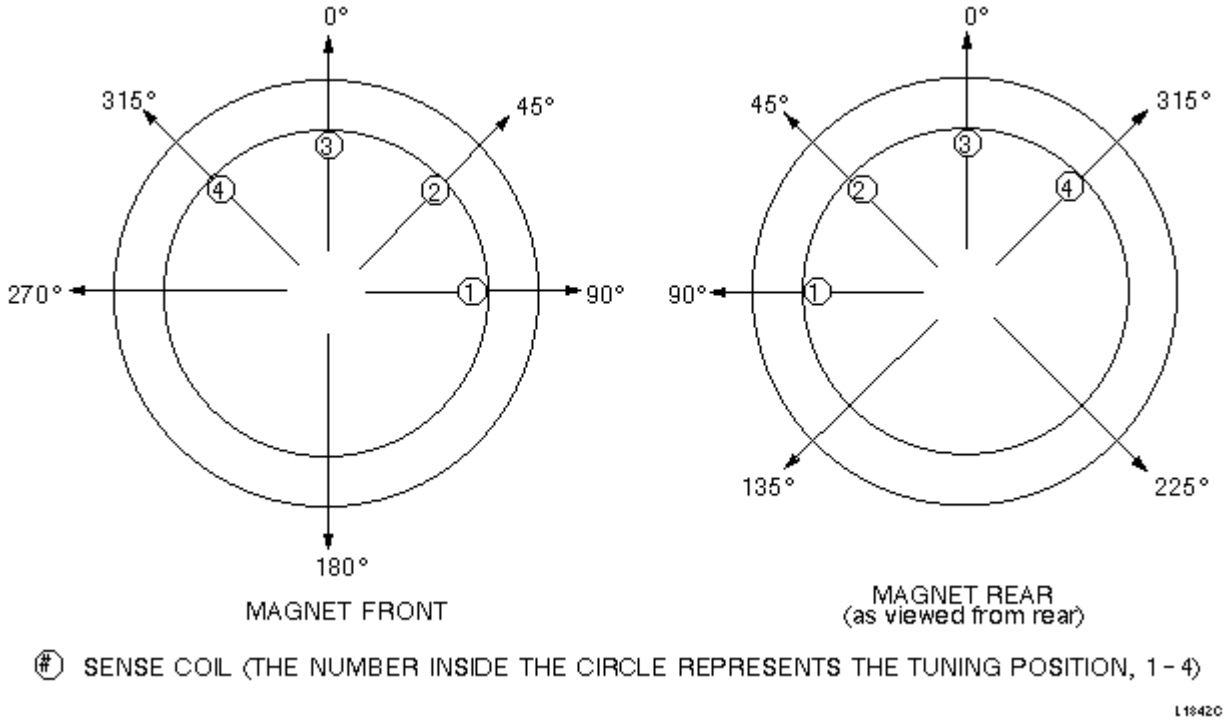
7. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

8. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

9. Select **[Done]**.

10. Select **[Scan]**. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record the "Center Frequency" value for the sense coil plane. (This value will later be used in calculating Peak Frequency).

11. Perform a new Body Coil Tune Sense Loop on all remaining planes. Refer to Illustration 4-5 for plane references (positions 2 through 4).



BODY SENSE COIL PLACEMENT
ILLUSTRATION 4-5

12. After obtaining Body Coil Tune Check Scans from all planes (0,45,90, and 315 degrees), perform the following analysis:
    a. Select **Report Tool** under **[Utilities]** on the Service Desktop. Select the File menu, then select **Open** from the pull-down sub-menu. Choose the pertinent file from the *Load Data File* pop up window. The most recent files appear at the end of the file directory.
    b. **Center Frequency:** Record the center frequency obtained at each plane. Subtract the lowest frequency value from the highest frequency. The “mode delta” difference must be less than or equal to 150,000 Hz (1.5T) or 100,000 Hz (1.0T).

       Example:
       - degree plane: body coil tune check scan: 42.731 MHz
       - degree plane: body coil tune check scan: 42.683 MHz
       - 42.731MHz - 42.683 MHz = 48,000 Hz or 48 kHz. These frequency values are within spec.
13. If the bandwidth is <u>not</u> correct, then perform “Preamplifier Bandwidth Check” and troubleshoot the problem.

4-2 Head Coil Tuning Sense Loop Test

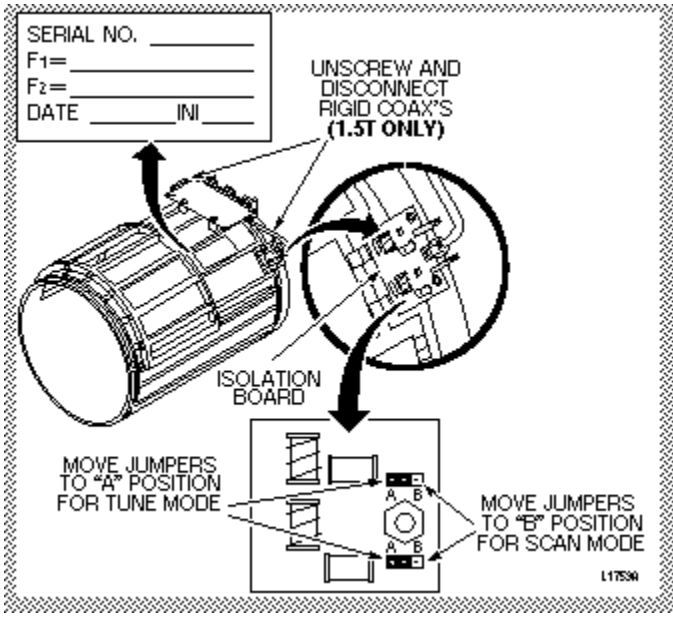
1. Setup the initial hardware using the following steps:
   a. Disconnect the 2 (two) white BNC cables and the Head Coil Quick Disconnect Adapter from the Head Coil.
   b. Locate and move both JP1 and JP2 jumpers to the Tune position (specific to the coil design). Refer to Illustrations 4-6 and 4-7.

Note

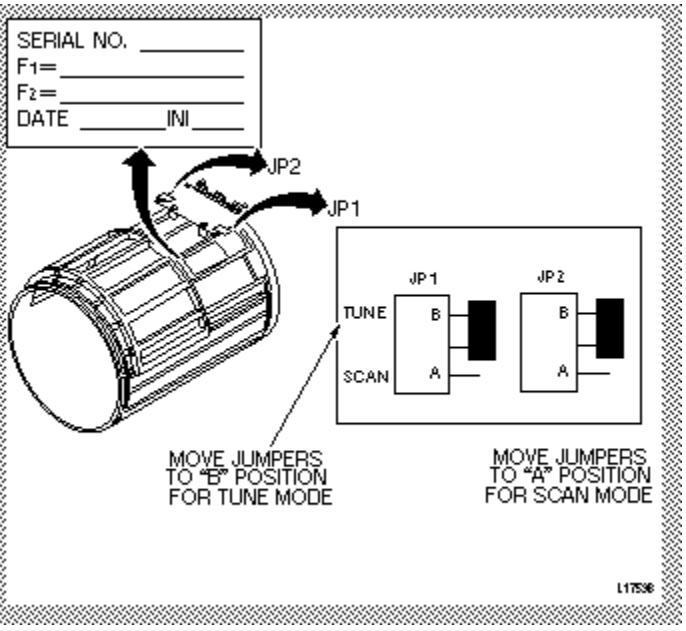
The 1.5T Isolation Boards and Hybrid Assembly are not removed, however, the semi-rigid coaxes are removed.

WARNING!

FOR THIS TEST CONFIGURATION, DO NOT LEAVE THE HEAD COIL CONNECTED TO THE CARRIAGE COVER ASSEMBLY. THE HEAD T/R ASSEMBLY MAY BE DAMAGED. REMOVE THE BNC CABLES AND HEAD COIL QUICK DISCONNECT ADAPTER BEFORE INSTALLING THE HEAD COIL IN THE BORE.

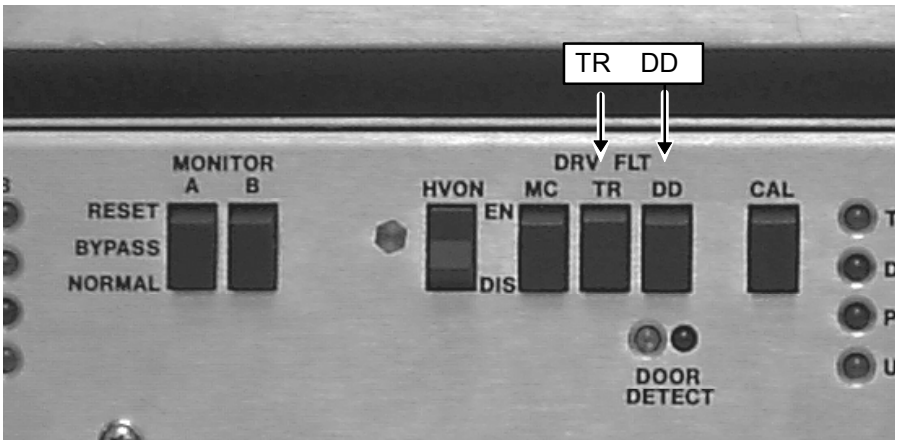


JUMPER POSITIONS ON 1.5T HEAD COIL
ILLUSTRATION 4-6



JUMPER POSITIONS ON 1.0T HEAD COIL
ILLUSTRATION 4-7

2. See Illustration 4-8. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 4-8

3. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

4. Prepare the system to scan in Head mode per Table 4-3.

TABLE 4-3
HEAD SCAN PROTOCOL: HEAD COIL TUNE SENSE LOOP CHECK TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.2<ENTER>**(o=Other, 16.2 =series) to load the head protocol
OR select **other** and select protocol **16** (RF test) and select series **2** (Head scan).

C. In the Additional Parameters field:
[User CVs Screen]
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **7<ENTER>**.
CV Name: **Sense Loop**, CV Value: **1<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **0<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **0<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **0<ENTER>**.
CV Name: **Bandwidth**, CV Value: **1<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

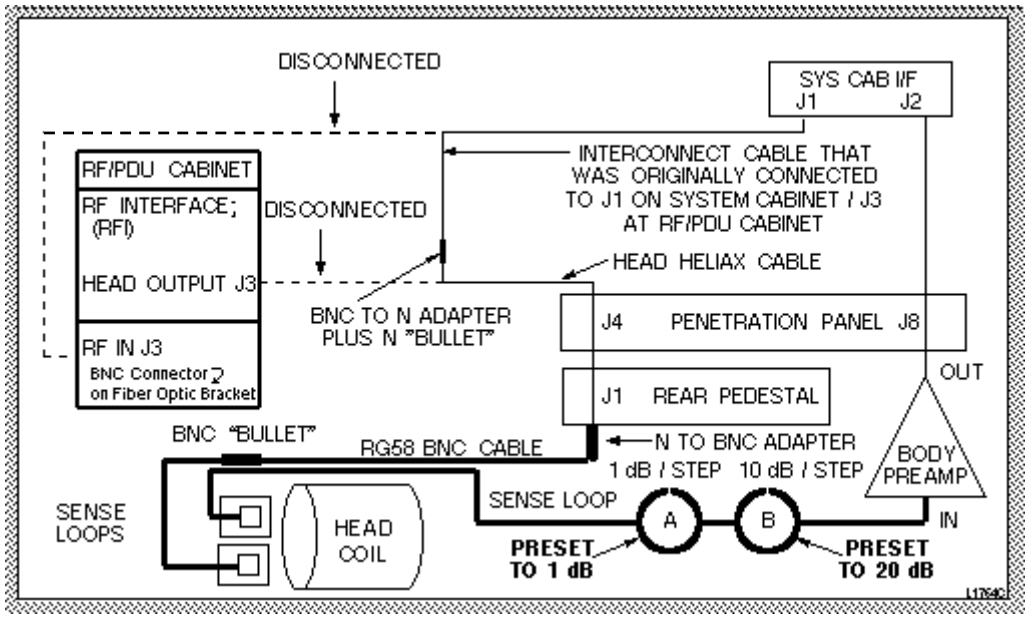
D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Setup system per Illustration 4-9 and Illustration 4-10.

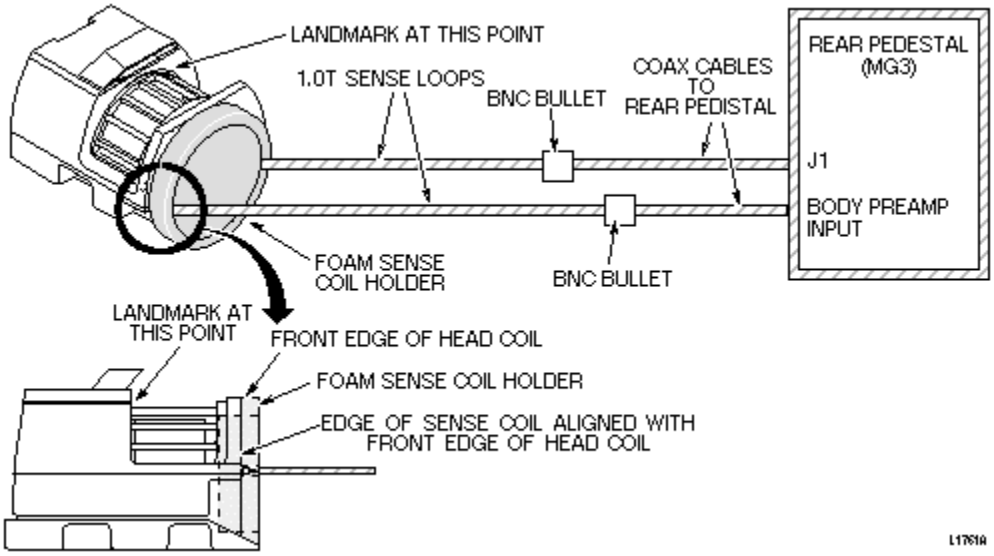


HEAD COIL TUNE SENSE LOOP CHECK
ILLUSTRATION 4-9

6. Position the Sense coils per Illustration 4-10.
   a. Place Head foam piece into front of head coil.
   b. Place Sense Coils into foam positioner until the edge of the sense coil is aligned with the front edge of the Head Coil.
   c. Landmark per Illustration 4-10.

Note

When routing the cables for the Sense Coils, try to lay them as straight as possible and without crossing them. Crossed cables will affect data collection due to crosstalk.



HEAD COIL SENSE COIL POSITIONING
ILLUSTRATION 4-10

7. Start **[Manual Prescan].**

8. From the "Windows" Menu bar on the Manual Prescan window, select "**Two Windows**".

   Plot Type = **Magnitude**
   Plot Gain =**1**
   Plot Type = **Magnitude**
   Plot Gain =**1**

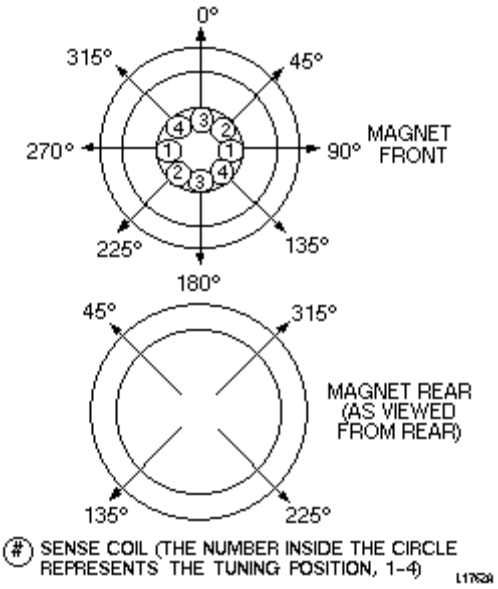
9. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

10. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

11. Select **[Done]**.

12. Select **[Scan]**.

13. For scan #1, place sense coils at position 1. For subsequent scans, place sense coils at next location. Refer to Illustration 4-11.



SENSE COIL POSITIONING / PLANE REFERENCES
ILLUSTRATION 4-11

14. Perform a new Head Coil Tune Sense Loop Test scan on all remaining planes (positions 2 through 4). Refer to Illustration 4-11 for plane / position references.

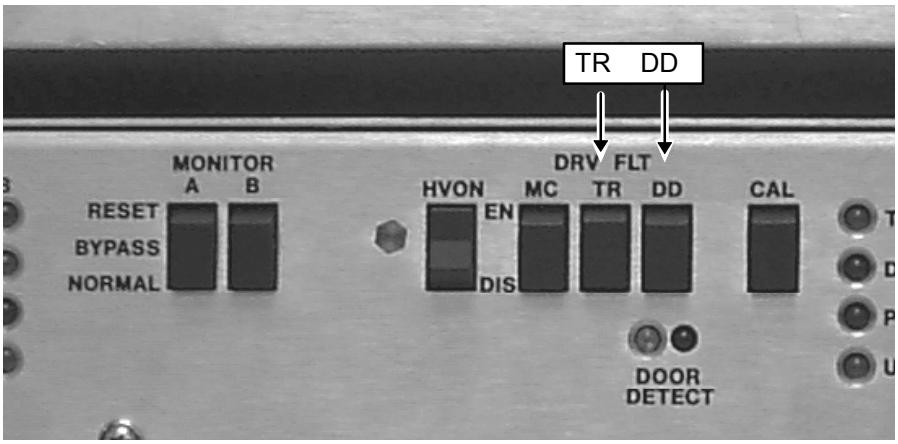
15. After obtaining Head Coil Tune Check Scans from all planes (0, 45, 90, and 315 degrees), view results by using the Report Manager tool. Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.
    a. Select **Report Tool** under **[Utilities]** on the Service Desktop. Select the **File** menu, then select **Open** from the pull-down sub-menu. Choose the pertinent file from the *Load Data File* pop up window. The most recent files appear at the end of the file directory.
    b. **Center Frequency:** Record the center frequency obtained at each plane. Subtract the lowest frequency value from the highest frequency. The “mode delta” difference must be less than or equal to 150,000 Hz (1.5T) or 100,000 Hz (1.0T).

    Example:
    - degree plane: body coil tune check scan: 42.731 MHz
    - degree plane: body coil tune check scan: 42.683 MHz
    - 2.731MHz - 42.683 MHz = 48,000 Hz or 48 kHz. These frequency values are within spec.
16. If the bandwidth is not correct, then perform “Pre-amplifier Bandwidth Check” and troubleshoot the problem.

5- BODY AND HEAD TROUBLESHOOTING TESTS

5-1 Body Dummy Load (Body Heliax Output)

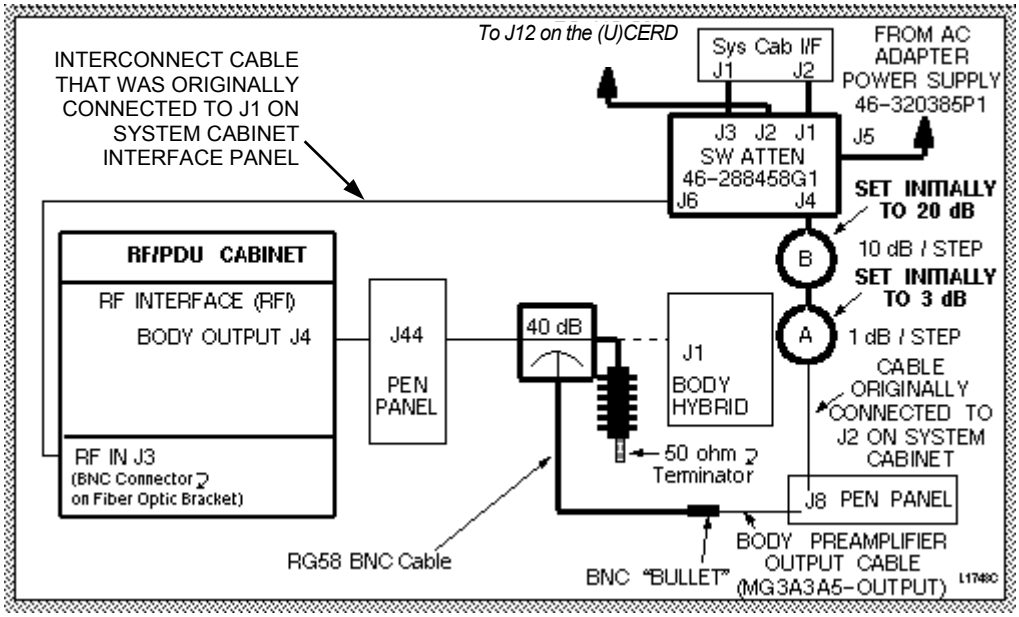
1. Refer to Illustration 5-1. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 5-1

2. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

3. Refer to Illustration 5-2 for hardware setup:



BODY MODE DUMMY LOAD LOOPBACK (BODY HELIAX OUTPUT)
ILLUSTRATION 5-2

4. Prepare the system to scan in Body mode per Table 5-1.

TABLE 5-1
BODY SCAN PROTOCOL: BODY DUMMY LOAD (BODY HELIAX OUTPUT) TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen] (see Table 5-2 for CV Values):
CV Name: **EFB Bypass**, CV Value: **<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **<ENTER>**.
CV Name: **Sense Loop**, CV Value: **<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **<ENTER>**.
CV Name: **Bandwidth**, CV Value: **<ENTER>**.
CV Name: **BW Cal**, CV Value: **<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Control Variables for Stability and Linearity troubleshooting are listed in Table 5-2 for **[User CV's]** screen select (refer to Appendix B for CV descriptions):

TABLE 5-2
BODY DUMMY LOAD (BODY HELIAX OUTPUT) CONTROL VARIABLES

User CV Name	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**
RFAmpMode	**3**	**3**
Sense Loop	**0**	**0**
StabNoGrad	**1**	**0**
Lin&Fidlty	**0**	**1**
Stab/Grad	**4**	**0**
Bandwidth	**0**	**0**
BW Cal	**0**	**0**

6. Start **[Manual Prescan].**

7. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

8. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

9. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

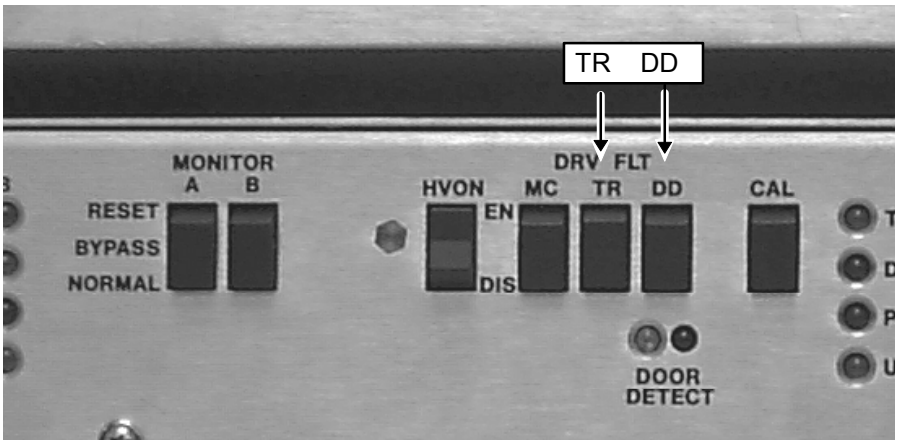
10. Select **[Done]**.

11. Select **[Scan]**.

12. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

5-2 Body Dummy Load (Body T/R Switch & Hybrid Output)

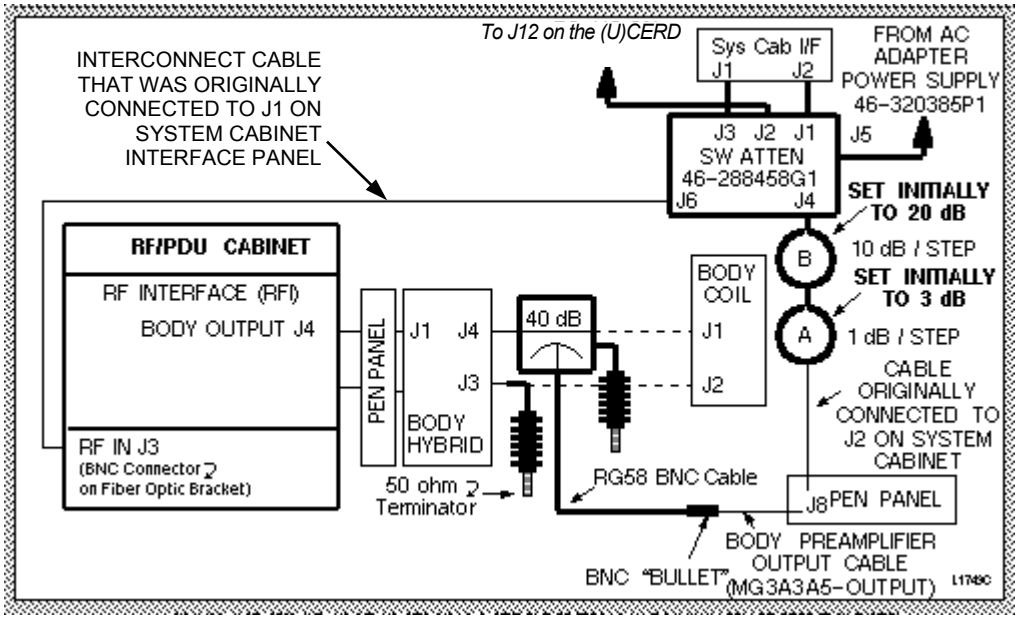
1. Refer to Illustration 5-3. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 5-3

2. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

3. Refer to Illustration 5-4 for hardware setup.



BODY MODE DUMMY LOAD LOOPBACK (BODY T/R & HYBRID OUTPUT) SETUP
ILLUSTRATION 5-4

4. Prepare the system to scan in Body mode per Table 5-3.

TABLE 5-3
BODY SCAN PROTOCOL: BODY DUMMY LOAD (BODY T/R SWITCH & HYBRID OUTPUT) TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen] (see Table 5-2 for CV Values):
CV Name: **EFB Bypass**, CV Value: **<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **<ENTER>**.
CV Name: **Sense Loop**, CV Value: **<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **<ENTER>**.
CV Name: **Bandwidth**, CV Value: **<ENTER>**.
CV Name: **BW Cal**, CV Value: **<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Control Variables for Stability and Linearity troubleshooting are listed in Table 5-4 for **[User CV's]** screen select (refer to Appendix B for CV descriptions):

TABLE 5-4
BODY DUMMY LOAD (BODY T/R SWITCH & HYBRID OUTPUT) CONTROL VARIABLES

User CV Name	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**
RFAmpMode	**3**	**3**
Sense Loop	**0**	**0**
StabNoGrad	**1**	**0**
Lin&Fidlty	**0**	**1**
Stab/Grad	**4**	**0**
Bandwidth	**0**	**0**
BW Cal	**0**	**0**

6. Start **[Manual Prescan].**

7. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

8. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

9. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

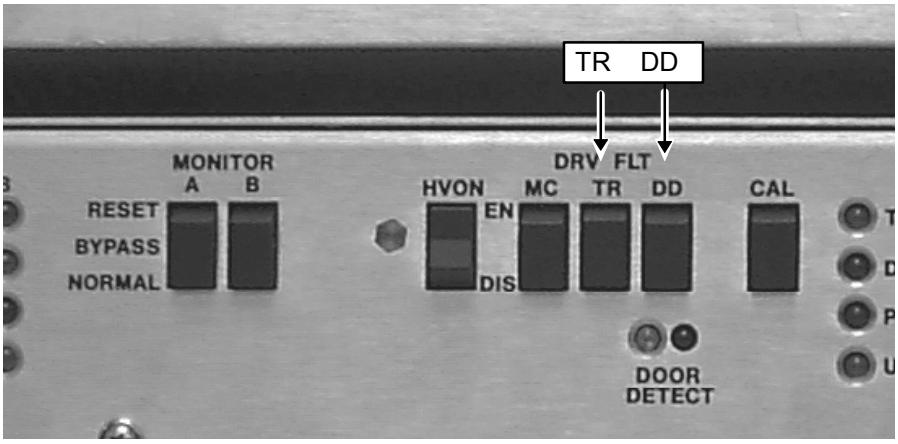
10. Select **[Done]**.

11. Select **[Scan]**.

12. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

13. 5-3 Head Dummy Load (Head Heliax Output)

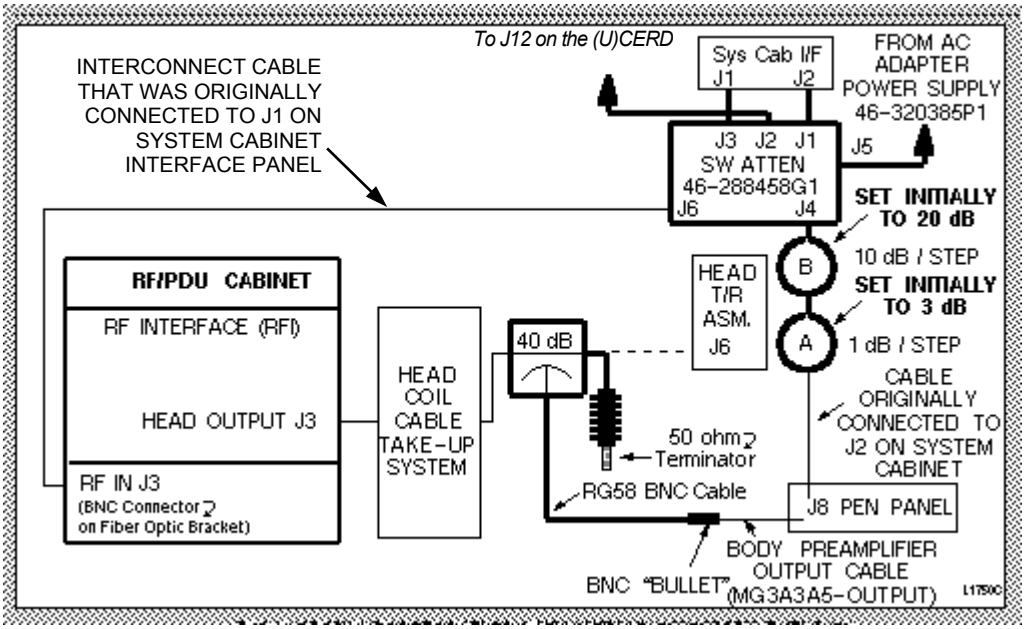
1. Refer to Illustration 5-5. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 5-5

2. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

3. Refer to Illustration 5-6 for hardware setup.



HEAD MODE DUMMY LOAD LOOPBACK (HEAD HELIAX OUTPUT)
ILLUSTRATION 5-6

4. Prepare the system to scan in Head mode per Table 5-5.

TABLE 5-5
HEAD SCAN PROTOCOL: HEAD DUMMY LOAD (HEAD HELIAX OUTPUT) TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.2<ENTER>**(o=Other, 16.2 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **2** (RFT Head).

C. In the Additional Parameters field:
[User CVs Screen] (see Table 5-2 for CV Values):
CV Name: **EFB Bypass**, CV Value: **<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **<ENTER>**.
CV Name: **Sense Loop**, CV Value: **<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **<ENTER>**.
CV Name: **Bandwidth**, CV Value: **<ENTER>**.
CV Name: **BW Cal**, CV Value: **<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Control Variables for Stability and Linearity troubleshooting are listed in Table 5-6 for **[User CV's]** screen select (refer to Appendix B for CV descriptions):

TABLE 5-6
HEAD DUMMY LOAD (HEAD HELIAX OUTPUT) CONTROL VARIABLES

User CV Name	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**
RFAmpMode	**1**	**1**
Sense Loop	**0**	**0**
StabNoGrad	**1**	**0**
Lin&Fidlty	**0**	**1**
Stab/Grad	**4**	**0**
Bandwidth	**0**	**0**
BW Cal	**0**	**0**

6. Start **[Manual Prescan].**

7. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

8. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

9. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

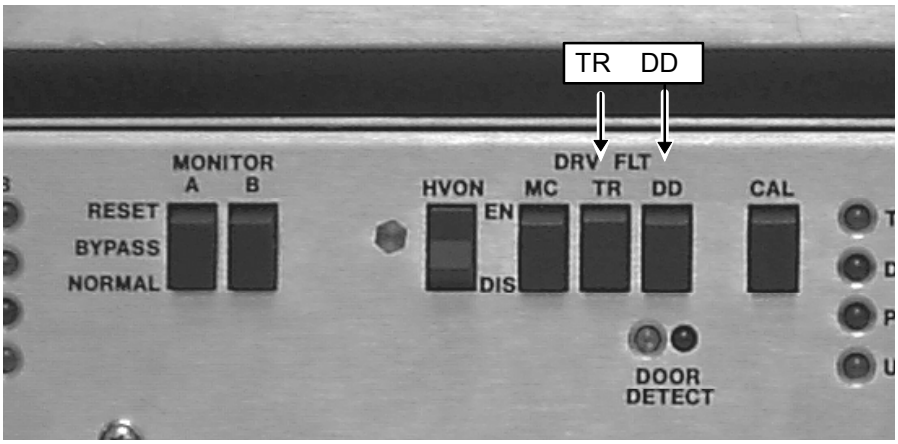
10. Select **[Done]**.

11. Select **[Scan]**.

12. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

5-4 Head Dummy Load (Head T/R Output) (Head Heliax Output)

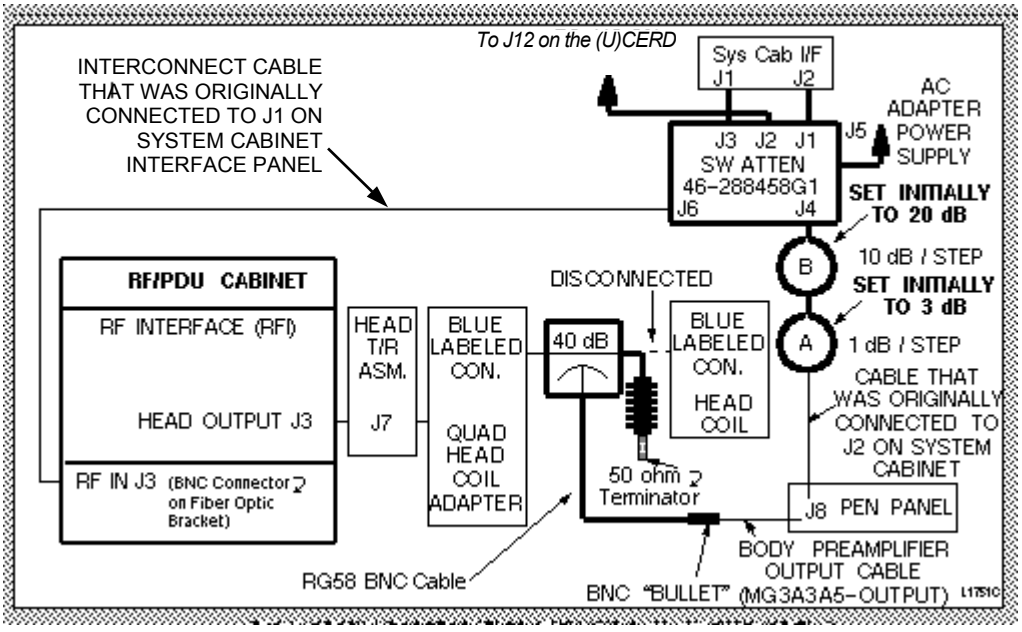
1. Refer to Illustration 5-7. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 5-7

2. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

3. Refer to Illustration 5-8 for the hardware setup:



HEAD MODE DUMMY LOAD LOOPBACK (HEAD T/R) SETUP
ILLUSTRATION 5-8

4. Prepare the system to scan in Head mode per Table 5-7.

TABLE 5-7
HEAD SCAN PROTOCOL: HEAD DUMMY LOAD (HEAD T/R OUTPUT) (HEAD HELIAX OUTPUT) TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.2<ENTER>**(o=Other, 16.2 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **2** (RFT Head).

C. In the Additional Parameters field:
[User CVs Screen] (see Table 5-2 for CV Values):
CV Name: **EFB Bypass**, CV Value: **<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **<ENTER>**.
CV Name: **Sense Loop**, CV Value: **<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **<ENTER>**.
CV Name: **Bandwidth**, CV Value: **<ENTER>**.
CV Name: **BW Cal**, CV Value: **<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Control Variables for Stability and Linearity troubleshooting are listed in Table 5-8 for **[User CV's]** screen select (refer to Appendix B for CV descriptions):

TABLE 5-8
HEAD DUMMY LOAD (HEAD T/R OUTPUT) (HEAD HELIAX OUTPUT) CONTROL VARIABLES

User CV Name	Stability T/S	Linearity T/S
EFB Bypass	**1**	**1**
RFAmpMode	**1**	**1**
Sense Loop	**0**	**0**
StabNoGrad	**1**	**0**
Lin&Fidlty	**0**	**1**
Stab/Grad	**4**	**0**
Bandwidth	**0**	**0**
BW Cal	**0**	**0**

6. Start **[Manual Prescan].**

7. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

8. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

9. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

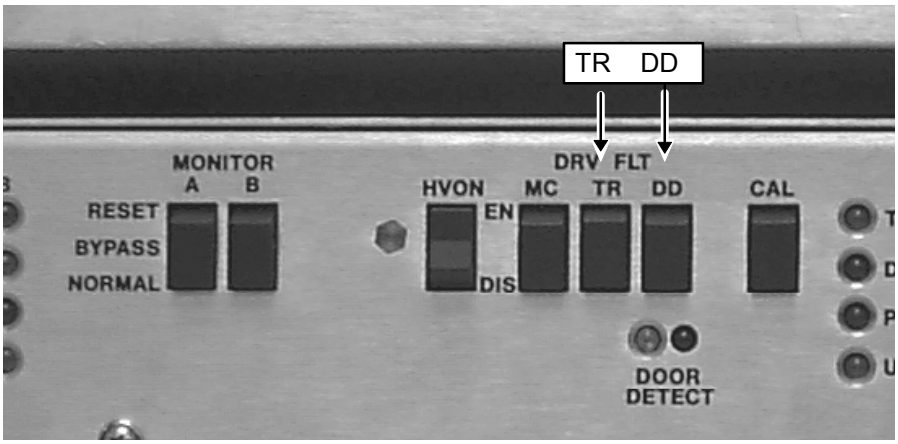
10. Select **[Done]**.

11. Select **[Scan]**.

12. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

5-5 Coil Tune Preamplifier Check

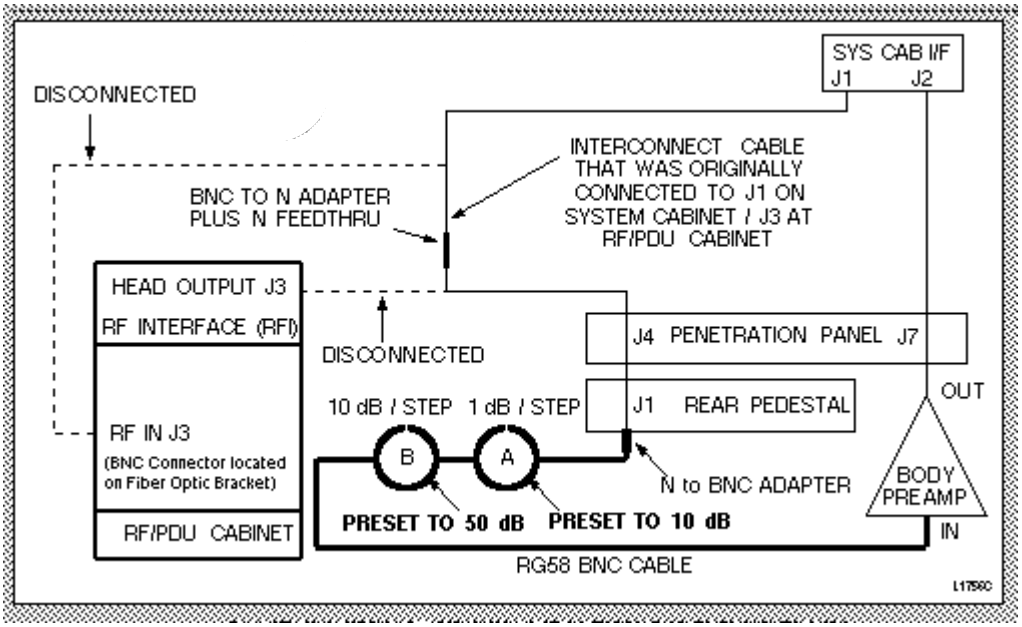
1. Refer to Illustration 5-9. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 5-9

2. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

3. Refer to Illustration 5-10 for the hardware setup:



COIL TUNE CHECK PREAMPLIFIER LOOP BACK MANUAL PRESCAN SETUP
ILLUSTRATION 5-10

4. Prepare the system to scan in Body mode per Table 5-9.

TABLE 5-9
BODY SCAN PROTOCOL: BODY COIL TUNE PREAMPLIFIER CHECK TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen] (see Table 5-2 for CV Values):
CV Name: **EFB Bypass**, CV Value: **1<ENTER>.**
CV Name: **RFAmpMode**, CV Value: **7<ENTER>**.
CV Name: **Sense Loop**, CV Value: **1<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **0<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **0<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **0<ENTER>**.
CV Name: **Bandwidth**, CV Value: **1<ENTER>**.
CV Name: **BW Cal**, CV Value: 1**<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Start **[Manual Prescan].**

6. From the “Windows” Menu bar on the Manual Prescan window, select “**Two Windows**”.

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

7. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 over range. Do NOT adjust R1 or R2.

8. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

9. Select **[Done]**.

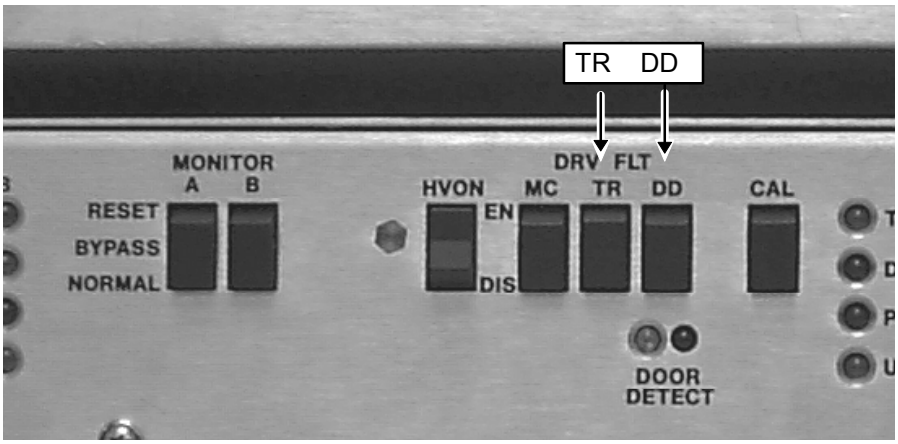
10. Select **[Scan]**.

11. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix.

12. This scan data is used by RFT Analysis for frequency compensation with hardware configurations (Body Coil Tune Sense Loop Check) and (Head Coil Tune Sense Loop Check). (Viewing RFT results for this scan not necessary.)

5-6 Preamplifier Bandwidth Check

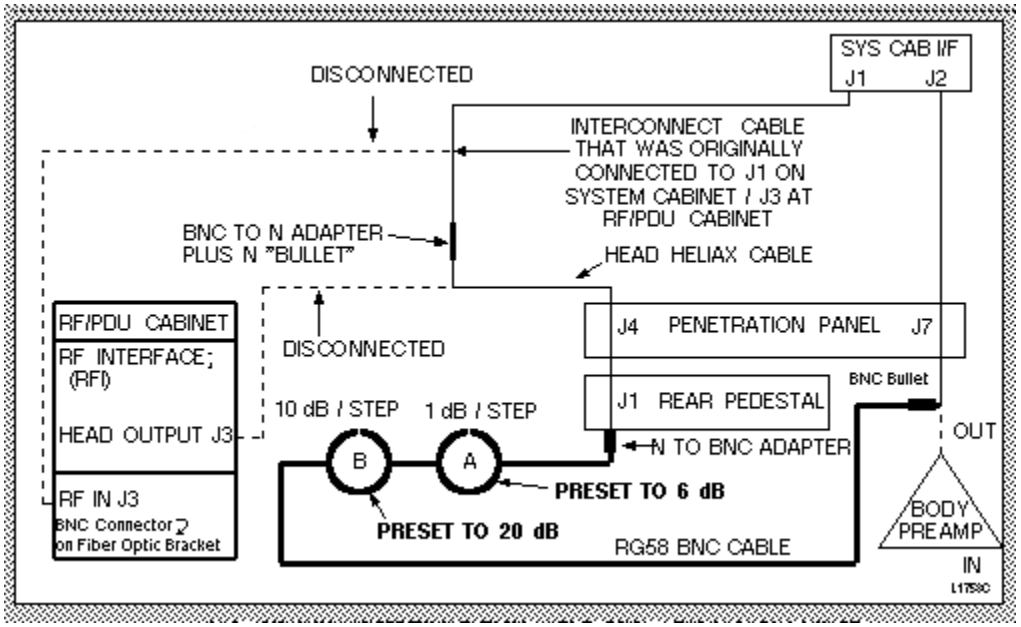
1. Refer to Illustration 5-11. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the DIS (disable faults) position.
   - DD switch to the DIS (disable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES DISABLED
ILLUSTRATION 5-11

2. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.

3. Refer to Illustration 5-12 for hardware setup.



PREAMPLIFIER BANDWIDTH CHECK TPS LOOPBACK MANUAL PRESCAN
ILLUSTRATION 5-12

4. Prepare the system to scan in Body mode per Table 5-11.

TABLE 5-11
BODY SCAN PROTOCOL: BODY COIL PREAMPLIFIER BANDWIDTH CHECK TEST

A. **[New Pt]**
Id: **geservice<ENTER>**
Name: **rft**
Weight (Lb.): **300<ENTER>**
Set Patient Protocols to **Service**.
At front enclosure, landmark in head area, press **LANDMARK**, then **MOVE TO SCAN**.

B. In the Patient Position Protocol field:
Type **o.16.1<ENTER>**(o=Other, 16.1 =series) to load the body protocol
OR select **other** and select protocol **16** (RF Test) and select series **1** (RFT Body).

C. In the Additional Parameters field:
[User CVs Screen] (see Table 5-2 for CV Values):
CV Name: **EFB Bypass**, CV Value: **1<ENTER>**.
CV Name: **RFAmpMode**, CV Value: **7<ENTER>**.
CV Name: **Sense Loop**, CV Value: **0<ENTER>**.
CV Name: **StabNoGrad**, CV Value: **0<ENTER>**.
CV Name: **Lin&Fidlty**, CV Value: **0<ENTER>**.
CV Name: **Stab/Grad**, CV Value: **0<ENTER>**.
CV Name: **Bandwidth**, CV Value: **1<ENTER>**.
CV Name: **BW Cal**, CV Value: **0<ENTER>**.
[Accept].

D. **[Save Series]**. If necessary --- **[Prepare to Scan]**.

E. **[Research Operations] [Setup Params]**.
R1 = 13
R2 = 14
TG = 50
Number of Frames: **4<ENTER>**
Window 1: Frame: **1<ENTER>**
+/- = **+**
Window 1: Frame: **0 <ENTER>**

Window 2: Frame: **2 <ENTER>**
+/- = **+**
Window 2: Frame: **0 <ENTER>**
[Done].

F. **[Research Operations] [Download]**.

5. Start **[Manual Prescan].**

6. From the "Windows" Menu bar on the Manual Prescan window, select "**Two Windows**".

   Plot Type = **Magnitude**
   Plot Gain = **1**
   Plot Type = **Magnitude**
   Plot Gain = **1**

7. Advance TG from 50 to 200, while adjusting variable attenuators A and B to prevent R1 and R2 overrange. Do NOT adjust R1 or R2.

8. With TG at 200, make final adjustments to variable attenuators A and B for R2 signal between 75 & 85%. Do NOT adjust R1 or R2.

9. Select **[Done]**.

10. Select **[Scan]**.

11. When scan completes, analysis is automatically run. Select **<Enter>** to quit. View results by using the Report Manager tool. (From the Service Desktop Manager, select **[Utilities],** select **[Report Manager],** then select **[Start]**). Record data for each test in Data Sheet 1.5T & Data Sheet 1.0T found in the appendix. Isolate/troubleshoot the bandwidth problem based on the results of this test.

6- RESTORATION CHECKLIST

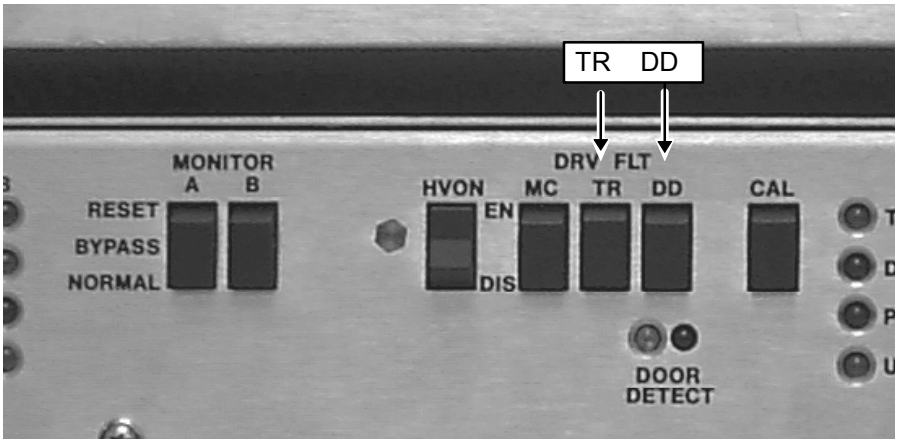
1. Remove Sense Coils and foam from inside of Body Coil or Head Coil.
2. At the System Cabinet:
   a. Remove Switchable Attenuator and associated test hardware.
   b. Locate the TNS in the rear of the upper part of the System Cabinet and move the switch on the front of the TNS into the down "**DISABLE**" position.
   c. Re-connect System Cabinet cables to original configuration.
   d. Reconnect I/F Panel J5 coaxial cable.
3. At the RF Cabinet:
   a. Remove associated test hardware.
   b. Re-connect RF Cabinet cables to original configuration.

4. At the rear pedestal:
   a. Remove associated test hardware.
   b. Re-connect Body Preamplifier to original configuration.

CAUTION

Equipment damage possibility. Application of RF energy to TR Switches with Jumpers in TUNE position can cause permanent damage or destruction of components. The Jumpers must be placed back to the scan (normal) position. This JP1 and JP2 position differs for 1.5T and 1.0T Head Coils. Refer to the Head Coil Tuning Sense Loop Test procedure for specific details.

5. **For 1.5T Head Coil Tune Only:** Reinstall rigid coaxes and install JP1 and JP2 jumpers on Isolation Boards in the B (scan) position.
6. **For 1.0T Head Coil Tune Only:** Install JP1 and JP2 jumpers in the A (scan) position.
7. **For Body and Head Coil Tune Only:** Remove N shorting caps from I and Q lines and reconnect I and Q lines to the Body Hybrid Splitter.
8. Refer to Illustration 6-1. On the front of the SSM place the DRV FLT switches as follows:
   - TR switch to the **EN** (enable faults) position.
   - DD switch to the **EN** (enable faults) position.



SSM FRONT PANEL TR AND DD FAULT SWITCHES ENABLED
ILLUSTRATION 6-1

9. When finished with RFT, delete all unneeded RFT studies.
10. Perform at least one head or body scan to verify proper system operation.

7- RFT RESULTS

7-1 RFT Analysis

RFT data analysis begins immediately after the scan is completed. The following is displayed while the data analysis is occurring:

Note

Only those tests which were selected during scan prescription will be processed.

```
Running RF Transmit Test Analysis
    ***************************************************
    *                  RFT Analysis Tool                *
    ***************************************************

    RF Stability:Slice 1, echo 1
    RF Stability:Slice 2, echo 1
    RF Stability:Slice 3, echo 1
    RF Stability:Slice 4, echo 1
    RF Linearity:Slice 1, echo 2
    RF Linearity:Slice 2, echo 2
    RF Droop:Slice 2, echo 1
    RF Fidelity:Slice 2, echo 3
    RF Fidelity:Slice 2, echo 4
    RF Bandwidth:Slice 5, echo 1    Note:  RF Bandwidth appears only
                                           when Bandwidth = 1.
    **************  RFT Analysis Completed  **************

Press any key to quit--> ..........................Enter any key to quit.
```

7-2 Report Program

RFT results (both text and graphics) can be viewed using the Report Manager program from the Service Tools menu. Refer to Table 7-1. This section describes how to initiate the Report program. Remaining sections provide examples of all reported parameters for RFT results. Record data for each test in Data Sheet 1.5T or Data Sheet 1.0T found in Appendix A.

Note

The RFT data sheet can automatically be generated. Refer to the Report Manager procedure.

TABLE 7-1
RESULT FILE ORGANIZATION

Group	Slice	Echo	Title	Plots
1	1	1	Low Power Magnitude Stability - - No Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
2	1	1	Low Power Phase Stability - - No Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
3	2	1	High Power Magnitude Stability - - No Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
4	2	1	High Power Phase Stability - - No Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
5	3	1	Low Power Magnitude Stability - - With Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
6	3	1	Low Power Phase Stability - - With Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation

TABLE 7-1 - CONTINUED
RESULT FILE ORGANIZATION

Group	Slice	Echo	Title	Plots
7	4	1	High Power Magnitude Stability - - With Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
8	4	1	High Power Phase Stability - - With Gradients	1 Sample deviation all (max% & min%) 2 View means 3 Min sample deviation 4 Max sample deviation
9	1 & 2	2	Linearity -61 dB to 0 dB	1 Magnitude Error 2 Phase Error
10	2	1	Magnitude Droop	1 Raw Droop 2 Early Droop 3 Average Droop 4 Late Droop
13	5	1	Bandwidth	1 Raw Magnitude vs. Frequency 2 Corrected Magnitude vs. Frequency
14	5	1	Coil Tune Check	1 Raw Magnitude vs. Frequency 2 Corrected Magnitude vs. Frequency

7-3 RFT Header Data

Refer to Table 7-2 for definition of legal value entries for all RFT Report header parameters:

TABLE 7-2
RFT HEADER PARAMETERS

Parameter	Legal Values	Source
Sitename	Site Name	Raw Header
Usn	Unique System Number (GE Cares Issued)	Config File
Srvconfig	Date/Time Srv Config File Last Changed	Srv Config File ("sysconfig")
Receiver	# Of Tps Rcvr Bds (4-4); # Channels/Bd (1) Starting Rec., Ending Rec, Port Enable	Srv Config File
Xmtrfcoil	Body, Head	Raw Header
Rcvrfcoil	Body, Head, <Surface Coil Name>	Raw Header
Freq	Magnet Frequency	Raw Header
Time	YY/MM/DD HH:MM:SS	Raw Header
Baserun	Base Run Number Of Scan	Raw Header
Configcode	_xxxxxxxxxx	Raw Header
Softrev	Software Revision	"mrswrev" Script
Rcvcoilgain	Calibration Value (Typ. 4-10)	Config File
R1	4-7	Raw Header
R2	4-30	Raw Header
TG	0-200	Raw Header
C1	Exam Description	Raw Header
C2	Series Description	Raw Header

Refer to the following for a sample header:

```
17JE1325.RFT/0 Header Info RDF/GRP Revision:   1.0  /41
=========================================================
SITENAME     = BAY 12
USN          = B15B0C0
MLN          = 9999
SRVCONFIG    = YY/MM/DD HH/MM/SS
EXCITER      = 000
RECEIVER     = S0/E0/PE0
XMTRFCOIL    = BODY
RCVRFCOIL    = BODY
FREQ         = 42663520 Hz
TIME         = 91/7/27 07:40:00
BASERUN      = 44032
CONFIGCODE   = _0201240000
SOFTREV      = 5.3
NUCLIDE      = 000
HEADERCODE   = 0x00000000
RCVCOILGAIN = 6.090  R1 = 13  R2 = 14  TG = 200
-------  Exam description   -------
NO COMMENT
------- Series description  -------
Body,Ax,2D,Spin  Echo,None
---------------------------------------------------
```

7-4 RFT Sample Test Outputs

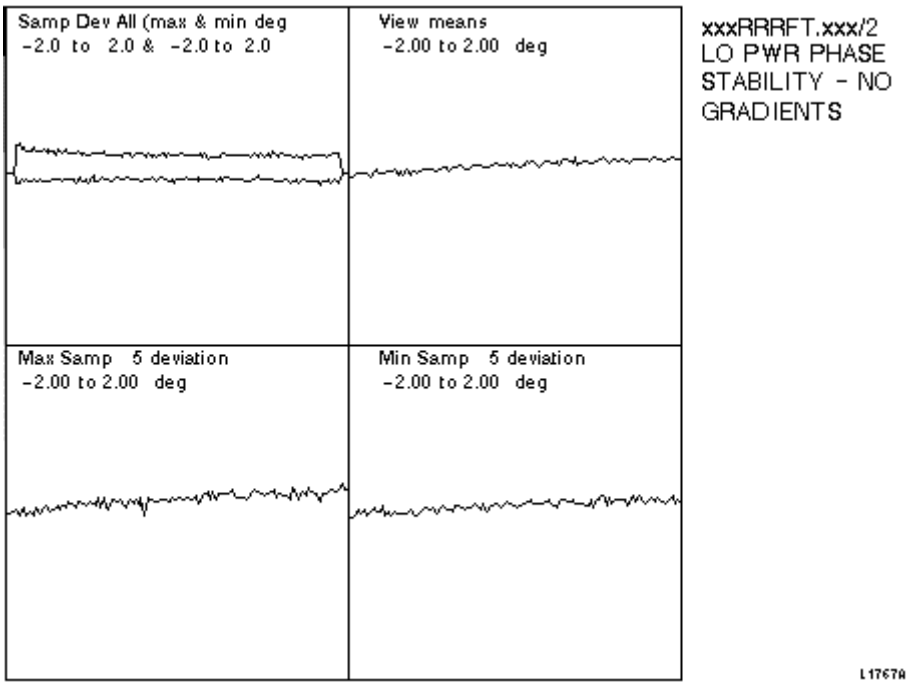
Refer to the following sections for sample RFT data for each test mode.

7-4-1 Low Power Magnitude (No Gradients) Stability Data

```
xxxxxxxx.RFT/1  LO PWR MAGNITUDE STABILITY - NO GRADIENTS
=========================================================
All values below are percent of peak pulse amplitude.
---------------------------------------------------------
max-min(pp)   + stdev     - stdev     + area      - area
    0.20        0.01        0.01       14.46      -14.99
---------------------------------------------------------
                           p-p        stdev
max sample column 157      0.16        0.02
min sample column  32      0.15        0.02
view means                 0.07        0.01
---------------------------------------------------------
```

7-4-2 Low Power Phase (No Gradients) Stability Data

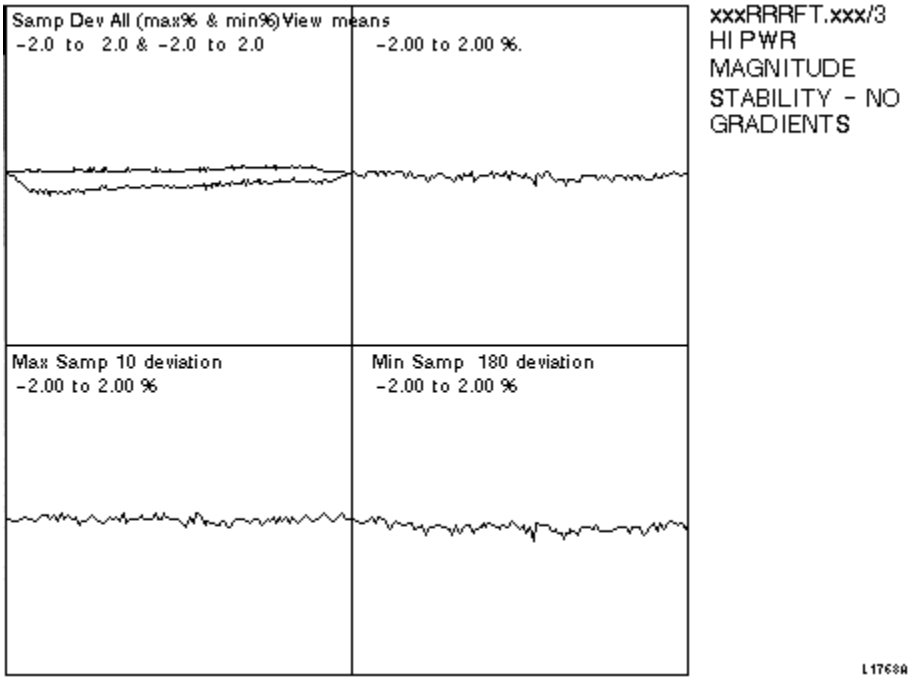
```
xxxxxxxx.RFT/2  LO PWR PHASE STABILITY - NO GRADIENTS
=============================================================
All values below are phase deviation in degrees.
-------------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.47         0.02        0.03       18.79      -28.01
-------------------------------------------------------------
                              p-p        stdev
max sample column    5        0.47        0.09
min sample column    5        0.47        0.09
view means                    0.12        0.02
-------------------------------------------------------------
```



RFT LOW POWER PHASE STABILITY (NO GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-1

7-4-3 High Power Magnitude (No Gradients) Stability Data

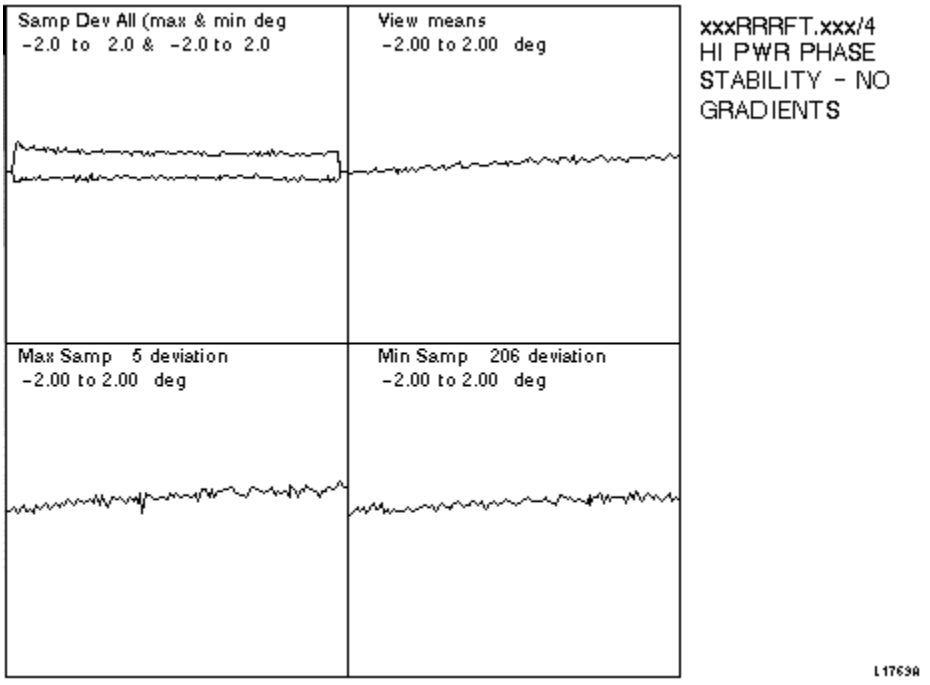
```
xxxxxxxx.RFT/3  HI PWR MAGNITUDE STABILITY - NO GRADIENTS
============================================================
All values below are percent of peak pulse amplitude.
------------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.28         0.01        0.03       10.26      -37.37
------------------------------------------------------------
                              p-p        stdev
max sample column  10         0.16        0.02
min sample column 180         0.21        0.04
view means                    0.17        0.03
------------------------------------------------------------
```



HIGH POWER MAGNITUDE STABILITY (NO GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-2

7-4-4 High Power Phase (No Gradients) Stability Data

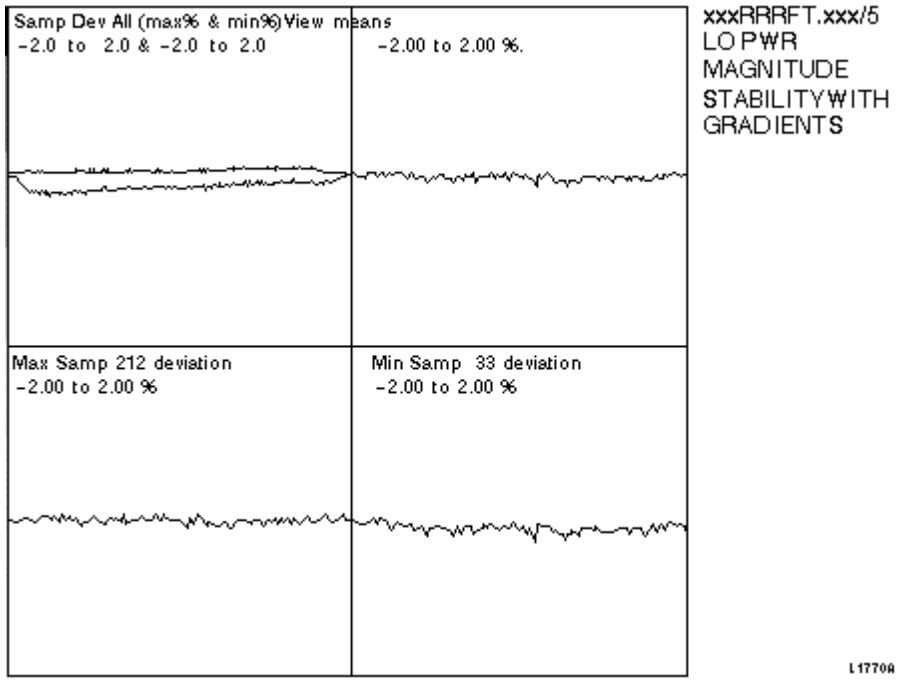
```
xxxxxxxx.RFT/4  HI PWR PHASE STABILITY - NO GRADIENTS
=============================================================
All values below are phase deviation in degrees.
-------------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.50         0.04        0.03       49.85      -32.21
-------------------------------------------------------------
                             p-p        stdev
max sample column   5        0.37        0.08
min sample column 206        0.40        0.05
view means                   0.29        0.04
-------------------------------------------------------------
```



HIGH POWER PHASE STABILITY (NO GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-3

7-4-5 Low Power Magnitude (With Gradients) Stability Data

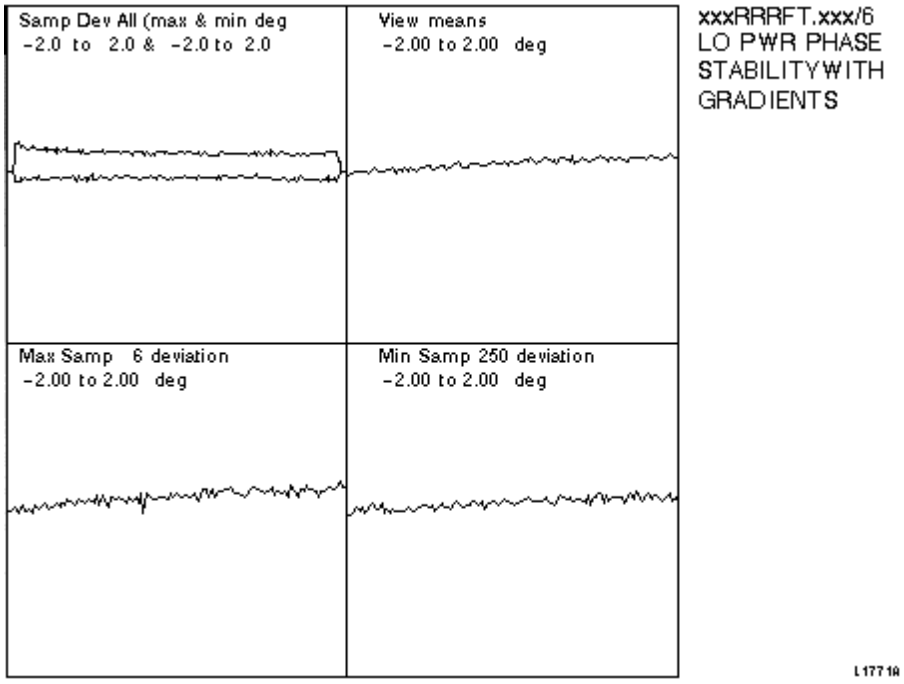
```
xxxxxxxx.RFT/5  LO PWR MAGNITUDE STABILITY WITH GRADIENTS
=========================================================
All values below are percent of peak pulse amplitude.
---------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.41         0.02        0.06       13.21      -32.16
---------------------------------------------------------
                             p-p        stdev
max sample column 212        0.15        0.03
min sample column  33        0.35        0.05
view means                   0.10        0.02
---------------------------------------------------------
```



LOW POWER MAGNITUDE STABILITY (WITH GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-4

7-4-6 Low Power Phase (With Gradients) Stability Data

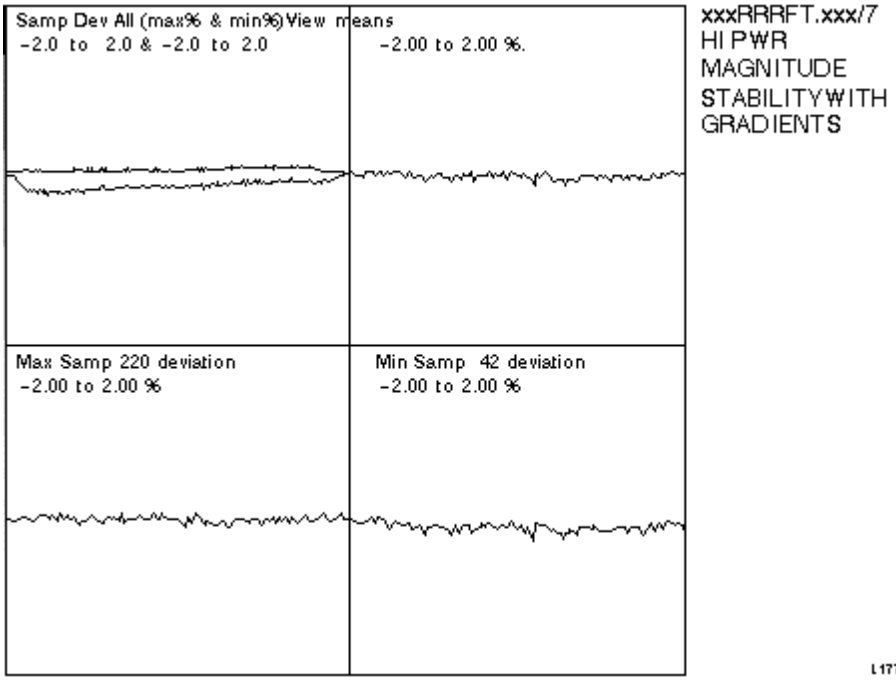
```
xxxxxxxx.RFT/6  LO PWR PHASE STABILITY WITH GRADIENTS
=========================================================
All values below are phase deviation in degrees.
---------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.42         0.02        0.03       15.76      -33.28
---------------------------------------------------------
                             p-p        stdev
max sample column   6        0.41        0.06
min sample column 250        0.34        0.06
view means                   0.12        0.02
---------------------------------------------------------
```



LOW POWER PHASE STABILITY (WITH GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-5

7-4-7 High Power Magnitude (With Gradients) Stability Data

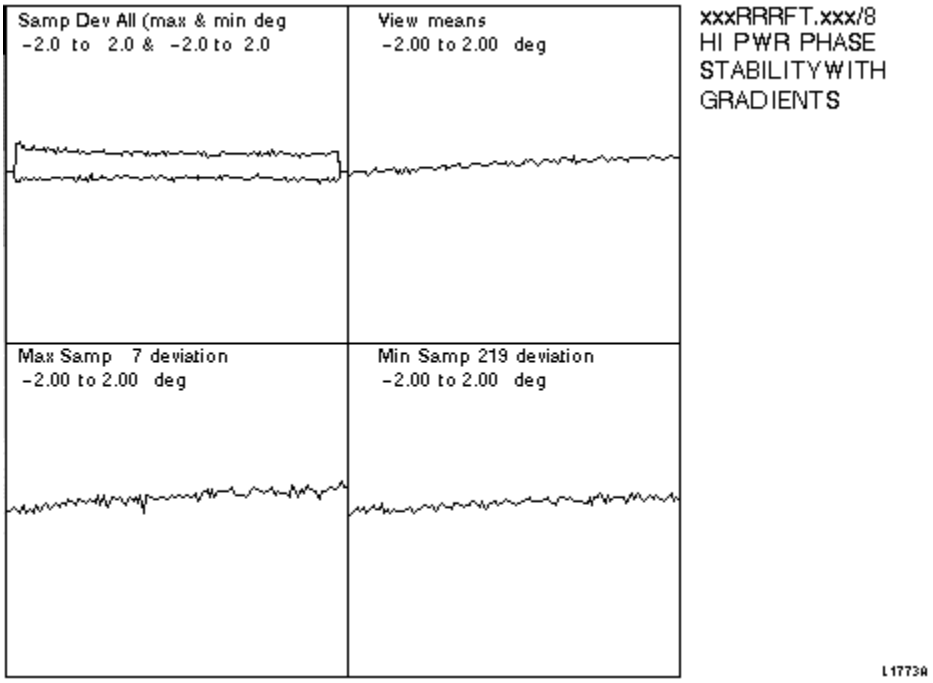
```
xxxxxxxx.RFT/7  HI PWR MAGNITUDE STABILITY WITH GRADIENTS
=========================================================
All values below are percent of peak pulse amplitude.
---------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.31         0.01        0.05       10.68      -34.00
---------------------------------------------------------
                             p-p        stdev
max sample column 220        0.15        0.03
min sample column  42        0.26        0.04
view means                   0.14        0.03
---------------------------------------------------------
```



HIGH POWER MAGNITUDE STABILITY (WITH GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-6

7-4-8 High Power Phase (With Gradients) Stability Data

```
xxxxxxxx.RFT/8  HI PWR PHASE STABILITY WITH GRADIENTS
=============================================================
All values below are phase deviation in degrees.
-------------------------------------------------------------
max-min(pp)    + stdev     - stdev     + area      - area
    0.45         0.05        0.01       57.23      -16.91
-------------------------------------------------------------
                             p-p         stdev
max sample column   7        0.42         0.08
min sample column 219        0.34         0.06
view means                   0.25         0.06
-------------------------------------------------------------
```



HIGH POWER PHASE STABILITY (WITH GRADIENTS) SAMPLE PLOTS
ILLUSTRATION 7-7

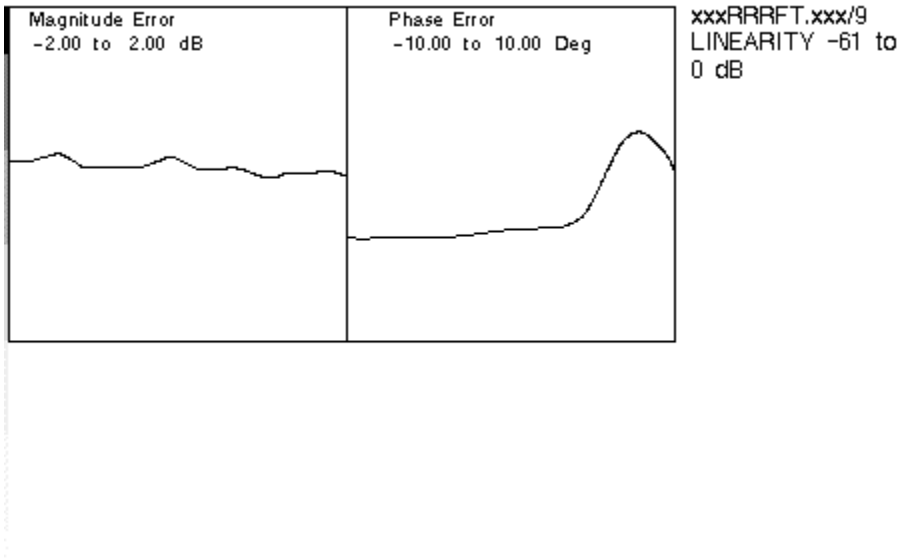
7-4-9 Linearity Data

```
xxxxxxxx.RFT/9    LINEARITY  -61 to 0 dB
============================================================
Carrier Leakage (dB below full scale modulation)

     N/A
------------------------------------------------------------
         Magnitude Linearity Error (dB)

    max          Min          P-P         Std Dev
    0.23        -0.02         0.25          0.06
------------------------------------------------------------
        Phase Linearity Error (degrees)

    max          Min          P-P         Std Dev
    2.41        -3.75         6.17          2.09
------------------------------------------------------------
```

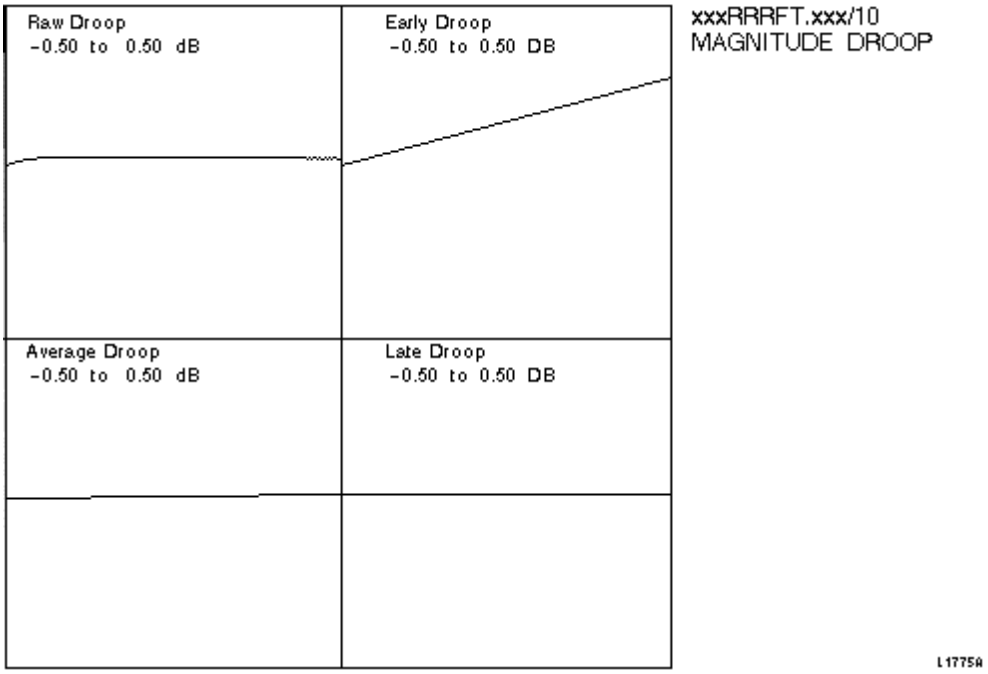


LINEARITY SAMPLE PLOT
ILLUSTRATION 7-8

7-4-10 Magnitude Droop Data

```
xxxxxxxx.RFT/10  MAGNITUDE DROOP
============================================================
Peak Amplitude  27260.2 counts
------------------------------------------------------------
Droop Rates in dB/millisecond

Early       0.0820
Average     0.0030
Late       -0.0000
------------------------------------------------------------
```



MAGNITUDE DROOP SAMPLE PLOT
ILLUSTRATION 7-9

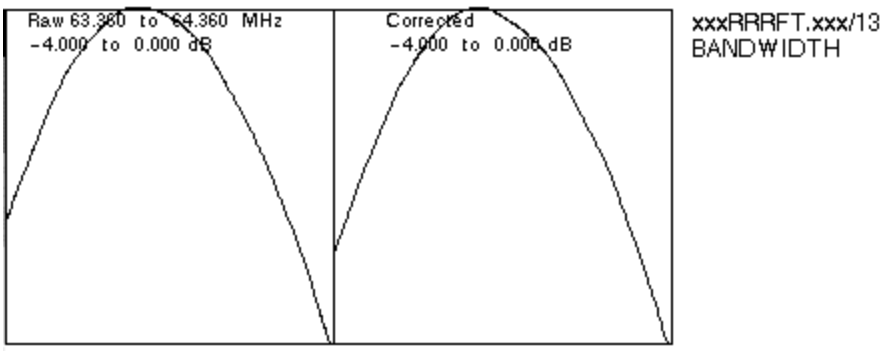
7-4-11 Bandwidth Data

```
xxxxxxxx.RFT/13    BANDWIDTH
=========================================================
Center Frequency              -0.25 dB Bandwidth

   63.777 MHz                      0.346 MHz
---------------------------------------------------------
Low -0.25 dB freq              High -0.25 dB freq

   63.612 MHz                     63.958 MHz
---------------------------------------------------------
Sweep start freq              Sweep end freq

   63.360 MHz                     64.360 MHz
---------------------------------------------------------
Cal File Data Acquired
No cal file required
---------------------------------------------------------
```



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RFT BANDWIDTH SAMPLE PLOT
ILLUSTRATION 7-10

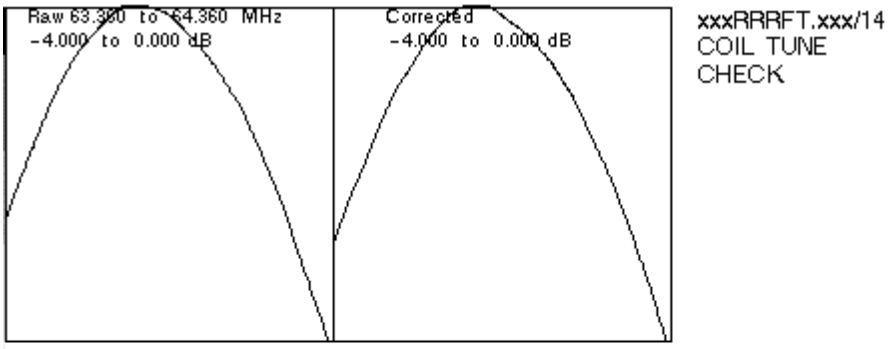
7-4-12 Coil Tune Check Data

```
xxxxxxxx.RFT/14    COIL TUNE CHECK
=========================================================
Center Frequency              -3.0 dB Bandwidth

   63.777 MHz                      0.346 MHz
---------------------------------------------------------
Low -3.0 dB freq              High -3.0 dB freq

   63.612 MHz                     63.958 MHz
---------------------------------------------------------
Sweep start freq              Sweep end freq

   63.360 MHz                     64.360 MHz
---------------------------------------------------------
Cal File Data Acquired
No cal file required
---------------------------------------------------------
```



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COIL TUNE CHECK SAMPLE PLOT
ILLUSTRATION 7-11

7-4-13 Config File Data

```
xxxxxxxx.RFT/15/15   SERVICE CONFIG FILE
============================================================
magnetSerNum        = "R244"
magnetType          = "GELCC-15"
fieldStrength       = "1.5T"
room                shielding (Yes/No) = "No"
magniShield         = (Yes/No) = "No"
shieldCooler        = type (0,1,2,3,4,5,6) = "4"
resistive           shim power supply (0,1,2,3,4,5,6) = "0"
RFAmpType           =(ErbtecTube, ErbtecSolidState, TELI Solid State) = "4"
spectroAmp          = (none, ENI) = "None"
line CondType       (0,1,2) = "2"
lineFreq            (50, 60) = "60"
SRMode              (120,77,20,17) = "120"
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""
ThisLineNotUsed     = ""

------------------------------------------------------
```

8- RFT THEORY

8-1 RFT Overview

RFT is an RF loop-back test that will quickly evaluate stability, magnitude and phase linearity, droop, pulse fidelity, and bandwidth of the RF transmit chain in a Signa system. This is accomplished by playing out four different RF pulses and collecting each one as a separate "echo". The first pulse has a wide flat top and is used for stability, droop and bandwidth testing. The second pulse has a narrower flat top and its amplitude increments during the scan for magnitude and phase linearity testing. The third pulse is a sync 2 and the fourth pulse is a sync 8. The amplitude of the third and fourth pulses is incremented like the second pulse for pulse fidelity analysis.

All tests are run at the following frequencies: (Actual magnet center frequency will not be used.)

1.5T - 63.86 MHz
1.0T - 42.57 MHz

For the bandwidth test, provision is made to characterize the Exciter/Receiver combination so that when the RF amp is tested the results can be corrected for errors in the Exciter/Receiver. When testing bandwidth using a sense loop in one of the scanner's transmit coils, the results will likewise be corrected for errors in the Exciter/RF Amplifier combination. User CVs are provided so the analysis tool can be told the exact status of the loop back configuration.

RFT Hardware

- A switchable attenuator controlled by the PSD through the DAB is required to extend the dynamic range of the linearity and stability tests. Linearity and stability data are collected twice, first with the transmit path attenuator set to 30 dB (IN) and again with it set to 0 dB (OUT). The receive path attenuator is 30 dB when the transmit path attenuator is 0 dB and vice versa. Stability data is collected twice more with a gradient pulse applied during the RF pulse. The switchable attenuator is used as before.

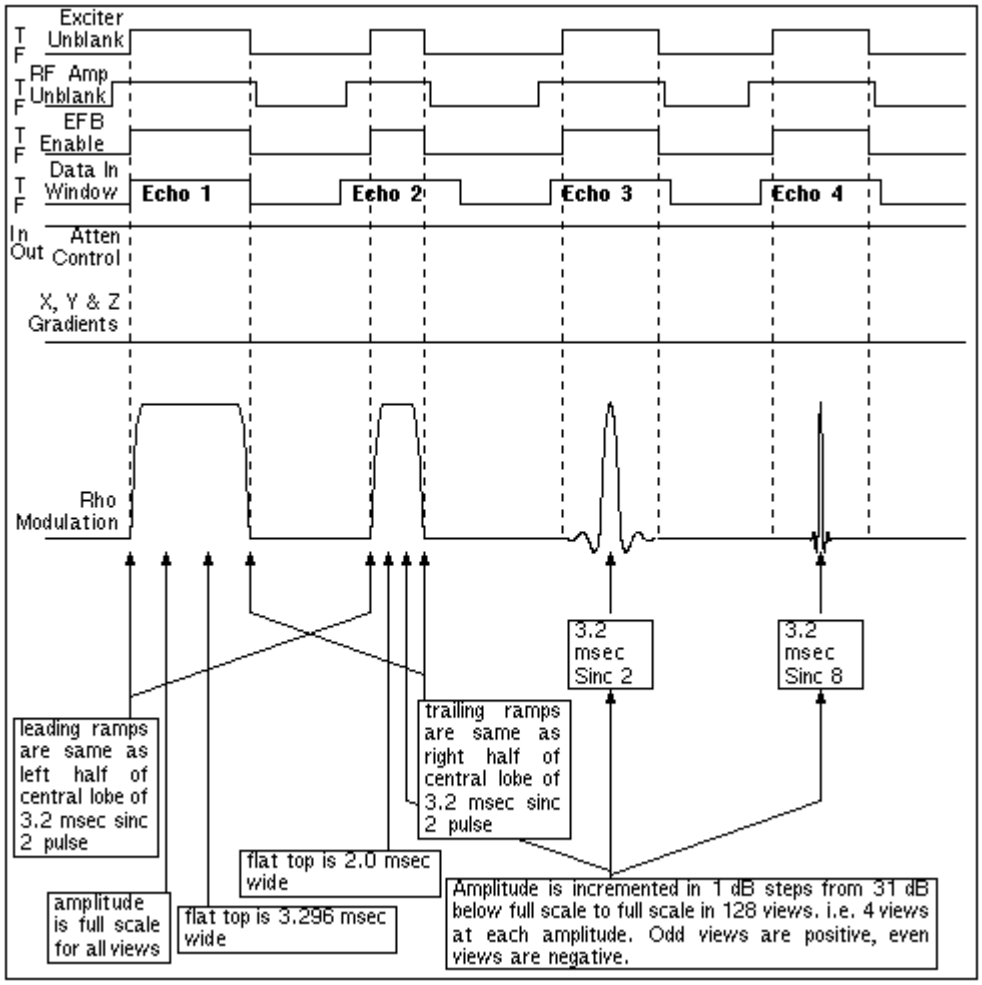
Testing Sequence

- This document is structured for four basic modes of running RFT: 1) baseline (reference) data collection, 2) coil tune check, 3) stability troubleshooting, and 4) pulse fidelity troubleshooting. Because the number of possible hardware and software configurations is large, flowcharts are provided for each mode. The flowcharts direct you to the appropriate tables and diagrams for software and hardware setup, prescan, and scan references.

8-2 Data Collection

First slice

The 128 views are collected with the switchable attenuator IN (i.e., transmit path set to 30 dB). Echo 2, 3, and 4 pulse amplitudes are incremented as specified in Illustration 8-1.



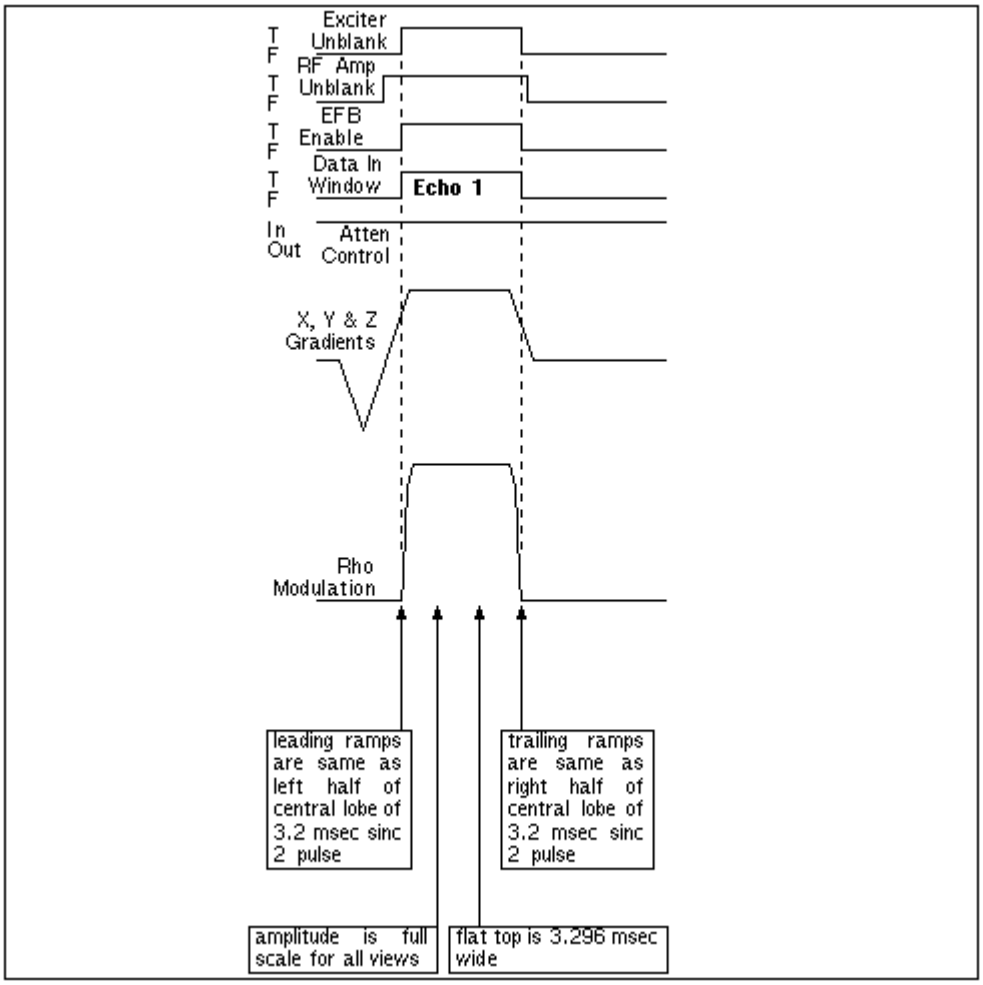
SLICE 1 & 2 DATA COLLECTION
ILLUSTRATION 8-1

Second slice

The 128 views are collected with the switchable attenuator OUT (i.e., transmit path set to 0 dB). Echo 2, 3, and 4 pulse amplitudes are incremented as specified in Illustration 8-1.

Third slice

The 128 views are collected with the switchable attenuator IN (i.e., transmit path set to 30 dB). Echo 2, 3, and 4 pulse amplitudes are set to zero with modulator unblank, EFB enable and Data In Windows disabled as specified in Illustration 8-2.



SLICE 3, 4, & 5 DATA COLLECTION
ILLUSTRATION 8-2

Fourth slice

The 128 views are collected with the switchable attenuator OUT (i.e., transmit path set to 0 dB). Echo 2, 3, and 4 pulse amplitudes are set to zero with modulator unblank, EFB enable and Data In Windows disabled as specified in Illustration 8-2.

Fifth slice

The switchable attenuator is OUT (i.e. transmit path set to 0 dB) and operating frequency is set to 500 kHz below 63.86 MHz (42.57 or 21.89 MHz). Transmit and receive frequency are incremented (1000/127) kHz per view while the echo 1 pulse is played out at full scale. The pulse amplitude for echoes 2, 3, and 4 is zero and the exciter and RF amplifier are not unblanked during the 128 views of the third slice. See Illustration 8-2.

8-3 Magnitude Stability Analysis (groups 1, 3, 5 and 7)

A magnitude matrix is calculated from echo 1 raw data. Each element in the normalization vector (**nvc**) contains the mean of the corresponding column in the magnitude matrix. Peak magnitude (**pkmag**) is the mean of elements 31 through 37 in the normalization vector. Each element in the sample max vector (**smaxc**) contains the maximum of the corresponding column in the normalized magnitude matrix. (**cmax**) is element number (**c**) for which smaxc is maximum. Each element in the sample min vector (**sminc**) contains the minimum of the corresponding column in the normalized magnitude matrix. (**cmin**) is element number (**c**) for which sminc is minimum. Each element in the view means vector (**vmeanr**) contains the mean of the corresponding row in the normalized magnitude matrix.

The test provides plots of "Sample Deviation All" (max% & min%), "View Means" (%), "Max Sample Deviation" (%), and "Min Sample Deviation" (%). Report data file summary:

- Max-Min (p-p)
- +Stdev
- -Stdev
- +Area
- -Area
- Max Sample Column
- Min Sample Column
- View Means

8-4 Phase Stability Analysis (groups 2, 4, 6 & 8)

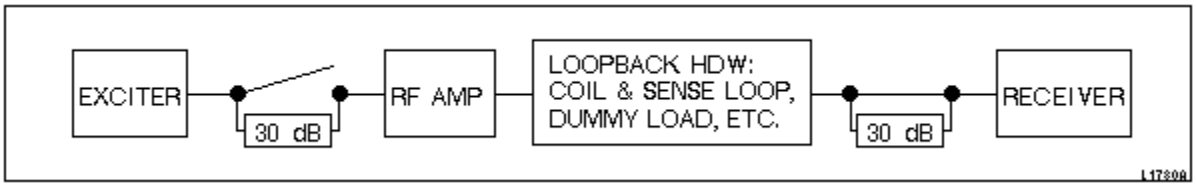
An unwrapped phase matrix is calculated from echo 1 raw data. Each element in the normalization vector (**nvc**) contains the mean of the corresponding column in the unwrapped phase matrix. Each element in the sample max vector (**smaxc**) contains the maximum of the corresponding column in the normalized phase matrix. (**cmax**) is element number (**c**) for which smaxc is maximum. Each element in the sample min vector (**sminc**) contains the minimum of the corresponding column in the normalized phase matrix. (**cmin**) is element number (**c**) for which sminc is minimum. Each element in the view means vector (**vmeanr**) contains the mean of the corresponding row in the normalized phase matrix.

The test provides plots of "Sample Deviation All" (max% & min%), "View Means" (%), "Max Sample Deviation" (%), and "Min Sample Deviation" (%). Report data file summary:

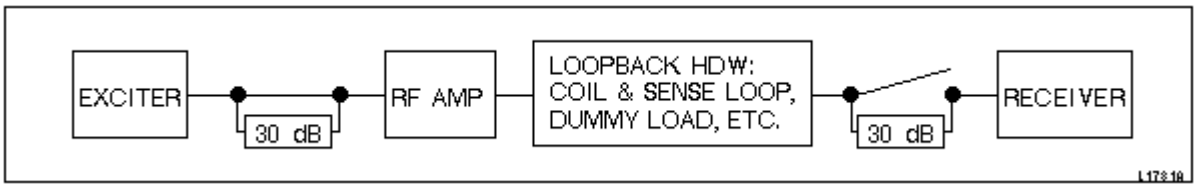
- Max-Min (p-p)
- +Stdev
- -Stdev
- +Area
- -Area
- Max Sample Column
- Min Sample Column
- View Means

8-5 Linearity And Carrier Leakage Analysis (group 9)

Data for Linearity and Carrier Leakage Analysis is collected in passes (slices) 1 and 2 of the scan. The second echo is analyzed for linearity. Polarity of the RF modulation is alternated on every other view and 4 views are taken at each magnitude. Therefore, there are 2 positive pulses and 2 negative pulses for each amplitude. Amplitude is incremented in 1.0 dB steps beginning at 31.0 dB below full scale and ending at full scale for a total of 32 different amplitudes in each pass. The switchable attenuator inserts 30 dB between output of the exciter and input of the RF amplifier or in the loopback path between output of the RF amplifier and input of the receiver. See Illustration 8-3 and Illustration 8-4. Since pulse amplitude is incremented through 32 dB in each pass and the attenuation change is 30 dB between passes, there is 2 dB of overlap in RF amplifier output between passes 1 and 2. This overlap is used to smoothly splice together linearity data for the two passes yielding a total dynamic range for the linearity test of 62 dB.



PASS 1 & 3 SWITCHABLE ATTENUATOR CONDITION
ILLUSTRATION 8-3



PASS 2, 4, & 5 SWITCHABLE ATTENUATOR CONDITION
ILLUSTRATION 8-4

The test provides plots of "Magnitude Error" (dB), and "Phase Error" (deg). Report data file summary:

- Carrier Leakage
- Magnitude Linearity Error (Max)
- Magnitude Linearity Error (Min)
- Magnitude Linearity Error (p-p)
- Magnitude Linearity Error (Std Dev)
- Phase Linearity (Max)
- Phase Linearity (Min)
- Phase Linearity (p-p)
- Phase Linearity (Std Dev)

8-6 Magnitude Droop Analysis (group 10)

Data for this test is collected in pass (slice) 2 of the scan. The first echo is analyzed for magnitude droop.

The test provides plots of "Raw Droop", "Early Droop", "Average Droop", and "Late Droop".

Report data file summary:

- Peak Amplitude
- Early Droop Rate
- Average Droop Rate
- Late Droop Rate

8-7 Sync 2 Pulse Fidelity Analysis (group 11) (TPS Loopback only)

Data for this test is collected in pass (slice) 2 of the scan. The third echo is analyzed for pulse fidelity.

The test provides plots of "+Half Scale Slice Error" (dB), "+Full Scale Slice Error" (%), "-Half Scale Slice Error" (%) and "-Full Scale Slice Error" (dB). Report data file summary:

- + Full Scale Slice Amplitude
- + Full Scale Total Error
- + Full Scale Pulse Amplitude
- + Half Scale Slice Amplitude
- + Half Scale Total Error
- - Full Scale Slice Amplitude
- - Full Scale Total Error
- - Full Scale Pulse Amplitude
- - Half Scale Slice Amplitude
- - Half Scale Total Error

8-8 Sync 8 Pulse Fidelity Analysis (group 12) (TPS Loopback only)

Data for this test is collected in pass (slice) 2 of the scan. The fourth echo is analyzed for pulse fidelity.

The test provides plots of "+Half Scale Slice Error" (dB), "+Full Scale Slice Error" (%), "-Half Scale Slice Error" (%) and "-Full Scale Slice Error" (dB). The Report data file summary is:

- + Full Scale Slice Amplitude
- + Full Scale Total Error
- + Full Scale Pulse Amplitude
- + Half Scale Slice Amplitude
- + Half Scale Total Error
- - Full Scale Slice Amplitude
- - Full Scale Total Error
- - Full Scale Pulse Amplitude
- - Half Scale Slice Amplitude
- - Half Scale Total Error

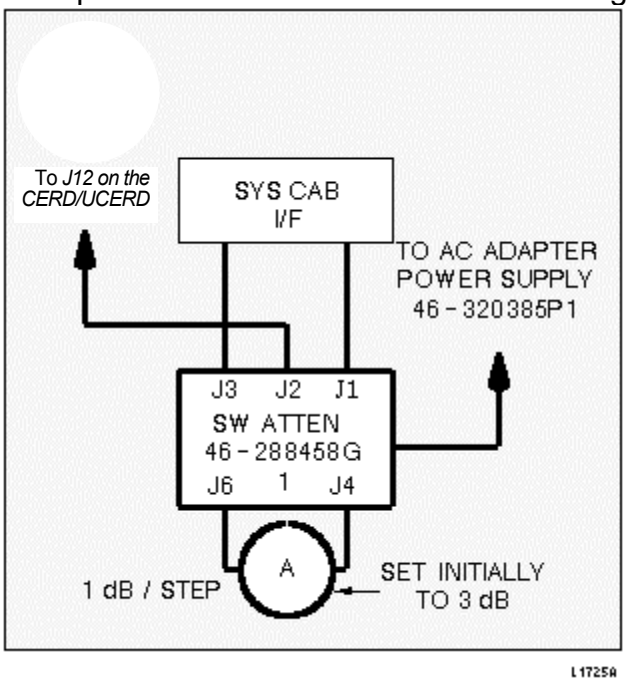
8-9 Magnitude Bandwidth Analysis (group 13 & 14)

Data for this test is collected in pass (slice) 5 of the scan. The first echo is analyzed for magnitude bandwidth.

Reference files are stored in /usr/g/service/data. They are required for the following conditions:

TPS Reference File (Group 13):

- The bandwidth test is run with output of the TPS looped back to the input of the receiver via the switchable attenuator as shown in Illustration 8-5. See Table 8-1 to determine when a copy of the filtered plot data will be written to the file /usr/g/service/data/tpsbw.cal.



TPS LOOPBACK SETUP
ILLUSTRATION 8-5

RF Amp Body Mode Reference File (Group 13):

- The bandwidth test will be run with output of the RF amplifier looped back through suitable attenuation to the input of the receiver via the switchable attenuator as shown in (Body Dummy Load, EFB Bypassed). See Table 8-1 to determine when a copy of the filtered plot data (prior to TPS bandwidth correction) will be written to the file /usr/g/service/data/bodybw.cal.

TABLE 8-1
BW CAL FILE LOGIC

OPUSER 1	OPUSER 2	OPUSER 7	READ CAL FILE	WRITE CAL FILE	RESULT FILE NUMBER	DBDOWN
0	0	0	none	none	13	-.5
0	0	1	none	tpsbw.cal	13	-.5
1	0	0	tpsbw.cal	none	13	-.5
2	0	0	tpsbw.cal	none	13	-.5
2	0	1	tpsbw.cal	headbw.cal	13	-.5
2	1	0	headbw.cal	none	13	-.5
3	0	0	tpsbw.cal	none	13	-.5
4	0	0	tpsbw.cal	none	13	-.5
4	0	1	tpsbw.cal	bodybw.cal	13	-.5
4	1	0	bodybw.cal	none	13	-.5
7	0	0	tpsbw.cal	none	13	-.5
7	0	1	tpsbw.cal	preampbw.cal	13	-.5
7	1	0	preampbw.cal	none	14	-.3

RF Amp Head Mode Reference File (Group 13):

- The bandwidth test will be run with output of the RF amplifier looped back through suitable attenuation to the input of the receiver via the switchable attenuator as shown in (Head Dummy Load, EFB Bypassed). See Table 8-1 to determine when a copy of the filtered plot data (prior to TPS bandwidth correction) will be written to the file /usr/g/service/data/headbw.cal.

Coil Tune Check Preamplifier Mode Reference File (Group 14):

- The bandwidth test will be run with output of the body preamplifier looped back through suitable attenuation to the input of the receiver as shown in Body tests (Coil Tune Body Preamplifier) & (Body Coil Tune Sense Loop), and Head tests (Coil Tune Head Preamplifier) & (Head Coil Tune Sense Loop). See Table 8-1 to determine when a copy of the filtered plot data (prior to TPS bandwidth correction) will be written to the file /usr/g/service/data/preampbw.cal.
- The test provides plots of "Raw" (MHz), and "Corrected" (MHz). Report data file summary:
  - Center Frequency
  - -0.5dB Bandwidth
  - Low -0.5dB Frequency
  - High -0.5dB Frequency
  - Sweep Start Frequency
  - Sweep End Frequency
  - Cal File Data Acquired

APPENDIX A - DATA SHEETS

1.5T RFT BODY/HEAD DATA

Site:	Name:		Date:
RFT File Number:			
Coil:	❑ Body ❑ Head	❑ Body ❑ Head	**Body/Head Spec.**
LO PWR MAGNITUDE STABILITY - NO GRADIENTS			5.0%*(1.0% no EFB) (MAX - MIN (PP) %) **[Note 1]**
LO PWR PHASE STABILITY - NO GRADIENTS			10.0°* (1.5° no EFB) (MAX - MIN (PP) °)
HI PWR MAGNITUDE STABILITY - NO GRADIENTS			1.0% (MAX - MIN (PP) %)
HI PWR PHASE STABILITY - NO GRADIENTS			1.5° (MAX - MIN (PP) %)
LO PWR MAGNITUDE STABILITY - WITH GRADIENTS			1.0% (MAX - MIN (PP) %) **[Note 1]**
LO PWR PHASE STABILITY - WITH GRADIENTS WITH EFB ENABLED			1.5° (MAX - MIN (PP) %)
HI PWR MAGNITUDE STABILITY - WITH GRADIENTS			1.0% (MAX - MIN (PP) %)
HI PWR PHASE STABILITY - WITH GRADIENTS			1.5° (MAX - MIN (PP) %)
MAGNITUDE LINEARITY -61 to 0 dB with EFB ENABLED			2.0 dB p-p (MAX (dB))
MAGNITUDE LINEARITY -61 to 0 dB with EFB BYPASSED			2.5 dB p-p (MAX (dB))
PHASE LINEARITY -61 to 0 dB with EFB ENABLED			30 %* (MAX - MIN (PP) %)
PHASE LINEARITY -61 to 0 dB with EFB BYPASSED			12 %* (MAX - MIN (PP) %)
MAGNITUDE DROOP			Not Available
BANDWIDTH			.5 dB down @ +/- 100 kHz from 63.86 MHz
COIL TUNE CHECK			BODY: 63.86 MHz +/- 50 kHz HEAD: 63.11 MHz +/- 50 kHz

Note 1 – Noisy RF envelope feedback hardware on APB Boards (RF/PEN Cabinet) and APM Boards (RF/PEN II Cabinets) can cause erroneous failures of low power magnitude stability tests. Disregard failures from systems with these RF Cabinets.

1.0T RFT BODY/HEAD DATA

Site:	**Name:**		**Date:**
RFT File Number:			
Coil:	❑ **Body** ❑ **Head**	❑ **Body** ❑ **Head**	**Body/Head Spec.**
LO PWR MAGNITUDE STABILITY - NO GRADIENTS WITH EFG ENABLED			5.0%*(1.0% no EFB) (MAX - MIN (PP) %) **[Note 1]**
LO PWR PHASE STABILITY - NO GRADIENTS WITH EFB ENABLED			10.0°* (1.5° no EFB) (MAX - MIN (PP) °)
HI PWR MAGNITUDE STABILITY - NO GRADIENTS WITH EFB ENABLED			1.0% (MAX - MIN (PP) %)
HI PWR PHASE STABILITY - NO GRADIENTS WITH EFB ENABLED			1.5° (MAX - MIN (PP) %)
LO PWR MAGNITUDE STABILITY - WITH GRADIENTS WITH EFB ENABLED			1.0% (MAX - MIN (PP) %) **[Note 1]**
LO PWR PHASE STABILITY - WITH GRADIENTS WITH EFB ENABLED			1.5° (MAX - MIN (PP) %)
HI PWR MAGNITUDE STABILITY - WITH GRADIENTS WITH EFB ENABLED			1.0% (MAX - MIN (PP) %)
HI PWR PHASE STABILITY - WITH GRADIENTS WITH EFB ENABLED			1.5° (MAX - MIN (PP) %)
MAGNITUDE LINEARITY -61 to 0 dB with EFB ENABLED			2.0 dB p-p (MAX (dB))
MAGNITUDE LINEARITY -61 to 0 dB with EFB BYPASSED	NOT USED		2.5 dB p-p (MAX (dB))
PHASE LINEARITY -61 to 0 dB with EFB ENABLED			30 %* (MAX - MIN (PP) %)
PHASE LINEARITY -61 to 0 dB with EFB BYPASSED	NOT USED		12 %* (MAX - MIN (PP) %)
MAGNITUDE DROOP			Not Available
BANDWIDTH			.5 dB down @ +/- 100 kHz from 42.68 MHz
COIL TUNE CHECK			BODY: 42.68 MHz +/- 50 kHz HEAD: NO SPEC

Note 1 – Noisy RF envelope feedback hardware on APB Boards (RF/PEN Cabinet) and APM Boards (RF/PEN II Cabinets) can cause erroneous failures of low power magnitude stability tests. Disregard failures from systems with these RF Cabinets.

APPENDIX B - CV DESCRIPTIONS

Name	Meaning	Controls	Allowable Values	Conditions required for values other than zero
EFB Bypass (opuser0)	0= No 1= Yes	Sets allowable values for RFAmpMode (opuser1) & Bandwidth (opuser6)	[0.0 to 1.0]	None **NOTE:** Set to 0 for RF/PDU or SRF Cabinet.
RFAmpMode (opuser1)	0= Exciter 1= Head Dummy Load 2 = Head coil load 3= Body Dummy Load 4= Body coil load 5= Test 6= SSDriver 7= Coil tune check	RF Amp Operating Mode 0= Standby 1= Head Mode 2 = Head mode 3= Body Mode 4= Body mode 5= Test mode 6= Head Mode 7= Standby	[0.0 to 7.0]	If RFAmpMode = 5 or 6 then EFB bypass must = 1. If RFAmpMode = 1, 2 or 6, then op coil must = 1 (Head coil) If RFAmpMode = 3 or 4, then op coil must = 2 (Body coil) Note: opcoil is coil selection
Sense Loop (opuser2)	0= No 1= Yes	Sets allowable value for BW Cal (opuser7)	[0.0 to 1.0]	RFAmpMode = 2, 4 or 7 only
StabNoGrad (opuser3)	0 = Tests Disabled 1= Yes	0 = No Stability Analysis 1 = Do Stability Analysis Note: Slices 1 & 2, echo 1 will always be played out even if StabNoGrad = 0.	[0.0 to 1.0]	None
Lin&Fidlty (opuser4)	0 = Test Disabled 1 = Lin only 2 = Lin & Fidelity	0 = Slices 1 & 2, echo 1 only 1 = Slices 1 & 2, echoes 1 & 2 2 = Slices 1 & 2, 4 echoes	[0.0 to 2.0]	If Lin&Fidlty = 2 then RFAmpMode must = 0 (Exciter)
Stab/Grad (opuser5)	0 = Test Disabled 1 = X Gradient Only 2 = Y Gradient Only 3 = Z Gradient Only	0 = Slices 3 & 4 not done 1 = do slices 3 & 4 w/ X grad. 2 = do slices 3 & 4 w/ Y grad 3 = do slices 3 & 4 w/ Z grad	[0.0 to 4.0]	None

	4= All Gradients	4 = do slices 3 & 4 w/ all grad. Note: Slices 3 & 4 will be played out but not analyzed if Stab/Grad = 0 and Bandwidth = 1.		
Bandwidth (opuser6)	0 = Test Disabled 1 = Test Enabled	0 = slice 5 not done 1 = Do slice 5 Sets allowable value for BW Cal	[0.0 to 1.0]	RFAmpMode = 0 or 7 OR RFAmpMode = 1, 2, 3 or 4 AND EFB Bypass = 1
BW Cal (opuser7)	0 = Disabled 1 = Enabled	Analysis Use Only	[0.0 to 1.0]	Bandwidth = 1 AND RFAmpMode = 0, 2, 4 or 7 AND Sense Loop = 0

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	Sep 11, 1998	K. L-P	Initial version in Word
1	Mar 16, 1999	Resa Lambert	Beginning corrections and cleanup of procedure.
2	May 6, 1999	Resa Lambert	Real scrub in in-house bays.
3	July 20, 1999	Resa Lambert	Corrected BRM-F measured value. Changed all EFB Bypass 1 CV's to 0 (zero).
4	Oct 19, 1999	Resa Lambert	Added Power Amp Isolation test in section 3-6-2. Changed all EFB Bypass 0 CV's to 1 because MRIge53530 was not fixed properly.
5	Dec 2, 1999	Resa Lambert	Removed notes from Appendix A.
6	Aug 25, 2000	Mark Jones	Deleted old illus. 3-1 (not needed). Replaced old illus. 3-4. Added (new) illus. 3-12 and 3-13. Cleaned up and renumbered other illus. Updated report file descriptions and plots. Deleted unneeded "proprietary procedure" notes. Numerous minor text changes for clarity. Deleted references to DAB.
7	Jan. 2, 2002	Don Thome'	Added references SRF Cabinet. Added comments concerning low power magnitude stability failures.
8	Feb. 12, 2003	D. Thome'	Added Note on page 20 to make sure J5 not connected.