



***GE Medical Systems***

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## **Technical Publications**

Direction 2135786

Revision 2

### **Signa® Phased Array Shoulder Coil**

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Operating Documentation

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## LANGUAGE POLICY FOR SERVICE DOCUMENTATION (DIR. 2128126)

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- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

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- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
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- VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
- WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.

### AVISO

- ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.
- SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.
- NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.
- LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.

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- ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.
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- NÃO TENHA TENTADO REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.
- O NÃO CUMPRIMENTO DESTA AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.

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- IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.
- SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.
- SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.
- NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

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## SECTION 1 - INTRODUCTION

### 1-1 How the Phased Array Shoulder Coil Operates

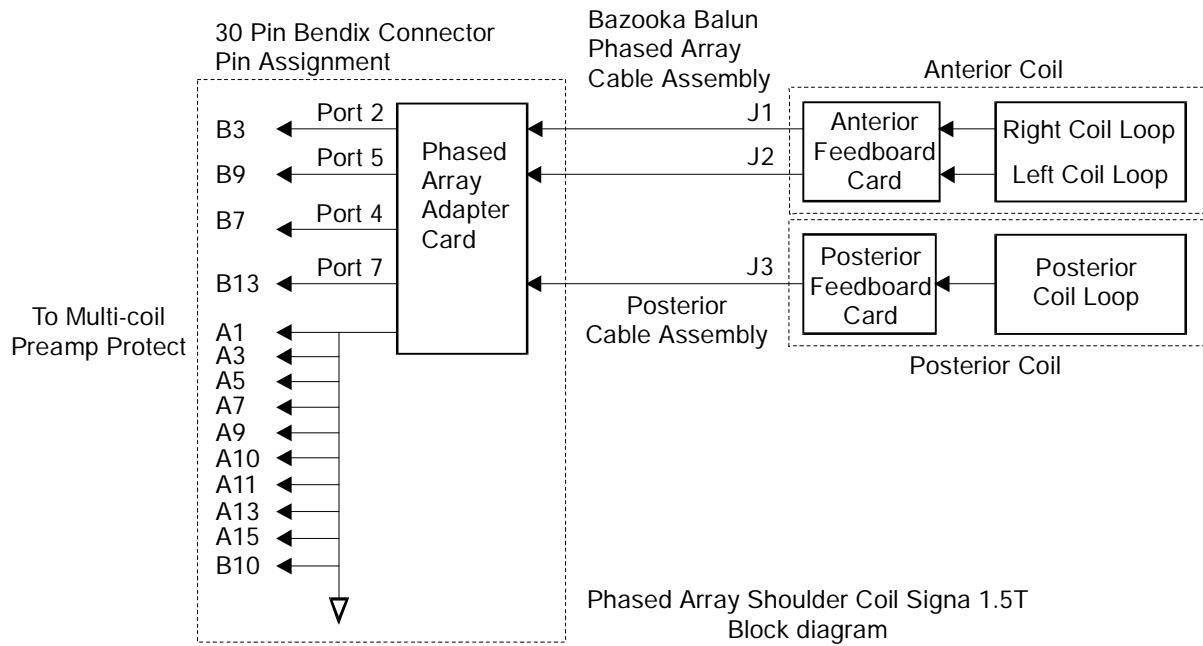
The Signa Phased Array Shoulder Coil is designed for Shoulder imaging on Signa 4.X and 5.X platforms. The coil operates as a two or three element array coil on Signa systems with Phased Array capability. It is a receive-only coil in both modes. Each of the two coil elements in the anterior unit drives a separate Phased Array coil port, the posterior unit drives a third Phased Array coil port.

The anterior unit consists of two single loop elements, the two elements are critically overlapped to minimize coupling between them. Each loop has identical RF circuitry, and each loop drives a separate output cable. Isolation of signal for the two outputs from each loop is accomplished by positioning the overlap of the two loops so as to cancel the coupling between them. The posterior unit consists of a single loop element. Isolation of the posterior loop from the anterior loop pair is accomplished by physical spacing of the coil elements and the preamplifier decoupling concept utilized with other Phased Array coils. The posterior unit plugs into a connector on the anterior unit connector plug, allowing it to be used or not at the discretion of the operator.

Each coil element consists of a single loop conductor with capacitors distributed in five locations around the coil conductor to minimize RF electric field losses in the patient. At gradient switching frequencies, these capacitors have a very high value of reactance to ensure that the circulating eddy currents induced in the loops from the MR system gradient coils are insignificant. At the signal output port of each anterior element, a coaxial bazooka balun having a phase delay of 90 degrees is used to minimize electric field losses in the coil, and to minimize RF currents on the outside of the output cable shields.

As this is a receive-only coil, decoupling from the transmit RF field is needed. This is accomplished by an active decoupling circuit on each coil loop element. The decoupling network consists of a PIN diode in series with an inductor. These components are shunted across one of the five series capacitors in each coil loop adjacent to the feed capacitor. The reactance of the inductor is chosen to parallel-resonate the capacitor at the operating frequency of the coil. This places a high impedance in series with each loop at the capacitor location during transmit RF pulses, thus decoupling the coil from the transmit RF field. A shunt PIN diode in series with an inductor is used at the feedpoint of the Posterior coil element for a similar function. These diodes are biased by the system T/R driver via the coil output cable.

Each coil element is connected to the cable via an SMA connector. The system end of the external cable is terminated in a Quick Disconnect connector that mates with the Phased Array Coil Port. The Quick Disconnect box terminates in a 30 pin Bendix connector and drives two or three coil inputs - Ports 2, 5, and optionally 7. These correspond to receiver channels 0, 1, and optionally 2, respectively. The box also contains three phase compensation networks that, in combination with the length of the output cable, cause the electrical length from the PIN diodes on each coil element to the zero phase reference point of the Phased Array Coil Port to be exactly zero - an integer multiple of 1/2 wavelength, creating an effect equal to zero phase, at the operating frequency.



**PHASED ARRAY SHOULDER COIL SIGNA 1.5T BLOCK DIAGRAM ILLUSTRATION**

## 1-2 Compatibility

The Phased Array Shoulder Coil is compatible with the following hardware configurations:

- Signa® Horizon™ 1.5T & 1.0T System (1.5T only)
- Signa® Advantage™ 1.5T, 1.0T, & 0.5T System (1.5T only)
- Signa Advantage System (1.5T only)

## 1-3 Related Documents

- Direction 2124201-3, MR Rel. 5.x Signa Service Methods & 5.x/4.x/3.x Common Docs.
- Direction 15400, Signa Advantage 1.5T, 1.0T, & 0.5T System
- Direction 15401, Signa Advantage 1.5T, 1.0T, & 0.5T Subsystems
- Direction 15404, Signa Advantage 1.5T, 1.0T, & 0.5T Renewal Parts
- Direction 15300, Signa Advantage System

## 1-4 Organization of this Document

This manual is divided into the following sections:

Section 1, Introduction, describes Phased Array Shoulder Coil operation, when and where it can be used.

Section 2, Setup and Calibration, describes installation procedures.

Section 3, Functional Checks, describes the normal power-up sequence.

Section 4, Replacement / Maintenance, describes field maintenance procedures.

Section 5, Renewal Parts, lists field replaceable parts.

### 1-5 Environmental Requirements

Operate and store the Phased Array Shoulder Coil in the Scanner Room.

**Dimensions:**     **Anterior unit** - 8.2 cm x 25.4 cm x 25.4 cm (3.25" x 10" x 10")

**Posterior unit** - 4.0 cm x 21.9 cm x 25.7 cm (1.56" x 6.62" x 10.12")

## SECTION 2 - SETUP AND CALIBRATION

### 2-1 Checking the Shipping List

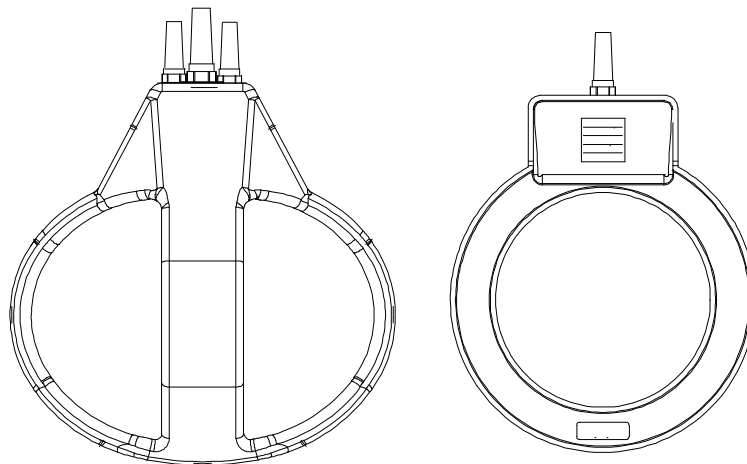
Table 2-1 lists the M1087SH Signa 1.5T Phased Array Shoulder Coil parts. Check that all parts have been shipped.

TABLE 2-1  
1.5T PHASED ARRAY SHOULDER COIL SHIPPING LIST

QTY.	ITEM	PART NUMBER
1	1.5T Phased Array Shoulder Coil	2127695
1	Comfort Strap	E8801LD
1	Comfort Pad	E8801LN
1	Service Direction	2135786
1	Operator Manual	2131390

### 2-2 Installing the Phased Array Shoulder Coil

At the Operator Console, install two new soft keys. These keys will be used by the operator to select Shoulder imaging. Name the keys "SHOPA2", and "SHOPA3".



PHASED ARRAY SHOULDER COIL  
ILLUSTRATION 2-1

Refer to the Signa, Signa Advantage, & Signa Horizon System Manuals for information on installing soft keys (use Coil/Phased Array default values in Tables 2-2 and 2-3).

TABLE 2-2  
COIL VALUES - ANTERIOR ONLY ARRAY

SYSTEM	COIL NAME	COIL TYPE	EXTREMITY COIL	CABLE LOSS	COIL LOSS	RECON SCALE FACTOR	XMIT COIL	MULTI-COIL
1.5T	SHOPA2	SURFACE	NO	1.05	0.313 \$ 1.72 @	Head Coil Recon Scale Factor x 0.75	QUAD	YES
MULTICOIL NAME	NUMBER OF RECEIVERS	START RECEIVER	STOP RECEIVER	PORT ENABLE MASK	ERROR ENABLE MASK			
SHOPA2	2	0	1	5	5			
NUMBER OF FAST RECEIVERS	START FAST RECEIVER	STOP FAST RECEIVER	TRANSMIT ATTENUATION					
0	4	4	0					

Note: \$ - 55 cm  
@ - 60 cm

TABLE 2-3  
COIL VALUES - ANTERIOR & POSTERIOR ARRAY

SYSTEM	COIL NAME	COIL TYPE	EXTREMITY COIL	CABLE LOSS	COIL LOSS	RECON SCALE FACTOR	XMIT COIL	MULTI-COIL
1.5T	SHOPA3	SURFACE	NO	1.05	0.313 \$ 1.72 @	Head Coil Recon Scale Factor x 0.75	QUAD	YES
MULTICOIL NAME	NUMBER OF RECEIVERS	START RECEIVER	STOP RECEIVER	PORT ENABLE MASK	ERROR ENABLE MASK			
SHOPA3	4	0	3	13	13			
NUMBER OF FAST RECEIVERS	START FAST RECEIVER	STOP FAST RECEIVER	TRANSMIT ATTENUATION					
0	4	4	0					

Note: \$ - 55 cm  
@ - 60 cm

## 2-3 Functional Checks

1. Perform a Body coil scan performance verification. Refer to Section 3-1, Signa Advantage 1.5T Scanner Verification.
2. Perform a Phased Array Shoulder Coil performance Verification. Refer to Section 3-2, Phased Array Shoulder Coil Imaging Performance Verification.
3. Perform an SNR Image analysis. Refer to Section 3-3-1, SNR Image Analysis for 4.X Systems, or Section 3-3-2, SNR Image Analysis for 5.X Systems.
4. Record the Original SNR value in the SNR QA Data Table.

## 2-4 Periodic Quality Assurance Check

On a periodic basis, such as during planned maintenance, perform the quality assurance checks outlined below to ensure that the coil is operating properly.

1. Check the external cable for cracks or breaks once a week. Refer to Section 4-7, Checking the External.
2. Perform a coil SNR verification. Refer to Section 3-2, Phased Array Shoulder Coil Imaging Performance Verification.
3. Record the date and value calculated in Section 3-3, SNR IMAGE ANALYSIS in column 2 under "SNR Data QA Check" of the Data Table as is instructed.
4. As is instructed in the Data Table, divide the SNR value obtained in the periodic QA check by the original SNR value and record in column 3 of the Data Table.
5. If this ratio is not greater than 85%, then there may be a problem in the coil system. Contact your local GE Service Representative.

## SECTION 3 - FUNCTIONAL CHECKS

### 3-1 Signa Advantage 1.5T Scanner Verification

#### Note

An alternate proprietary procedure is available for GE use and to customers with a valid Advanced Service Package Limited License. Refer to "TLT PROCEDURE" located on CD-ROM Direction 2124201-1, "MR Release 5.x, Signa Service Methods", navigate to System: Troubleshooting.

#### Phantom Required

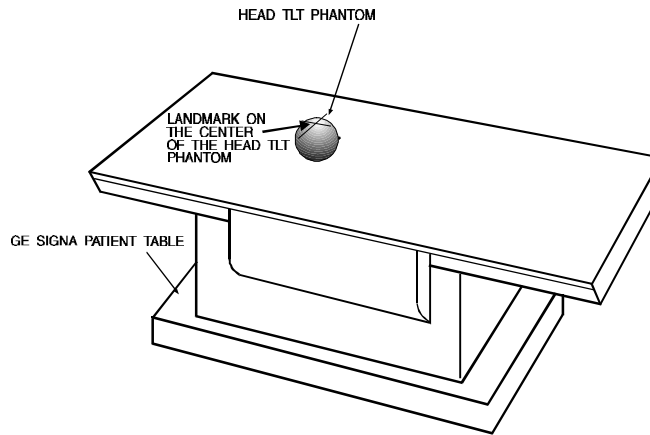
- Head TLT Phantom, 46-265826G6
- Universal Phantom Holder, 46-328383P1

**Setup Procedure**



The Quad Head Coil must be completely removed from the cradle before performing any body scans. Failure to do this may result in damage to the Quad Head Coil T/R Network.

1. Remove Quad Head Coil (if present) from cradle.
2. Select **[NEW STUDY] (4.x)** or **[New Exam] (5.x)** to allow a new Landmark to be set.
3. Position the Head TLT phantom in the center of the cradle. Landmark the center of the phantom and advance to isocenter using the **[ADVANCE TO SCAN]** button. See Illustration 3-1. The Universal Phantom Holder can be used to keep the TLT phantom stable.



**HEAD PHANTOM LANDMARK SETUP**  
ILLUSTRATION 3-1

4a. **For 4.x:** Setup Scan Prescription as shown in Table 3-1.

TABLE 3-1  
**BODY COIL SNR - SCAN PROTOCOL (4.X)**

Id:	<b>geservice</b>	Echo Time (TE):	<b>[40 msec]</b>
Name:	<b>body snr</b>	Rep Time (TR):	<b>[400 msec]</b>
Patient Weight:	<b>111</b>	Auto CF:	<b>[Peak]</b>
Patient Entry:	<b>[Head First]</b>	Field of View:	<b>[32 cm]</b>
Patient Position:	<b>[Supine]</b>	Scan Thickness:	<b>[3 mm]</b>
Axial/Sag Landmark:	<b>[Sternal Notch]</b>	Scan Location:	<b>(S/I) 0</b>
Coil Type:	<b>[Body Coil]</b>	FOV Center:	<b>(R/L) R0 (A/P) A0</b>
Scan Plane:	<b>[Axial]</b>	Acq. Matrix:	<b>[256 x 256]</b>
Image Mode:	<b>[Single Scan]</b>	Frequency Direction:	<b>[R/L]</b>
Pulse Sequence:	<b>[Multiple Echo]</b>	Imaging Time:	<b>[1 NEX 1:48]</b>
Imaging Options:	<b>[None]</b>	Contrast:	<b>[No]</b>
or enter PSD filename		Table Delta:	<b>0 mm</b>
Number of Echoes:	<b>[1]</b>		

4b. For 5.x: Setup Scan Prescription as shown in Table 3-2.

TABLE 3-2  
BODY COIL SNR - SCAN PROTOCOL (5.X)

Id:	geservice	Rep Time (TR):	[400 msec]
Name:	body snr	Auto CF:	[Peak]
Patient Weight:	111	Field of View:	[32 cm]
Patient Entry:	[Head First]	Scan Thickness:	[3 mm]
Patient Position:	[Supine]	Interscan Spacing:	[Other] 0
Axial/Sag Landmark:	[Sternal Notch]	Start Loc (I/S):	0
Coil Type:	[Body Coil]	No. of Scan Location:	1
Scan Plane:	[Axial]	FOV Center (L/R):	0
Image Mode:	[2D]	Acq. Matrix (freq.):	[256]
Pulse Sequence:	[Spin Echo]	Acq. Matrix (phase):	[256]
Imaging Options:	[None]	Frequency Direction:	[A/P]
or enter PSD filename		Imaging Time:	[1 NEX 1:49]
Number of Echoes:	[1]	Contrast:	[No]
Echo Time (TE):	[20 msec]	Table Delta:	0 mm

5. Select **[Auto Prescan]** to properly calibrate the RF power level for the 90 degree and 180 degree pulses.
6. Select **[Scan]**. Observe the resulting images. Ensure that there are no artifacts of any sort in the resulting image. Record the Exam number and Series number for SNR Calculations.
7. Select **[Scan]** again. This second image will be used for determination of Body Coil mode SNR.
8. Select **[Cancel]**. Refer to Section 3-3 for SNR Image Analysis.

### 3-2 Phased Array Shoulder Coil Imaging Performance Verification

**Note**

An alternate proprietary procedure is available for GE use and to customers with a valid Advanced Service Package Limited License. Refer to "TLT PROCEDURE" located on CD-ROM Direction 2124201-1, "MR Release 5.x, Signa Service Methods", navigate to System: Troubleshooting.

**Phantom Required**

- Head TLT Phantom, 46-265826G6

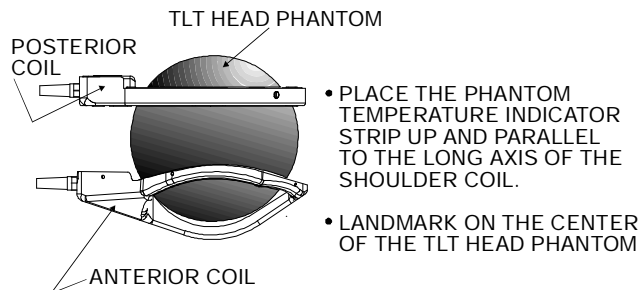
**Setup Procedure**

1. Select **[NEW STUDY] (4.x)** or **[New Exam] (5.x)** to allow a new Landmark to be set.



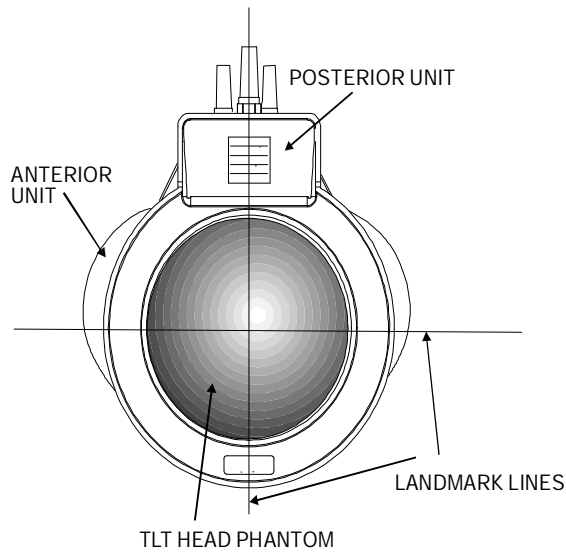
The Quad Head Coil must be completely removed from the cradle before performing any body scans. Failure to do this may result in damage to the Quad Head Coil T/R Network.

2. Remove Quad Head Coil (if present) from cradle.
3. Place the Anterior Coil of the Phased Array Shoulder Coil to be tested upside-down on the patient table. Use a wedge pad to support the coil. Place the TLT Head Phantom on the coil, and the Posterior Coil on the top of the phantom. See Illustration 3-2.



**PHASED ARRAY SHOULDER/TLT HEAD PHANTOM SETUP**  
ILLUSTRATION 3-2

4. Attach the velcro straps around the external cables to secure the two cables close to each other.
5. Connect Phased Array Shoulder Coil connector to the mating connector in the Carriage Assembly. Connect the Posterior Coil to the Phased Array Shoulder Coil Connector.
6. Position the Phased Array Shoulder Coil in the center of the table. Landmark for center of TLT Head Phantom and advance to isocenter using the **[ADVANCE TO SCAN]** button. See Illustration 3-3.



**PHASED ARRAY SHOULDER LANDMARK  
ILLUSTRATION 3-3**

7a. **For 4.x:** Setup Scan Prescription as shown in Table 3-3.

**TABLE 3-3  
PHASED ARRAY SHOULDER COIL SNR - SCAN PROTOCOL (4.X)**

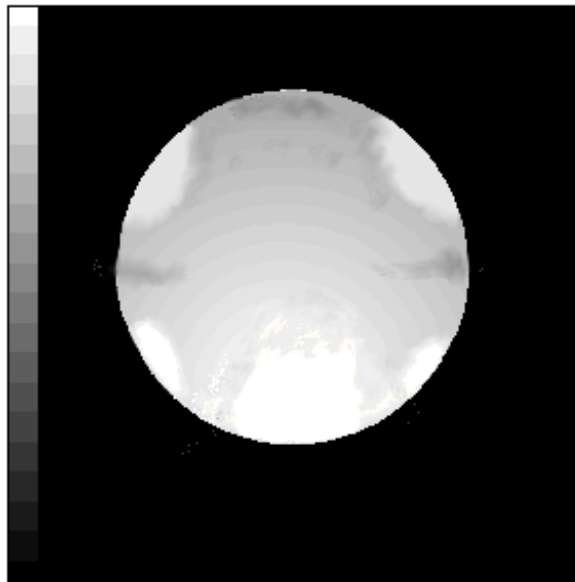
Id:	<b>geservice</b>	Echo Time (TE):	<b>[40 msec]</b>
Name:	<b>pa sholdr snr</b>	Rep Time (TR):	<b>[400 msec]</b>
Patient Weight:	<b>111</b>	Auto CF:	<b>[Peak]</b>
Patient Entry:	<b>[Head First]</b>	Field of View:	<b>[32 cm]</b>
Patient Position:	<b>[Supine]</b>	Scan Thickness:	<b>[3 mm]</b>
Axial/Sag Landmark:	<b>[Sternal Notch]</b>	Scan Location:	<b>(S/I) 0</b>
Coil Type:	<b>[Other Coil] [shopa3]</b>	FOV Center:	<b>(R/L) R0 (A/P) A0</b>
Scan Plane:	<b>[Axial]</b>	Acq. Matrix:	<b>[256 x 256]</b>
Image Mode:	<b>[Single Scan]</b>	Frequency Direction:	<b>[A/P]</b>
Pulse Sequence:	<b>[Multiple Echo]</b>	Imaging Time:	<b>[1 NEX 1:47]</b>
Imaging Options: or enter PSD filename	<b>[None]</b>	Contrast:	<b>[No]</b>
Number of Echoes:	<b>[1]</b>	Table Delta:	<b>0 mm</b>

7b. For 5.x: Setup Scan Prescription as shown in Table 3-4.

TABLE 3-4  
PHASED ARRAY SHOULDER COIL SNR - SCAN PROTOCOL (5.X)

Id:	geservice	Rep Time (TR):	[400 msec]
Name:	pa sholdr snr	Auto CF:	[Peak]
Patient Weight:	111	Field of View:	[32 cm]
Patient Entry:	[Head First]	Scan Thickness:	[3 mm]
Patient Position:	[Supine]	Interscan Spacing:	[Other] 0
Axial/Sag Landmark:	[Sternal Notch]	Scan Loc (I/S):	0
Coil Type:	[Other Coils][shopa3]	End Loc (S/I):	0
Scan Plane:	[Axial]	No. of Scan Location:	1
Image Mode:	[2D]	FOV Center (L/R):	0 (A/P) 0
Image Mode:	[2D]	Acq. Matrix (freq.):	[256]
Pulse Sequence:	[Spin Echo]	Acq. Matrix (phase):	[256]
Imaging Options:	[None]	Frequency Direction:	[R/L]
or enter PSD filename		Imaging Time:	[1 NEX 1:47]
Number of Echoes:	[1]	Contrast:	[No]
Echo Time (TE):	[40 msec]	Table Delta:	0 mm

8. Select **[Auto Prescan]** to properly calibrate the RF power level for the 90 degree and 180 degree pulses.
9. Select **[Scan]**. Observe the resulting image of the sphere. See Illustration 3-4 (normal image). Ensure that there are no artifacts of any sort in the sphere image. Record the Exam number and Series number for SNR Calculations.



PHASED ARRAY SHOULDER COIL IMAGE  
ILLUSTRATION 3-4

10. Select **[Scan]** again. This second image of the sphere will be used for determination of Phased Array Shoulder mode SNR.
11. Select **[Cancel]**. Refer to Section 3-3 for SNR Image Analysis.

### 3-3 SNR Image Analysis

#### 3-3-1 SNR Image Analysis (Release 4.x) (See Section 3-3-2 for Release 5.x)

#### Description

The CLIPS macro will ask for the first image in the series to analyze. The macro assumes you have done two back-to-back scans and will take the designated image and the next image in the series (i.e., if you give it image 3, it will take 3 and 4). It will also ask you to designate three points on the border of the phantom image to use in positioning the analysis ROI. If your image is too big, too small, or the three points were selected too close together, the macro will inform you.

#### Procedure

1. Touch [UTILITIES], then [Clips].

```

                                CLIPS
-----
    1 Run CLIPS
    2 Save files
    3 Restore files
    4 Remove files
    5 Exit

```

Enter the number of your selection: .....1 [ENTER]

- 1 = Operator console
- 2 = Remotel
- 3 = Remote2
- 4 = Exit

Which image processor would you like to use (1 2 or 3) ? ...1 [ENTER]

IP selected is at the operator console.

Do you wish to boot the Image Processor? (Y or N) .....Y [ENTER] You do not have to reboot the IP each time you enter.

Welcome to the Command Line Image Processing System (CLIPS)

CLIPS > .....LIST(STUDY); [ENTER]

STUDY LIST

STUDY #	PATIENT NAME	PATIENT I.D.	DATE
00001	BDY_SNR	GESERVICE	9-JULY-89

00002 HD\_SNR GESERVICE 9-JULY-89

CURRENT DEFAULTS --- PATIENT ID = / /

- N - NEXT PAGE
- P - PREVIOUS PAGE
- S - SELECT STUDY
- C - CANCEL

choice ?.....S [ENTER]  
 ENTER STUDY NUMBER --.....1 [ENTER] Enter appropriate number.

CLIPS > .....LIST(SERIES); [ENTER]

SERIES LIST

SERIES #	# OF IMAGES	SERIES TYPE	PULSE TYPE
001	002	AXIAL	ME
002	002	SAG	ME

CURRENT DEFAULTS --- PATIENT ID = SNR 0000S/00S/001

- N - NEXT PAGE
- P - PREVIOUS PAGE
- S - SELECT SERIES
- C - CANCEL

choice ? .....S [ENTER]  
 ENTER SERIES NUMBER --.....1 [ENTER] Enter appropriate number.

CLIPS > .....DIS; [ENTER] or you could LIST (IMAGE); to select the image you want.

CLIPS > .....EXECUTE(SNR); [ENTER] or just EXE(SNR); [ENTER]

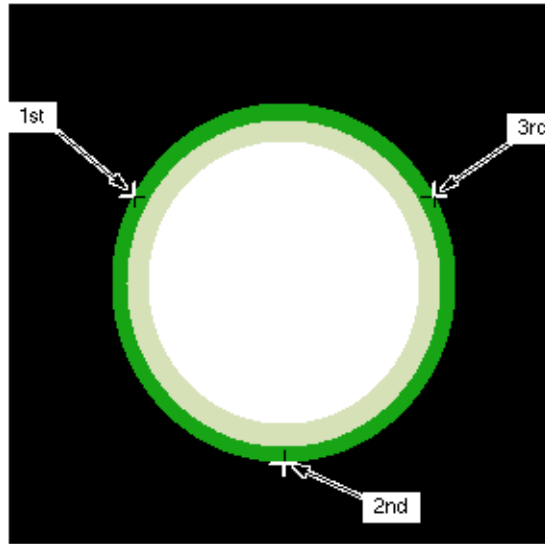
THIS MACRO CALCULATES THE SNR USING THE GE HEAD OR BODY PHANTOM.  
 ENTER THE NUMBER OF THE FIRST IMAGE OF THE TWO-IMAGE SET AND !  
 EXAMPLE INPUT> 1!

Please start entering data. Type an ! to end input mode.

CLIPS INPUT> .....! [ENTER]

Correct positioning of the SNR analysis ROI depends on finding the center of the phantom. You will be prompted to identify three points at the edge of the phantom. Care should be taken to pick three points as far away from each other as possible (i.e., 2, 6 and 10 o'clock) and to avoid flat spots and irregularities on the edge.

See Illustration 3-5.



**SNR CURSOR POSITIONS**  
ILLUSTRATION 3-5

**Note**

The order of cursor placement must be 10, 6, then 2 o'clock positions. Using a different order may give an error.

POSITION CURSOR AT FIRST POINT AND ENTER !

Place cursor at 10:00 position on edge of image.

Please start entering data. Type an ! to end input mode.

CLIPS INPUT> .....! [ENTER]

POSITION CURSOR AT SECOND POINT AND ENTER !

Place cursor at 6:00 position.

Please start entering data. Type an ! to end input mode.

CLIPS INPUT> .....! [ENTER]

POSITION CURSOR AT THIRD POINT AND ENTER !

Place cursor at 2:00 position.

Please start entering data. Type an ! to end input mode.

CLIPS INPUT> .....! [ENTER]

PHANTOM POINTS AND RADIUS OK. BEGIN ANALYSIS.

The program will then perform the analysis and display the final values on the image monitor. Record Signal, Noise and Signal to Noise in Data Table.

DO YOU WANT TO SAVE THIS DATA?

ENTER A 1! FOR YES, A 0! FOR NO.

Please start entering data. Type an ! to end input mode.

CLIPS INPUT>..... 0! [ENTER]

DATA NOT SAVED

CLIPS > ..... **LIST(SERIES); [ENTER]** Select the next series and repeat the above analysis for each image pair. Type **BYE**; when completed to exit **CLIPS**.

2. When all analyses are complete, reset Auto Center Frequency mode by touching **[SCAN MODES]**, **[Default Auto CF]**, then **[EXECUTE]**.

Note

You do not have to reset the Auto Center Frequency mode if you are proceeding on to more image quality scans.

3. Record the date and value calculated in the appropriate column under “SNR Data QA CHECK” of the Data Table (following Section 5 Renewal Parts), as is instructed.

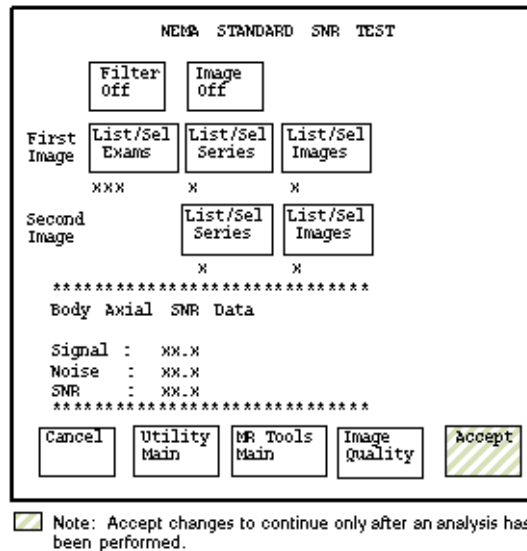
**3-3-2 SNR Image Analysis (Release 5.x)**

**Description**

The SNR tool retrieves two operator selected images. Signal value is computed as the mean pixel value in a ROI covering 80% of the image. The image is analyzed to determine the center of the image for positioning the ROI. A difference image is created by subtracting the second image from the first and the same ROI is used to calculate noise from the subtracted image. The signal value, noise value, and signal to noise ratio are reported. There is an option to save the difference image with the results annotated.

**Procedure**

1. Touch **[UTILITIES]**, **[MR Tools]**, **[Image Quality]**, then **[SNR Test]**. The SNR Test screen is displayed. See Illustration 3-6.



**SNR TEST SCREEN**  
ILLUSTRATION 3-6

2. Enter image exam, series, and image numbers. If exam, series, or image numbers are not known, select **[List Exams]**, **[List Series]**, or **[List Images]** to display list to choose from.

**Note**

Image number selection must be back lit (highlighted) to be able to enter information. Use Switch key on keyboard to transfer control from left to right side of Touch Screen.

3. If high pass filtering is desired to be performed on data, touch **[Filter Off]** which will highlight and change to **[Filter On]**.
4. If the difference image annotated with data is to be created, touch **[Image Off]** which will highlight and change to **[Image On]**.
5. Touch **[Accept]** to begin analysis. The final values are displayed on the touch screen, see Illustration 3-6 (see previous screen).
6. Touch **[Continue]** then select the next exam and repeat the above analysis for each image pair.
7. Record the date and value calculated in the appropriate column under "SNR Data QA Check" of the Data Table (following Section 5 Renewal Parts), as is instructed.

### 3-4 Checking the Anterior Coil External Cable and PIN Diodes

**Note**

The Posterior Coil must be plugged in for the following measurements.

1. Select the DIODE TEST function on the Digital Multimeter (DMM). Ensure that the Posterior Coil is connected.

2. Connect the positive and negative leads as detailed in Table 3-5. Verify that a reading of 0.400 to 0.900 is obtained at each test point.

TABLE 3-5  
DIODE TEST CONNECTIONS

COIL TYPE	POSITIVE LEAD CONNECTION		NEGATIVE LEAD CONNECTION	
	FOR STEP 2	FOR STEP 5	FOR STEP 2	FOR STEP 5
A1	3B	3A	3A	3B
A2	9B	9A	9A	9B
P	13B	13A	13A	13B

3. If a reading of less than 0.400 is obtained, a PIN diode or the coil output cable is likely to be shorted.
4. If a reading of more than 0.900 is obtained, a PIN diode or the coil output cable is likely to be open.
5. Connect the positive and negative leads as shown in Table 3-5. Verify that a reading of Infinity (overrange) is obtained at each test point.
6. If a finite reading is obtained, a PIN diode is likely to be shorted or leaky, or the coil output cable is likely to be shorted.

**3-5 Checking the Posterior Coil Cable and PIN Diode**

NOTE

Disconnect the Posterior Coil cable from the Anterior Coil Connector.

1. Select the DIODE TEST function on the Digital Multimeter (DMM).
2. Connect the positive and negative leads as described in TABLE 3-6 directly to the Posterior element coaxial fitting. Verify that a reading of 0.400 to 0.900 is obtained at the test point.

TABLE 3-6  
POSTERIOR PADDLE CABLE TEST CONNECTIONS

COIL TYPE	POSITIVE LEAD CONNECTION		NEGATIVE LEAD CONNECTION	
	FOR STEP 2	FOR STEP 5	FOR STEP 2	FOR STEP 5
P	J4 center	J4 shell	J4 shell	J4 center

3. If a reading less than 0.400 is obtained, the PIN diode or cable is likely to be shorted.
4. If a reading of more than 0.900 is obtained, the PIN diode or cable is likely to be open.
5. Connect the positive and negative leads as shown in Table 3-6. Verify that a reading of Infinity (overrange) is obtained.

- If a finite reading is obtained the PIN diode is likely to be shorted to leaky, or the Posterior Paddle Cable is defective.

**3-6 Checking the PIN diodes at the coil - Anterior and Posterior.**

Disassemble the coil as described in Section 4-1, and remove the output cable of the Phased Array Shoulder Coil.

- Select the DIODE TEST function on the Digital Multimeter (DMM).
- Connect the positive and negative leads as described in TABLE 3-7 directly to the coil element coaxial fitting. Verify that a reading of 0.400 to 0.900 is obtained at the test point.

TABLE 3-7  
DIODE TEST CONNECTIONS

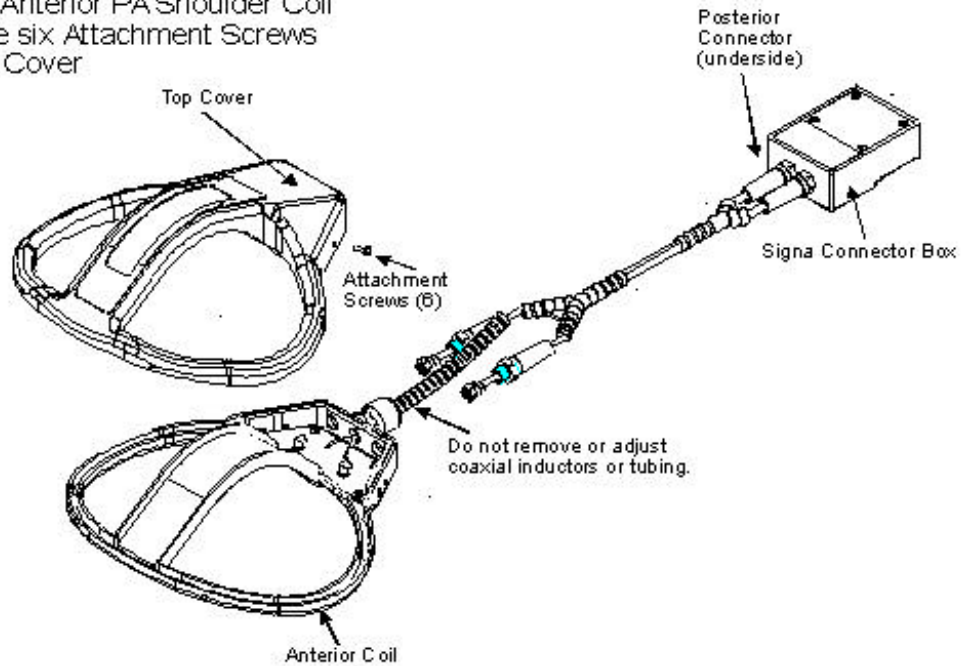
COIL TYPE	POSITIVE LEAD CONNECTION		NEGATIVE LEAD CONNECTION	
	FOR STEP 2	FOR STEP 5	FOR STEP 2	FOR STEP 5
A1	J1 center	J1 shell	J1 shell	J1 center
A2	J2 center	J2 shell	J2 shell	J2 center
P	J3 center	J3 shell	J3 shell	J3 center

- If a reading less than 0.400 is obtained, the PIN diode is likely to be shorted.
- If a reading of more than 0.900 is obtained, the PIN diode is likely to be open.
- Connect the positive and negative leads as shown in TABLE 3-7. Verify that a reading of Infinity (overrange) is obtained.
- If a finite reading is obtained the PIN diode is likely to be shorted or leaky.

## SECTION 4 - REPLACEMENT / MAINTENANCE

### 4-1 Disassembly of the Anterior Coil of the Phased Array Shoulder Coil

- Remove Cover on Anterior PA Shoulder Coil
1. Remove the six Attachment Screws
  2. Lift the Top Cover

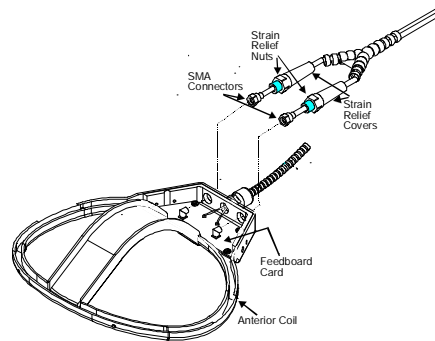


**REPLACEMENT / MAINTENANCE  
ILLUSTRATION**

### 4-2 Replacing the External Cable

#### External Coil Cable Removal

1. Unscrew the Strain Relief Covers and pull away from the Strain Relief Nuts.
2. Disconnect the SMA Connectors from the Feedboard Card.
3. Unscrew the Strain Relief Nuts.
4. Back the SMA Connectors through the threaded holes.



#### External Coil Cable Replacement

1. Insert the SMA Connectors through the threaded holes.
2. Connect the SMA Connectors in the same way as the original.
3. Insert and tighten the Strain Relief Nuts. Tighten the Strain Relief Covers.

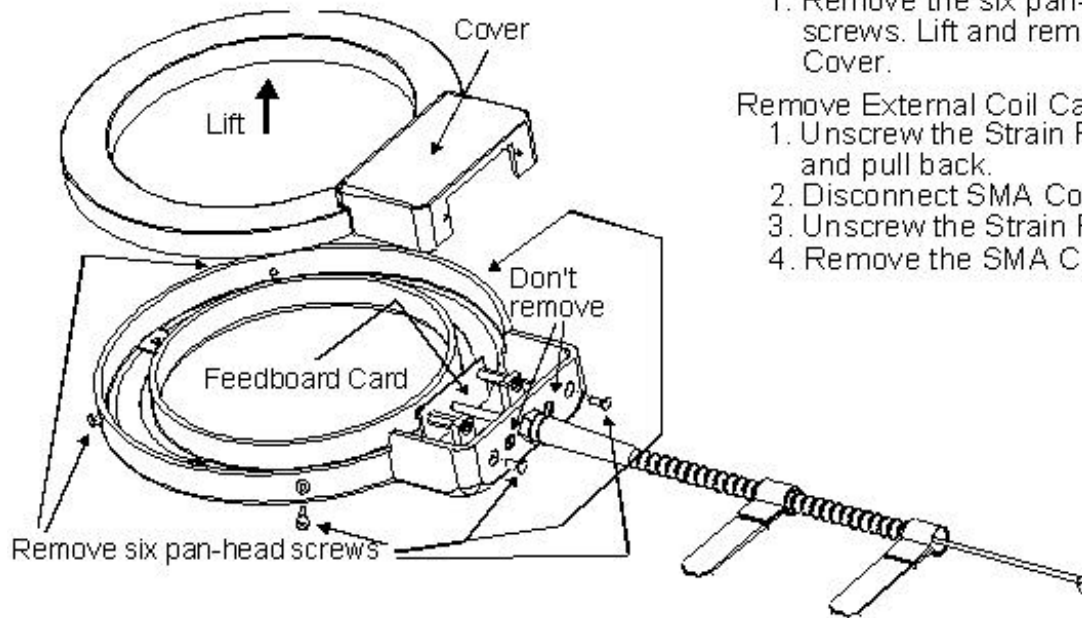
#### Anterior Coil Assembly

1. Replace cover, insert and tighten screws.

**EXTERNAL CABLE REMOVAL, REPLACEMENT, AND ASSEMBLY  
ILLUSTRATION**

Repeat the performance tests in Section 3-2.

### 4-3 Disassembly of the Posterior Coil and Removing the External Cable



#### Disassembly

1. Remove the six pan-head screws. Lift and remove the Cover.

#### Remove External Coil Cable

1. Unscrew the Strain Relief Cover and pull back.
2. Disconnect SMA Connector.
3. Unscrew the Strain Relief Nut.
4. Remove the SMA Connector.

### DISASSEMBLY OF THE POSTERIOR COIL AND REMOVING THE EXTERNAL CABLE ILLUSTRATION

### 4-4 Replacing the Mechanical Hardware

#### Replacing the External Cable

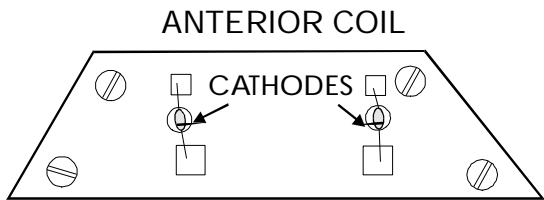
1. Insert the SMA Connector through the threaded hole.
2. Connect the SMA Connector. Quick Disconnect end should point away from the open coil.
3. Insert and tighten the Strain Relief Nut. Tighten the Strain relief Cover.

#### Assembly of the Posterior Coil

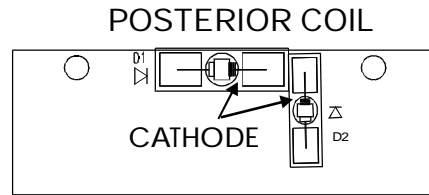
1. Replace the Cover of the coil.
2. Insert and tighten the six pan-head screws.

Repeat the Performance Tests in Section 3-2.

#### 4-5 Checking the External Cable



1. The diodes are on the front side of the Feedboard Card.
2. Unsolder the defective diode(s) and replace with new diode(s) ensuring that the diode is oriented correctly.
3. Repeat the Performance Tests in Section 3-2.



1. The diodes are on the back side of the Feedboard Card.
2. Unsolder the defective diode(s) and replace with new diode(s) ensuring that the diode is oriented correctly.
3. Repeat the Performance Tests in Section 3-2.

#### 4-6 Replacing the Mechanical Hardware (except housing screws)

1. Replace the entire Phased Array Shoulder Coil. Refer to Section 5, Renewal Parts, for Phased Array Shoulder Coil part number.

#### 4-7 Checking the External Cable

1. Check the external cables for cracks or breaks once each week. Replace the appropriate Phased Array Shoulder Coil cable if any damage or wear is found to the external cables.

#### 4-8 Cleaning the Coil



**Avoid damaging sensitive electronic parts. Do not spray or pour dishwashing solution directly onto the Phased Array Shoulder Coil, or external cable. Do not use alcohol to clean the Phased Array Shoulder Coil. Never submerge the Phased Array Shoulder Coil in any liquid.**

Clean the Phased Array Shoulder Coil and external cable with a mild dishwashing liquid and water solution. Wet a soft cloth with the solution and proceed to clean.

Before returning the coil for servicing, thoroughly clean the coil, cable, and connectors with a 10% bleach in water solution.

5- RENEWAL PARTS

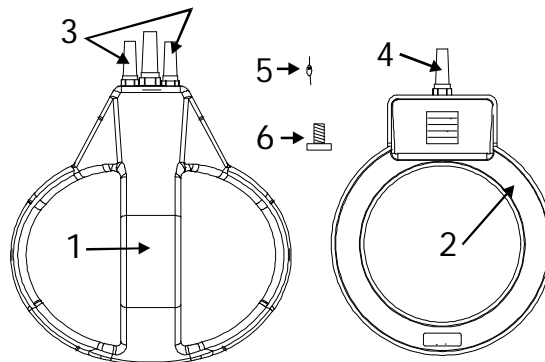


**BIO HAZARD! EQUIPMENT BEING RETURNED FROM USE IN A CLINICAL SETTING MUST BE CLEAN AND FREE OF BLOOD AND OTHER INFECTIOUS SUBSTANCES. THE DEPARTMENT OF TRANSPORTATION (DOT) HAS RULED THAT ITEMS THAT WERE SATURATED AND/OR DRIPPING WITH HUMAN BLOOD THAT ARE NOW CAKED WITH DRIED BLOOD; OR WHICH WERE USED OR INTENDED FOR USE IN PATIENT CARE ARE REGULATED MEDICAL WASTE FOR TRANSPORTATION PURPOSES AND MUST BE TRANSPORTED AS A HAZARDOUS MATERIAL. UNDER NO CIRCUMSTANCES SHOULD A PART OR EQUIPMENT WITH VISIBLE BODY FLUIDS BE TAKEN OR SHIPPED FROM A CLINIC OR SITE (FOR EXAMPLE, SURFACE COILS).**

1. Employees shall follow proper decontamination procedures for clean up of bloodborne pathogens. Refer to Section 4-8, Cleaning The Coil. It is the responsibility of the GEMS employee to insure the part/equipment has been properly decontaminated prior to shipment.

1.5T Phase Array Shoulder Coil

2131390



ITEM	PART NO.	FRU	NAME	QTY.	DESCRIPTION (REMARKS)
1	2100937-17	1	MEDRAD FRU	1	305002514 1.5T PA ANTERIOR w/CABLE
2	2100937-19	1	MEDRAD FRU	1	305002516 1.5T PA POSTERIOR w/CABLE
3	2100937-18	1	MEDRAD FRU	1	305002515 1.5T PA ANTERIOR w/CABLE
4	2100937-20	1	MEDRAD FRU	1	305002517 1.5T PA POSTERIOR w/CABLE
5	46-221735P1	2	DIODE	4	UM 9415 PIN DIODES
6	46-208922P4	2	SCREW, MACH	12	6-32 x 0.375 NYLON SCREWS

**Data Table**

Use the space provided below to record the calculated signal to noise ratio (SNR) data obtained from Section 3 Functional Checks. After recording the SNR data obtained during the initial coil installation, record subsequent SNR data in column 2 below and the date they were obtained in column 1 as a periodic QA check. If the ratio of any of the coils found is not greater than 85%, column 3, then there is a problem in the coil or the MR system.

Original SNR data obtained at initial coil installation:

Body Coil SNR Value: \_\_\_\_\_

Phased Array Shoulder Coil SNR Value: Both (Anterior/Posterior) \_\_\_\_\_

Date: \_\_\_\_\_

SNR Data QA (Quality Assurance) Check:

1	2	3
Date	Posterior/Anterior	Are new Values Divided by Original Values > 85%?
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N

*Make additional copies of this document as is needed.*

**Defective Coil Return Form**

Note

To allow for proper assessment of defective returned coils, this form must be completely filled out and accompany all returned coils. Include films or prints of any image quality related complaints with a description of scan protocol used.

Date \_\_\_\_\_

Site Name \_\_\_\_\_

Site Address \_\_\_\_\_

Service Engineer \_\_\_\_\_

Coil Serial Number \_\_\_\_\_

Date Coil Installed \_\_\_\_\_

Description of Coil Problem \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ELECTRICAL CHECKS

PIN Diode Test

Meter Reading Forward Bias - Anterior D1 \_\_\_\_\_

Meter Reading Reverse Bias - Anterior D1 \_\_\_\_\_

Meter Reading Forward Bias - Anterior D2 \_\_\_\_\_

Meter Reading Reverse Bias - Anterior D2 \_\_\_\_\_

Meter Reading Forward Bias - Posterior D1 \_\_\_\_\_

Meter Reading Reverse Bias - Posterior D1 \_\_\_\_\_

Meter Reading Forward Bias - Posterior D2 \_\_\_\_\_

Meter Reading Reverse Bias - Posterior D2 \_\_\_\_\_

Note

An alternate proprietary procedure is available for GE use and to customers with a valid Advanced Service Package Limited License. Refer to "TLT PROCEDURE" located on CD-ROM *Direction 2124201-1, "MR Release 5.x, Signa Service Methods"*, navigate to System: Troubleshooting. Use Table DR-1 and DR-2 to record the TLT results of the defective coil.

TABLE DR-1  
TLT DATA FOR DEFECTIVE SURFACE COIL

<b>SITE:</b> _____	<b>NAME:</b> _____	<b>DATE:</b> _____
<b>TLT FILE NUMBER:</b> _____		
<b>SNR:</b>	<b>NOISE</b> _____	
	<b>SNR MEAN</b> _____	
	<b>SNR SIGNAL</b> _____	
	<b>SNR AREA</b> _____	
<b>TR MAP:</b>	89-91 _____	%
	85-95 _____	%
	65-115 _____	%

FLIP MEAN \_\_\_\_\_

TABLE DR-2  
TLT DATA FOR DEFECTIVE PHASED ARRAY COIL

**SITE:** \_\_\_\_\_ **NAME:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

**TLT FILE NUMBER:** \_\_\_\_\_

**SNR:** NOISE (0) \_\_\_\_\_  
NOISE (1) \_\_\_\_\_  
NOISE (2) \_\_\_\_\_  
NOISE (3) \_\_\_\_\_  
NOISE (C) \_\_\_\_\_

SNR MEAN (0) \_\_\_\_\_  
SNR MEAN (1) \_\_\_\_\_  
SNR MEAN (2) \_\_\_\_\_  
SNR MEAN (3) \_\_\_\_\_  
SNR MEAN (C) \_\_\_\_\_

**TR MAP:** 89-91 (C) \_\_\_\_\_ %  
(Combined 85-95 (C) \_\_\_\_\_ %  
Results) 65-115 (C) \_\_\_\_\_ %

FLIP MEAN (C) \_\_\_\_\_  
FLIP SDV (C) \_\_\_\_\_  
RCV MEAN (C) \_\_\_\_\_  
RCV SDV (C) \_\_\_\_\_

## Damage in Transportation Statement

All packages should be closely examined at time of delivery. If damage is apparent, have notation "**damage in shipment**" written on **all** copies of the freight or express bill **before** delivery is accepted or "signed for" by a General Electric representative or a hospital receiving agent. Whether noted or concealed, damage **MUST** be reported to the carrier **immediately** upon discovery, or in any event, within **14** days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this **14** day period.

Call Traffic and Transportation, Milwaukee, WI (414) 785-5052/8\*323-5052 **immediately** after damage is found. At this time be ready to supply name of carrier, delivery date, consignee name, freight or express bill number, item damaged and extent of damage.

Complete instructions regarding claim procedure are found in Section "S" of the Policy & Procedure Bulletins.

3/12/92



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### REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	Sep 9, 1998	L. Loehrer	Converted Toolbook document to MS Word 7.0