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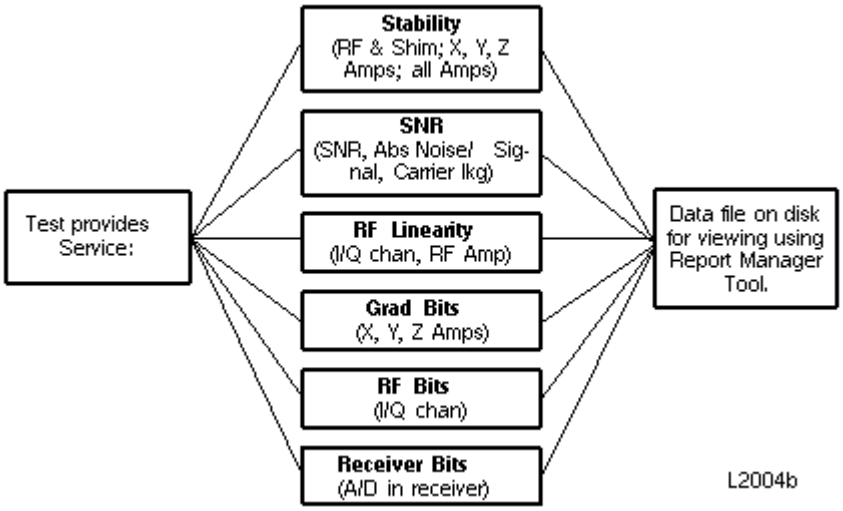
Description

Small Sample Test (SST) may be run as a group of tests, or individually, to check multiple subsystem functions. Illustration 1-1 shows the individual tests executed by SST, along with the actions required to view/obtain test results.



INDIVIDUAL TESTS EXECUTED BY SST
ILLUSTRATION 1-1

1- SST OVERVIEW

Note

Starting with ASP2 software the SNR Test, RF Linearity Test, Gradient Bits Test, RF Bits Test and Receiver Bits Test have been removed from SST. Use SPT to check SNR and use RFT to check RF linearity. The other tests are obsolete.

Note

For version 12x or Excite HD, SST will only work in the Gradient Stability mode. All other tests are not supported.

SST tests the transceiver, RF deck, gradient amplifiers, and head/body preamplifier sections of the Signa Advantage, Signa Horizon, Signa EXCITE systems; this represents most of the analog circuitry of the system. SST does not test body, head, or surface coils. The SST test principle is to pulse RF into a small sample (0.014M $NiCl_2$ solution), and then analyze the characteristics of the received echo to measure various parameters of the system.

There are two primary ways to run SST to analyze system performance. Two scans should be performed with hardware configuration for body and head full power. (Both full power tests—body and head modes—are run with the RF amplifier body output at full power.) The Universal SST kit provides a means of running additional bypass modes to help isolate bad hardware, as well as provide means to test multicoil hardware.

1-1 SST Test Hardware

The original SST kit (46-287357G1, G2) is a collection of all items needed to set up and perform the various SST test modes. The major items in the various SST kits are listed below and described in the Procedure for SST (Theory).
For the original SST kit, 46-287357G2, see Table 1-1.

TABLE 1-1
SST KIT 46-287357G2 HARDWARE

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	0.01M $CuSO_4$ Solution Vial (obsolete - replace w/item 14)	46-287780G1	3
2	Coil, for 1.5T systems	46-301220G1	1
3	Column Assembly	46-301219G1	1
4	Cable, 0.5 ft., RG58, with BNC connectors	46-251920G4	1
5	Cable, 10 ft., RG223 with BNC connectors	46-251710G9	1
6	Attenuator, Variable 0-10 in 1db steps	46-255838P3	1
7	Attenuator, Variable 0-1 in 0.1db steps	46-255838P7	1
8	RF Combiner Assembly, for 1.5T systems	46-264790G1	1
9	Cable, 5ft., RG58, with BNC connectors	46-251710G4	4
10*	TR Filter	46-288356G1	1
11*	Coil, for 0.5T systems	46-317276G1	1
12*	RF Combiner Assembly, for 0.5T systems	46-288480G1	1
13*	Cable, 1 ft., RG58 with BNC connectors	46-282803G16	2
14*	0.014M $NiCl_2$ Solution Vial	46-287780G2	3
15*	Service Tool Adapter, for 0.5T/1.0T systems	46-317222G2	1

*Items 10 through 15 are not in the G1 version of this kit, which is made for 1.5T systems only.
The other items needed to run SST with the 46-287357 kit are listed below:

- 30-dB 200-watt RF attenuator,
  46-255837P10, or can substitute 30-dB attenuator (46-317724P14) from RF Power Measurement Kit (46-317724G2)

- 10-ft N-to-N cable (46-255595G3) from RF Cable Kit, 46-255816G1

- Grafidy Holder Base Plate, 46-271410G1

The Universal Kits (46-320383G1 through G7) provide a means of running additional bypass modes to help isolate bad hardware, and a means of testing multicoil hardware.

Note

Additional hardware is also included to perform procedures unrelated to SST, including RF Test (RFT) and High Speed Stability Tests (HSS).

Universal SST kit 46-320383G1 contents related to running SST can be found in Table 1-2.

TABLE 1-2
UNIVERSAL SST KIT 46-320383G1 HARDWARE

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	0.014M $NiCl_2$ Solution Vial	46-287780G2	3
2	Universal Coil, 1.5T Proton	46-320153G1	1
3	Universal Coil, 0.5T Proton	46-320153G2	1
4	Cable, 5ft., RG58, with BNC connectors	46-251710G4	4
5	Cable, 1ft., RG58, with BNC connectors	46-282803G16	2
6	Cable, 0.5 ft., RG58, with BNC connectors	46-251920G4	1
7	Cable, 10 ft., RG223 with BNC connectors	46-251710G9	1
8	Attenuator, Variable 0-10 in 1dBsteps	46-255838P3	1
9	Attenuator, Variable 0-1 in 0.1Bsteps	46-255838P7	1
10	Attenuator, Fixed 50 ohm, 20 dB	46-258601P2	1
11	Attenuator, Fixed 50 ohm, 10 dB	46-258601P3	1
12	Case of Connectors	46-301042G1	1
13	RF Combiner Assembly, for 1.5T systems	46-264790G1	1
14	RF Combiner Assembly, for 0.5T systems	46-288480G1	1
15	TR Filter	46-288356G1	1
16	Quick Disconnect Adapter for 1.5T systems	46-282468G3	1
17	Quick Disconnect Adapter for 0.5T/1.0T systems	46-317222G2	1
18	8-way Power Divider for 1.5T systems	46-320324P1	1
19	8-way Power Divider for 0.5T systems	46-320324P2	1

The other items needed to run SST with the 46-320383 kits are listed below:

- 30-dB 200-watt RF attenuator,
  46-255837P10, or can substitute 30-dB attenuator (46-317724P14) from RF Power Measurement Kit (46-317724G2)

- 10-ft N-to-N cable (46-255595G3) from RF Measurement Kit (46-317724G2)

The G2 version of the Universal kit is the same as G1 with the addition of a coil for spectroscopy (49-320153G3, 1.5T phosphorus).

The other items needed to run 1.0T SST are listed in Table 1-3. These items are included with the 46-320383G4 and G6 versions of the kit:

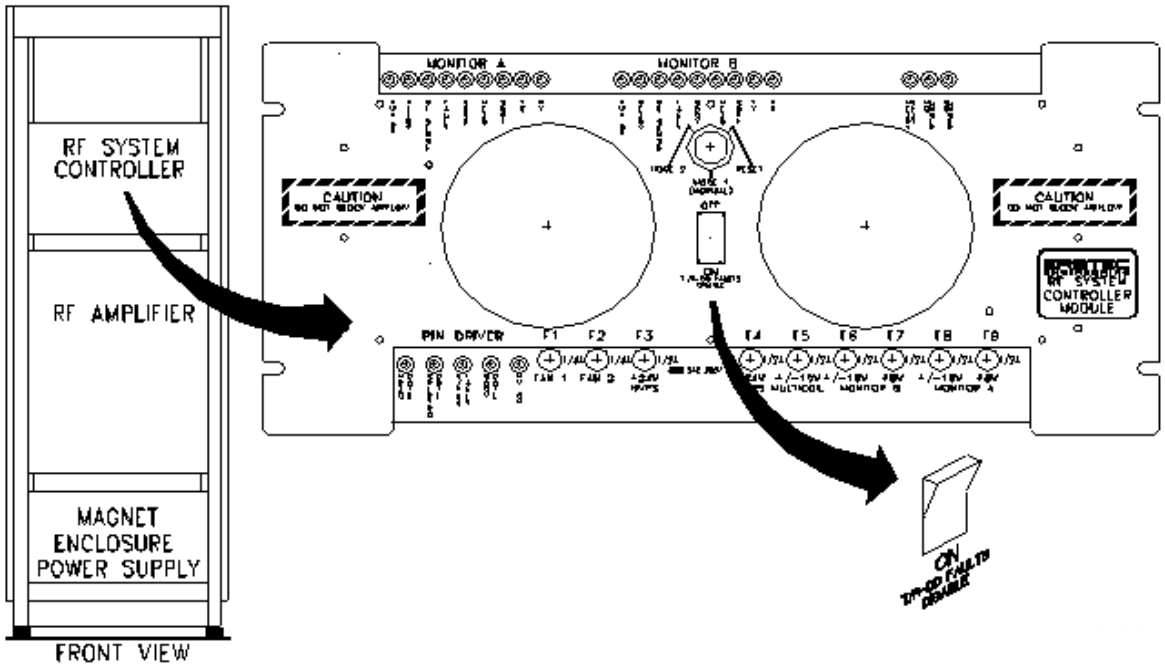
TABLE 1-3
ITEMS NEEDED TO RUN 1.0T SST

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Universal Coil, 1.0T Proton	46-320153G4	1
2	RF Combiner Assembly, for 1.0T systems	46-321430G1	1

2- T/R DRIVER BOARD SERVICE MODE ACTIVATION

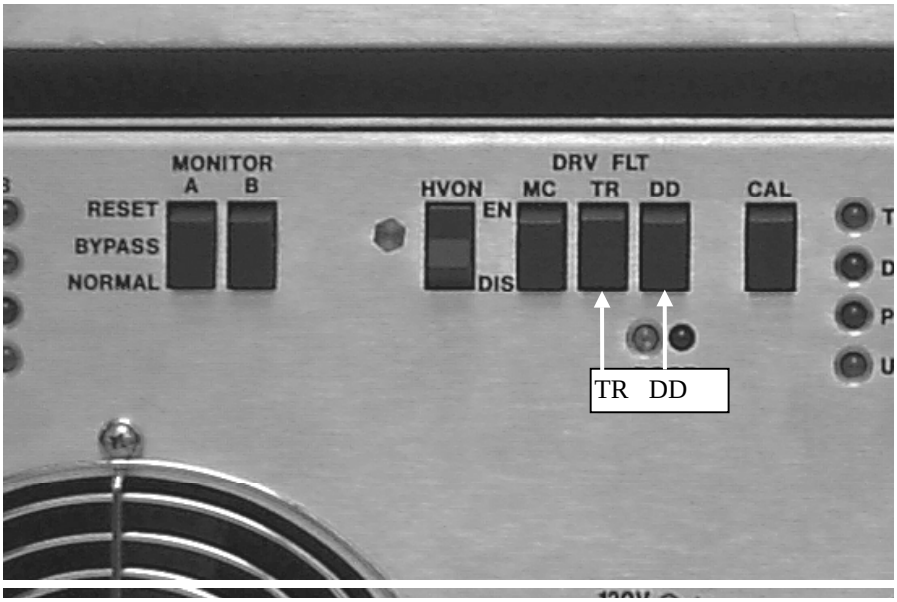
See illustrations listed below for T/R Driver or T/R Driver Board Service Mode Activation:

- **For RF Pen** cabinet with RF System Controller: Set the T/R-DD Faults Disable switch on the front of the RF System Controller to the ON position to disable reporting T/R-DD Faults. See Illustration 2-1.



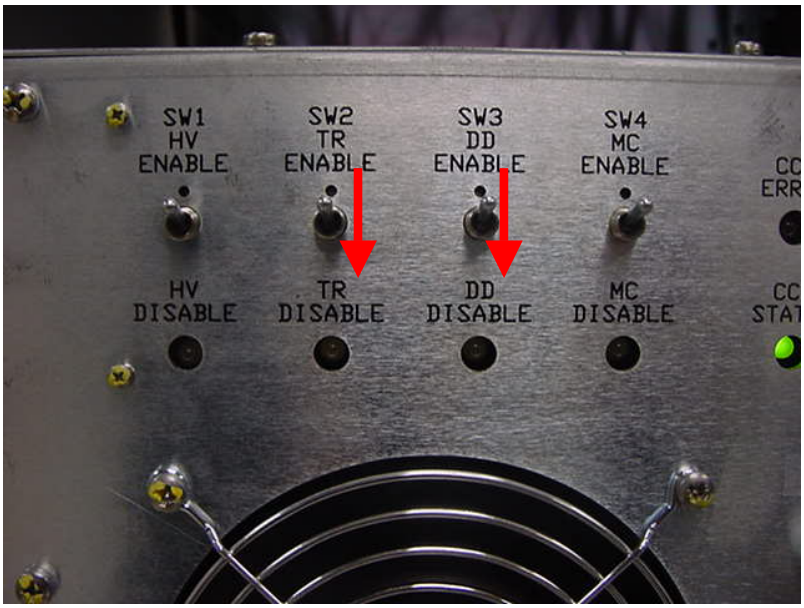
T/R DRIVER BOARD SERVICE MODE - RF PEN I
ILLUSTRATION 2-1

- **For RF Pen II, RF/PDU, SRFD, and SRFD2 Cabinets:** Set DRV FLT switches TR and DD to the DIS (disable) position as shown in Illustration 2-2.



RF PEN II, RF/PDU, SRFD, SRFD2 - FRONT PANEL SWITCHES DISABLED
ILLUSTRATION 2-2

- For Excite HD Driver Module Set DRV FLT switches TR and DD to the DIS (disable) position as shown in Illustration 2-3.



EXCITE HD WITH NEW DRIVER MODULE
ILLUSTRATION 2-3

3- SST HEAD FULL POWER TEST

3-1 Coil and Base Plate Setup

1. Click on **[New Pt]**.

2. Select the 0.014M $NiCl_2$ sample vial from SST kit; this is the recommended solution for all systems. SST results using $NiCl_2$ solution are not sensitive to temperature variations as those using $CuSO_4$ solution are.

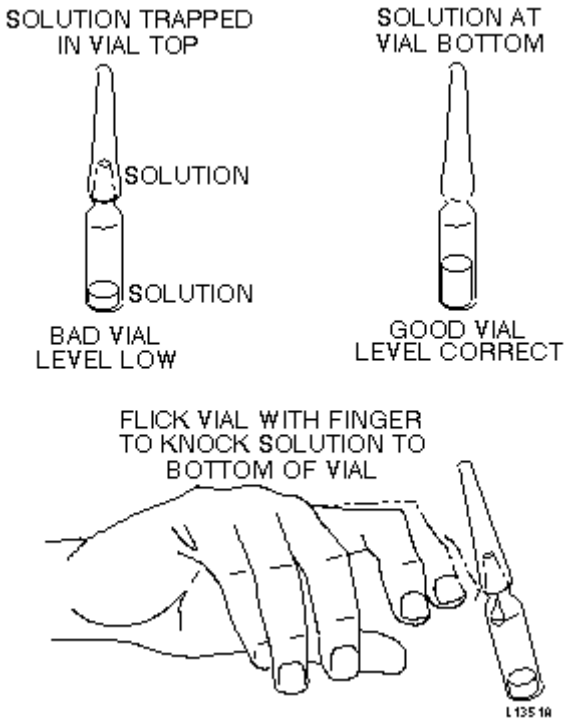
WARNING!

POISON HAZARD! SAMPLE CONTAINS NICKEL, A SUSPECTED CARCINOGEN. DO NOT INGEST. DISPOSE OF AS A HAZARDOUS WASTE ACCORDING TO STATE AND FEDERAL REGULATIONS.

3. Inspect solution level in sample vial to ensure correct fluid level. If solution level is incorrect due to solution being trapped in vial top, correct by flicking vial with finger to knock solution to bottom of vial. See Illustration 3-1.

Note

If any solution remains trapped in the upper portion of the vial, the SNR test will probably fail. If vial is cracked or damaged and solution is leaking out, dispose of the vial immediately per local regulations.



SAMPLE VIAL LEVEL CHECK
ILLUSTRATION 3-1

4. Remove the head holder from the cradle.

5. Select the proper SST RF coil for the system (1.5T or 1.0T).

6. Connect cable from coil to proper adapter: **For 1.5T**, use Extremity Coil/Linear Head Coil Adapter or 1.5T Service Tool Interface; **For 1.0T**, use Service Tool Interface Adapter.

Note

Do *NOT* use a Surface Coil Adapter; it will not work for this test.

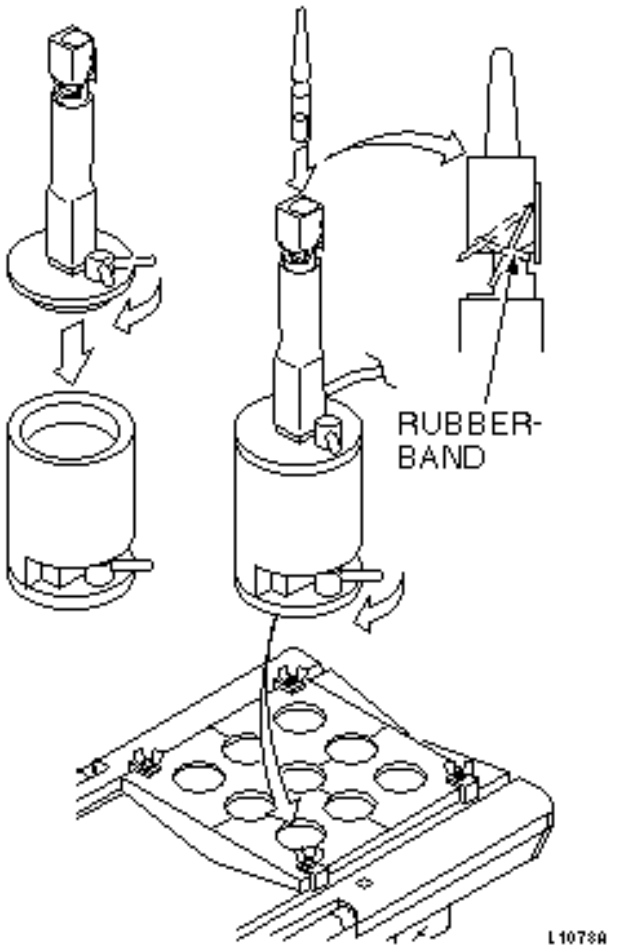
7. Position base plate on patient table near head end of cradle.

Steps 8 through 10 are for Original SST kits (46-287357) only.

8. Position column on base plate in position indicated in Illustration 3-2. Turn lever to lock in place.

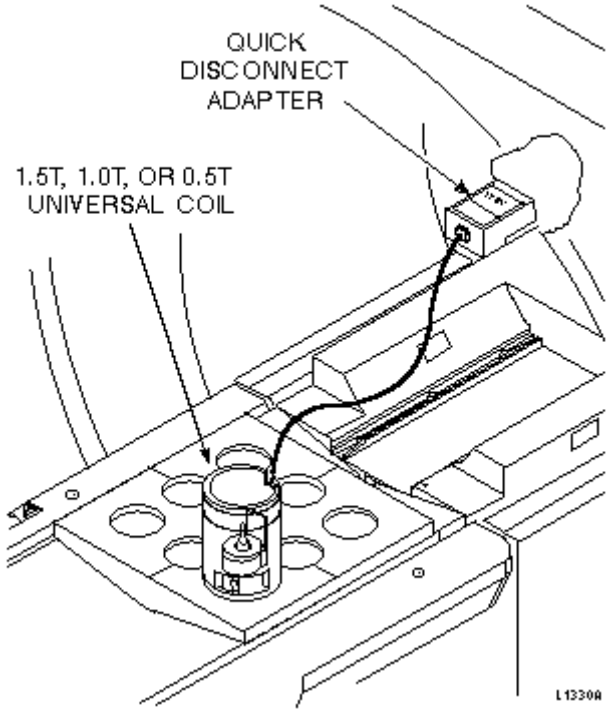
9. Position SST coil on column and turn lever to lock in place. See Illustration 3-2. This arrangement will offset the sample vial 10 cm in the X, Y, and Z directions from isocenter.

10. Pull back wire bail and insert sample vial into coil assembly. Ensure that sample vial is pushed all the way down into coil assembly, then release wire bail to lock vial in place (small rubber band must be intact on bail to hold the sample in place). See Illustration 3-2.



ORIGINAL SST COIL AND COLUMN POSITIONING
ILLUSTRATION 3-2

11. **This step is for Universal kits (46-320383) only**. Place the 1.5T, or 1.0T Universal SST Coil into base plate in corner as shown in Illustration 3-3 and turn lever to lock to base plate. (This arrangement offsets the sample vial 10 cm in the X, Y, and Z directions from isocenter). Unwrap entire length of cable from around coil. Insert the sample vial into the Universal Proton Coil.



UNIVERSAL SST COIL
ILLUSTRATION 3-3

12. Insert applicable head coil adapter or Service Tool Interface into Head T/R Switch.

Note

Do *NOT* use a Surface Coil Adapter; it will not work for this test.

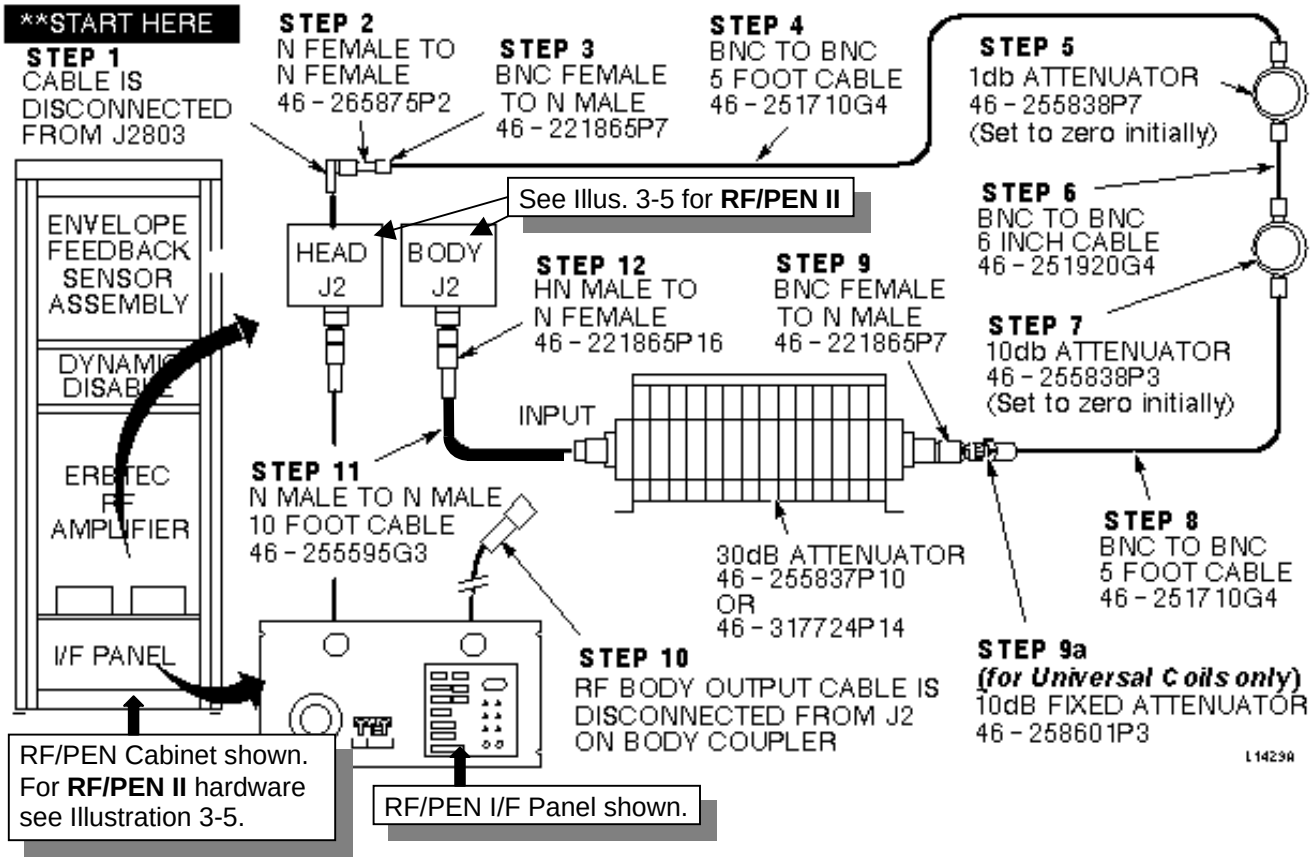
13. Landmark at center of base plate (not on the coil). Press MOVE TO SCAN to send the coil to isocenter.

Note

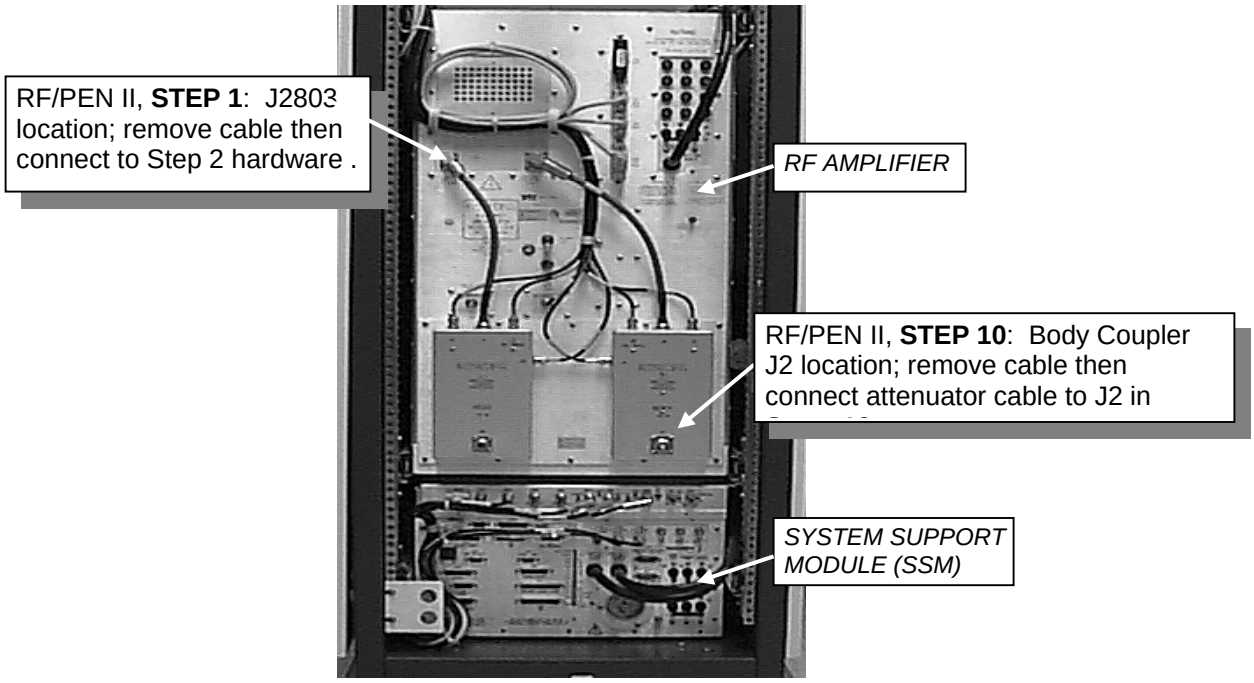
Software automatically turns on the bore vent for every scan. SST is done with the bore vent on to detect any noise problems it may be causing.

3-2 RF Cabinet Alterations

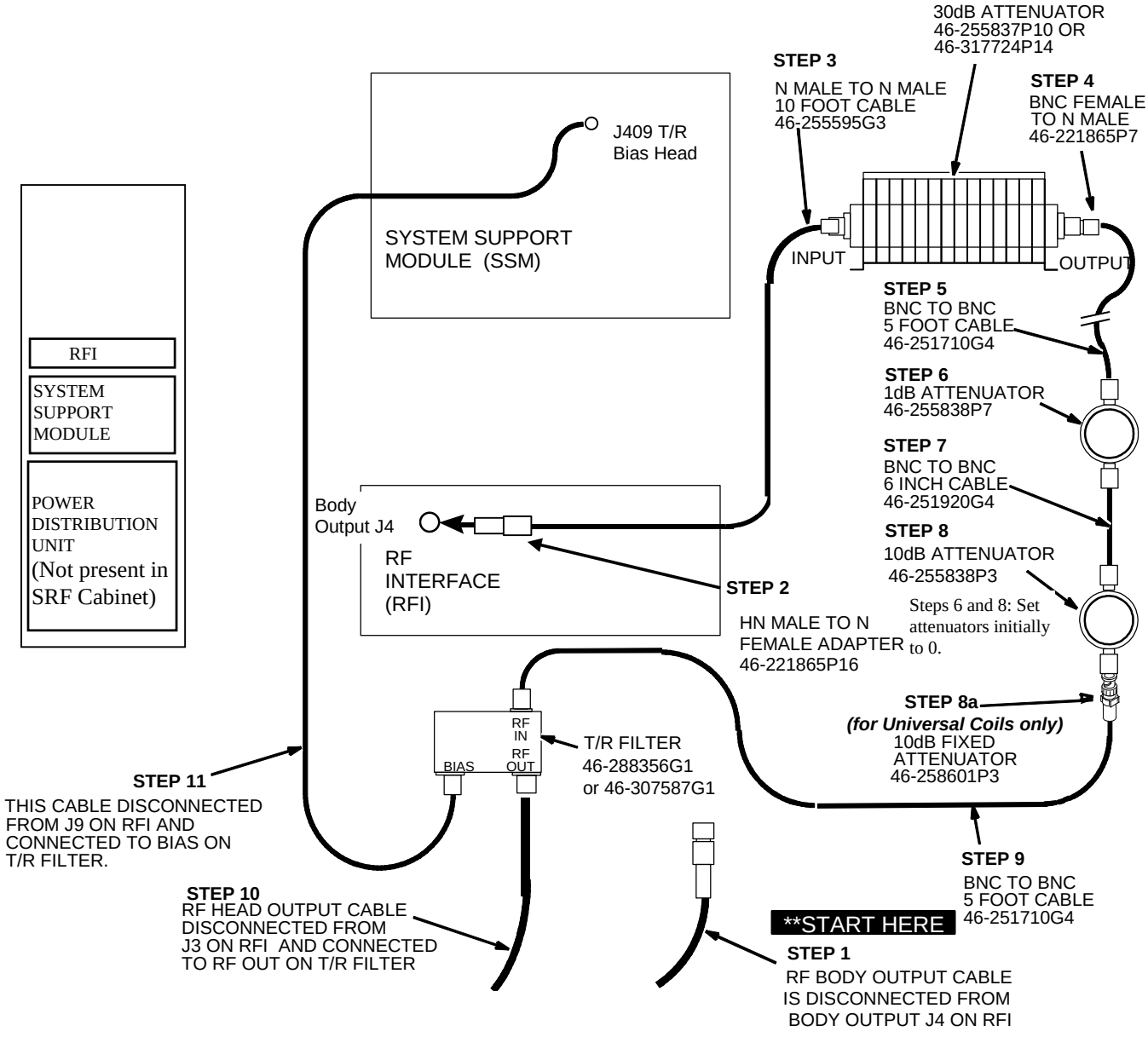
RF Pen Cabinet: See Illustration 3-4 (follow steps in numerical order).
RF Pen II Cabinet: See Illustrations 3-4 and 3-5 (follow steps in numerical order).
RF/PDU or SRFD Cabinet: See Illustrations 3-6 and 3-7.
SRFD2 Cabinet: See Illustration 3-8.
RFS Cabinet: See Illustration 3-8A.



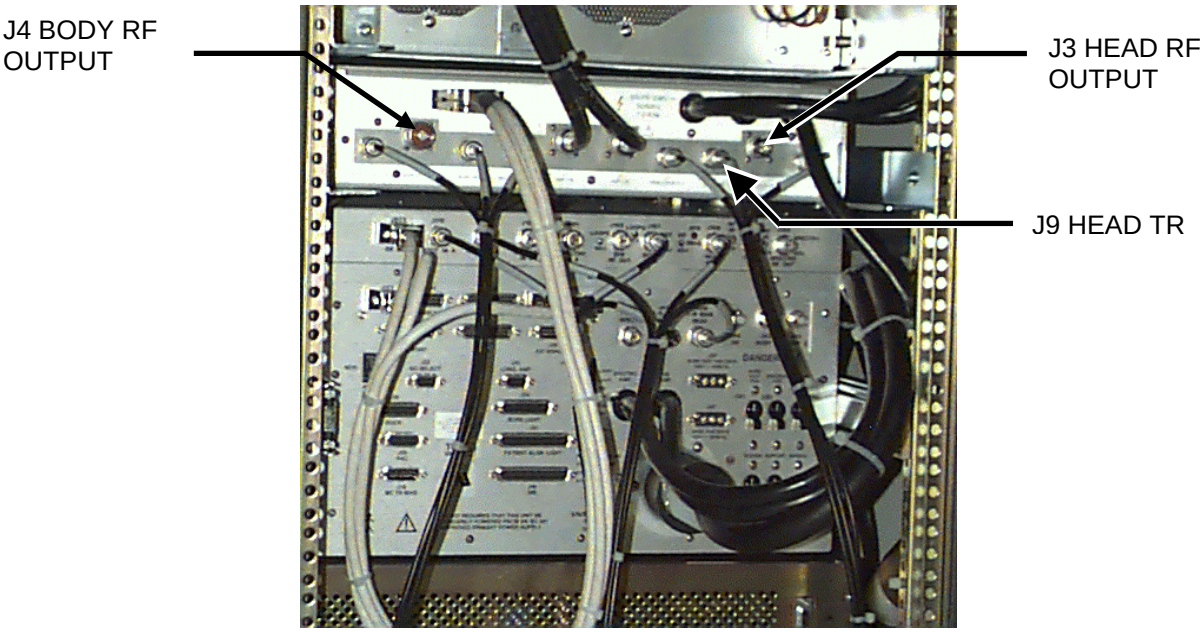
RF/PEN AND RF/PEN II CABINET ALTERATIONS - SST HEAD FULL POWER
ILLUSTRATION 3-4



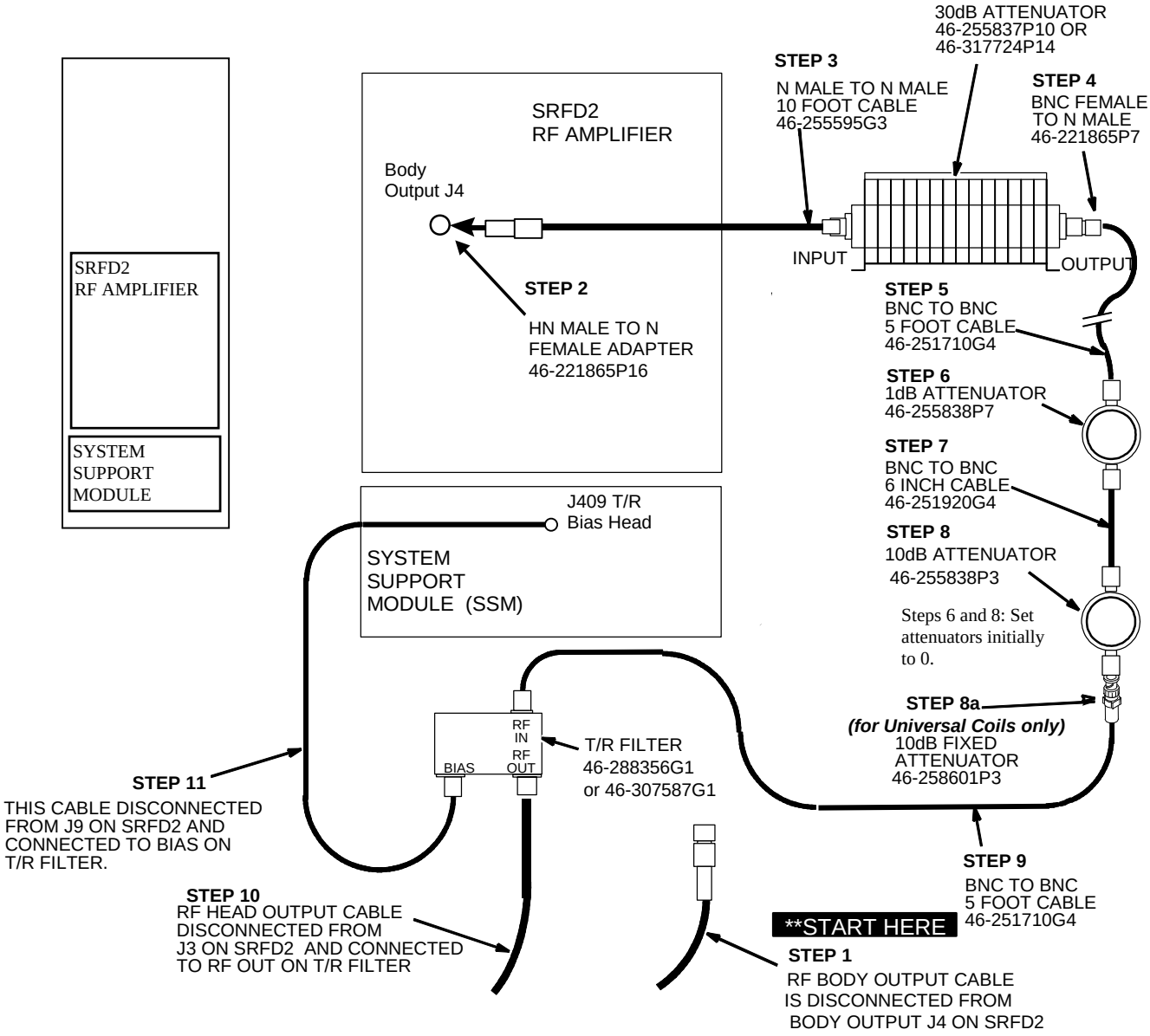
RF/PEN II HARDWARE AND CABLE LOCATIONS – SST HEAD FULL POWER
ILLUSTRATION 3-5



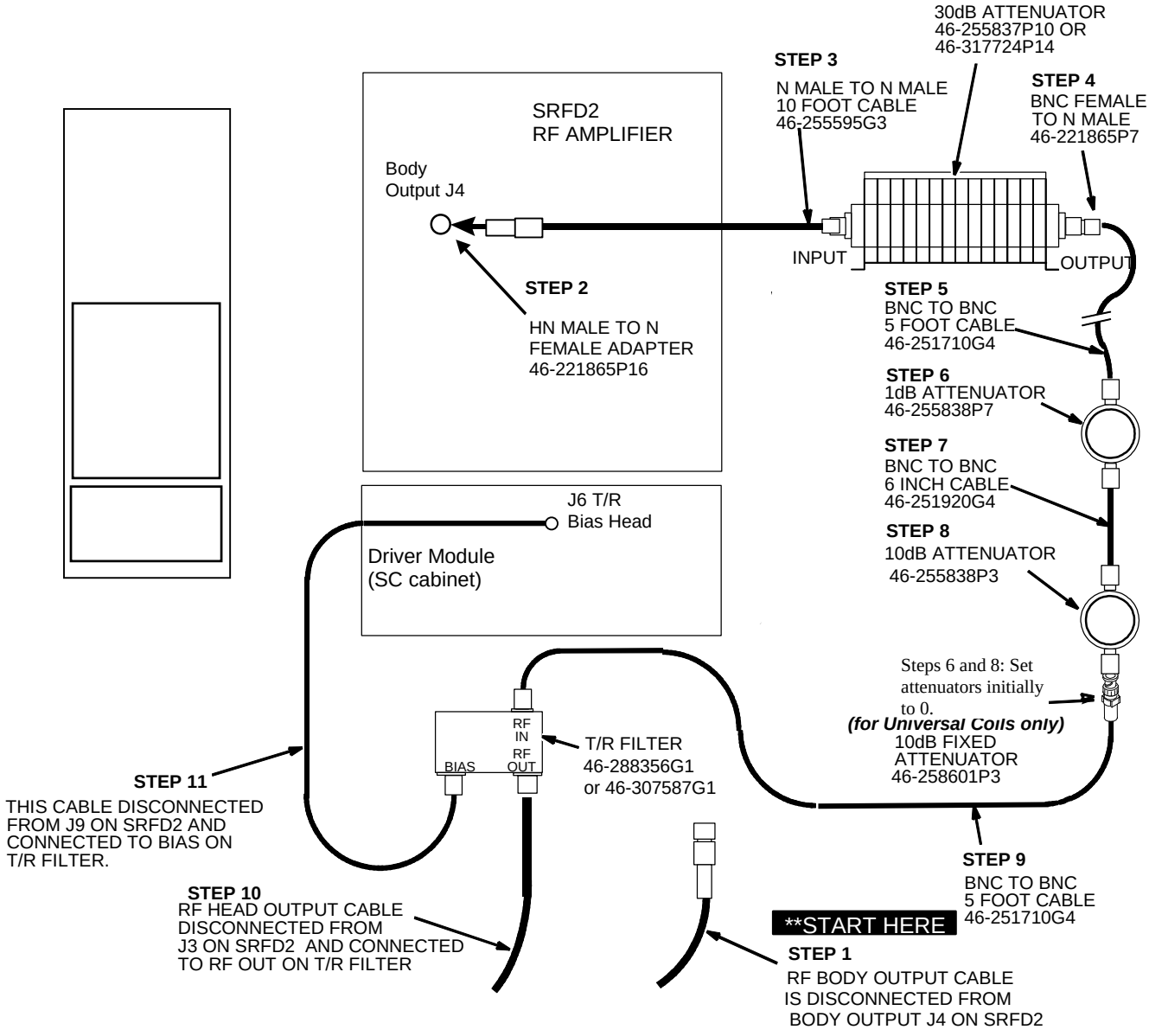
RF/PDU AND SRF CABINET ALTERATIONS - SST HEAD FULL POWER
ILLUSTRATION 3-6



RF/PDU AND SRF: RFI AND SYSTEM SUPPORT MODULE (SSM)
ILLUSTRATION 3-7



SRFD2 CABINET ALTERATIONS - SST HEAD FULL POWER
ILLUSTRATION 3-8



RFS CABINET - SST HEAD FULL POWER
ILLUSTRATION 3-8A

3-3 Scan Prescription

For ***TwinSpeed***, the user should select a GradMode (**WHOLE** or **ZOOM**) and keep to the same one throughout the test in the SST protocol.

1. Set up scan protocol as follows: Id: **geservice**, Name: **SST head**, Weight (lb.): **111**

Note

On the Patient Position screen, several characters can be typed in the Exam description field as comments. (Comments are displayed on the Report Header Info. Screen.

2. Click on **[Patient Protocols]** and select **Service**. In the Protocol field, type **o.26.1** (o=Other, 1=series number) to load the SST Head Full Power protocol. **<Enter>**. For ***TwinSpeed***, select the GradMode.

Note

On the Patient Position screen, several characters can be typed in the Series description field as comments. (Comments are displayed on the Report Header Info. Screen.)

3. **[User CVs]**, enter *Coil/Sample* CV 7 value:
2=O/N (original SST coil/$NiCl_2$ sample, **3**=U/N (universal SST coil/$NiCl_2$).

Note

Always use the 0.014M $NiCl_2$ sample vial from the SST Kit; this is the recommended solution for all systems. SST results using the $NiCl_2$ solution are not sensitive to temperature variations as are those using $CuSO_4$.

4. Change test selections as desired; protocol selects all. Refer to Table 3-1A for test option information for 8.3 or ASP1 software. Refer to Table 3-1B for test option information for ASP2 software. Click on **[Accept]**.

Note

Starting with ASP2 software the SNR Test, RF Linearity Test, Gradient Bits Test, RF Bits Test and Receiver Bits Test have been removed from SST. Use SPT to check SNR and use RFT to check RF linearity. The other tests are obsolete.

TABLE 3-1A
SST STABILITY TEST MODES (*8.3 OR ASP1 SOFTWARE ONLY*)

TEST OPTION	MODE	DESCRIPTION	PSD TIME MIN: SECS
STABILITY	0	TEST OFF	--
	-1	NO GRADIENTS (X,Y, & Z GRADIENTS IN READY)	1:18
	-11	NO GRADIENTS (X, Y, & Z GRADIENTS IN STANDBY)	1:20
	1	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN READY)	2:36
	11	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN STANDBY)	2:44
	21	NO GRADIENTS & X GRADIENT (Y IN READY & Z IN STANDBY)	2:44
	31	NO GRADIENTS & X GRADIENT (Y IN STANDBY & Z IN READY)	2:44
	2	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN READY)	2:36
	12	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN STANDBY)	2:44
	22	NO GRADIENTS & Y GRADIENT (X IN STANDBY & Z IN READY)	2:44
	32	NO GRADIENTS & Y GRADIENT (X IN READY & Z IN STANDBY)	2:44
	3	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN READY)	2:36
	13	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN STANDBY)	2:44
	23	NO GRADIENTS & Z GRADIENT (X IN READY & Y IN STANDBY)	2:44
	33	GRADIENTS & Z GRADIENT (X IN STANDBY & Y IN READY)	2:44
	4	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN READY)	6:30
	14	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN STANDBY)	6:56
RF S/N	-1	NOISE ONLY (***NOTE**: RF S/N should not be used to measure SNR. Use SPT to measure SNR.*)	1:13
	0	TEST OFF	
	1	TEST ON	1:13
RF LINEARITY	0	TEST OFF	
	1	TEST ON	2:16
GRADIENT BITS	0	TEST OFF	
	1	TEST ON (***NOTE**: Gradient bits tests only the upper 16 gradient data bits. The 8645 amplifiers have 20 bits. Therefore, the lower 4 bits of gradient data are not tested.*)	1:09
RF BITS	0	TEST OFF	
	1	TEST ON	2:17
COIL/ SAMPLE	1	ORIGINAL SST COIL W/CuSO4 SOLUTION	
	2	ORIGINAL SST COIL W/ NiCl2 SOLUTION	
	3	UNIVERSAL SST COIL W/ NiCl2 SOLUTION	
RECEIVE COIL	1	HEAD	
	2	BODY	
	3	SURFACE COIL (NOT USED)	
	4	TEST PORT	
CONFIG CODE	0	ENVELOPE FEEDBACK ENABLED	
	1	ENVELOPE FEEDBACK BYPASSED	
	2	SOLID STATE DRIVER OUTPUT	
ASC ANALYSIS	0	OFF	
	1	ON (***NOTE**: ASC is no longer available. Must be set to "OFF".*)	
AUTO GRADAMP CTRL	0	OFF	--
	1	ON. (***Note:** If this option is on, SST runs an additional pass of gradient stability test with undriven gradients in standby.)*	6:56

TABLE 3-1B
SST STABILITY TEST MODES *(ASP2 SOFTWARE ONLY)*

TEST OPTION	MODE	DESCRIPTION	PSD TIME MIN: SECS
STABILITY	0	TEST OFF	--
	-1	NO GRADIENTS (X,Y, & Z GRADIENTS IN READY)	1:18
	-11	NO GRADIENTS (X, Y, & Z GRADIENTS IN STANDBY)	1:20
	1	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN READY)	2:36
	11	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN STANDBY)	2:44
	21	NO GRADIENTS & X GRADIENT (Y IN READY & Z IN STANDBY)	2:44
	31	NO GRADIENTS & X GRADIENT (Y IN STANDBY & Z IN READY)	2:44
	2	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN READY)	2:36
	12	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN STANDBY)	2:44
	22	NO GRADIENTS & Y GRADIENT (X IN STANDBY & Z IN READY)	2:44
	32	NO GRADIENTS & Y GRADIENT (X IN READY & Z IN STANDBY)	2:44
	3	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN READY)	2:36
	13	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN STANDBY)	2:44
	23	NO GRADIENTS & Z GRADIENT (X IN READY & Y IN STANDBY)	2:44
	33	GRADIENTS & Z GRADIENT (X IN STANDBY & Y IN READY)	2:44
	4	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN READY)	6:30
	14	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN STANDBY)	6:56
COIL/ SAMPLE	1	ORIGINAL SST COIL W/CuSO4 SOLUTION	
	2	ORIGINAL SST COIL W/ NiCl2 SOLUTION	
	3	UNIVERSAL SST COIL W/ NiCl2 SOLUTION	
RECEIVE COIL	1	HEAD	
	2	BODY	
	3	SURFACE COIL (NOT USED)	
	4	TEST PORT	
AUTO GRADAMP CTRL	0	OFF	--
	1	ON. (***Note:*** *If this option is on, SST runs an additional pass of gradient stability test with undriven gradients in standby.)*	6:56

5. Click on **[Save Series].**

6. Right click on **[Research Operations]** and select **Setup Params**. Enter the proper parameters for field strength of your system. See Table 3-2.

TABLE 3-2
SET UP PARAMETERS FOR 1.5T AND 1.0T SYSTEMS

1.5T SETUP PARAMETERS	1.0T SETUP PARAMETERS
R1 = **13** *(Original Coil)* R1 = **9** *(Universal Coil)* R2 = **14** TG = **170** *(Original Coil)* TG = **70** *(Universal Coil)* Number of Frames: **2 <Enter>** <u>WINDOW ONE</u>	R1 = **11** *(Universal Coil)* R2 = **14** TG = **90** *(Universal Coil)* Number of Frames: **2 <Enter>** <u>WINDOW ONE</u> Frame: **1 <Enter>** Frame: **0 <Enter>**

1.5T SETUP PARAMETERS	1.0T SETUP PARAMETERS
Frame: **1 <Enter>** Frame: **0 <Enter>** WINDOW TWO Frame: **1 <Enter>** Frame: **0 <Enter>** **[Done]**	WINDOW TWO Frame: **1 <Enter>** Frame: **0 <Enter>** **[Done]**

7. Select **[Done]**.

3-4 Prescan & Data Collection

Note

The 1dB step and 0.1dB step attenuators initially must be set to zero. For manual attenuators that do not have zero stops (to locate 0 dB position), zero marking on dial should be directly in line with BNC connector to provide 0dB attenuation.

1. Click on **[Manual Prescan]**, and record the X, Y, and Z shim values; if not at zero, then set to zero. Old grad shim values must be restored after testing is complete. If grad shim values are not at zero, the Gradient Missing Bit Test may fail.

Note

For RF/PEN set the T/R-DD Faults Disable Switch to On to disable fault reporting. If a T/R fault is detected, refer to section 2, T/R Driver Board Service Mode Activation. For RF PEN II, RF/PDU, and SRF set T/R and DD switches to the DISABLE position.

2. At top of screen click on **[Windows]**, from pull-down menu select **Two Windows** and setup as shown:

WINDOW ONE	WINDOW TWO
Rec: **1**	Rec: **1**
Type: **Magnitude**	Type: **P. Spect**
Plot Gain: **2**	Plot Gain: **1**

3. Click on **[Center Freq Fine]**, adjust the **DX Freq** value to position the P. Spect profile waveform (right display) on proper center frequency.

Note

If no prescan waveform is present, be sure that:

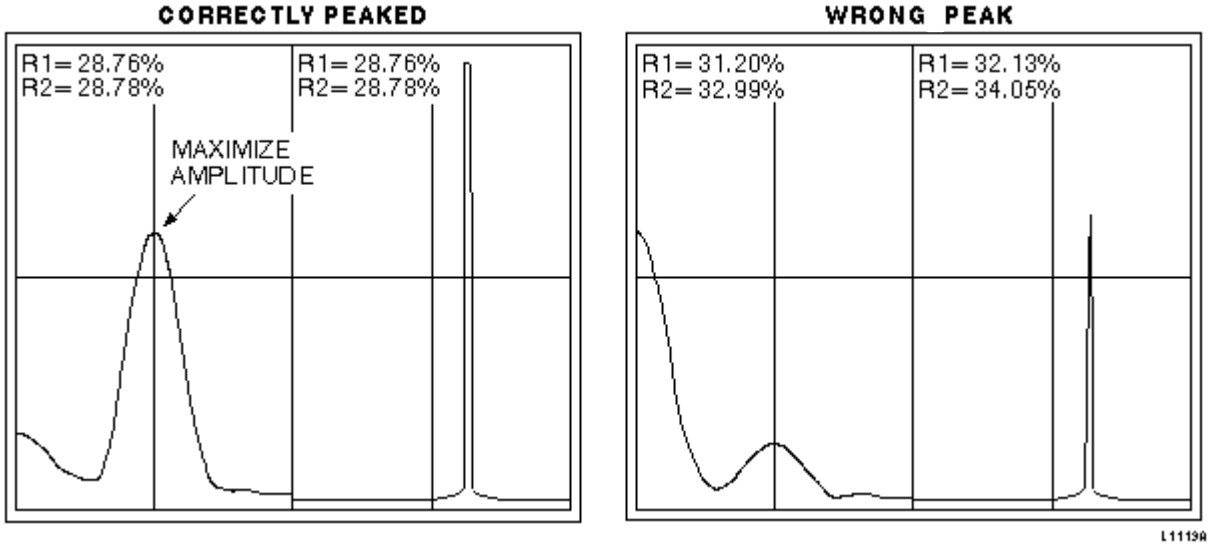
- 0.014M $NiCl_2$ solution and proper proton coil are selected for the field strength of the system.
- Sample vial solution level is correct, and vial is properly positioned in Universal Coil.
- TG value is high enough to excite solution.
- New values for left and right displays are entered correctly.
- RCV Coil=1 specified on Users CVs page during scan prescription.

- The proper adapter is being used: For 1.5T, Extremity Coil / Linear Head adapter box or 1.5T Service Tool Interface Adapter; for 1.0T Service Tool Interface Adapter. Do *NOT* use a Surface Coil Adapter.

4. Click on **[Transmit Gain]**. Adjust TG to obtain maximum flip. Peak using the maximum amplitude of the waveform on left display (magnitude). See Illustration 3-8. Test results accuracy depend on an accurate TG peaking. Take time and care to ensure accuracy in finding flip.

CAUTION

If no peak is visible in window 1 (magnitude) then change the window 2 type from "P. Spect" to "Magnitude" and see if the signal is now present in window 2. If the signal is now present, then peak it using window 2.



RF PRE-SCAN WAVEFORMS - HEAD FULL POWER TEST MODE
ILLUSTRATION 3-8

5. The R1% at peak varies with the type of SST coil used (original or universal) and the field strength of the system (1.0T or 1.5T). Typical values are as follows:
   - Original SST coil: 10% to 15% (1.5T)
   - Universal SST coil: 25% to 60% (all)

Note

If the power spectrum R1 signal is greater than 60%, you can reduce R1 to 9, which is recommended for 1.5T Systems. If an SST scan is done with R1=9, be aware of the fact that SNR noise has been seen to increase by as much as 15% with a corresponding reduction in the SNR number.

Note

If prescan waveform is not normal, verify that the proper Universal Proton Coil is selected for the field strength of the system, and verify that the 0.014M $NiCl_2$ solution vial is fully seated inside of Universal Coil.

6. Note the power spectrum R1% level before doing the next two steps. This value is compared to the power spectrum level in step 8.

Note

For 1.0T and 1.5T systems, if TG peaks below 100, substitute a 20-dB fixed attenuator (46-258601P2) for the 10-dB fixed attenuator already in the setup along with the rotary attenuators in the step below.

7. Use the following formula to adjust the rotary attenuators to correspond to the TG value that peaked the sample. If needed, add additional fixed attenuation as noted previously.

Formula to determine attenuator settings:

$$\frac{(200 - TG)}{10} = \text{attenuation in dB}$$

where TG is the TG setting at peak

Example (if TG peaks at 175):

Step 1: 200 - 175 = 25

Step 2: $\frac{25}{10} = 2.5$ **dB**

Set 0-to-10 dB attenuator to 2 dB
Set 0-to-1 dB attenuator to .5 dB
} for a total of **2.5 dB**

8. Set TG to **200**.

9. Prescan power spectrum % level should be the approximately same (+0.5%) after dialing in manual attenuation and setting TG=200. If not, verify proper peak with the manual attenuators by adjusting in 0.1 dB steps.

10. Click on **[Done]**, click on **Research Operations,** select **[Download].** Then **[Scan]**.

Note

If the message "MR Signal too high, reduce R1" occurs during a scan, this may indicate that receive cables between the preamp and system cabinet are shorter than product cable lengths. If this is the case, replace the non-product cables and retest. If you receive the message above, this would occur during the RF Linearity test, and the overrange condition would cause invalid results for this test. The filter for the RF Linearity test has been changed to prevent an overrange condition.

11. After the scan completes, automatic data analysis begins in a desktop window called *Running Small Sample Test*. The analysis provides messages that identify each test as its data are analyzed.

12. When analysis completes, verify that no errors messages were reported. Place the cursor inside the window, and press **<Enter>** to close the window.

13. To view SST results select **[Service Desktop Manager], [Utilities]**, then select **[Report Manager]**.

14. Record results in Data Sheet 1.5T or Data Sheet 1.0T.

15. For additional SST Head Full Power scans, click on **[New Series]**. When completed click on **[End Exam]**.

4-SST BODY FULL POWER TEST

This section is not applicable to a ***TwinSpeed*** scanner.

4-1 Coil, Column and Base Plate Setup

1. Click on **[New Pt]**.

2. Select the 0.014M $NiCl_2$ sample vial from SST kit; this is the recommended solution for all systems. SST results using $NiCl_2$ solution are not sensitive to temperature variations as those using $CuSO_4$ solution are.

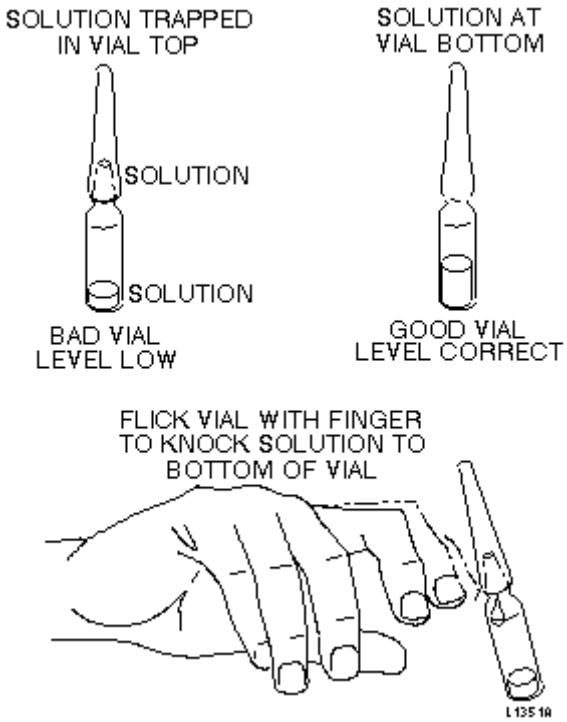
WARNING!

POISON HAZARD! SAMPLE CONTAINS NICKEL, A SUSPECTED CARCINOGEN. DO NOT INGEST. DISPOSE OF AS A HAZARDOUS WASTE ACCORDING TO STATE AND FEDERAL REGULATIONS.

3. Inspect solution level in sample vial to ensure correct fluid level. If solution level is incorrect due to solution being trapped in vial top, correct by flicking vial with finger to knock solution to bottom of vial. See Illustration 4-1

Note

If any solution remains trapped in the upper portion of the vial, the SNR test will probably fail. If vial is cracked or damaged and solution is leaking out, dispose of the vial immediately per local regulations.



SAMPLE VIAL LEVEL CHECK
ILLUSTRATION 4-1

4. Remove the head holder from the cradle.

5. Select the proper SST RF Coil for the system (1.5T or 1.0T).

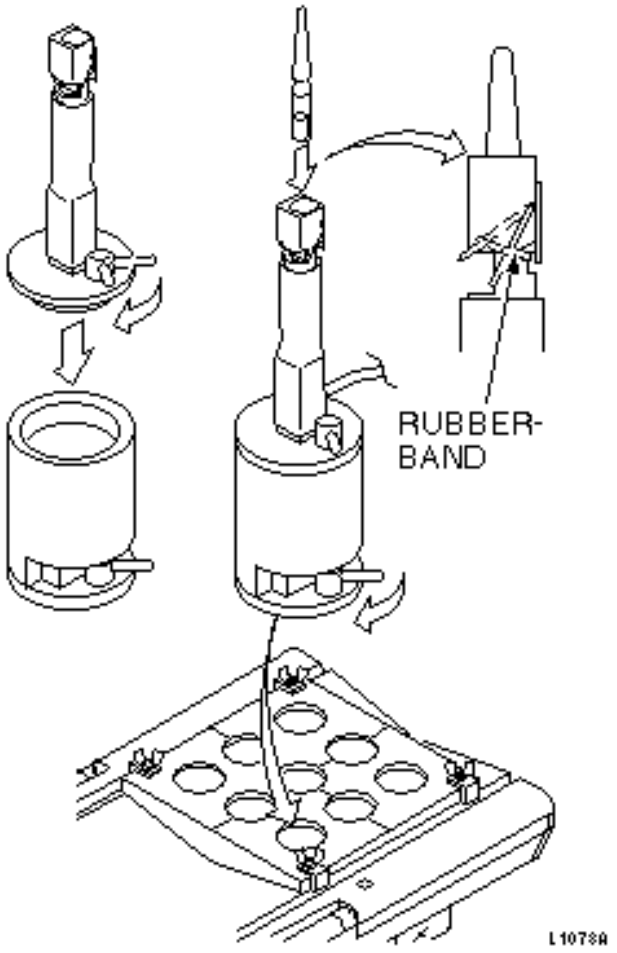
6. Position base plate on patient table near head end of cradle.

Steps 7 through 9 are for Original SST kits (46-287357) only

7. Position column on base plate in position indicated in Illustration 4-2. Turn lever to lock in place.

8. Position SST coil on column and turn lever to lock in place. See Illustration 4-2. This arrangement will offset the sample vial 10 cm in the X, Y, and Z directions from isocenter.

9. Pull back wire bail and insert sample vial into coil assembly. Ensure that sample vial is pushed all the way down into coil assembly, then release wire bail to lock vial in place (small rubber band must be intact on bail to hold the sample in place). See Illustration 4-2.

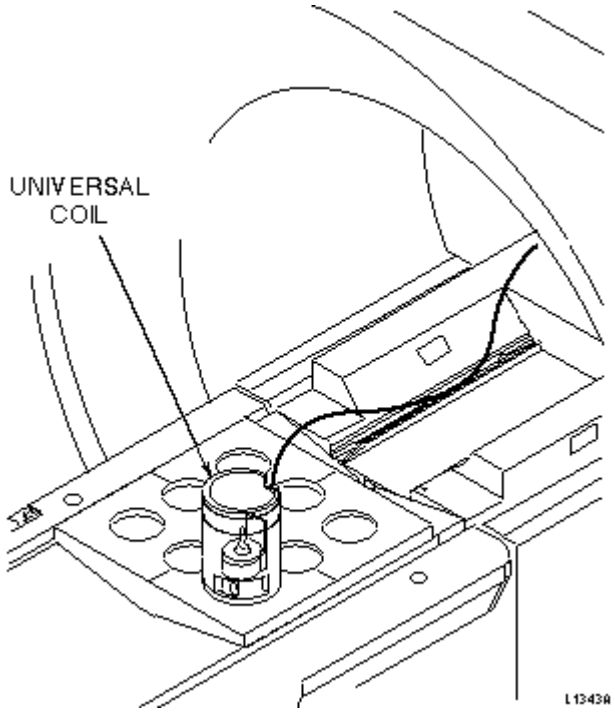


ORIGINAL SST COIL AND COLUMN POSITIONING
ILLUSTRATION 4-2

10. **This step is for Universal kits (46-320383) only**. Place the 1.5T, or 1.0T Universal SST Coil into base plate in corner as shown in Illustration 4-3 and turn lever to lock to base plate. (This arrangement offsets the sample vial 10 cm in the X, Y, and Z directions from isocenter). Unwrap entire length of cable from around coil. Insert the sample vial into the Universal Proton Coil.

Note

Always use the 0.014M $NiCl_2$ sample vial from the SST Kit; this is the recommended solution for all systems. SST results using the $NiCl_2$ solution are not sensitive to temperature variations as are those using $CuSO_4$.



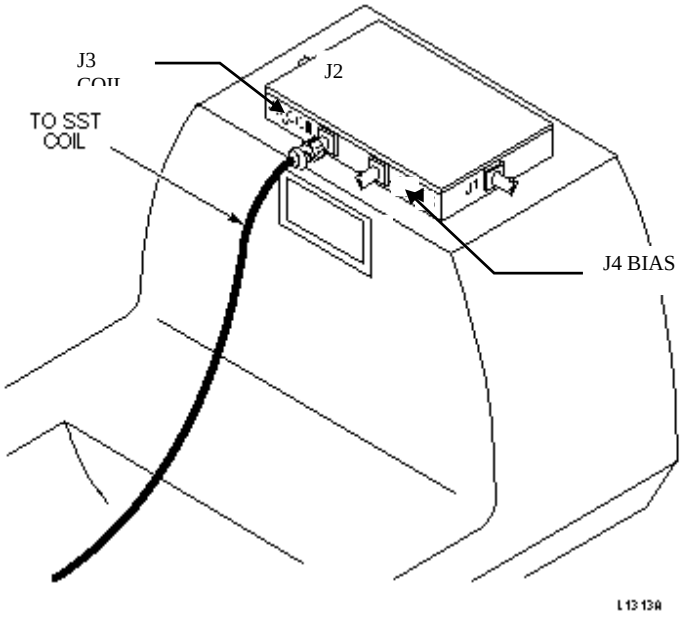
UNIVERSAL SST COIL
ILLUSTRATION 4-3

11. Landmark at center of base plate (not on the coil). Press MOVE TO SCAN to send the coil to isocenter.

Note

Software automatically turns on the bore vent for every scan. SST is done with the bore vent on to detect any noise problems it may be causing.

12. Locate proper SST RF Combiner Assembly for the field strength of your system (1.5T or 1.0T) and position on trolley assembly. See Illustration 4-4 for RF combiner location.



SST RF COMBINER ASSEMBLY
ILLUSTRATION 4-4

13. Connect SST RF coil BNC connector to connector J3 on RF combiner assembly. See Illustration 4-4.

Note

Instructions and illustrations for connections to J1, J2, and J4 on SST RF Combiner Assembly are given in Section 4-3 for 1.5.T and 1.0T systems. Connections to these points on the SST RF Combiner should not be made until after a landmark is established, and the cradle is advanced to the rear of the magnet. Cables going to the combiner are intentionally short, and will not reach SST Combiner Assembly until the cradle is advanced to the rear of the magnet.

4-2 RF Combiner Connection

Note

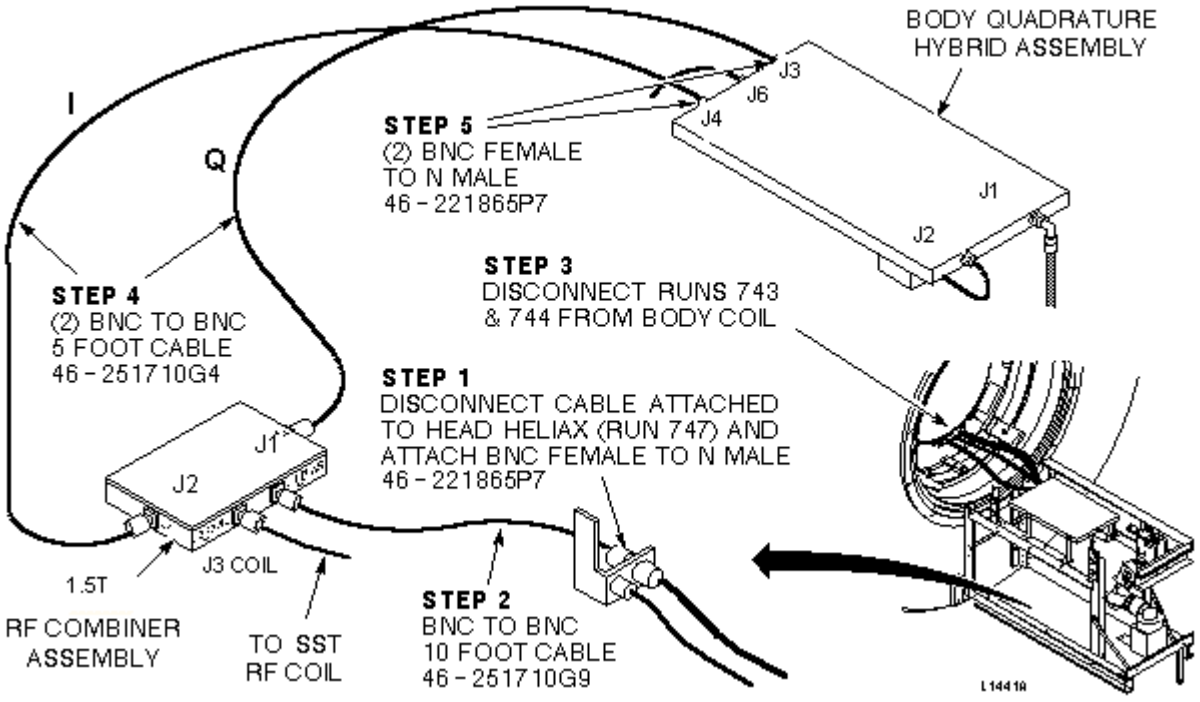
The SST RF Combiner Assembly is used with all Body Small Sample Tests when the complete RF chain (excluding body coil itself) is being tested. The RF Combiner Assembly converts quadrature RF drive to linear so the SST RF coil (a linear coil) can be properly used.

1. Select the appropriate RF Combiner Assembly from SST kit (1.5T, or 1.0T). Access the rear pedestal by removal of appropriate covers.

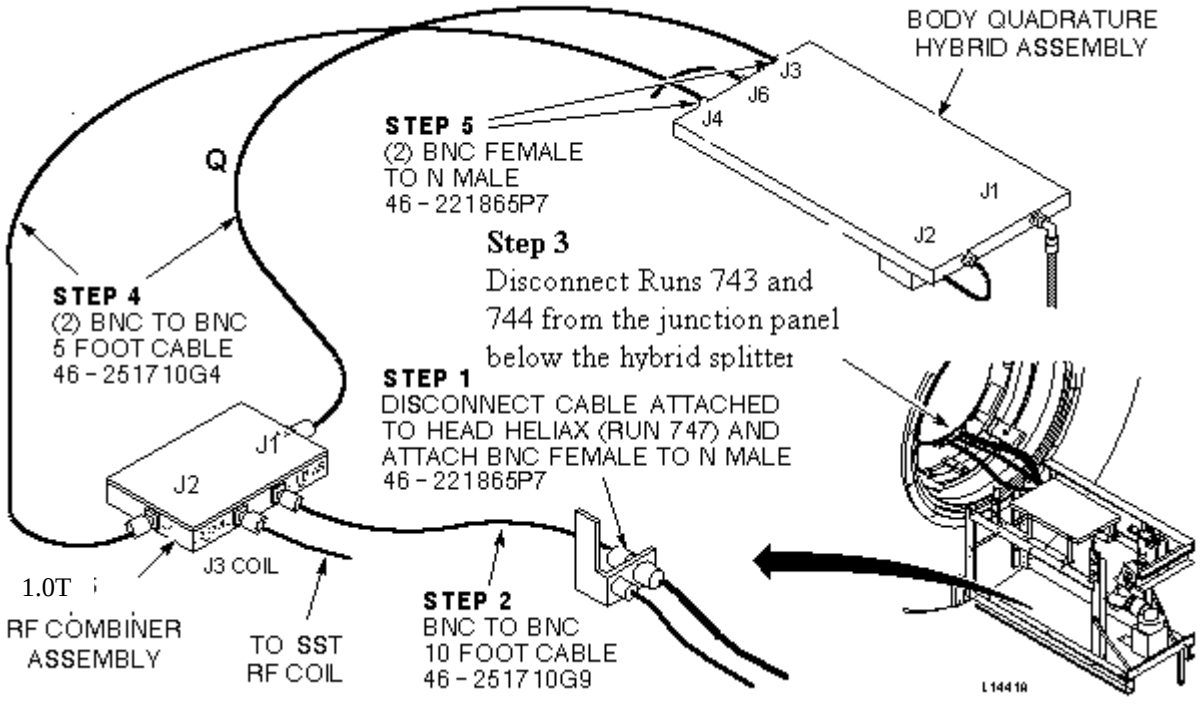
Note

Connections to J1, J2, and J4 on the RF Combiner Assembly should not be made until after a landmark is established and cradle is advanced to isocenter. Cables going to the RF Combiner Assembly are intentionally short and will not reach until cradle is at isocenter.

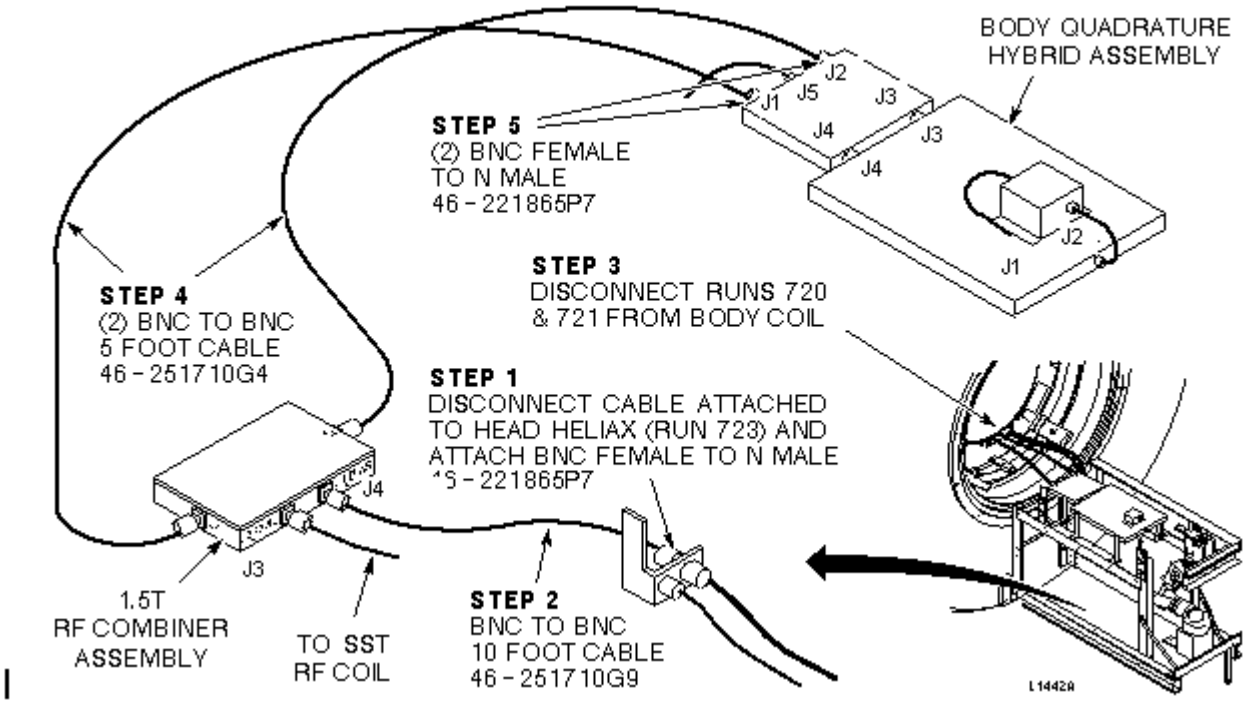
2. Refer to the appropriate illustration (follow steps in numerical order):



RF COMBINER ASSEMBLY CONNECTION TO 1.5T BODY HYBRID ASSEMBLY
ILLUSTRATION 4-5



RF COMBINER ASSEMBLY CONNECTION TO 1.0T BODY HYBRID ASSEMBLY
ILLUSTRATION 4-6



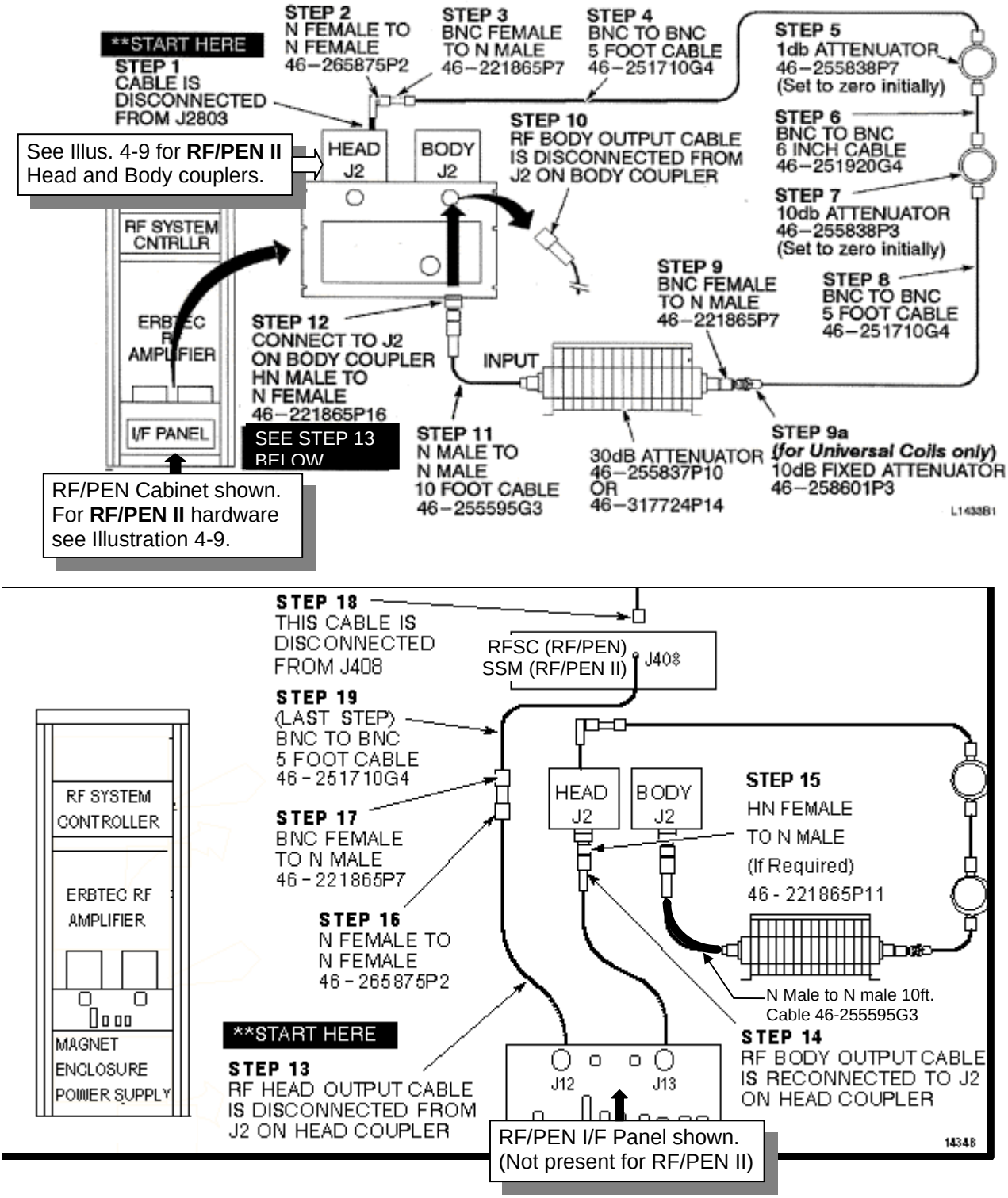
RF COMBINER ASSEMBLY CONNECTION TO EARLY 1.5T DIRECT DRIVE ASSEMBLY
ILLUSTRATION 4-7

Note

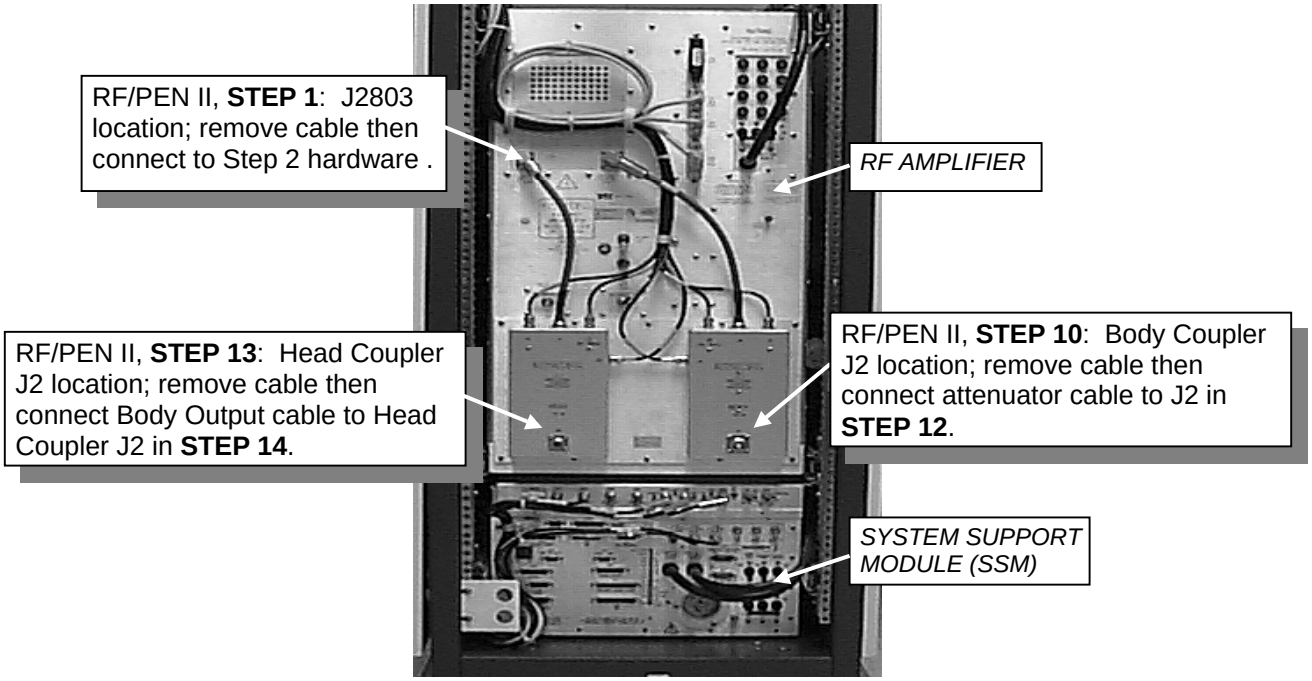
I and Q Inductive Drive connections to RF Combiner Assembly connectors J1 and J2 are dependent on magnet ramp polarity. Incorrect hookup will yield no prescan waveform. If no waveform is present during prescan, them swap the J1 and J2 connections to the RF Combiner Assembly.

4-3 RF Cabinet Alterations

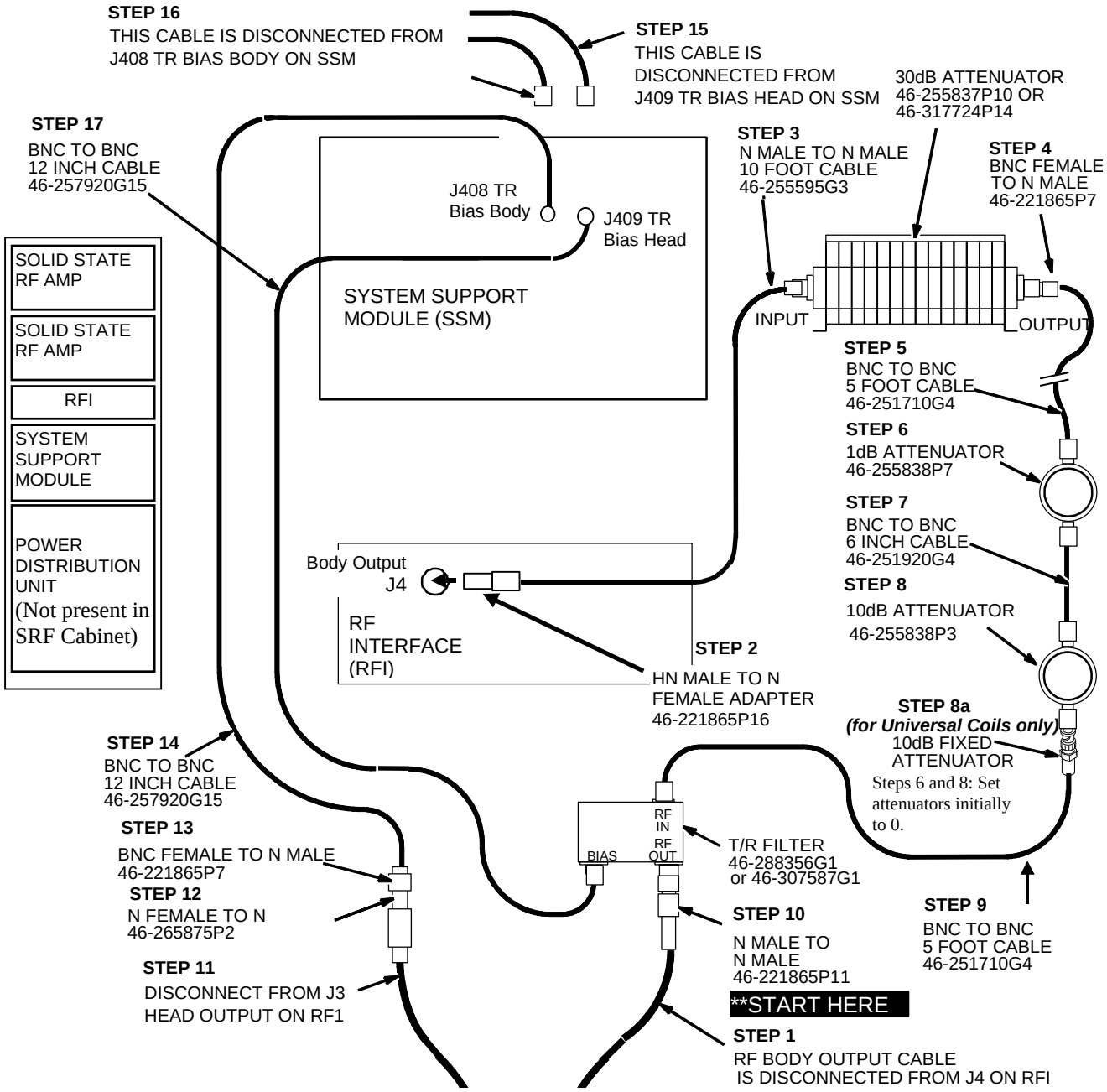
RF Pen Cabinet: See Illustration 4-8 for alterations (follow steps in numerical order).
RF Pen II Cabinet: See Illustrations 4-8 and 4-9 (follow steps in numerical order).
RF/PDU and SRF Cabinet: See Illustration 4-10.
SRFD2 Cabinet: See Illustration 4-11.
RFS Cabinet: See Illustration 4-11A



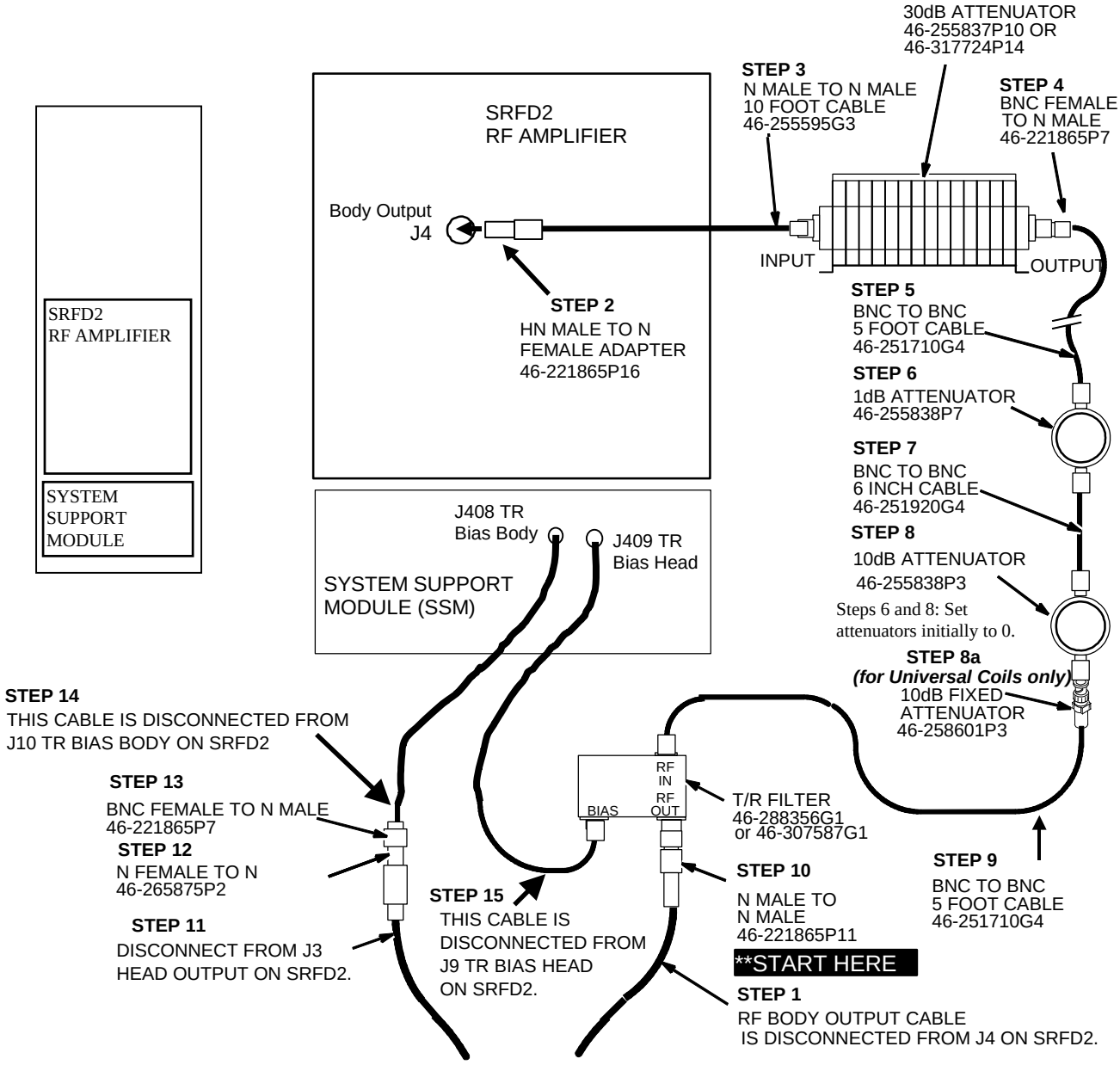
RF/PEN AND RF/PEN II CABINET ALTERATIONS - SST BODY FULL POWER TEST
ILLUSTRATION 4-8



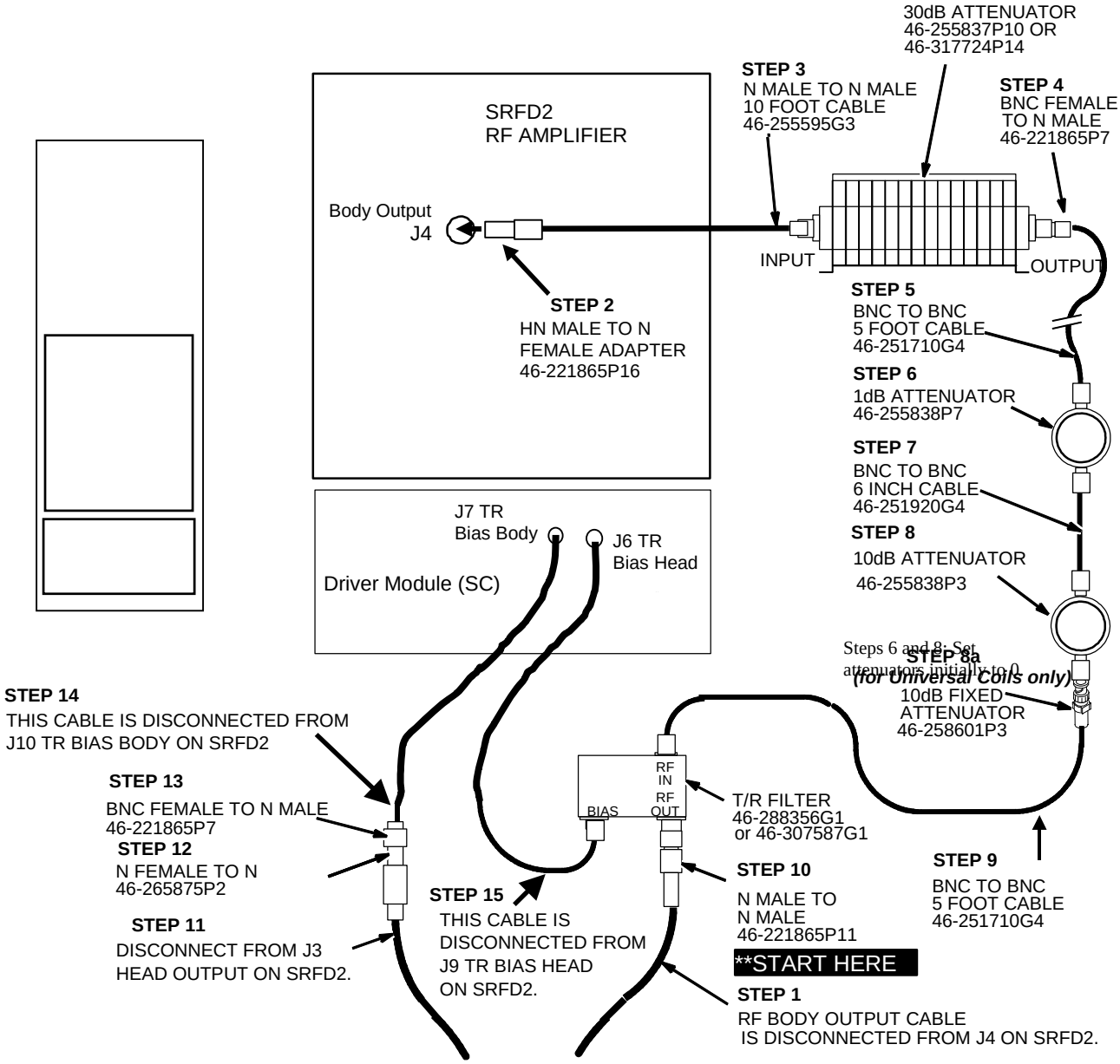
RF/PEN II HARDWARE AND CABLE LOCATIONS – SST BODY FULL POWER TEST
ILLUSTRATION 4-9



RF/PDU AND SRF CABINET ALTERATIONS - SST BODY FULL POWER TEST
ILLUSTRATION 4-10



SRFD2 CABINET ALTERATIONS - SST BODY FULL POWER TEST
ILLUSTRATION 4-11



RFS CABINET ALTERATIONS - SST BODY FULL POWER TEST
ILLUSTRATION 4-11A

4-5 Scan Prescription

1. Set up scan protocol as follows:
   Id: **geservice**
   Name: **SST body**
   Weight (lb.): **111**

Note

On the Patient Position screen, up to 32 characters can be typed in the Exam description field as comments. (Comments are displayed on the Report Header Info. Screen.

2. Click on **[Patient Protocols]** and select **Service**. In the Protocol field, type **o.26.2** (o=Other, 1=series number) to load the SST Body Full Power protocol. Click on **[Accept]**.

Note

On the Patient Position screen, up to 29 characters can be typed in the Series description field as comments. (Comments are displayed on the Report Header Info. Screen.

3. **[User CVs]**, enter *Coil/Sample* CV 7 value:
   2=O/N (original SST coil/$NiCl_2$ sample, **3**=U/N (universal SST coil/$NiCl_2$).

Note

Always use the 0.014M $NiCl_2$ sample vial from the SST Kit; this is the recommended solution for all systems. SST results using the $NiCl_2$ solution are not sensitive to temperature variations as are those using $CuSO_4$.

4. **[User CVs]**, enter *Receive Coil* CV 8 value: **2** = Body receive
5. Change test selections as desired; protocol selects all. Refer to Table 4-1A for test option information for 8.3 or ASP1 software. Refer to Table 4-1B for test option information for ASP2 software. Click on **[Accept]**.

Note

Starting with ASP2 software the SNR Test, RF Linearity Test, Gradient Bits Test, RF Bits Test and Receiver Bits Test have been removed from SST. Use SPT to check SNR and use RFT to check RF linearity. The other tests are obsolete.

TABLE 4-1A
SST STABILITY TEST MODES (*8.3 OR ASP1 SOFTWARE ONLY*)

TEST OPTION	MODE	DESCRIPTION	PSD TIME MIN: SECS
STABILITY	0	TEST OFF	--
	-1	NO GRADIENTS (X,Y, & Z GRADIENTS IN READY)	1:18
	-11	NO GRADIENTS (X, Y, & Z GRADIENTS IN STANDBY)	1:20
	1	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN READY)	2:36
	11	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN STANDBY)	2:44
	21	NO GRADIENTS & X GRADIENT (Y IN READY & Z IN STANDBY)	2:44
	31	NO GRADIENTS & X GRADIENT (Y IN STANDBY & Z IN READY)	2:44
	2	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN READY)	2:36
	12	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN STANDBY)	2:44
	22	NO GRADIENTS & Y GRADIENT (X IN STANDBY & Z IN READY)	2:44
	32	NO GRADIENTS & Y GRADIENT (X IN READY & Z IN STANDBY)	2:44
	3	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN READY)	2:36
	13	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN STANDBY)	2:44
	23	NO GRADIENTS & Z GRADIENT (X IN READY & Y IN STANDBY)	2:44
	33	GRADIENTS & Z GRADIENT (X IN STANDBY & Y IN READY)	2:44
	4	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN READY)	6:30
	14	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN STANDBY)	6:56
RF S/N	-1	NOISE ONLY (***NOTE**: RF S/N should not be used to measure SNR. Use SPT to measure SNR.*)	1:13
	0	TEST OFF	
	1	TEST ON	1:13
RF LINEARITY	0	TEST OFF	
	1	TEST ON	2:16
GRADIENT BITS	0	TEST OFF	
	1	TEST ON (***NOTE**: Gradient bits tests only the upper 16 gradient data bits. The 8645 amplifiers have 20 bits. Therefore, the lower 4 bits of gradient data are not tested.*)	1:09
RF BITS	0	TEST OFF	
	1	TEST ON	2:17
COIL/ SAMPLE	1	ORIGINAL SST COIL W/CuSO4 SOLUTION	
	2	ORIGINAL SST COIL W/ NiCl2 SOLUTION	
	3	UNIVERSAL SST COIL W/ NiCl2 SOLUTION	
RECEIVE COIL	1	HEAD	
	2	BODY	
	3	SURFACE COIL (NOT USED)	
	4	TEST PORT	
CONFIG CODE	0	ENVELOPE FEEDBACK ENABLED	
	1	ENVELOPE FEEDBACK BYPASSED	
	2	SOLID STATE DRIVER OUTPUT	
ASC ANALYSIS	0	OFF	
	1	ON (***NOTE**: ASC is no longer available. Must be set to "OFF".*)	
AUTO GRADAMP CTRL	0	OFF	--
	1	ON. (***Note:** If this option is on, SST runs an additional pass of gradient stability test with undriven gradients in standby.)*	6:56

TABLE 4-1B
SST STABILITY TEST MODES *(ASP2 OR LATER SOFTWARE ONLY)*

TEST OPTION	MODE	DESCRIPTION	PSD TIME MIN: SECS
STABILITY	0	TEST OFF	--
	-1	NO GRADIENTS (X,Y, & Z GRADIENTS IN READY)	1:18
	-11	NO GRADIENTS (X, Y, & Z GRADIENTS IN STANDBY)	1:20
	1	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN READY)	2:36
	11	NO GRADIENTS & X GRADIENT (Y & Z GRADIENTS IN STANDBY)	2:44
	21	NO GRADIENTS & X GRADIENT (Y IN READY & Z IN STANDBY)	2:44
	31	NO GRADIENTS & X GRADIENT (Y IN STANDBY & Z IN READY)	2:44
	2	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN READY)	2:36
	12	NO GRADIENTS & Y GRADIENT (X & Z GRADIENTS IN STANDBY)	2:44
	22	NO GRADIENTS & Y GRADIENT (X IN STANDBY & Z IN READY)	2:44
	32	NO GRADIENTS & Y GRADIENT (X IN READY & Z IN STANDBY)	2:44
	3	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN READY)	2:36
	13	NO GRADIENTS & Z GRADIENT (X & Y GRADIENTS IN STANDBY)	2:44
	23	NO GRADIENTS & Z GRADIENT (X IN READY & Y IN STANDBY)	2:44
	33	GRADIENTS & Z GRADIENT (X IN STANDBY & Y IN READY)	2:44
	4	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN READY)	6:30
	14	NO GRADIENTS & ALL GRADIENTS (UNDRIVEN GRADIENTS IN STANDBY)	6:56
COIL/ SAMPLE	1	ORIGINAL SST COIL W/CuSO4 SOLUTION	
	2	ORIGINAL SST COIL W/ NiCl2 SOLUTION	
	3	UNIVERSAL SST COIL W/ NiCl2 SOLUTION	
RECEIVE COIL	1	HEAD	
	2	BODY	
	3	SURFACE COIL (NOT USED)	
	4	TEST PORT	
AUTO GRADAMP CTRL	0	OFF	--
	1	ON. (***Note:*** *If this option is on, SST runs an additional pass of gradient stability test with undriven gradients in standby.)*	6:56

6. Click on **[Accept]**, then **[Save Series]**.

7. Right click on **[Research Operations]** and select **Setup Params**. Enter the proper parameters for the field strength of your system. See Table 4-2.

TABLE 4-2
SET UP PARAMETERS FOR 1.5T AND 1.0T SYSTEMS

1.5T SETUP PARAMETERS	1.0T SETUP PARAMETERS
R1 = **13** *(Original Coil)* R1 = **9** *(Universal Coil)* R2 = **14** TG = **170** *(Original Coil)* TG = **70** *(Universal Coil)* Number of Frames: **2 <Enter>**	R1 = **11** *(Universal Coil)* R2 = **14** TG = **90** *(Universal Coil)* Number of Frames: **2 <Enter>** <u>WINDOW ONE</u> Frame: **1 <Enter>**

1.5T SETUP PARAMETERS	1.0T SETUP PARAMETERS
WINDOW ONE	Frame: **0 <Enter>**
Frame: **1 <Enter>**	WINDOW TWO
Frame: **0 <Enter>**	Frame: **1 <Enter>**
WINDOW TWO	Frame: **0 <Enter>**
Frame: **1 <Enter>**	**[Done]**
Frame: **0 <Enter>**	
[Done]	

4-6 Prescan & Data Collection

Note

The 1dB step and 0.1dB step attenuators initially must be set to zero. For manual attenuators that do not have zero stops (to locate 0 dB position), zero marking on dial should be directly in line with BNC connector to provide 0dB attenuation.

1. Click on **[Manual Prescan]**, and record the X, Y, and Z shim values; if not at zero, then set to zero. Old grad shim values must be restored after testing is complete. If grad shim values are not at zero, the Gradient Missing Bit Test may fail.

Note

Set the T/R-DD Faults Disable Switch to On to disable fault reporting. If a T/R fault is detected, refer to section 2, T/R Driver Board Service Mode Activation. For RF PEN, RF/PDU, SRFD, and SRFD2 set the T/R and DD switches to the DISABLE position.

2. Click on **[Manual Prescan]** and setup twin plot mode as listed:

PULL DOWN MENU
[Windows]
Select*:* **Two Windows**

WINDOW ONE	WINDOW TWO
Rec: **1**	Rec: **1**
Type: **Magnitude**	Type: **P. Spect**
Plot Gain: **2**	Plot Gain: **1**

3. Click on **[Center Freq Fine]**, adjust the **DX Freq** value to position the P. Spect profile waveform (right display) on proper center frequency.

Note

If no prescan waveform is present, be sure that:

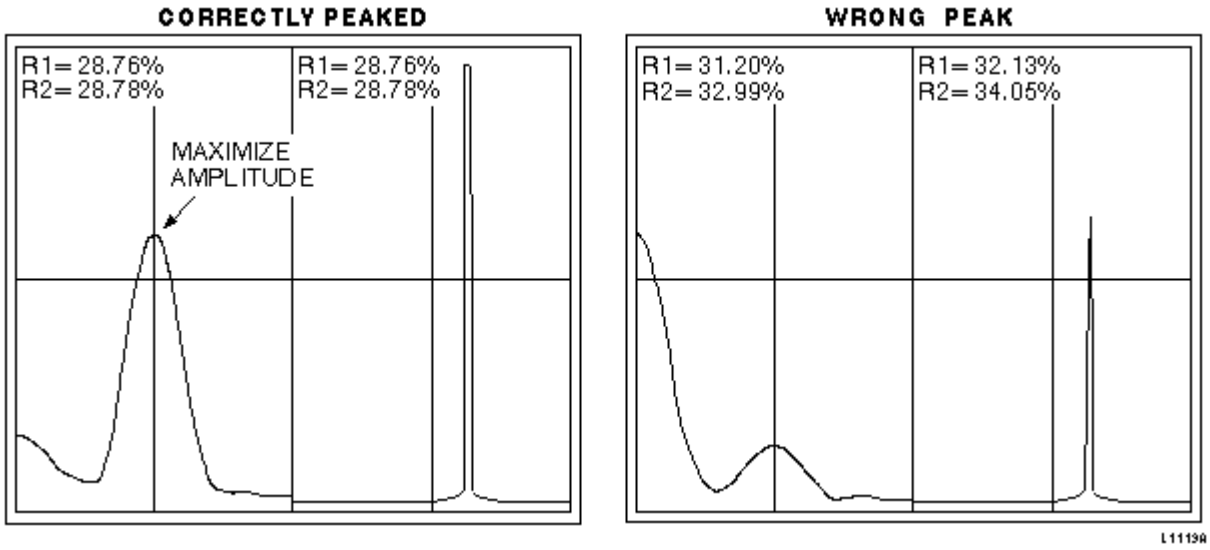
- 0.014M $NiCl_2$ solution and proper proton coil are selected for the field strength of the system.
- Sample vial solution level is correct, and vial is properly positioned in Universal Coil.
- TG value is high enough to excite solution.
- New values for left and right displays are entered correctly.

- RCV Coil=2 specified on Users CVs page during scan prescription.
- The proper adapter is being used: For 1.5T, Extremity Coil / Linear Head adapter box or 1.5T Service Tool Interface Adapter; for 1.0T Service Tool Interface Adapter.

4. Click on **[Transmit Gain]**. Adjust TG to obtain maximum flip. Peak using the maximum amplitude of the waveform on left display (magnitude). See Illustration 4-10. Test results accuracy depend on an accurate TG peaking. Take time and care to ensure accuracy in finding flip.

CAUTION

If no peak is visible in window 1 (magnitude) then change the window 2 type from "P. Spect" to "Magnitude" and see if the signal is now present in window 2. If the signal is now present, then peak it using window 2. This will be corrected in the next software release.



RF PRE-SCAN WAVEFORMS - BODY FULL POWER TEST MODE
ILLUSTRATION 4-10

5. The R1% at peak varies with the type of SST coil used (original or universal) and the field strength of the system (1.0T or 1.5T). Typical values are as follows:
   - Original SST coil: 10% to 15% (1.5T)
   - Universal SST coil: 25% to 60% (all)

Note

If the power spectrum R1 signal is greater than 60%, you can reduce R1 to 9, which is recommended for 1.5T Systems. If an SST scan is done with R1=9, be aware of the fact that SNR noise has been seen to increase by as much as 15% with a corresponding reduction in the SNR number.

Note

If prescan waveform is not normal, verify that the proper Universal Proton Coil is selected for the field strength of the system, and verify that the 0.014M $NiCl_2$ solution vial is fully seated inside of Universal Coil.

6. Note the power spectrum R1% level before doing the next two steps. This value is compared to the power spectrum level in step 8.

Note

For 1.0T and 1.5T systems, if TG peaks below 100, substitute a 20-dB fixed attenuator (46-258601P2) for the 10-dB fixed attenuator already in the setup along with the rotary attenuators in the step below.

7. Adjust rotary attenuators (and if needed, add additional fixed attenuation as noted above) to correspond to TG value that peaked sample; follow example below.

   Example:
   TG=175 => 200-175=25; 25÷10=2.5
   0-1 dB attenuator setting = .5 dB 0-10 dB attenuator setting = 2 dB

8. Set TG to **200**.

9. Prescan power spectrum % level should be the approximately same (+0.5%) after dialing in manual attenuation and setting TG=200. If not, verify proper peak with the manual attenuators by adjusting in 0.1 dB steps.

10. Click on **[Done]**, click on **Research Operations,** select **[Download].** Then **[Scan]**.

Note

If the message "MR Signal too high, reduce R1" occurs during a scan, this may indicate that receive cables between the preamp and system cabinet are shorter than product cable lengths. If this is the case, replace the non-product cables and retest. If you receive the message above, this would occur during the RF Linearity test, and the overrange condition would cause invalid results for this test. The filter for the RF Linearity test has been changed to prevent an overrange condition.

11. After the scan completes, automatic data analysis begins in a desktop window called *Running Small Sample Test*. The analysis provides messages that identify each test as its data are analyzed.

12. When analysis completes, verify that no errors messages were reported. Place the cursor inside the window, and press **<Enter>** to close the window.

13. To view SST results:
    Release 9.X and 10.X: From CSD **[Utilities]** menu, select **[Report Manager]**.
    Release 8.2: From the **[Utilities]** menu, select **[Report Manager]**.
    Release 8.1: Transfer the SPT file(s) to the PC, then use the Report Manager tool. Refer to Section 5-1, SGI Host to PC File Transfer.

14. Record results in Data Sheet 1.5T or Data Sheet 1.0T.

15. For additional SST Head Full Power scans, click on **[New Series]**. When completed click on **[End Exam]**.

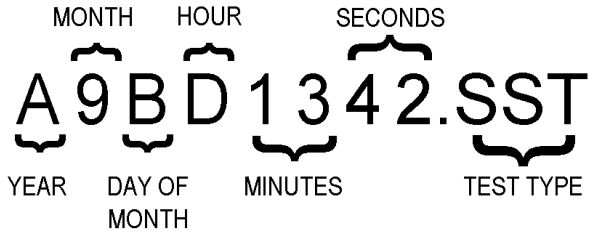
5- SST RESULTS

To view Small Sample Test results (both graphics and text), on the Service Desktop select **[Utilities]**, then **[Report Manager]** tool program located. Refer to the Report Manager Tool procedure to view the SST test results.

Note

Starting with ASP2 software the SNR Test, RF Linearity Test, Gradient Bits Test, RF Bits Test and Receiver Bits Test have been removed from SST. Use SPT to check SNR and use RFT to check RF linearity. The other tests are obsolete.

See Illustration 5-1 for an example file name. Refer to Table 5-1 for data file naming convention.



Example file created September 11, 2000 at 1:13:42 p.m.

DATA FILE NAMING CONVENTION (EXAMPLE)
ILLUSTRATION 5-1

TABLE 5-1
DATA FILE NAMING CONVENTION

YEAR	MONTH	DAY		HOUR		MINUTES, SECONDS
0 = 1990 1 = 1991 2 = 1992 3 = 1993 4 = 1994 5 = 1995 6 = 1996 7 = 1997 8 = 1998 9 = 1999 A = 2000 B= 2001 : Z= 2026	1 = JAN. 2 = FEB. 3 = MAR. 4 =APR. 5 = MAY 6 = JUN. 7 = JUL. 8 = AUG. 9 = SEP. A = OCT. B = NOV. C = DEC.	1 = 01 2 = 02 3 = 03 4 = 04 5 = 05 6 = 06 7 = 07 8 = 08 9 = 09 A = 10 B = 11 C = 12 D = 13 E = 14 F = 15 G = 16	H = 17 I = 18 J = 19 K = 20 L = 21 M = 22 N = 23 O = 24 P = 25 Q = 26 R = 27 S = 28 T = 29 U = 30 V = 31	0 = 00:00 1 = 01:00 2 = 02:00 3 = 03:00 4 = 04:00 5 = 05:00 6 = 06:00 7 = 07:00 8 = 08:00 9 = 09:00 A = 10:00 B = 11:00 C = 12:00	D = 13:00 E = 14:00 F = 15:00 G = 16:00 H = 17:00 I = 18:00 J = 19:00 K = 20:00 L = 21:00 M = 22:00 N = 23:00 O = 24:00	0 to 59

5-1 SST Report Screens

The following tables contain example SST test results displayed by the Report Manager Tool:

- Scan Header - Screen 1
- Stability Test No Gradients - Screen 2
- Stability Test X Gradient - Screen 3
- Stability Test Y Gradient - Screen 4

- Stability Test Z Gradient - Screen 5
- Stability Test All Gradients - Screen 6
- Signal-to-noise (SNR) Test - Screen 7
- SNR Test (Baseline Stab.) - Screen 8
- RF Linearity Test - Screen 9
- Gradient Bit Test - Screen 10
- Rho Modulator Bits Test - Screen 11
- Transmitter Quad Test - Screen 12
- Receiver Bit Test - Screen 13
- Service Config File

SCAN HEADER - SCREEN 1

```
9ALD1254.SST/0/0 Header Info RDF/GRP Revision:   1.2  /44
=======================================================
SITENAME    = Cardiac Bay 3
USN         = 54321
MLN         = 9999
SRVCONFIG   = 11/08/1999 21:13:05
EXCITER     = 000
RECEIVER    = S0/E0/PE0
XMTRFCOIL   = BODY
RCVRFCOIL   = HEAD UNIVERSALSST NiCl2
FREQ        = 63892058 Hz
TIME        = 11/10/1999 11:02:00
BASERUN     = 00512
CONFIGCODE  = 000
SOFTREV     = 8.3.9944c
NUCLIDE     = 000
HEADERCODE  = 0x00000000
RCVCOILGAIN = 5.2  R1 = 9  R2 = 14  TG = 200
-------  Exam description  -------
8.3 M4 validation
------- Series description  -------
Body,Ax,2D,SE
```

STABILITY TEST NO GRADIENTS - SCREEN 2

```
03ARRSST.000/2     STABILITY TEST - NO GRADIENTS
================================================
                     Mean       P-P       RMS
Peak Signal       : 3758.5
Delay (msec)      :    3.7
Signal Drift (%)  :      .0       .4        .0        <--Record "P-P" drift values
Freq Drift (Hz)   :      .0       .2        .0        <--on data sheet.
Phase Drift (Deg):       .0       .6        .1        <--
------------------------------------------------
Gradient amplifier control is disabled

X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready
------------------------------------------------
```

STABILITY TEST X GRADIENT - SCREEN 3

```
03ARRSST.000/3   STABILITY TEST - X GRADIENT
============================================
                     Mean       P-P       RMS
Delay Shift (msec): -.0
Signal Drift (%)  : -.1         .2        .0        <--Record "P-P" drift values
Freq Drift (Hz)   : -.2         .2        .0        <--on data sheet.
Phase Drift (Deg) : 16.3        .8        .1        <--
--------------------------------------------
Gradient amplifier control is disabled
X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready
--------------------------------------------
```

STABILITY TEST Y GRADIENT - SCREEN 4

03ARRSST.000/4 STABILITY TEST - Y GRADIENT

	Mean	P-P	RMS	
Delay Shift (msec):	-.0			
Signal Drift (%) :	-.3	.2	.0	<-- **Record p-p drift values**
Freq Drift (Hz) :	-.0	.4	.1	<-- **on data sheet.**
Phase Drift (Deg) :	13.9	9	.2	<--

Gradient amplifier control is disabled
X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready

STABILITY TEST Z GRADIENT - SCREEN 5

```
STABILITY TEST - Z GRADIENT
===========================================
              Mean     P-P     RMS
Delay Shift (msec):  -.0
Signal Drift (%)  :  -.2      .2      .0          <-- Record "P-P" drift values
Freq Drift (Hz)   :  -.7      .5      .1          <-- on data sheet.
Phase Drift (Deg) :  19.8     1.1     .2          <--
-------------------------------------------
Gradient amplifier control is disabled

X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready
-------------------------------------------
```

STABILITY TEST ALL GRADIENTS - SCREEN 6

```
STABILITY TEST - ALL GRADIENTS
==========================================
                      Mean       P-P       RMS
Delay Shift (msec):   -.0
Signal Drift (%)   :  -.0        .2        .0          <--Record "P-P" drift values
Freq Drift (Hz)    :  -1.5       .4        .1          <--on data sheet.
Phase Drift (Deg)  :  -15.1      1.3       .2          <--
------------------------------------------
Gradient amplifier control is disabled

X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready

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

SIGNAL-TO-NOISE (SNR) TEST - SCREEN 7

```
STABILITY TEST - ALL GRADIENTS
==============================================
                      Mean      P-P       RMS
Delay Shift (msec):   -.0
Signal Drift (%)   :  -.0       .2        .0          <--Record "P-P" drift values
Freq Drift (Hz)    :  -1.5      .4        .1          <--on data sheet.
Phase Drift (Deg)  :  -15.1     1.3       .2          <--
----------------------------------------------
Gradient amplifier control is disabled

X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready

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

SNR TEST (BASELINE STAB.) - SCREEN 8 *(NOT PRESENT IN ASP2 OR EQUIVALENT)*

```
STABILITY TEST - ALL GRADIENTS
==============================================
                      Mean      P-P       RMS
Delay Shift (msec):   -.0
Signal Drift (%)   :  -.0       .2        .0          <--Record "P-P" drift values
Freq Drift (Hz)    :  -1.5      .4        .1          <--on data sheet.
Phase Drift (Deg)  :  -15.1     1.3       .2          <--
----------------------------------------------
Gradient amplifier control is disabled

X gradient amplifier status is: ready
Y gradient amplifier status is: ready
Z gradient amplifier status is: ready

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

RF LINEARITY TEST - SCREEN 9 *(NOT PRESENT IN ASP2 OR EQUIVALENT)*

```
L3A193912.SST/9     RF LINEARITY
=============================================
              Magnitude Linearity Error (dB)

  Max     Min     P-P    Std Dev   Top
  0.32   -0.02    0.34     0.07    0.11
-----------------------------------------------------
```

<-- **Record "P-P" value on data sheet.**

GRADIENT BIT TEST - SCREEN 10 *(NOT PRESENT IN ASP2 OR EQUIVALENT)*

```
17FG4121.SST/11    GRADIENT BITS
=========================================================
(MSB)                                                (LSB)
  15 14 13 12 11 10  9  8  7  6  5  4  3  2  1  0
---------------------------------------------------------
X: 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1   <--

Y: 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1   <--

Z: 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1   <--
---------------------------------------------------------
Key:
0 - Bad
1 - Good
2 - Reference bit bad: Can't test
3 - Echo center for reference bit is outside A/D window.
---------------------------------------------------------
```

<-- **Verify all bits on all axes are good.**

RHO MODULATOR BITS TEST - SCREEN 11 *(NOT PRESENT IN ASP2 OR EQUIVALENT)*

```
17FG4121.SST/12        RHO MODULATOR BITS
================================================
       (MSB)                                (LSB)
         15 14 13 12 11 10  9  8  7  6  5  4
------------------------------------------------
Rho Bits: 1  1  1  1  1  1  1  1  1  0  0  0
-6059   6048   4195   2212   1130    553    255
3391   1722   1272   1193    579   1047
Only the twelve most significant bits of the sixteen
bit Rho modulator are actually tested. The effects of
modulating bits zero through three cannot be reliably
measured using NMR. Exciter carrier leakage can also
cause low order bits to fail.
------------------------------------------------
Key
0 - Bad
1 - Good
2 - Sign bit can't be tested because bit 14 is bad.
------------------------------------------------
Carrier leakage : -65.89 dB
------------------------------------------------
```

<- **Record "Bits" test result on data sheet.** Note - Bits 4-6

<- **Record value in data sheet.**

TRANSMITTER QUAD TEST - SCREEN 12 *(NOT PRESENT IN ASP2 OR EQUIVALENT)*

```
17FG4121.SST/13    TRANSMITTER QUADRATURE
================================================
                 Theta Control         SSP Control
                 -------------         -------------
  Angle            RFI       RFQ         RFI       RFQ
    0            1.000      .000       1.000      .000
   90             .003     1.003        .000     1.000
  180           -1.003      .000      -1.000     -.003
  270             .003    -1.003        .003    -1.002
------------------------------------------------
Gain (RFQ/RFI)       : 1.001             1.001
Phase Error          :   .030 Deg         .010 Deg
Sideband Suppression : -66.3 dB          -71.0 dB
------------------------------------------------
```

<-- **Record "Suppression" values on data sheet.**

RECEIVER BIT TEST - SCREEN 13 *(NOT PRESENT IN ASP2 OR EQUIVALENT)*

```
17FG4121.SST/14    RECEIVER BITS
=================================================
 (MSB)                                       (LSB)
   15 14 13 12 11 10  9  8  7  6  5  4  3  2  1  0
-------------------------------------------------
I:  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  <--
                                                    Verify all bits on both
                                                    channels are good.
Q:  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  <--
-------------------------------------------------
1 - Bit is good (being flipped)
0 - Any bits that have never been set to one
5 - Any bits that have never been reset to zero
-------------------------------------------------
```

6- SYSTEM RESTORATION

1. Depending on tests run, restore connections at back of the RF cabinet:
   a. RF PEN 1 Cabinet:
      - EFB bypass BNC coupling
      - RFSC J409 HEAD T/R, J408 BODY T/R
      - Head Port J2803
      - Solid-state Output J2506
      - Body Port J2804
   b. RF PEN 2 Cabinet:
      - EFB bypass BNC coupling
      - SSM J408 BODY T/R, J409 HEAD T/R
      - Head Port J2803
      - Solid-state Output J2506
      - Body Port J2804
   c. RF/PDU, SRFD Cabinets:
      - SSM J408 BODY T/R, J409 HEAD T/R
      - RFI J3 HEAD OUT cabling
      - RFI J4 BODY OUT cabling
   d. SRFD2 Cabinet:
      - SRFD2 RF Amplifier J9 HEAD T/R, J10 BODY T/R
      - SRFD2 RF Amplifier J4 BODY OUT, J3 HEAD OUT

2. **RF/PEN 1:** Restore the T/R-DD Faults Disable switch, on the RF System Controller, to the OFF position.

3. **RF/PEN 2, RF/PDU, SRFD, SRFD2:** Restore T/R and DD Fault Switches on the SSM to the ENABLE position.

4. Depending on tests run, remove all SST coil hardware (coil, combiner, test cables, etc.) from the bore and magnet rear, restoring original connections:

   - Head Heliax connection
   - I/Q connections on quad hybrid assembly

Perform at least one head and body scan to verify proper system operation.

7 - DATA SHEETS

SITE:		NAME:		DATE:	
SST FILE NUMBER:				BODY SPECS	HEAD SPECS
COIL:		❑ BODY ❑ HEAD	❑ BODY ❑ HEAD	(prelim. specs for fixed sites)	(prelim. specs for fixed sites)
STABILITY	MAG.			<1.77 p-p	<1.68 p-p
NO GRADIENTS	FREQ.			<1.57 p-p	<1.43 p-p
	PHASE			<3.20 p-p	<3.00 p-p
X GRADIENT	MAG.			<2.66 p-p	<2.23 p-p
	FREQ.			<2.06 p-p	<1.87 p-p
	PHASE			<3.61 p-p	<3.51 p-p
Y GRADIENT	MAG.			<2.66 p-p	<2.23 p-p
	FREQ.			<2.06 p-p	<1.87 p-p
	PHASE			<3.61 p-p	<3.51 p-p
Z GRADIENT	MAG.			<2.66 p-p	<2.23 p-p
	FREQ.			<2.06 p-p	<1.87 p-p
	PHASE			<3.61 p-p	<3.51 p-p
ALL GRADIENTS	MAG.			<2.78 p-p	<2.73 p-p
	FREQ.			<2.41 p-p	<2.37 p-p
	PHASE			<4.29 p-p	<4.00 p-p
SNR	SIGNAL PEAK			See Note 1	See Note 1
	SYSTEM GAIN			See Note 1	See Note 1
TIME TO PEAK (ECHO CENTER)				See Note 1	See Note 1
	COMBINED NOISE			See Note 1	See Note 1
	SNR VALUE			See Note 1	See Note 1
BASELINE STABILITY	I-CHAN			Typ. <0.6 p-p	Typ. <0.6 p-p
W/GRADIENTS	Q-CHAN			Typ. <0.6 p-p	Typ. <0.6 p-p
W/O GRADIENTS	I-CHAN			Typ. <0.7 p-p	Typ. <0.6 p-p
	Q-CHAN			Typ. <0.7 p-p	Typ. <0.6 p-p
UNBLANK STABILITY	AVG.			Typ. <0.04 p-p	Typ. <0.05 p-p
	PEAK			Typ. <0.07 p-p	Typ. <0.10 p-p
RF LINEARITY	MAG ERR			<2.0 p-p	<2.0 p-p
GRAD BITS (pass/fail)	X, Y, Z			See Notes 2 & 3	See Note 2 & 3
RF BITS	I & Q CHAN			bits 8-15 pass	bits 8-15 pass
	CARRIER LEAKAGE			< -60 dB	< -60 dB
RCVR BITS (pass/fail)	I & Q			all bits pass	all bits pass

1.0T SST HEAD AND BODY SST DATA SHEET
ILLUSTRATION 7-1

Note 1: SST is no longer used to measure SNR. Use SPT to measure SNR.

Note 2: Gradient Bits test does not work properly with SGD (Scalable Gradient Driver). Ignore bit 6 failures with SGD Gradient Subsystem.

Note 3: Gradient Bits test does not work properly with SGD (Scalable Gradient Driver). Ignore bit 6 failures with SGD Gradient Subsystem.

SITE:		NAME:		DATE:	
SST FILE NUMBER:				BODY SPECS	HEAD SPECS
COIL:		❑ BODY ❑ HEAD	❑ BODY ❑ HEAD	(sample specs for fixed site systems with GE magnets)	(sample specs for fixed site systems with GE magnets)
STABILITY	MAG.			<1.77 p-p	<1.68 p-p
NO GRADIENTS	FREQ.			<1.57 p-p	<1.43 p-p
	PHASE			<3.20 p-p	<3.00 p-p
X GRADIENT	MAG.			<2.66 p-p	<2.23 p-p
	FREQ.			<2.06 p-p	<1.87 p-p
	PHASE			<3.61 p-p	<3.51 p-p
Y GRADIENT	MAG.			<2.66 p-p	<2.23 p-p
	FREQ.			<2.06 p-p	<1.87 p-p
	PHASE			<3.61 p-p	<3.51 p-p
Z GRADIENT	MAG.			<2.66 p-p	<2.23 p-p
	FREQ.			<2.06 p-p	<1.87 p-p
	PHASE			<3.61 p-p	<3.51 p-p
ALL GRADIENTS	MAG.			<2.78 p-p	<2.73 p-p
	FREQ.			<2.41 p-p	<2.37 p-p
	PHASE			<4.29 p-p	<4.00 p-p
SNR				Orig. Coil | Univ. Coil	Orig. Coil | Univ. Coil
	SIGNAL PEAK			See Note 1	See Note 1
	SYSTEM GAIN			See Note 1	See Note 1
	TIME TO PEAK (ECHO CENTER)			See Note 1	See Note 1
	COMBINED NOISE			See Note 1	See Note 1
	SNR VALUE			See Note 1	See Note 1
BASELINE STABILITY	I-CHAN			<1.28 p-p	<1.10 p-p
W/GRADIENTS	Q-CHAN			<1.25 p-p	<1.10 p-p
W/O GRADIENTS	I-CHAN			<1.40 p-p	<1.15 p-p
	Q-CHAN			<1.40 p-p	<1.15 p-p
UNBLANK STABILITY	AVG.			<0.24 p-p	<0.10 p-p
	PEAK			<1.90 p-p	<0.48 p-p
RF LINEARITY	MAG ERR			<2.0 p-p	<2.0 p-p
GRAD BITS (pass/fail)	X, Y, Z			See Notes 2 & 3	
RHO BITS	I & Q CHAN			bits 8-15 pass	bits 8-15 pass
	CARRIER LEAKAGE			< -60 dB	< -60 dB
RCVR BITS (pass/fail)	I & Q			all bits pass	all bits pass

1.5T SST HEAD AND BODY SST DATA SHEET
ILLUSTRATION 7-2

Note 1: SST is no longer used to measure SNR. Use SPT to measure SNR.

Note 2: If Y Gradient bits all fail and X and Z all pass, you forgot to put the column under the Original SST coil.

Note 3: Gradient Bits test does not work properly with SGD (Scalable Gradient Driver). Ignore bit 6 failures with SGD Gradient Subsystem.

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0-2	Unknown	Unknown	Rev 0-2 change information unknown.
3	Mar 5, 1998	F. Fiore	Converted Toolbook File to Word Style Format. Updated procedures and illustrations to conform to SRFD requirements.
4	Aug 28, 1998	F. Fiore, M. Keber	Incorporate changes based on Cardiac and SRFD product changes and bay validation. Miscellaneous format cleanup.
5	Oct. 15, 1998	M. Keber	Removed obsolete Release 8.1 information; style guide cleanup.
6	Feb 5, 1999	F. Fiore	Edited proc. Based on Bay Validation of 8.3 software
7	Feb 22, 1999	R. Kaufman	Updated data sheets to compensate for SST coil modification
8	Feb 23, 1999	F. Fiore	Edit RF Cabinet alterations for Head and Body Full Power Tests
9	Oct 14, 1999	M. Keber	Added correct proprietary heading to document.
10	Nov 11, 1999	M. Keber	Updated hardware alteration illustrations for RF/PEN II, scan header test example, and made style guide corrections.
11	Oct 19, 2000	M. Jones	Deleted ASC references.
12	Jan. 19, 2001	M. Jones	Added separate CV tables (3-1A & B; 4-1A & B) for 8.3/ASP1 and ASP2. Deleted notes describing total test time.
13	March 23, 2001	M. Jones	Replaced Ill. 2-1 w/ correct artwork. Deleted Ill. 2-3. Clarified switch setting instructions for RF Pen II & RF/PDU cabinets to Section 2-.
14	July 17, 2001	S.Nahmani J.Gerber	Updated for TwinSpeed scanner for Release 9.0. SST Body Full Power is not supported.
15	Oct. 30, 2001	D. Thome'	Added reference to SRF Cabinet. Added notes indicating which tests ASP2 software does not support. Added Caution concerning window 1.
16	Jan. 25, 2002	D. Thome	Added corrections to Illustration 3-6.
17	Jan 12, 2003	D. Thome	Modified document for EXCITE hardware and SRFD2 hardware.
18	June 20, 2003	D. Thome	Correct omission for body receive on page 30.
19	Feb 22, 2005	P. Kargard	Updates for Excite HD hardware